

**In the Sense of Product and Communication Design:  
Investigating the Role of Sensory-Related Design Benefits in Marketing  
Management**

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## **Abstract**

Basically, every design consists of a composition of sensory design elements. As a result, there are numerous possibilities for marketing managers to design products and conduct marketing communication. In addition, this broad spectrum of design opportunities offers rich value potential and therefore the design can be an important strategic tool for companies and brands. Today, design is mainly considered as an instrument to generate a competitive advantage in the market. Specifically, an appealing product design may help to positively differentiate the company's own products from competing products with similar properties and features. To create an appealing product design, not only knowledge from design theory, but also a comprehensive understanding of the perception of design from the customer's point of view is of fundamental importance. Accordingly, the need for new insights into the influence of product design on consumer behavior has increased significantly among researchers and practitioners. In particular, efficiently communicating the product's benefits through product and communication design represents an essential issue for marketers.

This dissertation, consisting of a total of eight research articles, therefore focuses on two main areas of research. In the first module, existing research gaps regarding the impact of product-related sensory design elements and design benefits on consumer behavior are identified and empirically investigated. Further, the second module focuses on the influence of sensory design elements in marketing communication on the perception of product design and design benefits. Both modules consist of four research articles each.

The results of the various research contributions confirm the important role nowadays attributed to design in marketing management. Furthermore, the new insights provide valuable practical implications for a multitude of application areas in marketing across different industries and additionally set the foundation for future research directions in the field of value-based design research.

**Keywords:** Product design, Communication design, Sensory design elements

## **Zusammenfassung**

Grundsätzlich basiert jedes Design auf einer Komposition von sensorischen Designelementen. Dadurch ergeben sich für Marketingverantwortliche vielfältige Möglichkeiten, Produkte zu gestalten und Marketingkommunikation zu betreiben. Dieses breite Spektrum an Gestaltungsmöglichkeiten bietet zudem auch ein großes Wertpotenzial, weshalb Design als wichtiges strategisches Instrument für Unternehmen und Marken dienen kann. Mittlerweile gilt Design vor allem als Instrument zur Generierung eines Wettbewerbsvorteils auf dem Markt. Insbesondere ein ansprechendes Produktdesign kann dazu beitragen, die eigenen Produkte positiv von Konkurrenzprodukten mit ähnlichen Eigenschaften und Merkmalen zu unterscheiden. Um ein ansprechendes Produktdesign zu schaffen, ist nicht nur Wissen aus der Designtheorie, sondern auch ein umfassendes Verständnis der Wahrnehmung von Design aus Kundensicht von grundlegender Bedeutung. Dementsprechend ist der Bedarf an neuen Erkenntnissen über den Einfluss von Produktdesign auf das Konsumentenverhalten bei Forschern und Praktikern deutlich gestiegen. Vor allem die effiziente Kommunikation des Produktnutzens über Produkt- und Kommunikationsdesign ist für Marketingverantwortliche von zentraler Bedeutung.

Die vorliegende Dissertation, die aus insgesamt acht Forschungsartikeln besteht, konzentriert sich daher auf zwei Forschungsschwerpunkte. Im ersten Modul werden bestehende Forschungslücken über den Einfluss produktbezogener sensorischer Designelemente und Designbenefits auf das Konsumentenverhalten identifiziert und empirisch untersucht. Darüber hinaus bezieht sich das zweite Modul auf den Einfluss sensorischer Designelemente in der Marketingkommunikation auf die Wahrnehmung von Produktdesign und Designbenefits. Beide Module bestehen aus jeweils vier Forschungsartikeln.

Die Ergebnisse der verschiedenen Forschungsbeiträge bestätigen zum einen die wichtige Rolle, die dem Thema Design heutzutage im Marketingmanagement zugeschrieben wird. Zum anderen liefern die neuen Erkenntnisse wertvolle praktische Implikationen für eine Vielzahl von Anwendungsbereichen im Marketing über Branchengrenzen hinweg und bilden zudem die Grundlage für zukünftige Forschungsrichtungen im Bereich der wertorientierten Designforschung.

**Schlagwörter:** Produktdesign, Kommunikationsdesign, Sensorische Designelemente

## **Preface**

*“Design is everything. Everything!”*

Paul Rand

(Professor at Yale University and graphic designer, 1914-1996)

### **1. Motivation and research objectives**

The topic of ‘design’ is omnipresent and highly relevant in marketing nowadays (Bloch Gopalakrishna, Crecelius, & Scatolin Murarolli, 2017; Kumar & Noble, 2016). Particularly in competitive buyer markets, it is becoming increasingly difficult for companies to differentiate themselves from their competitors. However, companies such as Apple or BMW have shown in practice that the use of unique and appealing designs can achieve a clear competitive advantage for a company (Fenko & van Rompay, 2018). Due to this potential for success, design is meanwhile regarded as a strategic instrument for the target-oriented positioning of brands and products in marketing (Jindal, Sarangee, Echambadi, & Lee, 2016). Because of the increased practical relevance of design in marketing, the demand for new theoretical and empirical insights in this field has also increased (Ulrich, 2011). About 20 years ago, design was still regarded as an underrepresented sub-topic in marketing research literature (Bloch, 1995). Since then, however, the number of research articles in marketing journals on design-related topics has increased strongly and steadily. Nevertheless, although design is recurrently classified as one of the research priorities of marketing research institutes, design is still considered a relatively unexplored field in marketing (Homburg, Schwemmler, & Kuehnl, 2015; Luchs, Swan, & Creusen, 2016). In particular, there are many calls for further in-depth research into the impact of product design on consumer perception and behavior (e.g., Candi, Jae, Makarem, & Mohan, 2017; Creusen, 2011; Franzak, Makarem, & Jae, 2014).

Product design relates to the multidimensionally perceived constitutive sensory design elements of a product, which are generally organized within the perception process along the three dimensions of aesthetics, functionality, and symbolism. Accordingly, every design basically consists of a composition of sensory design elements. Thus, from the designer's perspective, there are almost unlimited possibilities for creating different designs. However, on

the basis of psychological findings from Gestalt theory, it is known that designs are usually perceived by people as holistic entities and not as the interplay of individual sensory design elements (Homburg *et al.*, 2015) or, as the architect Charles Eames once accurately put it, “The details are not the details. They make the design”. Yet from a marketing point of view, it is especially the individual sensory design elements that can be changed and controlled, so that the effects of sensory design elements on the holistic perception of design appear to be of special interest in marketing (Crilly, Moultrie, & Clarkson, 2004; Noble & Kumar, 2010). Moreover, the customer’s perception of the holistic design is of high relevance for successful marketing (Orth & Malkewitz, 2008). In particular, the holistic product design can transmit so-called design benefits that have a decisive relevance for the product appeal and a possible product purchase to the potential customer (Chitturi, Raghunathan, & Mahajan, 2008).

Therefore, target-oriented product design is considered a central component in marketing today. For marketing management, it is particularly relevant on the one hand to understand the effects of sensory product design elements and product design benefits with regard to different consumer groups and product categories and on the other hand to find innovative and novel ways of creating appealing and unique product designs. For this reason, the first part of the dissertation deals with the targeted investigation of influences of sensory design elements and design benefits in the context of product design. Thereby, different product types and consumer groups are included in the examination and different levels and possibilities of designing products are highlighted.

***Research objective 1: Providing new insights on the influence of sensory design elements and design benefits in the context of product design***

As products are generally perceived in a specific context by the consumer, it also plays a central role for marketing management to present the product design as appealingly and target-oriented as possible through the design of context-related sensory design elements (Piqueras-Fizman & Spence, 2015). An efficient communication design can help to clearly communicate the intended design benefits of a product to the customer, for instance in marketing-specific communication and advertising efforts (Krishna, Cian, & Sokolova, 2016). Consequently, there is a high relevance of new findings for marketing management with regard to the supporting effect of communication and advertising activities in transmitting product-specific design benefits to potential customers (Crilly, Good, Matravers, & Clarkson, 2008). The second part of this dissertation takes up this issue and deals with different design possibilities of



sensory communication design elements and their effects on the perception of product design benefits.

*Research objective 2: Providing new insights on the influence of sensory design elements on the perception of design benefits in the context of communication design*

Based on the two research objectives outlined above, this dissertation is divided into two modules. The articles of module 1 refer to the first research objective whereas the articles of module 2 focus on the second research objective. Both modules consist of four research articles. The two modules and the corresponding research articles are presented in more detail in the following chapter.

## **2. Description of the research articles**

### **2.1. Module 1: Sensory design elements and design benefits in the context of product design**

The research articles of the first module focus on the influences of product-related sensory design elements and design benefits on consumer perception and behavior. In particular, the articles refer to selected research gaps, whereby different consumer groups as well as different product types were included in the studies across all research articles of this module. Initially, research article 1 provides an overview of the relevance of design benefits in relation to consumers' product choice. In addition, in the other three articles of this module (research articles 2 – 4) the influence of sensory design elements on consumer perception, particularly the perception of design benefits, is examined more closely across industries and application areas.

*Research article 1 “Taking a closer look at the relevance of design benefits for product choice from an international perspective: A correspondence analysis”* provides an overview of the relevance of different design benefits for product choice using an explorative research approach in an international context. Based on the general classification of design benefits into aesthetic, functional, and symbolic dimensions, nine different design benefits (i.e., aesthetics, performance, durability, ease of use, self-identification, social self-expression, and altruistic self-expression) were included in this research study and investigated for their relevance in product choice. In the course of an explorative study with participants from three different countries (Germany, United Kingdom, and Italy), the relevance of the selected design benefits for 18 different product types were investigated. Correspondence analysis was used for the data analysis, allowing the data to be graphically presented in the form of a joint plot. The results of the correspondence analysis may be used to draw conclusions for the efficient design of an appealing product design, since individual product types can be examined in a perceptual space of design benefits. In addition, the respective product types and design benefits can be analyzed in relation to each other. Thus, the insights offer the possibility to identify consumer perceptual relationships between different product types and design benefits.

*Research article 2 “It’s not all about function: Investigating the effects of visual appeal on the evaluation of industrial products using the example of product color”* focuses on the effect of sensory design elements (here: product color) on perception of design benefits and general product evaluation in the specific context of industrial products. The results of a quasi-

experiment with 300 potential customers show that the product color influences the attitude towards the product. In addition, the results of a structural equation modeling (SEM) reveal a significant causal chain of direct and indirect effects on attitude. The most effective path leads via visual appeal and aesthetics, while haptics and functionality are of secondary importance. Based on these results, this research article provides empirical evidence for the effect of non-functional design elements such as product color on the evaluation of an industrial product. The findings provide valuable insights in this context and underline the great importance of visual appeal and aesthetics in the process of product evaluation.

*Research article 3 “Multisensory product design – An eye-tracking experiment on driving safety and product evaluation”* examines the impact of multisensory product design in the automotive context. In detail, a mixed-method experiment including eye-tracking, driving simulation, and online survey tested the effects of a newly developed (multi)sensory car display of a renowned automotive supplier on driving safety and product evaluation. The research results provide empirical evidence for the potential value of a multisensory product design as driving safety could be increased when more senses were approached. However, there was no difference in terms of product evaluation regardless of the number of senses being engaged. The primary practical implication for marketers and designers derived from these findings is to ensure that the customer efficiently recognizes the product’s benefits. Otherwise, the marketability of a new product can be in danger, despite all functional improvements that are achieved by technological progress.

*Research article 4 “Shaping consumer perception: Effects of vertical and horizontal packaging alignment on the evaluation of organic food products”* investigates the effects of different packaging alignments (vertical vs. horizontal) on consumer perception and behavior. Over the course of two studies, effects on product perception and willingness to pay in the context of organic food were analyzed. The results of a mediation analysis indicate that a change in packaging alignment can affect consumers’ willingness to pay. Importantly, this effect is mediated by utilitarian value perception. Horizontal packaging evokes a higher utilitarian value perception as a consequence of enhanced efficiency when processing the packaging visual cues (e.g., utilitarian claims) horizontally and thus a higher willingness to pay. The findings emphasize the relevance of an efficient perception of design benefits supported by the packaging design for the consumer’s willingness to pay.

## **2.2. Module 2: Sensory design elements and design benefits in the context of communication design**

Since the relevance of efficiently communicating product-related design benefits to the consumer was highlighted in module 1, the research articles of module 2 deal with the influences of sensory design elements in communication design on the consumer's perception of design benefits. Research articles 5 – 7 focus on the field of advertising design and examine potential ways to support the perception of product design benefits by means of communication activities in several application areas. In Addition, research article 8 concentrates on another important communication tool in marketing, the brand logo. In particular, this research article examines the relationship between brand logo design and product design inferences.

*Research article 5 “How to best promote my product? Comparing the effectiveness of sensory, functional and symbolic advertising content in food marketing”* examines the effectiveness of advertising content comprising text (sensory, functional and symbolic messages) and pictures (product image) on product evaluation. In the context of food products, two online experiments were conducted to determine any significant differences among various advertisement texts and among the combinations of text and pictures. Importantly, the data analysis indicated that advertising effectiveness increases with the complementarity of the text and picture. The findings provide new insights into advertising design that food firms can use to enhance consumer product evaluations in terms of expected taste, perceived experience and quality, overall attitude and purchase intention.

*Research article 6 “Sensory stimuli in print advertisement – Analyzing the effects on selected performance indicators”* explores the potential utility of sensory stimuli in advertising design. In a laboratory experiment, the effects of a multisensory appealing print advertisement on selected marketing performance indicators (e.g., perceived product design) were tested. The results show that the congruent approach of different sensory modalities can have a positive influence on marketing-related outcome variables. Additionally, the study provides new insights into the effects of both explicit and implicit sensory perception on perceived product design, brand experience, brand perception, and consumer behavior. Beyond that, it could be shown that perception of product design functions as a mediating factor between the sensory stimulation and the consumer's response.

*Research article 7 “Sensory imagery in advertising: How the senses affect perceived product design and consumer attitude”* investigates the effects of sensory imagery in the context of advertisements on marketing related key performance indicators (i.e., sensory perception, perceived product design, and attitude), while also exploring the underlying causal relationships between these potential market success factors. Findings based on analysis of variance (ANOVA) and SEM affirm the usefulness of sensory imagery in advertising, as it offers a valuable approach to engage certain senses and positively influence consumer perception. In addition, the results reveal a causal chain of several direct and indirect effects between relevant performance indicators. Implications for marketing managers can be derived from this study on how to design powerful advertisements by utilizing sensory imagery that may help to efficiently communicate the actual design benefits of a product to the potential consumer.

*Research article 8 “Brand logo symmetry and product design: The spillover effects on consumer inferences”* examines the impact of brand logo symmetry on the consumer’s product design inferences. In the course of three studies, the effects of symmetry on logo perception, logo liking, and product design inferences were tested. The results show that asymmetry in objects leads to lower perceptual fluency and higher arousal. Moreover, in line with self-congruity theory, consumers with a more exciting self-concept have a stronger tendency to like an asymmetric brand logo as it creates higher arousal and thus higher excitement. Furthermore and in accordance with the concepts of attitude-based inferences and spillover effects, the findings of moderated-mediation analysis indicate that consumers with a more exciting self-concept are more likely to make more positive product design inferences (in terms of aesthetics, functionality, and symbolism) based on an asymmetric brand logo than based on a symmetric brand logo. One key insight from this research is that marketers should consider the importance of their target group’s self-concept when planning the design of a brand logo. Awareness of potential brand logo associations can serve as a basis for the creation of a target-group-specific design and thus, may enable marketers to avoid logos with unintended meanings and effects.

### **3. Conclusion and implications**

#### **3.1. Main contributions**

This dissertation provides several contributions for a more comprehensive understanding of the relevance of design in consumer research and marketing management. Based on the defined research objectives, the main contributions of this thesis are twofold.

First, new insights on the impact of sensory design elements and design benefits on consumer perception and behavior could be gained. In particular, it could be shown that individual sensory design elements (e.g., visual, acoustic, and haptic cues) can have a significant influence on the perception and evaluation of different product designs in the consumer and industrial goods sector. Furthermore, significant causal relationships between sensory design elements and perceived design benefits could be confirmed empirically, such as a significant impact of product color on the evaluation of industrial goods as well as the influence of packaging alignment on utilitarian value perception of organic foods. In addition, this thesis provides novel insights into the relevance of design benefits for consumer behavior. The results empirically support the high relevance of design benefits for consumer behavior in general and allow a differentiated consideration of the importance of design benefits for various customer segments.

Second, the importance of efficiently communicating product design benefits is highlighted in this dissertation. In particular, the results of the thesis provide new insights with respect to a target-oriented design of communication activities in marketing. In fact, the findings suggest that there are several ways in communication design to influence the perception of product design benefits. In the context of advertising design, it could be shown that the perceived product design benefits can be influenced by the targeted use of sensory product-extrinsic design elements. Both direct sensory appeal and indirect sensory appeal (through sensory imagery) may influence perception of product design. In addition, the results demonstrate that the perceived benefits of product design cannot only be influenced by advertising efforts, but also by other instruments of marketing communication, such as the design of the brand logo. In this respect, a significant relationship between brand logo design and product design inferences could be confirmed for different product types.

### **3.2. Implications for management practice**

The present findings of this dissertation also have various important managerial implications, because only companies that understand the impact of different factors in product design are able to make the most of them and create a product design that can add significant value to their business. First and foremost, marketers may use the insights to more effectively address customer needs through product design. Since the relevance of design benefits can be very product-specific, it can be useful from an economic point of view to focus on the product design benefits that are most important from the customer's point of view. The specific modification of certain sensory design elements allows to intensify the perception of those product design benefits that have the highest relevance for consumer behavior. For instance, the targeted use of visual design elements such as product color or product packaging alignment can have a significant influence on the perception of product design benefits and thus decisively influence a potential purchase decision. Second, also non-visual sensory design elements may be used to influence the perception of the product design. However, it has to be taken into account that the sensory cues can have both individual effects as well as interaction effects on the consumer's perception. Third, while creating an excellent product design is important in itself, it is also essential to consider and design the perceivable environment of the product design. The design of supporting product-extrinsic communication elements is therefore also of very high practical relevance. An effective interplay between product and communication design can have a decisive advantage when it comes to presenting product benefits and can thus lead to a positive attitude towards the product and a desired consumer behavior. Fourth, the findings of this thesis with regard to the design of communication instruments such as advertisements and brand logos provide practical guidance on how specific design elements (e.g., advertising text, product images, and symmetry in brand logos) can influence the perception of product design benefits. Marketers should consider that perceived product design benefits can be altered by both the explicit and implicit perception of sensory stimuli. In line with this, directly experienced sensory sensations, but also indirectly experienced sensory sensations via sensory imagery, significantly affect the communication process of product design benefits. Finally, these practical implications do not only apply to profit-oriented businesses, but also offer rich application potential for non-profit communication activities. For example, the results could be used to specifically highlight social, health-related, and ecological public issues and may help to communicate proposed solutions more effectively.

### **3.3. Implications for future research**

The findings of this dissertation extend the existing literature on the role of design benefits in marketing. Based on these new insights, this thesis also serves as a basis for future research activities in this field. To extend the understanding of the relevance of design benefits for consumer behavior constantly, future studies should investigate even more different product types. In particular, the identified effects, such as the influence of product color on the perception of industrial goods, could be tested with other goods from this product segment. Extending this line of reasoning, it may also be insightful to replicate the studies in different contexts as well as including more diverse sensory design elements (e.g., different color variations). Furthermore, the knowledge with regard to the consumer's perception of product design benefits could be further increased if studies were to focus more on consumer personality traits in the future. Findings from such studies could help to form consumer segments, on which basis the design of products could become more target-oriented. Moreover, further product-extrinsic factors that relate to the potential contextual environment of product design presentation can be considered in the future. This dissertation mainly focused on advertisements and brand logos as important product-extrinsic factors in this relation, although there are other aspects such as store atmospherics and website design that might be worth investigating. Lastly, subsequent studies are encouraged to include both the conscious and unconscious levels of perception more closely in their investigations. For instance, it may be more important for the success of some products that the product design unfolds positive effects especially through unconscious perception. By including both levels of perception, possible underlying relationships may be revealed in this context. In principle, future research that follows these implications can help to better understand the role of design in marketing.



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## Research articles

### Module 1: Sensory design elements and design benefits in the context of product design

- A1. **Bettels, J.**, & Wiedmann, K.-P. (2019). Taking a closer look at the relevance of design benefits for product choice from an international perspective: A correspondence analysis. Article accepted for presentation at the Global Brand Conference 2019 (Special Issue Journal of Marketing Management), Berlin, May 8-10.
- A2. Wiedmann, K.-P., Haase, J., **Bettels, J.**, & Reuschenbach, C. (2019). It's not all about function: Investigating the effects of visual appeal on the evaluation of industrial products using the example of product color. *Journal of Product and Brand Management*, 28(1), 15-27.
- A3. Wiedmann, K.-P., Haase, J., & **Bettels, J.** (2018). Multisensory product design – An eye-tracking experiment on driving safety and product evaluation. *transfer – Werbeforschung & Praxis*, 64(4), 6-13.
- A4. **Bettels, J.**, Wiedmann, K.-P., & Haase, J. (2018). Shaping consumer perception: Effects of vertical and horizontal packaging alignment on the evaluation of organic food products. *Journal of Customer Behaviour*. Submitted and under review.

## **Module 2: Sensory design elements and design benefits in the context of communication design**

- A5. Haase, J., Wiedmann, K.-P., **Bettels, J.**, & Labenz, F. (2018). How to best promote my product? Comparing the effectiveness of sensory, functional and symbolic advertising content in food marketing. *British Food Journal*, 120(8), 1792-1806.
- A6. Labenz, F., Wiedmann, K.-P., **Bettels, J.**, & Haase, J. (2018). Sensory stimuli in print advertisement – Analyzing the effects on selected performance indicators. *Journal of International Business Research and Marketing*, 3(2), 7-15.
- A7. Haase, J., Wiedmann, K.-P., & **Bettels, J.** (2018). Sensory imagery in advertising: How the senses affect perceived product design and consumer attitude. *Journal of Marketing Communications*, forthcoming.
- A8. **Bettels, J.**, & Wiedmann, K.-P. (2019). Brand logo symmetry and product design: The spillover effects on consumer inferences. *Journal of Business Research*, 97, 1-9.

**A1:**

**Taking a closer look at the relevance of design benefits for product choice from an international perspective: A correspondence analysis**

Jannick Bettels

Klaus-Peter Wiedmann

*Global Brand Conference 2019*

*(Special Issue Journal of Marketing Management)*

Accepted for presentation

## **Taking a Closer Look at the Relevance of Design Benefits for Product Choice from an International Perspective: A Correspondence Analysis**

**Keywords:** Product design, Design benefits, Product branding, International consumer behavior, Correspondence analysis

### **Purpose**

It has been known for some time that design can be an important strategic instrument for companies and brands (Bloch, 1995; Kotler and Rath, 1984). However, only in the recent past has it become apparent that many companies now actually regard design as a central marketing strategy rather than just a small step in the product development process (Jindal *et al.*, 2016). Today, design is mostly considered to be an instrument to gain a competitive advantage over competitors and to ensure market success (Moon *et al.*, 2015). In particular, an appealing product design offers the opportunity to positively differentiate the company's own products in a broad mass of products with similar qualities and features (Homburg *et al.*, 2015). In order to create an appealing product design, not only knowledge from design theory, but also information about the perception of design from the customer's point of view is of fundamental importance (Fenko and van Rompay, 2018; Luchs *et al.*, 2016). Accordingly, the demand of academics and practitioners for new insights about the influence of product design on consumer behavior has increased significantly. Especially, insights into ways of increasing the value of products and brands through design elements are of great interest (Kumar and Noble, 2016; Ulrich, 2011). As there is a close product-brand relationship in customers' perception, a design-induced increase in product value can also be transferred to the respective brand and thus can have a positive effect on brand equity (Franzak *et al.*, 2014; Mishra, 2016). With regard to the design-based value generation of products, various forms of design benefits can be found in the research literature. According to recent research findings, design benefits may in principle be of aesthetic, functional and symbolic value. (Beverland *et al.*, 2017; Candi *et al.*, 2017; Homburg *et al.*, 2015). The functional value can be subdivided into aspects such as perceived quality or performance, durability or reliability and ergonomics or ease of use (Creusen and Schoormans, 2005; Creusen *et al.*, 2010; Moon *et al.*, 2015). Furthermore, the symbolic value can be classified into self-identification as well as social and altruistic self-expression (Franzak *et al.*, 2014; Kumar and Noble, 2016). However, research in this area often concentrates on specific product types, consumer segments or design benefits to specifically

investigate certain effects and relationships (e.g., Chitturi *et al.*, 2008; Creusen *et al.*, 2010; Jindal *et al.*, 2016). This results in a relatively high number of calls for more extensive studies that examine the relevance of different facets of design benefits (e.g., Candi *et al.*, 2017; Creusen, 2011) for different product groups (e.g., Homburg *et al.*, 2015; Creusen *et al.*, 2010; Creusen and Schoormans, 2005), while including consumers from different countries (e.g., Jindal *et al.*, 2016; Luchs *et al.*, 2016). The purpose of this paper is to take up these research calls and to provide an overview of the relevance of different design benefits for product choice applying an explorative research approach in an international context.

## **Methodology**

We conducted an online study with three different countries of origin (Germany, United Kingdom and Italy) to investigate the relevance of design benefits for product choice. The total sample size of the study was  $n = 555$  ( $M_{age}$ : 33.6; 60% females), with 340 respondents coming from Germany, 118 from the United Kingdom and 97 from Italy. Participants were asked to rate the importance of different design benefits for the choice of specific product types on five-point scales (1 = not really important; 5 = very important). In order to include a large number of different product types in the study, which also represent the consumer goods market in the respective countries possibly well, a standardized classification was made on the basis of common product segmentation characteristics. First, a classification was made with regard to durable and non-durable consumer goods. Three further subgroups were then formed for all segments, each including a further three relevant product types (see table 1). Every participant was randomly assigned to rate all durable or all non-durable consumer goods (i.e., a total of nine different product types) in succession to ensure that the length of the questionnaire was still adequate. The relevance of the design benefits (i.e., aesthetics, performance, durability, ease of use, self-identification, social self-expression and altruistic self-expression) was operationalized via single-item measurements. The respective items were strictly based on already established scales (e.g., Homburg *et al.*, 2015; Kumar and Noble, 2016; Moon *et al.*, 2015) and successfully tested for comprehensibility in a pre-test ( $n = 33$ ). For data analysis we applied correspondence analysis (CA). CA is especially recommended for explorative research (Hair *et al.*, 2010; O'Brien, 1993). Moreover, CA can generate a perceptual map that allows to identify structural similarities and differences between the considered variables (Opoku *et al.*, 2006). Since our data were measured using rating scales, the data were prepared for data analysis according to the recommended doubling procedure (Greenacre, 2017).

**Table 1.** Product types.

<b>Segment</b>	<b>Product category</b>	<b>Product type</b>
Durable goods	Clothing products	Clothing
		Shoes
		Accessories
	Household & furniture	Furniture
		Small appliances
		Large appliances
Consumer electronics	Televisions	
	Laptops	
	Smartphones	
Non-durable goods	Beverages	Mineral water
		Juices
		Softdrinks
	Food products	Meat products
		Dairy products
		Snacks & Candy
	Cosmetics & body care	Body care products
		Oral care products
Perfumes		

## Findings

First, the result of the chi-square test ( $\chi^2 = 9819.98$ ;  $p < 0.001$ ) confirmed that there is indeed a significant relation between the relevance of design benefits and the choice of different product types. For determining the dimensionality of a solution, it is recommended to keep the number of dimensions to be extracted from the CA considerably low to minimize possible presentation and interpretation issues. In addition, the dimensions of the solution should also have high explanatory value with regard to the variance of the data. Therefore, the eigenvalue and explained variance of each dimension may be considered (Berthon *et al.*, 1999; Greenacre, 2017). In our case, dimension 1 has an eigenvalue of 0.21 and accounts for 64.4% of the cumulative solution. Furthermore, dimension 2 shows an eigenvalue of 0.14 and explains 27.6% of the variance. As dimension 3 only provides an additional explanatory value of 5.2%, we opted for a two-dimensional solution. This solution accounts for 92% of the total variance.

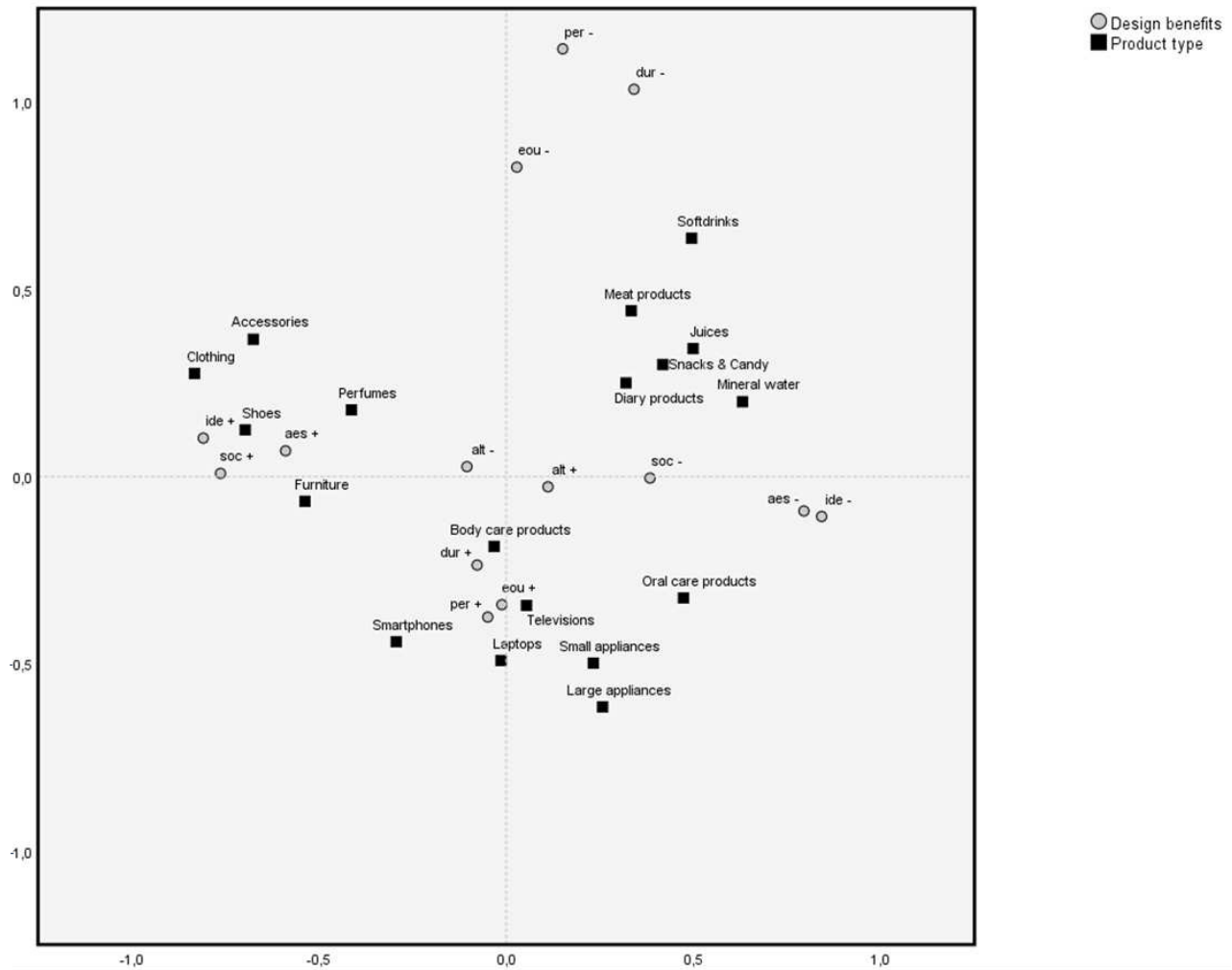


Next, the relative contribution of each design benefit to the dimensions 1 and 2 was examined to be able to interpret the specific characteristics of the two dimensions. Dimension 1 is explained in particular by the design benefits aesthetics (31.5%), self-identification (45.7%) and social self-expression (19.7%). By contrast, dimension 2 is determined by the three functional design benefits ease of use (31.4%), performance (44%) and durability (25.1%). The altruistic self-expression fails to considerably contribute to either of the two dimensions. Additionally, altruistic self-expression is the only design benefit with a cumulative total of variances explained by a point along the two dimensions below the general 50% criterion that should be applied for a meaningful interpretation (Hair *et al.*, 2010).

These described contributions of each design benefit are also reflected in the joint plot of the CA, which is shown in figure 1. When interpreting a CA joint plot of rating scales the negative and positive attributes of each characteristic are displayed as two different points. If a positive attribute is closer to the origin than the negative attribute, the mean rating for that attribute is relatively high and vice versa. In addition, the distance between the two poles is a measure of the attribute's variance (Torres and van de Velden, 2007). It is important to note that only relative relationships between product types and the relevance of design benefits are reflected by the dimensions. A point that is further away from the origin does not necessarily indicate a higher absolute value along one dimension. The distance from the origin rather corresponds with a greater deviation from the average (Lee and Bradlow, 2011).

Because a detailed discussion of the joint plot results would be beyond the scope of this conference article, we focus on a number of selected general aspects. When assessing the position of the various product types in the joint plot, it is evident that design benefits tend to be more relevant for durable consumer goods. Food products and beverages are located exclusively in the upper right quadrant, which suggests a lower relevance of the design benefits relative to the other product types. However, the product types of the other category of non-durable consumer goods, that is cosmetics and body care, are more widely distributed in the perceptual map. The position of perfume is relatively close to that of products from the clothing products category and furniture, which all reveal a relatively high relevance with respect to the design benefits aesthetics, self-identification and social self-expression. In contrast, body and oral care products are located much closer to consumer electronics and small and large household appliances. For these product types, the functional design benefits have the relatively highest relevance.

**Figure 1.** Joint plot of design benefits and product types.



Note. aes = aesthetics, per = performance, eou = ease of use, dur = durability, ide = self-identification, soc = social self-expression, alt = altruistic self-expression

### Implications & Originality

The results of this study provide original and valuable implications for theoretical research and practitioners. First, the results greatly contribute to the research stream of value-based design. In particular, these results may lead to a more comprehensive understanding of the relevance of design benefits for consumer behavior. In addition, the results provide a fundamental basis for further research opportunities such as more detailed investigations of possible differences between specific product types with respect to selected design benefits.

As the results of this study offer a detailed overview of the relevance of design benefits in product choice, practitioners may also build on these findings in several ways. The application of CA allows to examine individual product types in a perceptual space of design benefits and to draw conclusions for the efficient creation of an appealing product design. Furthermore, the respective

product types and design benefits can be analyzed in relation to each other. In this way, differences and similarities between these aspects can be identified with regard to consumer perception. Such findings are particularly relevant from a practical point of view, as it is often not possible to optimally design a product in relation to all design benefits. Rather, it is advisable to concentrate on those design benefits that have the highest relevance from the customer's point of view.

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**A2:**

**It's not all about function: Investigating the effects of visual appeal on the evaluation of industrial products using the example of product color**

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**It's not all about function: Investigating the effects of visual appeal on the evaluation of industrial products using the example of product color**

**Abstract**

**Purpose** – Industrial markets are generally associated with objective decision-making in which rational and functional product benefits are central. Recently, however, subjective aspects of decision-making, such as visual appeal, are attracting research attention. The aim of this paper is to examine, first, the effect of product color as a non-functional design element on attitude toward the product and, second, the underlying causal relationships of this effect, in the context of industrial products.

**Design/methodology/approach** – The authors conducted an online quasi-experiment in the dental market with a sample of 300 dentists. The product stimulus was a picture of a treatment chair that varied in color. An analysis of variance tested the effect of product color on attitude. Structural equation modeling investigated the underlying effects of product evaluation.

**Findings** – The results indicate that product color affects attitude toward the product. Further, the authors find an insightful causal chain of direct and indirect effects on attitude. The most effective path runs via visual appeal and aesthetics, while haptics and functionality are of minor importance.

**Originality/value** – This paper is one of the first to provide empirical evidence for the effect of non-functional design elements such as product color on the evaluation of an industrial product. The results provide valuable insights into the effects on attitude in this context and stress the great importance of visual appeal and aesthetics in the product evaluation process.

**Keywords:** product management, product evaluation, visual appeal, sensory perception, product design, aesthetics, functionality, symbolism, attitude, color, industrial products

**Paper type:** Research paper

## Introduction

Industrial markets are generally associated with rational customer behavior and objective decision-making [1], where hard facts, such as expected return of investments, cost reduction, and functional product features, are of primary importance (Bonoma and Johnston, 1978; Moon and Tikoo, 2002). However, whether decision-makers are acting for themselves or for a firm, they are nevertheless individual people, and as such, even the most rational are affected by their own subjective perceptions (Kotler and Pfoertsch, 2006; Leek and Christodoulides, 2011). Therefore, to succeed in competition, companies in industrial markets should not only consider rational concerns but also address emotional aspects and individual preferences (Lynch and De Chernatony, 2004). Recent research in the context of consumer goods has highlighted the importance of sensory design elements in effectively appealing to the consumer and increasing the overall product evaluation (Krishna, 2012). The impact of product color is especially well-documented in consumer research literature. Even though product color generally provides no functional value, it often represents a main driver of the consumer's product-related emotions and hedonic value (Labrecque *et al.*, 2013). Accordingly, the use of sensory cues, such as product color, to evoke positive emotions and increase value and sales may also be a promising approach for companies in the industrial market (Noad and Rogers, 2008; Soars, 2009).

There is, however, little empirical foundation for the importance of such soft facts with regard to customers' decision-making in an industrial context (Visentin *et al.*, 2015; Wolter *et al.*, 1989). For instance, there is little insight into the effects that a product's sensory appeal and design benefits have on a customer's evaluation of an industrial product, even though these factors are essential for the evaluation of consumer goods (Homburg *et al.*, 2015; Krishna, 2012). As industrial products are generally not intended to provide any specific aesthetic or symbolic value to the customer (Bingham and Raffield, 1990), there is a great

need for research that investigates how these factors might still influence customers' decision-making (Yamamoto and Lambert, 1994). For instance, Chitturi *et al.* (2008) call for further investigations on the effects of hedonic design elements in the context of industrial products. Additionally, Hansen *et al.* (2008) and Mencarelli and Riviere (2015) stress the importance of including non-rational dimensions to the assessment of the customer's perceived value in business-to-business markets. Thus, this paper addresses these calls and contributes to the stream of industrial product perception research by specifically focusing on the impact of non-functional product elements in the context of industrial markets.

The objectives of this paper are (1) to examine the effect of product color as an exemplary visual and hence non-functional design element on attitude toward the product and (2) to explore the underlying effects by taking into account the causal relationships between visual and haptic appeal, aesthetics, functionality, symbolism, and attitude toward the product in the context of industrial markets. For this purpose, the authors conducted a quantitative study in the dental market as a specific industrial application area with a treatment chair as the industrial product under investigation. The dental market represents a good example of the still-growing medical sector with professional decision-makers in small and medium-sized organizations (Calnan *et al.*, 2000; Kent, 1984). As such, it might also serve as a good example for highly educated decision makers in small- and medium-sized organizations in other industries.

The paper is organized as follows. The next chapter presents the literature review, outlines the included constructs and provides the research hypotheses. The subsequent section describes the methodology of the empirical study. Then, an analysis of variance (ANOVA) and partial least squares structural equation modeling (PLS-SEM) yield the findings. Finally, the paper provides a discussion and implications followed by the study's limitations and recommendations for further research.



## Literature review and hypothesis development

### *Effect of product color*

Managers and researchers alike have long realized the relevance of color as one of the most important visual design elements in marketing. With regard to the term, it is necessary to note that “color” is composed mainly of three different dimensions: hue, saturation and value (Hagtvedt and Brasel, 2016; Hynes, 2009; Labrecque *et al.*, 2013). As most consumer studies focus on hue (Bagchi and Cheema, 2012; Mehta and Zhu, 2009), this paper follows this proven approach as a first step in investigating the effects of product color in the context of industrial products. Researchers have also studied the impact of color in different marketing areas of consumer goods, such as branding (Bottomley and Doyle, 2006; Labrecque and Milne, 2012), advertisement (Lohse and Rosen, 2001; Meyers-Levy and Peracchio, 1995), atmospherics (Lee *et al.*, 2018; Spence, 2018), and product and packaging design (Mead and Richerson, 2018; Rebollar *et al.*, 2012; Zampini *et al.*, 2008). In the context of consumer goods, color plays a significant role in the product evaluation process. Several studies have shown the effects of color on the overall perception of a product, for example, in terms of attitude toward the product (e.g., Guido *et al.*, 2017; Silayoi and Speece, 2007). These overall judgments are often explained by fluency theory, which states that a color that fits a certain product or brand leads to reduced mental perceptual effort and therefore to a higher probability of liking such products or brands (De Bock *et al.*, 2013). Moreover, the choice of product color often significantly affects the visual appeal of a product and can further create specific associations in the consumer’s mind. A more attractive appearance or liked associations can contribute to a more positive attitude toward a product for the consumer. (Deng *et al.*, 2010). According to these described premises, color is often linked to emotion and affect rather than cognition and rationality (Gilbert *et al.*, 2016). Hence, the effect of color on attitude toward a product strongly relates to a person’s subjective perception and

preference (Spence and Wan, 2015). Thus, to provide a better understanding of the relevant underlying factors in the product evaluation process of consumer goods, some researchers have investigated the impact of color on different aspects of perception, such as sensory appeal (e.g., Piqueras-Fiszman *et al.*, 2012; Szocs and Biswas, 2013) and perceived product design (e.g., Madzharov *et al.*, 2016; Rebollar *et al.*, 2012). However, given that most research on color focuses on consumer goods, the question arises: are similar effects of such non-functional design elements on product evaluation also present in the context of industrial goods (Chitturi *et al.*, 2008)? From a traditional point of view, functional product benefits are crucial for industrial product evaluation (Bonoma and Johnston, 1978). Accordingly, a non-functional product benefit, such as the product color, would be of minor importance. Nevertheless, recent research on value perceptions of business customers highlights the importance of aspects such as product appearance and emotions, which gives reason to assume that color as a non-functional product benefit still has an essential impact on the product evaluation process. Mencarelli and Riviere (2015) note in this context that although there are differences between B2C and B2B customer behavior, several aspects overlap. Studies by Flint *et al.* (2002) and Prior (2013), for example, emphasize the importance of emotional aspects for customer value perception in the business-to-business context. Boksberger and Melsen (2011) argue similarly that affect-related aspects such as pleasure and arousal are important factors for the perceived value of business customers. Moreover, Yamamoto and Lambert (1994) provided the first evidence that product appearance has an impact on the evaluation of industrial products. In addition, the existence of a symbolic value was also proposed for products in industrial markets (Lindgreen and Wynstra, 2005). Accordingly, the use of different colors in business-to-business advertising has been empirically investigated and the results point to a similar potential as in consumer goods advertising (Clarke and Honeycutt, 2000).

As a result, the authors assume the following:

H1. Product color has an effect on attitude toward the product in the context of an industrial product.

### *Underlying effects of product evaluation*

As product color is perceived via the visual sense, color as a visual stimulus closely relates to visual perception and visual appeal. In this regard, a favored product color may lead to higher visual appeal. Moreover, the visual sense can also influence other sensory modalities, for example, by sensory imagery or through the occurrence of cross-modal correspondences (Elder *et al.*, 2017). In particular, the perception of a product's haptic properties is closely related to visual perception (Raghubir and Krishna, 1999). In the case of this paper's study and research focus, visual and haptic cues are most relevant, as the target product of the quasi-experiment was a picture of a dental treatment chair. Based on insights from gestalt theory and design research, consumers tend to organize and interpret objects as a result of the sensory perception process (Veryzer, 1999). These higher order constructs, such as the perceived aesthetics of a product, closely relate to the overall evaluation of a product in terms of attitude toward the product (Orth and Malkewitz, 2008). The following sections will explain these outlined causal relationships in detail.

*Effect of visual appeal on haptic appeal.* Recent research on the topic of sensory appeal gives evidence for the consumers' ability to transfer a sensory experience from one sensory modality to another. There are a rising number of studies that focus on the relationships between different sensory modalities, that is, exploring the research field of cross-modal correspondences (Spence, 2011). Given that the first contact with a product or brand is mostly visual by nature, prior studies have focused on the transfer of visual stimuli to other sensory modalities. Research from this field has then confirmed the consumers' ability to mentally imagine various sensory properties of a product by just seeing it (Aydinoğlu and Krishna,

2011; Cardello, 1996; Underwood *et al.*, 2001). A strong connection between visual and haptic appeal is empirically well-confirmed and is thus increasingly important in evaluating most tangible products (e.g., Alexander and Shansky, 1976; Deng and Kahn, 2009; Krishna, 2006; Raghubir and Krishna, 1999; Xu and Labroo, 2014). In this context, visual cues tend to influence haptic experiences (Krishna, 2012; Piqueras-Fiszman and Spence, 2015). Thus, the authors assume:

H2. Visual appeal has a positive effect on haptic appeal.

*Effects of visual and haptic appeal on product design.* Moreover, as multisensory perception leads to a holistic perception of a stimulus, perceived product design represents a further underlying factor in the evaluation process (Schifferstein and Desmet, 2008). Product design comprises constitutive elements of a product that consumers perceive and organize as a multidimensional construct comprising aesthetics, functionality, and symbolism (Homburg *et al.*, 2015). All three dimensions contribute to the overall evaluation. Aesthetics refers to the level of perceived beauty (Desmet and Hekkert, 2007), functionality indicates the utilitarian value (Bloch, 2011), and symbolism represents the perceived meanings of a product's design (Creusen and Schoormans, 2005). There is strong evidence of relationships between sensory design elements (e.g., product color) and all three dimensions of product design. During the perception process, consumers aggregate sensory design elements into more complex components (design benefits), which transmit specific characteristics to the consumer (Orth and Malkewitz, 2008). Empirical work in this area suggests relationships between visual perception and all three dimensions of product design, that is, perceived aesthetics (Patrick, 2016; Sharma, 2018; Veryzer and Hutchinson, 1998), functionality (Hoegg *et al.*, 2010; Hoegg and Alba, 2011), and symbolic meaning of a product (Aslam, 2006; De Bock *et al.*, 2013). Moreover, there is also evidence of a relationship between a product's haptic properties and its perceived aesthetics (Argo *et al.*, 2008; Becker *et al.*, 2011), functionality

(Peck and Childers, 2003), and symbolic meaning (Krishna and Morrin, 2008). Therefore, the authors suggest:

H3. Visual appeal has a positive effect on product design in terms of (a) aesthetics, (b) functionality, and (c) symbolism.

H4. Haptic appeal has a positive effect on product design in terms of (a) aesthetics, (b) functionality, and (c) symbolism.

*Effect of product design on attitude.* Practitioners and researchers have recognized that product design is an important factor when evaluating a product and therefore impacts its success in the marketplace (Bloch, 1995; Page and Herr, 2002). Generally, all products comprise characteristics of all three product design dimensions (i.e., aesthetics, functionality, and symbolism). Accordingly, all three dimensions should have an impact on the overall evaluation in terms of the attitude toward the product (Homburg *et al.*, 2015). The authors follow the definition of Schmitt (2012), describing attitude as “psychological tendencies to evaluate objects along a degree of favor or liking”. Researchers have already addressed the effects of product design on attitude and found evidence for strong relationships between each design dimension and consumer attitudes (e.g., Becker *et al.*, 2011; Brunner *et al.*, 2016; Homburg *et al.*, 2015; Luchs and Swan, 2011). Consequently, the authors propose:

H5. Product design in terms of (a) aesthetics, (b) functionality, and (c) symbolism has a positive effect on attitude toward the product.

Figure 1 shows the structural model including all the underlying effects mentioned in H2-H5.

Insert Figure 1 about here.

## Methodology

### *Pre-test*

First, the authors conducted a pre-test to increase the quality of the data collection for the main study (Hunt *et al.*, 1982). The main objective was to obtain preliminary information on color preferences in the specific group of dentists. In this regard, a specific and primary aim was to identify the most relevant product colors in the given context – that is, colors that are perceived positively by the target group and that might thus be relevant for product choice. Therefore, the authors conducted an online quasi-experiment with 300 dentists (see Table 1). The sample ranged in age from 27 to 68 years with the average age at 49.4 years, consisted of 41% female and 59% male dentists, and included dental offices with an average of 3.3 treatment chairs.

Insert Table 1 about here.

In addition to sociodemographic attributes and working conditions, the questionnaire presented a color palette from which the subjects could choose their favorite color with regard to the design of dental products. The results show that blue is the most popular color (42.3%), followed by gray (18.7%), and green (15.0%). The results coincide with existing works on general consumer preferences that state that blue is most commonly the favorite hue, often followed by green (Crozier, 1999; Madden *et al.*, 2000). In addition to the dentists' personal preferences, the contextual effects and meanings of colors are important to consider. Cool colors such as blue are calming, whereas warm colors are arousing and, in the case of red, often associated with danger or blood (Grossman and Wisenblit, 1999; Walters *et al.*, 1982). Thus, blue and green appear to be especially relevant for the given case. As a neutral color, the authors additionally consider gray for the main study. In conclusion, the choice of the three product colors in the main study is grounded by relevant literature on color perception and is supported by a context-specific pre-test.

### *Measures*

The main study included six variables (i.e., visual appeal, haptic appeal, aesthetics, functionality, symbolism, and attitude). Thus far, marketing literature has been lacking an integrated measurement concept for the consumer's sensory appeal enabling a uniform measurement of the five senses. Haase and Wiedmann (2018) recently developed the sensory perception item set (SPI) to close this gap. The SPI, established by successive scale development relying on literature review and expert interviews, contains the most expressive adjectives to describe how well a product appeals to the consumer's five senses. Factor analyses and the computation of Cronbach's alpha tested the SPI in several different contexts, which all confirmed the validity and reliability. Thus, to measure sensory appeal, the authors used the items from the SPI to capture visual appeal (e.g., attractive) and haptic appeal (e.g., comfortable). For the measurement of the three dimensions of product design, the scale of Homburg *et al.* (2015) was applied. To capture attitude toward the product as a general evaluation of the product, the authors used a single item ("I think the product is good") based on Low and Lamb (2000) as recommended by Derbaix (1995) and performed by several researchers such as Burke and Edell (1986), Burton and Lichtenstein (1988), and Park and Young (1986). Further, per Bergkvist and Rossiter (2007), in the case of attitude, single-item measures are equally as valid as multiple-item measures and reduce respondent refusal and data collection costs. Finally, all of the items were rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Table 2 shows the measurement items for all six variables.

Insert Table 2 about here.

### *Data collection and sample*

The authors conducted an online quasi-experiment with three conditions – a gray-, blue-, and green-colored stimulus. The product stimulus was a dental treatment chair in one of the three

colors. When conducting an experiment, two objectives are of central concern: (1) internal validity, which ensures that any change in the dependent variable is due to the manipulation of the independent variable, and (2) external validity, which determines that the observed causal relationship can be generalized to the real world (Aaker *et al.*, 2001; Babin and Zikmund, 2016; Burns and Bush, 2014; Malhotra *et al.*, 2013). For internal validity, the authors made sure that product color was the only aspect that varied from subject to subject. For all subjects, the same picture of the treatment chair was used, just varying in the color of the upholstery. Thus, all other aspects (e.g., shape, size, materials) were controlled. In addition, the authors chose a homogeneous sample (only German dentists with similar working conditions). Further, empirical research in an industrial context is specific to the people who operate in a particular business area. Consequently, for external validity, the sample for this study is composed exclusively of dentists, as they are the decision-makers and thus the relevant customer group in the dental market. Moreover, through cooperation with one of the largest manufacturers of dental products, the authors were able to use a realistic product picture, which could also be used in the real world on a homepage or in an online shop. The treatment chair represented a standard product in terms of shape, size, materials etc. The product and the picture were detached from brand-identifying elements to avoid biased results due to brand associations.

The questionnaire was structured in the following way. First, the participants answered some introductory questions concerning their working conditions (e.g., size of practice location, number of treatment chairs). After that, an image of the treatment chair was shown according to random selection, either with gray-, blue- or green-colored upholstery. The authors decided on that particular product stimulus due to its central importance in all dental offices. Subsequently, the participants evaluated the presented product with regard to visual and haptic appeal, the three product design dimensions (i.e., perceived aesthetics, functionality, and symbolism), and attitude toward the product. Finally, sociodemographic



characteristics were captured. In total, the sample consisted of 300 dentists (see Table 3). The dentists' age ranged from 32 to 70 years, with the average age at 44.9 years. Further, gender distribution was almost even (52.7% female, 47.3% male). In addition, the majority worked in a single practice (80.7%), were located in a small town (28.7%), and did not employ dental technicians (88.7%). Finally, the dental offices had an average of 3.4 treatment chairs.

Insert Table 3 about here.

### *Data analysis*

The authors test the first hypothesis H1 – assuming a significant difference between the three groups in their attitude toward the product – by a one-way ANOVA using SPSS 24. Here, the authors investigate the F- and p-values that indicate the significance of the tested differences as well as the means and standard deviations that reveal the magnitude of the differences.

Hypotheses H2 to H5 – postulating the underlying effects between sensory appeal, product design, and attitude – are tested by structural equation modelling (SEM). The structural model, as shown in Figure 1, has not been sufficiently tested in the marketing literature; with specific regard to the context of industrial products, it represents a new phenomenon. In addition, the SPI measurement concept is quite novel. Consequently, the authors decided to take the partial least squares (PLS) approach (Chin and Newsted, 1999) applying SmartPLS 2.0. Following the two-step approach recommended by Henseler *et al.* (2009), the authors first evaluated the measurement models, followed by the structural model. The first step checks for validity and reliability based on relevant quality criteria. As all measurement models are reflective, the authors follow the recommendations of Hair *et al.* (2012) and examine factor loadings, the average variance extracted, the Fornell-Larcker criterion, cross loadings, and the composite reliability. The second step determines the model's goodness of fit and predictive relevance. For hypothesis testing, the authors ran a bootstrapping procedure

(individual sign changes, 300 cases and 5000 subsamples) providing the t-values and a partial least squares algorithm (path-weighting scheme) calculating the path coefficients.

## **Findings**

### *Effect of product color (H1)*

The results of the one-way ANOVA support hypothesis H1. Product color has a significant impact on attitude toward the product ( $F_{2,297} = 2.735$ ,  $p = 0.067$ ). With regard to the magnitude of the measures for the single groups (i.e., the subjects who evaluated the gray, blue or green chair), the means show that blue performs best ( $M = 4.07$ ,  $SD = 0.77$ ), followed by gray ( $M = 3.97$ ,  $SD = 0.78$ ), and green ( $M = 3.81$ ,  $SD = 0.83$ ). Scheffé post-hoc tests were conducted to determine which groups significantly differ (Burns and Bush, 2014; Cheng *et al.*, 2007; Vaidyanathan and Aggarwal, 2000). The results show a significant difference between the means of blue and green ( $p = 0.070$ ). Thus, dentists might prefer a color that contributes to a relaxing atmosphere. Blue is located at the lower end of the color spectrum, while green is positioned more toward the middle. Thus, blue compared to green has a shorter wavelength, which leads to a more calming color effect (Walters *et al.*, 1982). As there are actually significant differences in attitude toward the product that are dependent on color design, the usage of color in an industrial context appears to have great potential. In addition, a further group comparison with regard to visual appeal shows that there are also differences between the color groups ( $F_{2,297} = 2.680$ ,  $p = 0.070$ ). Based on this effect on visual appeal, the following section will investigate which factors and underlying relationships are decisive for the positive effect on attitude toward the product in the given context. In particular, the effects of visual appeal in general (i.e., without considering a specific design element) in an industrial context are examined to gain further relevant insights.

*Underlying effects of product evaluation (H2-H5)*

In H1, we made the assumption that the visual stimulus product color has an influence on the overall evaluation of the product in terms of the attitude toward the product. Therefore, we used group comparison tests (ANOVA) to examine if a change in color influences the attitude toward the product. Indeed, we found differences in this regard. On this basis, H2-H5 propose the causal relationships between sensory appeal, perceived product design and attitude toward the product. In this way, we examine the general underlying effects and causal relationships between the visual appeal and the overall evaluation of a product in an industrial context.

*Evaluation of the measurement models.* Prior to hypothesis testing, the authors checked the measurement models for validity and reliability by means of several quality criteria (see Table 4). The results show satisfactory values for all factors. The factor loadings lie between 0.766 and 0.937, therefore falling between the Bagozzi and Yi (1988) required range of 0.5 and 0.95 while also exceeding the frequently mentioned critical value of 0.7 (e.g., Hair *et al.*, 2011). The average variance extracted (AVE) showed values between 67.4% and 84.9%, clearly surpassing the minimum requirement of 50%. In addition, the AVE is always higher than the highest squared correlation with another factor. Thus, the Fornell-Larcker-criterion (FLC) is satisfied (Fornell and Larcker, 1981). Moreover, each indicator's loadings are higher than all of its cross loadings. Finally, the composite reliability ( $\rho_c$ ) has a minimum value of 0.878, which is significantly higher than the minimum requirement of 0.7 (Bagozzi and Yi, 2012).

Insert Table 4 about here.

*Evaluation of the structural model.* To assess the quality of the structural model, the authors determined two prediction-oriented and non-parametric measures (see Table 5). According to Chin (1998), the authors calculate the coefficient of determination ( $R^2$ ) and the cross-validated redundancy measure ( $Q^2$ ).  $R^2$  revealed a minimum of 40.9% and a maximum of

67.6%. Consequently, the amount of the explained variance of the endogenous variables is at least acceptable and up to substantial. Thus, the results confirm the model's goodness of fit (Hair *et al.*, 2011). In addition,  $Q^2$  has a minimum of 0.294 and a maximum of 0.656. Hence, all of the endogenous and reflective factors show a value above zero. In line with this, the findings attest to the model's predictive relevance. Consequently, the proposed hypotheses can be properly tested, as presented in the following section.

Insert Table 5 about here.

*Effect of visual appeal on haptic appeal (H2).* The results of the PLS-SEM (see Table 6) confirm hypothesis H2. The findings reveal that visual appeal influences haptic appeal on a highly significant level and with strong positive power ( $b = 0.669$ ,  $p < 0.001$ ). This supports the assumption that the visual sense is dominant over the other senses (here: the haptic sense), which complies with the literature (e.g., Krishna, 2012). Hence, the visual appearance of a product, and thus the degree to which it appeals to a customer, obviously affects the way the customer evaluates the product in terms of haptic attributes as well.

*Effect of visual appeal on product design (H3).* The findings support hypothesis H3. Visual appeal has a highly significant and positive impact on all three product design dimensions – aesthetics ( $b = 0.762$ ,  $p < 0.001$ ), functionality ( $b = 0.267$ ,  $p < 0.001$ ), and symbolism ( $b = 0.386$ ,  $p < 0.001$ ). Thus, visual cues (e.g., product color) may substantially alter a customer's perception of a product, which is in line with diverse research insights (e.g., Blijlevens *et al.*, 2009). For example, if the customer perceives the product color as appealing, he or she may certainly evaluate the product as more aesthetically pleasing and therefore better identify with the product; strikingly, the customer may also assess the product as more functional. Consequently, just as in the case of consumer goods, visual cues seem to be very important in the context of industrial products as well.

*Effect of haptic appeal on product design (H4).* Further, the results partly support hypothesis H4. Haptic appeal shows a highly significant and positive impact on functionality ( $b = 0.429$ ,  $p < 0.001$ ) and on symbolism ( $b = 0.427$ ,  $p < 0.001$ ), but no significant impact on aesthetics ( $b = 0.086$ ,  $p > 0.1$ ). Although relevant literature describes aesthetics as a perceptual construct that may result from all five senses (e.g., Bloch, 2011), in the given context, visual cues are obviously decisive, which reinforces their importance in attaining a positive perception of the product. Nevertheless, haptics is highly important in communicating the functionality of the product. For example, if the treatment chair seems to be comfortable and have a nice surface, it will most likely appear to be more functional. For the symbolic meaning of the product, both senses are of significant importance.

*Effect of product design on attitude (H5).* The results support hypothesis H5. All three product design dimensions have a highly significant and positive impact on the attitude toward the product – aesthetics ( $b = 0.473$ ,  $p < 0.001$ ), followed by symbolism ( $b = 0.254$ ,  $p < 0.001$ ), and functionality ( $b = 0.198$ ,  $p < 0.001$ ). Most interestingly, functionality does not have the strongest, but instead the weakest, influence. In contrast, aesthetics turned out to be the most powerful driver of attitude in the context of the industrial good “treatment chairs”. Further, for a positive attitude, it is obviously also very important that the product has a high symbolic value to the customer, meaning that he or she can identify with the product or express himself or herself through the product. Consequently, subjective factors that have to do with individual preferences actually drive the customers’ attitude toward the product most effectively. Calling to mind that the focus in industrial markets is still most often on function and practicability, the results are surprising and very insightful.

Insert Table 6 about here.

## **Discussion and implications**

### *General discussion*

This paper is one of the first to provide empirical evidence for the effect of non-functional design elements on product evaluation in the context of an industrial market. The results of the ANOVA show a significant impact of product color on the evaluation of an industrial product in terms of the attitude toward that product. Additionally, post-hoc tests revealed a significant difference between the colors blue and green. Moreover, deeper investigations into the relevant underlying effects of product evaluation yield new insights into the perception of industrial products.

The PLS-SEM analysis – except for the effect of haptic appeal on aesthetics – confirms all of the proposed causal effects. The result is an insightful causal chain of direct and indirect effects (see Figure 2). In the context of an industrial product, visual cues (e.g., product color) appear to be an important driver of the consumer's attitude toward the product. Visual appeal – that is, the degree to which the product's visual cues please the consumer – enhances attitude via an improvement of perceived product design. The positive effect on attitude toward the product is most effective through aesthetics (total effect:  $b = 0.36$ ,  $p < 0.001$ ). In contrast, functionality plays a minor role (total effect:  $b = 0.11$ ,  $p < 0.001$ ). Thus, the findings affirm the great importance of visual appeal and aesthetics in the context of an industrial product, which may be considerably higher than the impact of more rational concerns like functionality.

Insert Figure 2 about here.

### *Theoretical implications*

The results from this study importantly add to pre-existing literature on the perception of industrial products. First, on a general note, studies in the context of industrial markets tend to

use qualitative research methods, whereas this study provides results based on a quantitative approach. The focus on qualitative studies in this context is mainly due to the difficulty in recruiting sufficient numbers of industry-specific business customers for quantitative studies. Insights from both qualitative and quantitative studies, however, are needed for an efficient exploration of a research topic (Piekkari *et al.*, 2010). Second, the findings demonstrate differences in the evaluation of an industrial product by manipulating only the product color. Thus, the results from this study also contribute to research on the effects of product color in general (Labrecque *et al.*, 2013; Spence, 2018). The impact of visual cues such as color on product evaluation is well-explored in the context of consumer goods but has been mostly overlooked by studies in the context of industrial products (Chitturi *et al.*, 2008; Lehmann and O'Shaughnessy, 1974). Third, color influences industrial product evaluation without adding further functional value or creating a rational advantage for the customer. Therefore, the results give further indication of the importance of non-functional design elements in the product evaluation process in industrial markets (Lindgreen and Wynstra, 2005; Yamamoto and Lambert, 1994). In addition, the results support recent research propositions of including non-rational aspects when investigating the customer's product evaluation in a business-to-business context (Mencarelli and Reviere, 2015; Prior, 2013). Fourth, deeper analysis of the underlying factors (i.e., sensory appeal and perception of product design) provides additional evidence supporting the importance of product appearance. Additionally, these findings extend the current literature on sensory product perception (Haase and Wiedmann, 2018; Krishna *et al.*, 2017) and product design research (Candi *et al.*, 2017; Haase *et al.*, 2018) by combining these factors in the specific case of industrial products.

### *Managerial implications*

Moreover, the causal effects of these factors are indeed relevant from a practical point of view. Product developers and managers can use these insights when designing a new product

to effectively appeal to customers and convince them of the product's value. Instead of relying solely on functional and rational product properties, product developers and managers may also focus on the product's sensory appeal in their design thinking. In an industrial market, the sensory appeal can positively influence the holistic perception of a product in terms of the perceived product design. In particular, product designers should consider the intended use of sensory cues such as product color to create a pleasant product design for the customer. This can be achieved through targeted enhancement of the three design dimensions (aesthetics, functionality, and symbolism). With regard to aesthetics, product designers might rely on general principles of aesthetic pleasure based on findings in design research, for example, unity in variety (Hekkert, 2006). To improve the perception of functionality, specific haptic properties such as form, weight and texture can be of great importance for the ease of use of a product (Hoegg and Alba, 2011). For more symbolic value, product designers might, for instance, provide the possibility of customized design options like specific embossing and colors (Deng *et al.*, 2010). By taking into account these ideas, companies operating in industrial markets may decisively improve the perception of the product in the customers' minds and thus increase the likelihood of market success.

### **Limitations and further research**

This paper lays the foundation for future research activities on the perception of industrial products. First, the study is specific to the dental market. It shows that soft facts such as visual and haptic appeal and color as specific non-functional design elements actually affect the perception processes of dentists. Dentists without a doubt fall into the category of business customers who purchase industrial products; however, they feature a fairly high degree of personal involvement in their business. Therefore, they were suitable to test the proposed hypotheses for the industrial context in a first attempt. Nevertheless, it is not unlikely that the



findings may also be true for other industrial sectors. Consequently, for future research, it would be interesting to investigate the effects of non-functional design elements for further industrial products to broaden the understanding of the opportunities such as sensory marketing in the field of industrial markets. In addition, for the given product of treatment chairs, only the visual design in terms of product color, more precisely only the hue of color, was manipulated. However, further research could specifically examine differences or similarities in the effects of a broader range of colors on the customer's attitude. In particular, it would be insightful to explore if and why some colors may generate a more favorable attitude toward the product than other colors or also non-colors like black and white in a given context. Moreover, with regard to sensory appeal outcomes, only the visual and haptic appeal were examined because acoustics, scent and taste were not relevant product characteristics in this case. In different industrial sectors, additional or other senses may be of crucial importance (e.g., acoustics in machinery, scent in retailing, taste in catering, or all five senses in the context of trade fairs). In addition, systematically leveraging different forms of stimuli presentation (e.g., not only in the form of a picture that is presented online) would be expedient. Thus, it would be insightful to analyze the associated effects for the specific product and to identify which sense is the most effective with which to appeal to the customer. Hence, to support management practice, academic marketing research should engage in further investigation to explain existing and non-existing relationships.

Moreover, future research could examine whether sociodemographic parameters, such as cultural (e.g., mentality or values), personal (e.g., centrality of visual product aesthetics, individual color preferences), motivational (e.g., the subjective importance of safety, power and joy) or locational aspects (e.g., rural or urban environments) play a moderating role in the decision processes of business customers. In the case of industrial customers, it is also important to differentiate between task and non-task variables (Webster and Wind, 1972), for instance, motives in terms of doing a good job for patients, and motives that are aligned to

personal benefits (e.g., enjoyment). In addition, a whole range of important moderators emerge from a consistent recourse on the figure-ground schema (e.g., the positioning of a specifically designed treatment chair against the background of the dental practice situation, which is composed of elements such as the premises, the entire interior architecture, the working situation, the dominant type of patient). With respect to the outcome variable, due to space constraints and to keep the analysis on a reasonable level, the study only considers attitude toward the product. Although it is well-established in marketing literature that attitude has significant effects on behavioral outcomes such as purchase behavior or the willingness to pay a higher price (e.g., Chaudhuri and Holbrook, 2001; Esch *et al.*, 2006), the direct and indirect effects of sensory design elements on further outcome variables may be examined in the given context.

Finally, the study was limited to the explicit level, which is to say, the customer's conscious perception of the product. However, as the majority of sensory cues are processed unconsciously, further studies may also consider implicit sensory information processing. Hence, in addition to classical self-assessment scales, innovative techniques (e.g., reaction time measurement, facial expression recognition, and electroencephalography) may be involved.

## Notes

- 1 The terms “rational customer behavior” and “objective decision-making” refer to a purpose-oriented way of thinking and acting, which includes the deliberate decision for actions that are considered reasonable to achieve a particular goal.

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## Tables

**Table 1: Sample characteristics (pre-test)**

<b>Variable</b>	<b>Characteristics</b>	<b>n</b>	<b>%</b>
Age	27 – 30 years	3	1.0
	31 – 40 years	39	13.0
	41 – 50 years	118	39.3
	51 – 60 years	113	37.7
	61 – 68 years	27	9.0
Gender	female	123	41.0
	male	177	59.0
Number of treatment chairs	2	105	35.0
	3	106	35.3
	4 or more	89	29.7
Practice type	single practice	231	77.0
	joint practice	69	23.0
Size of practice location (population in K)	small town (population < 20)	123	41.0
	small medium-sized town (20 ≤ population < 50)	73	24.3
	big medium-sized town (50 ≤ population < 100)	54	18.0
	small city (100 ≤ population < 500)	21	7.0
	big city (population ≥ 500)	29	9.7
	Employment of dental technician	yes	90
	no	210	70.0
<b>Total sample size</b>		<b>300</b>	<b>100.0</b>



**Table 2: Measurement items**

<b>Visual appeal</b>
attractive
beautiful
pretty
<b>Haptic appeal</b>
comfortable
soothing
well-shaped
<b>Aesthetics</b>
The product is visually striking.
The product is good looking.
The product looks appealing.
<b>Functionality</b>
The product is likely to perform well.
The product seems to be capable of doing its job.
The product seems to be functional.
<b>Symbolism</b>
The product would help me in establishing a distinctive image.
The product would be helpful to distinguish myself from the mass.
The product would accurately symbolize my achievements.
<b>Attitude</b>
I think the product is good.

**Table 3: Sample characteristics (main study)**

Variable	Characteristics	n	%
Age	32 – 40 years	88	29.3
	41 – 50 years	147	49.0
	51 – 60 years	59	19.7
	61 – 70 years	6	2.0
Gender	female	158	52.7
	male	142	47.3
Number of treatment chairs	2	80	26.7
	3	119	39.7
	4 or more	101	33.7
Practice type	single practice	242	80.7
	joint practice	58	19.3
Size of practice location (population in K)	small town (population < 20)	86	28.7
	small medium-sized town (20 ≤ population < 50)	72	24.0
	big medium-sized town (50 ≤ population < 100)	51	17.0
	small city (100 ≤ population < 500)	35	11.7
	big city (population ≥ 500)	56	18.7
Employment of dental technician	yes	34	11.3
	no	266	88.7
<b>Total sample size</b>		<b>300</b>	<b>100.0</b>

**Table 4: Evaluation of the measurement models**

	Loadings	AVE	FLC (AVE > r <sup>2</sup> )	Cross loadings < Loadings	ρ <sub>c</sub>
Visual appeal	0.800 – 0.887	0.710	0.710 > 0.671	fulfilled	0.907
Haptic appeal	0.766 – 0.870	0.674	0.674 > 0.470	fulfilled	0.892
Aesthetics	0.866 – 0.890	0.774	0.774 > 0.671	fulfilled	0.912
Functionality	0.834 – 0.843	0.706	0.706 > 0.389	fulfilled	0.878
Symbolism	0.904 – 0.937	0.849	0.849 > 0.503	fulfilled	0.944
Attitude	1	1	1 > 0.598	fulfilled	1

Note: AVE = average variance extracted; ρ<sub>c</sub> = composite reliability; FLC = Fornell-Larcker-criterion; r<sup>2</sup> = highest latent variable correlation squared.

**Table 5: Evaluation of the structural model**

	<b>R<sup>2</sup></b>	<b>Q<sup>2</sup></b>
Haptic appeal	0.447	0.297
Aesthetics	0.676	0.520
Functionality	0.409	0.294
Symbolism	0.553	0.464
Attitude	0.667	0.656

**Table 6: Evaluation of the structural relations**

	<b>Original Sample</b>	<b>Sample Mean</b>	<b>SD</b>	<b>SE</b>	<b>t-value</b>
<b>H2:</b> Visual appeal → Haptic appeal	0.669	0.669	0.049	0.049	13.785
<b>H3a:</b> Visual appeal → Aesthetics	0.762	0.760	0.055	0.055	13.771
<b>H3b:</b> Visual appeal → Functionality	0.267	0.268	0.076	0.076	3.505
<b>H3c:</b> Visual appeal → Symbolism	0.386	0.388	0.072	0.072	5.377
<b>H4a:</b> Haptic appeal → Aesthetics	0.086	0.094	0.053	0.053	1.615
<b>H4b:</b> Haptic appeal → Functionality	0.429	0.429	0.073	0.073	5.895
<b>H4c:</b> Haptic appeal → Symbolism	0.427	0.428	0.065	0.065	6.539
<b>H5a:</b> Aesthetics → Attitude	0.473	0.473	0.054	0.054	8.757
<b>H5b:</b> Functionality → Attitude	0.198	0.196	0.053	0.053	3.735
<b>H5c:</b> Symbolism → Attitude	0.254	0.254	0.056	0.056	4.555

Note: SD = standard deviation; SE = standard error.

Figures

Figure 1: Structural model

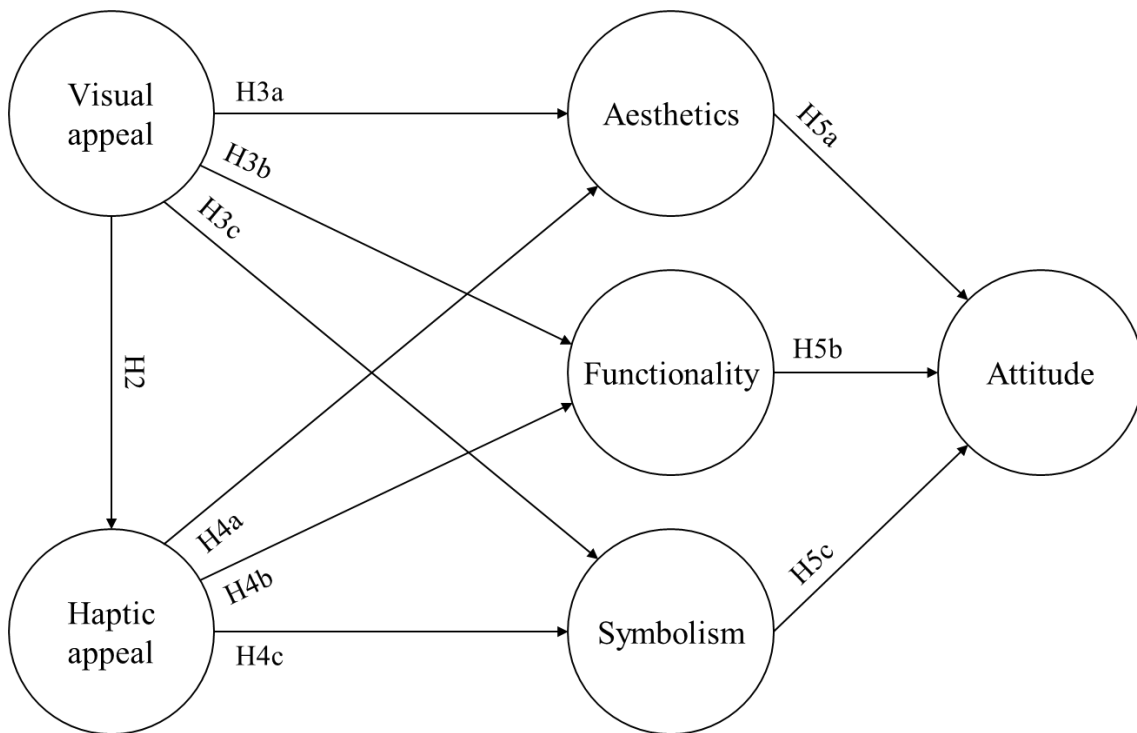
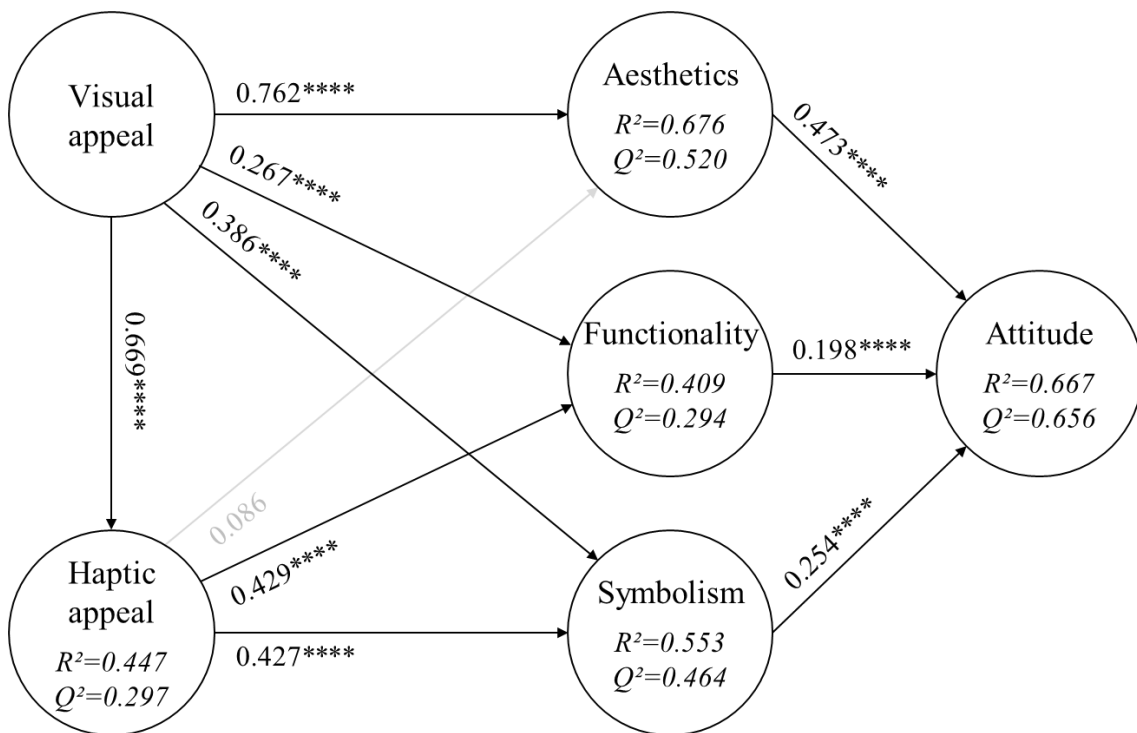


Figure 2: Empirical model



**A3:**

**Multisensory product design – An eye-tracking experiment on driving safety and product evaluation**

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*transfer – Werbeforschung & Praxis*

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# Multisensory Product Design – An Eye-Tracking Experiment on Driving Safety and Product Evaluation



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The integration of sensory cues that create a multisensory product design can improve customer appeal and product performance. Thus, it may be a promising approach for product designers of new in-car technologies to enhance both customers' driving experience and driving safety. We conducted a mixed-method experiment including eye-tracking and driving simulation to examine the impact of a multisensory car display. Although driving safety increased when specific senses were appealed to, there was no difference in product evaluation. The primary implication for marketers is to ensure that product benefits, which result from technological progress, are efficiently communicated to the customer.

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**Schlagworte:** > Sensory marketing > Product design > Eye-tracking > Driving safety > Automotive

## 1 Introduction

In the competitive automotive industry, car manufacturers are able to choose from a large number of suppliers that offer quite similar products. Additionally, technologies in the automotive industry are rapidly outdated for such a dynamic and fast-moving environment (Townsend et al., 2017). These factors give automotive companies the specific need for new product innovations to gain a competitive advantage. In the development of innovative technologies, automotive companies are particularly confronted with two major challenges regarding the product design of car interfaces (Eyben et al., 2010; Ho & Spence, 2013). On the one hand, the technologies must satisfy the demands of car manufacturers in terms of a specific design orientation for target

groups' driving experience expectations. For instance, in the luxury segment, consumers constantly ask for more sophisticated technologies, whereas in the low-budget segment, consumers prefer standard functionalities at reasonable prices (Townsend & Calantone, 2014). On the other hand, the technologies should be designed under the constraint of enhancing driving safety. Because most car crashes (especially rear-end collisions) result from a lack of driver attention, a strong desire exists to develop products that can provide important assistance to the driver in that respect (Gray, 2011; Ledesma et al., 2010; Wang et al., 1996). In this context, a multisensory product design (i.e., a product design that specifically engages at least two sensory modalities) has recently emerged as a potential solution for both of these challenges (Liu, 2001). Given work from the field of sensory and experiential marketing, empirical results provide evidence for a (positive) causal relationship bet-

**Abstract**

*Der Einsatz von sensorischen Reizen zur Bildung eines multisensorischen Produktdesigns kann die Kundenansprache und die Produktleistung verbessern. Insbesondere für Produktdesigner von neuen Automobiltechnologien kann es ein vielversprechender Ansatz sein, um sowohl das Fahrerlebnis als auch die Fahrsicherheit zu verbessern. Wir haben hierzu ein Mixed-Method-Experiment mit Eye-Tracking und Fahrsimulation durchgeführt, um die Auswirkungen eines multisensorischen Auto-Displays zu untersuchen. Obwohl die Fahrsicherheit durch die Ansprache bestimmter Sinne erhöht wurde, gab es keinen Unterschied in der Produktbewertung. Für Marketer bedeutet dies in erster Linie, dass die Produktvorteile, die sich aus dem technologischen Fortschritt ergeben, effizient an den Kunden kommuniziert werden müssen.*

**Schlagerworte:** > Sensorisches Marketing > Produktdesign  
> Eye-tracking > Fahrsicherheit > Automobil

ween a multisensory consumer approach and product experience and evaluation (e.g., Hultén, 2011; Joy & Sherry, 2003). Moreover, prior studies showed that multisensory car interfaces may reduce a driver's mental workload and lead to a more efficient human-computer interaction (e.g., Merat et al., 2007; Spence & Driver, 1997). Because most research in this area has solely focused on either one or the other of the aforementioned challenges, this study aims to combine both aspects by investigating whether a multisensory car display design may lead to improved driving safety and, further, to better product evaluation. From a practical point of view, new findings on this specific topic are also very interesting, as more and more such innovative products have recently come onto the market or are about to be launched. To address a real practical problem and thus to be able to draw relevant conclusions for practice, our study uses a newly developed car display of a renowned automotive supplier. A major contribution of our study is therefore that we transfer a current practical problem into a theoretical and scientific context and from there, based on our empirical results, transfer its implications back into practice. This paper is organized as follows. The next chapter presents the theoretical background and deduces the research

hypotheses. In the subsequent section, we describe the methodology of the empirical study. Then, a series of analyses of variance (ANOVAs) yield the findings. Finally, this paper provides a discussion on the interpretation of the results, managerial implications, and limitations of the study, leading to recommendations for further research.

## 2 Theoretical Background

The visual overload of the car driver represents a general concern for the increase in driving safety (Ho et al., 2007; Sivak, 1996). Because the capacity of human attention is strictly limited, drivers are unable to efficiently perceive and process all relevant visual information at a given time when driving (Driver, 2001). Therefore, the selective integration of further senses, such as audition and touch in car interfaces, seems to be a plausible option to provide additional support for the driver (Spence & Ho, 2008). This approach is mainly based on findings from the fields of neuropsychology and multisensory integration that show the human capability to effectively merge different sensory information into a holistic impression (Calvert et al., 2004; Spence & Driver, 2004). Correspondingly, many researchers have started to investigate several sensory stimulation possibilities for enhancing driving safety (Ho & Spence, 2012). In particular, in the past few years, the effects of multisensory in-car warning systems have been examined. The results provide evidence for the positive effects of multisensory in-car warning systems on the driver's reaction time, gaze orientation, and overall driving performance (Ho & Spence, 2009). Moreover, in this context, further research analyzed the effects of multisensory integration in product design. For instance, some studies found significant advantages of multisensory car displays over monosensory displays. Participants in a driving simulation had reduced braking latencies and reported less mental workload while driving when assisted by a multisensory display (Ho et al., 2007; Lee & Spence, 2008). Given these former findings, we expect that the more senses are targeted by product design, the easier the driver can focus on the street and, therefore, the better driving safety becomes.

**H1:** Multisensory product design has a negative effect on (a) the share of gazes toward the display, (b) the duration of the gazes toward the display, and (c) the mean deviation of the ideal path in the lane change test.

Interest in the field of sensory marketing continuously increases. Consequently, research has already provided deeper understandings of the relationship between sensory stimulation and consumer perception and behavior (Krishna & Schwarz, 2014). As previously stated, in the case of an in-car multisensory product design, the use of different sen-

sory stimuli is assumed to lead to more efficient information processing and enhanced driving safety. In the literature, a higher mental processing fluency has often been linked to a greater degree of perceived pleasure from the subjective ease of product usage (Brakus et al., 2014). Therefore, the design of an in-car display is expected to influence a consumer's evaluation of the product even when sensory stimulation is processed without explicit awareness, which might be the case when driving (Veryzer, 1999). In line with this finding, the literature states that, particularly for new technology products, multisensory design can affect a consumer's attitude and behavior in favor of the product (Petit et al., 2015). Moreover, extensive research exists that focuses on the general effects of (multisensory) product design. Accordingly, a congruent multisensory product design is expected to have a positive effect on overall product evaluation (Krishna et al., 2010). Furthermore, particularly regarding behavioral outcomes such as word-of-mouth recommendation and purchase intention, a robust impact of product design has been empirically shown (Homburg et al., 2015). Thus, we suppose that the more senses are targeted by product design, the better the product evaluation becomes.

**H2:** Multisensory product design has a positive effect on (a) the attitude toward the product, (b) the word-of-mouth recommendation behavior, and (c) the purchase intention.

### 3 Methodology

#### 3.1 Data Collection and Sample

To test the research hypotheses, we conducted a laboratory experiment, including an eye-tracking procedure, a driving simulation, and an online survey (see Figure 1). The object of investigation was a newly developed car display of a renowned automotive supplier. The display offers three modes of sensory feedback (e.g., when pressing a button): visual (change of color), haptic (vibration), and acoustic (signal tone). To check the effect of increasing sensory appeal, we investigate three display configurations: only visual (group 1); visual and haptic (group 2); visual, haptic, and acoustic (group 3). The subjects were randomly assigned to one of the three conditions. The data collection started with introductory questions (e.g., car ownership, involvement in automotive technologies). Then, the subjects were equipped with eye-tracking glasses (Dikablis 2.0) and seated in front of the driving simulator (lane change test). According to ISO (2010), the lane change test (LCT) is a "method that quantitatively measures human performance degradation on a primary driving-like task while a secondary task is being

performed." In the given case, the secondary task was to operate the car display (which was configured according to the respective group number). After detailed instructions and a practice round, the actual test started, and the LCT score (i.e., the mean deviation of the ideal path) and eye-tracking data (i.e., gaze duration and share) were measured. When driving, the subjects were asked at standardized time intervals to complete realistic tasks related to the display, such as adjusting the volume or changing the radio station. After completing the LCT, the eye-tracking glasses were removed, and the steering wheel was replaced by a keyboard. Then, participants continued with the online survey. The questionnaire inquired about the attitude toward the display, the word-of-mouth recommendation behavior, and the purchase intention. Finally, socio-demographic attributes were requested. The data collection took an average of 42 minutes per subject.

A total of 48 subjects participated in the study (30 male, 18 female; age range: 19-60 years; mean age: 28 years). All of the subjects had a driver's license, and 56.3 percent owned a car. Moreover, 72.9 percent stated positive involvement related to car equipment. Regarding family status, education, occupation, and salary, the majority was single (87.5 percent), had a university degree (64.6 percent), was students (56.3 percent), and had a monthly income higher than € 4,000 (29.2 percent), respectively. The three groups were equally represented (16 participants each) and fairly homogeneous in reference to socio-demographic characteristics.

#### 3.2 Measures

In addition to the independent variable (sensory product design) containing the three groups with different display configurations, this study investigates six dependent variables resulting from three measurement tools. To measure inattention – in this case the distraction from driving – we recorded the percentage of looks at the display (gaze share) that the subject took and the total time in seconds (gaze duration). For this purpose, we used eye-tracking. To determine driving performance, we relied on the mean deviation of the ideal path (LCT score) that was computed during the LCT. These three variables provide information on driving safety. Furthermore, to measure product evaluation (attitude, word of mouth, and purchase behavior), we relied on single-item scales rated on five-point Likert scales (1 = "strongly disagree", 5 = "strongly agree"). For attitude, we applied the statement "I have a positive attitude toward the product" from Burton et al. (1998). Word-of-mouth recommendation behavior was captured by the item "I would recommend the product" according to Kim et al. (2009). Finally, for purchase intention, we used the statement "I intend to buy the product in the future" based on Esch et al. (2006).



Fig. 1: Experimental setup (left) and heat map at driving simulation (right)



Source: own illustration.

## 4 Results

### 4.1 Effect on Driving Safety (H1)

The results of the one-way ANOVAs show significant differences between the three groups with respect to all three variables related to driving safety (see Table 1). More precisely, sensory product design has a significant and negative influence on inattention in terms of gaze share ( $F_{2,45} = 3.690$ ,  $p \leq 0.05$ ) and gaze duration ( $F_{2,45} = 3.715$ ,  $p \leq 0.05$ ), and on driving deviation of the ideal path represented by the LCT score ( $F_{2,45} = 3.641$ ,  $p \leq 0.05$ ). Referring to the magnitude of the differences, the values improve with each sense that is added. Accordingly, group 1 (only visual) scored the worst, followed by group 2 (visual and haptic), and group 3 (visual, haptic, and acoustic) performed the best by far. This effect applies to all three variables. The more sensory feedback is given, the less the driver needs to look at the display, which can be determined in the form of gaze share ( $M_1 = 10.566$ ,  $M_2 = 10.370$ ,  $M_3 = 8.010$ ) and gaze duration ( $M_1 = 18.620$ ,  $M_2 = 18.268$ ,  $M_3 = 14.103$ ). In addition, with increasing sensory feedback, the driver can achieve better driving performance. Group 1 still shows an average deviation of the ideal path of 0.682 m, group 2 of 0.559 m, and group 3 of only 0.464 m. To further determine the exact groups that significantly differ, we conducted Scheffé post hoc tests. Regarding the eye-tracking measures, group 3 significantly differs from group 1 and group 2. Regarding the LCT score, a significant difference exists between group 1 and group 3. Thus, hypothesis H1 finds full empirical support.

### 4.2 Effect on Product Evaluation (H2)

In contrast to the effect on driving safety, the results reveal no significant differences between the three groups concerning the three variables representing product evaluation (see Table 1). Hence, sensory product design has no significant effect on the attitude toward the display ( $F_{2,45} = 0.265$ ,  $p > 0.1$ ), word-of-mouth recommendation ( $F_{2,45} = 0.076$ ,  $p > 0.1$ ), and purchase intention ( $F_{2,45} = 1.088$ ,  $p > 0.1$ ). Regarding the descriptives, the display is determined generally as not being rated very well. The values are approximately 3, signifying a primarily neutral position. Referring to the attitude toward the display, the ratings are still slightly higher than 3 ( $M_1 = 3.250$ ,  $M_2 = 3.125$ ,  $M_3 = 3.375$ ). However, for word-of-mouth recommendation, the assessment decreases ( $M_1 = 3.000$ ,  $M_2 = 2.875$ ,  $M_3 = 2.875$ ). For purchase intention, all three values remain lower than 3 ( $M_1 = 2.938$ ,  $M_2 = 2.438$ ,  $M_3 = 2.563$ ). Overall, it is evident that the evaluations of groups 2 and 3 fall short of the expectations. Instead of providing additional perceived benefits to the consumer, the haptic and acoustic features seem to downgrade the assessment. Particularly regarding the two behavioral measures, groups 2 and 3 clearly fall off, but not significantly. Consequently, hypothesis H2 must be rejected.

## 5 Discussion

The results provide empirical evidence for the positive influence of multisensory product design on driving safety but also indicate that product evaluation is not affected in the case of the given car display. Regarding the first hypothesis, the findings show that the driver tends to look less at the display when more senses are involved in the display

Tab. 1: Results of the one-way ANOVA

Variables	Means (standard deviations)			F	p
	Group 1 (V)	Group 2 (V, H)	Group 3 (V, H, A)		
Gaze share (in %)	10.566 (2.817)	10.370 (3.258)	8.010 (2.788)	3.690	0.033
Gaze duration (in s)	18.620 (4.933)	18.268 (5.751)	14.103 (4.915)	3.715	0.032
LCT score (in m)	0.682 (0.354)	0.559 (0.161)	0.464 (0.083)	3.641	0.034
Attitude	3.250 (0.856)	3.125 (0.957)	3.375 (1.088)	0.265	0.769
Word of mouth	3.000 (1.095)	2.875 (0.957)	2.875 (1.088)	0.076	0.927
Purchase intention	2.938 (0.929)	2.438 (1.031)	2.563 (1.031)	1.088	0.346

Note: V = visual, H = haptic, A = acoustic; gaze statistics refer to fixation of the car display; LCT score = lane change test score, indicating the mean deviation of the ideal path. Source: own illustration.

feedback. With each additional sensory signal (haptic and/or acoustic), the driver is more likely to omit a glance at the display to verify the input. Consequently, the driver can concentrate more intensively on the traffic, which becomes evident in better driving performance values. In this regard, group 3 (all three senses) in particular stood out in a positive manner; groups 1 and 2 scored clearly worse and fairly similar, with no significant differences. After the data collection, some participants mentioned that they hardly recognized the haptic signal. This fact may explain the similarity of groups 1 and 2; when the haptic effect is disregarded, both groups are likewise limited to the visual feedback. Thus, the major deciding factor for better driving safety seems to be found in the acoustic signal, which was responsible for the significant improvement in attention and driving performance. Regarding the second hypothesis, the results show no significant differences in the evaluation of the display in terms of attitude, willingness to recommend and to buy. In addition, the absolute values show that the display, in general, was not truly convincing to the consumers, particularly groups 2 and 3. In contrast to expectations, group 1 still rated the display the best, which might have been for various reasons related to the given car display. First, several subjects criticized the visual design of the display. In particular, the user interface could not keep up with the state of the art that people were already accustomed to through their smartphones, notebooks, and other devices. Second, the test individuals who felt the haptic feedback mentioned that it was novel and unfamiliar to them but also may have been somehow irritating. In contrast to the haptic feature, an acoustic signal is usually already known from everyday interactions with other technologies and thus more accepted. Third, although acoustic feedback is not a novel feature to most customers, mere familiarity does not seem to be sufficient. In the present case, the acoustic design obviously led to a poor evaluation. Some subjects in group 3 characterized the tone as unpleasant or annoying

and conveyed the impression of low quality. These descriptions are in line with recent findings that showed the relationship between alert tones and unpleasant feelings (McKeown & Isherwood, 2007). All in all, the product per se works better when more specific senses are involved. However, consumers do not realize this major benefit, meaning that the positive effect is not transmitted to their product evaluation. As a result, several implications for marketing practice can be deduced.

### 5.1 Managerial Implications

Regarding product management, the application of various senses in the form of a multimodal display feedback is stated as definitely worthwhile to improve the product, such that inattention in road traffic can be reduced, and thus driving performance can be enhanced. In particular, acoustics appear to supply added value. Haptics have also shown a slight impact. However, this effect may be strengthened by a higher intensity of the haptic feature. This concept applies generally to the conscious perception of the feature and specifically to the non-visual location of the button, which may provide a further essential benefit to make control gazes unnecessary. Furthermore, the findings have shown that the design of each individual sensory feedback offers potential for improvement. Although the acoustic signal could enhance driving safety, product evaluation decreased when it was present, leading us to conclude (supported by statements from the test persons) that consumers did not like the tone per se. Hence, companies must not follow a general approach of multisensory product design but rather must ensure that the sensory cues appeal to their (potential) customers on an individual level and during interactions. For the given case of the car display, this may be achieved by, for example, offering diverse acoustic signals from which the driver can choose. The same applies to haptics. Accordingly, the intensity (in an appropriate range) and structure of

the vibration might be selectable. Moreover, the visual design of the user interface needs to be updated to meet the expectations of a state-of-the-art technology (e.g., high-resolution pictures, bold colors). Given the dominant role of sight, the visual appearance of a product represents the essential foundation for consumer perception (Blijlevens et al., 2009; Schifferstein, 2006). Therefore, the poor visual impression of the car display might also have negatively influenced haptic and acoustic perception. Consequently, for companies to take into account the importance of visual elements when deciding on their product design is fundamental. In particular, this concept applies to automotive suppliers or other firms that address similar products, especially when consumers interact with high-definition technologies on a daily basis.

As important as having an excellent product per se is guidance for marketing communication. The results indicate that, although the product performs better when more senses are appealed to, consumers' evaluation of the product is worse. Obviously, they do not (sufficiently) perceive the added value. This contradiction emphasizes the importance of communicating such product benefits to achieve positive attitudes toward the product and favorable consumer behavior (e.g., in terms of word-of-mouth recommendation and purchase intention). Regarding the present case, during the pre-purchase phase, the innovativeness of the haptic feature needs to be highlighted, and the salesperson has to give consumers an understanding of its functioning to ensure that they do not perceive it as unusual or somehow distracting. Furthermore, the advantage of the haptic and acoustic features needs to be illustrated, such as in a TV commercial that shows a situation in which a car accident is prevented because the driver did not have to look away from the street because of the multimodal display. The range of opportunities is broad, but the necessity to manifest the product's benefits becomes evident. If the benefits are neglected, the chances of market success will most likely decrease.

## 5.2 Limitations and Further Research

This study was limited mainly with regard to methodological aspects and the object of investigation. First, given the significant expenditure of time per subject, the study comprises a sample of 48 test drivers. Hence, in a subsequent research step, the proposed hypotheses might be taken up and tested on a larger sample. Regarding the characteristics of the sample, we decided on convenience sampling. The slight surplus of male subjects is attributable to the fact that men tend to be more familiar with automobile issues (Bell, 1967) and are more dominant in decision-making processes in the automotive market (Belch & Willis, 2002; Davis, 1976). In addition, a major part of the sample consists of students and full-time employees. Consequently, further

studies may also consider people with other education levels and occupations. With regard to the sample size, we were limited to investigating 3 groups; for 48 test drivers, each group contained 16 test persons. For future research, it would be insightful to add a fourth group with visual and acoustic feedback but without haptic feedback to investigate the effect of multisensory feedback in more detail.

Apart from that, this work has focused on the particular car display of a cooperating automotive supplier with the aim of dealing with a real practical problem and drawing practical conclusions. Hence, the findings refer to the given specific visual design, developed haptic effect, and configured acoustic signal. Further, we deliberately decided on a relatively short phase of familiarization (i.e., the time the subjects had to become acquainted with the display and its features) to keep participants fairly unbiased. However, as a result, some subjects might not have consciously recognized the haptic feature. To further investigate the effect of the haptic feature, future research needs to be conducted. Researchers may for example manipulate intensity levels and examine the effect on driving safety or product evaluation. For subsequent studies, in any case, it is important to preclude the non-perception of the haptic effect, such as through more precise prior information and learning of the feature. Nevertheless, researchers must consider an adequate trade-off between sensitizing the subjects for the haptic effect and not providing too much influencing information. Moreover, the display offered only one acoustic tone, which obviously did not appeal to the consumers. Thus, further studies may be conducted to examine more closely the effect of acoustic signals (especially taking into account, for example, diverse and freely selectable tones or individualized voice recordings) that were revealed to be very promising. Future research may only consider pleasant stimuli to support the theory of multisensory enhancement. Therefore, the stimuli may be pretested and selected with regard to positive perception. A general recommendation for future studies may be to include more relevant variables to the given relationship between multisensory feedback of the display and driving safety and product evaluation. For instance, the already mentioned level of intensity and pleasure of the sensory stimuli could be included as possible moderators. Moreover, other aspects from related research such as congruency effects of the multisensory stimuli (Krishna et al., 2010) and the perceived positioning of product quality (Grohmann et al., 2007) could be considered as moderators in further research. Another way of gaining relevant insights would be to include possible mediators in this context. With regard to this, it may be valuable to measure general aspects of the consumer's perception of the display such as utilitarian value and hedonic value.

Accordingly, it might also be interesting to investigate further hypotheses on driving safety and product evaluati-

on. For example, an unpleasant sound in general could generate more attention and thus contribute to increased driving safety. In other words, higher driving safety could correspond with the cost of less pleasure. These contrasting effects could also be tested under different driver conditions. When drivers are more tired, a higher degree of acoustic and haptic feedback may be more beneficial to increase driving safety, but when drivers are more alert, a lower intensity may be perceived as more comfortable.

Finally, the findings originate from a driving simulation in a laboratory experiment. To test the hypotheses in a first research step, we have focused on increasing internal validity. In particular, we wanted to control for distraction from ambient noise, different driving situations, etc. Although we made sure that the setting was as realistic as possible (e.g., holistic driving simulation with steering wheel, brake and gas pedals, placement of the display at the same height as would be in the car, realistic tasks with regard to the operation of the display), it would be important to replicate the study in a real car setting as a second research step. In this regard, external validity may be increased by embedding the display into the car's interior design. Further tests may then be conducted in a real-life traffic situation or on a test track to make even more reliable statements about the effectiveness of the multisensory car display.

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**A4:**

**Shaping consumer perception: Effects of vertical and horizontal packaging alignment  
on the evaluation of organic food products**

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# **Shaping consumer perception: Effects of vertical and horizontal packaging alignment on the evaluation of organic food products**

## **Abstract**

In the organic food industry packaging represents an essential issue for marketers in terms of efficiently communicating the product's benefits. Due to logistical advantages, rectangular packaging is frequently used for organic food products. However, the question arises whether packaging alignment may significantly influence consumers' decision making at the point of sale. Therefore, this paper examines the effects of rectangular packaging alignment (vertical vs. horizontal) on consumer perception in the context of organic food products. The results of two empirical studies provide evidence for the assumed relevance of packaging alignment by ultimately showing that a change in packaging alignment affects consumers' willingness to pay. Importantly, this effect is mediated by utilitarian value perception. This paper importantly contributes to research on packaging design of organic food products. Specifically, the relevance of an efficient utilitarian value perception for the consumer's willingness to pay is highlighted in this context.

**Keywords:** Packaging alignment, Information processing, Utilitarian value, Willingness to pay, Organic food, Mediation analysis

**Paper type:** Research paper

## **Introduction**

Packaging design represents one of the most important elements in a firm's marketing mix to communicate product benefits and to gain competitive advantage (McDaniel & Baker, 1977; Rundh, 2009). Because of its presence at the point of sale and its role as a crucial aid upon which consumers rely for their decision making, packaging design is a very powerful medium (Orth & Malkewitz, 2008). It offers the possibility to stand out from the mass of competitive products and thus to direct the consumer's choice in favour of a firm's own product (Clement, 2007). In particular, the packaging form can be a decisive factor. A specific shape differentiating the product from all other products may decisively attract the consumer's attention, allowing the product to be considered in the first place (Underwood, Klein, & Burke, 2001). The form of the packaging helps consumers to perceive products as belonging to a certain product category. The visual impression of the product is thereby interpreted as a category code within the cognition process and is thus a decisive factor for the desired positioning of the product (Pieters & Warlop, 1999). Further, product form can influence the consumer's perception in terms of product beliefs (e.g., quality, value, content) and can lead to the preference of a product over others (Bloch, 1995). This is especially important for highly competitive markets such as the food industry, which mainly contains products with very similar features and qualities (Wells, Farley, & Armstrong, 2007). Moreover, in the food market, consumers' product choice is strongly influenced by the product's visual appearance (Bublitz & Peracchio, 2015). As a result, packaging design and, in particular, packaging form as a visual stimulus are extremely relevant in this context (Becker, Van Rompay, Schifferstein, & Galetzka, 2011). There is an ongoing issue for food marketers to efficiently communicate the product's benefits to the consumer through the packaging design. In particular, the benefits of organic food products, such as the advantages of high-quality ingredients to create



healthier products, are difficult to transmit to the consumer at the point of sale, because consumers tend to pay little attention to that kind of information (Husić-Mehmedović, Omeragić, Batagelj, & Kolar, 2017; Van Rompay, Deterink, & Fenko, 2016). Mostly, consumers lack the knowledge, time or motivation to consciously and precisely process such health and nutrition claims (Mead & Richerson, 2018). An extraordinary packaging form that attracts the consumer's attention could be an opportunity to solve this problem. However, in reality, the invention of a novel packaging form that distinguishes a product from its competitors also brings many risks. For instance, consumers are less familiar with the new product appearance and may even fail to identify the corresponding product category of the product (Berkowitz, 1987; Krishna, Cian, & Aydinoglu, 2017). As a result of these risks and because of logistical advantages with regard to storage and transport, many product packages in the food industry are rectangular (Raghubir & Greenleaf, 2006; Robertson, 2016). The alignment of rectangular packages can be either vertical or horizontal (Emblemi, 2013). The question arises whether changing the packaging alignment of an organic food product while maintaining size and logistical advantages may lead to a more positive product perception and, consequently, to better performance at the point of sale.

The marketing literature presents little deliberation on this relevant issue. In general, there is little guidance for managers with reference to packaging design (Orth & Malkewitz, 2008). With regard to packaging alignment, there is a strong need for insight. Researchers have called for deeper investigations into the effect of rectangular proportions on consumer perception and behaviour in the case of specific products (Raghubir & Greenleaf, 2006). Moreover, in their recent work on applying industry practices to promote healthy foods Bublitz and Peracchio (2015) called for new research on innovations in packaging that can provide distribution and promotional opportunities. This paper takes up these calls and focuses on a relevant research gap in this context.

The aim of our research is to investigate whether the packaging alignment (vertical vs. horizontal) of an organic food product has a significant influence on product perception and intended consumer behaviour. By drawing upon research on visual information processing (e.g., Deng, Kahn, Unnava, & Lee, 2016; Veryzer, 1999), we propose that there are differences in consumers' perceptions of a product's packaging information (e.g., claims of utilitarian benefits) depending on the product's packaging alignment. The results of our research support these assumptions. Importantly, the findings show that the consumer's willingness to pay for the product is also affected by packaging alignment as a consequence of the differences in product perception. Therefore, our study adds new insights to the research on packaging design and provides further evidence for the high importance of packaging alignment at the point of sale.

In the following sections, we first present the theoretical background of our research, which leads to our proposed hypotheses. After this, the procedure and the results of a pilot study are described. The pilot study serves to empirically test the theoretical rationale of our hypotheses in the context of organic food. Then, we explain the methodology of our main study, specifying the stimuli, the data collection and sample, and the measures. Next, we present the results of our main study. Finally, we provide a discussion of our findings, theoretical and practical implications, and further research opportunities resulting from the study limitations.

## **Theoretical background**

### *Packaging alignment, information processing, and product perception*

Research on the perception of product design has provided a better understanding of the underlying mechanisms of the consumer's processing of package information (Krishna et al., 2017; Veryzer, 1999). In addition to contextual factors that play a key role in influencing consumer

perception (e.g., personality, culture, and atmospherics), different elements of packaging design affect consumer responses (Bloch, 1995). Packaging design is a crucial means of attracting the consumer's attention, providing product-specific information, and framing the product's positioning (Westerman, Sutherland, Gardner, Baig, Critchley, Hickey, Mehigan, Solway, & Zervos, 2013). Findings in the field of neuroscience underline the importance of visual packaging elements for an effective consumer approach (Milosavljevic & Cerf, 2008). Various effects of packaging design elements (e.g., packaging colour, packaging texture, and packaging weight) on consumer perception and behaviour have already been demonstrated in research (e.g., Krishna & Morrin, 2008; Piqueras-Fizman & Spence, 2012; Rebollar, Lidón, Serrano, Martín, & Fernández, 2012; Velasco, Wan, Salgado-Montejo, Woods, Oñate, Mu, & Spence, 2014). However, there are few studies on the effects of rectangular packaging form or, more specifically, packaging alignment on consumer perception (Raghubir & Greenleaf, 2006). In particular, the investigation of possible effects of packaging alignment on the information processing of packaging elements (e.g., information regarding the qualities and the positioning of the product) is mostly neglected by prior research, even though the importance of ensuring efficient information processing of packaging cues has often been highlighted in the literature (e.g., Magnier, Schoormans, & Mugge, 2016; Valenzuela & Raghubir, 2009; Wang, 2013; Westerman et al., 2013). Nevertheless, there is reason to assume a significant relationship between the alignment of rectangular packages (either vertical or horizontal) and consumer information processing. This assumption is based on research findings providing evidence for differences between consumers' ability to process vertical and horizontal information (Deng et al., 2016). The field of view is wider in the horizontal direction than in the vertical direction. Hence, consumers are able to process more information with a higher fluency when scanning information on the horizontal axis (Shi, Wedel, & Pieters, 2013), and

information read in the horizontal direction is more fluently and easily processed than in the vertical direction (Rayner, 1998). Psychological research on visual attention tasks found that people perform better on the horizontal dimension than on the vertical dimension (Nazir, 1992; Yeshurun & Carrasco 1999). Transferring these findings to consumers' information processing of packaging elements, a horizontal packaging alignment may lead to a more efficient consumer perception compared to a vertical packaging alignment. As a result, text information and other visual stimuli of the product packaging, such as with regard to product positioning, should be perceived more efficiently by the consumer. In consequence, the effect of more efficient information processing on the horizontal axis may be considered relevant for the relationship between rectangular product packaging and product perception and is thus transferred to the specific context of organic food products in the following section.

#### *Packaging alignment of organic food products, utilitarian value, and willingness to pay*

Monetary related outcome variables such as the consumer's willingness to pay for a product are key success factors for marketing practitioners. In the case of organic food products, researchers have explored and investigated different determinants of the consumer's willingness to pay (e.g., Didier & Lucie, 2008; Janssen & Hamm, 2012; Krystallis & Chryssohoidis, 2005; Rebollar et al., 2012; Van Doorn & Verhoef, 2011). Utilitarian products, such as organic food products, are mainly bought and consumed because of their functional and practical aspects (Bloch, 2011; Huettl & Gierl, 2012). Thus, the consumer's perception of the product's utilitarian benefits is vital for the overall product evaluation (Lee & Yun, 2015; Magnier et al. 2016). The efficient information processing of packaging design can therefore play a key role in consumers' product evaluation and thus in the willingness to pay for a utilitarian product (Johar & Sirgy, 1991). Moreover, research

has revealed decisive impacts of packaging form on consumers' evaluation of utilitarian products (Ampuero & Vila, 2006).

Organic food products are generally associated with healthy and functional attributes and therefore fit into the category of utilitarian products (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007; von Alvensleben, 2001). In the specific context of organic food products, utilitarian value is mainly determined by functional and health aspects, such as nutritional content and ecological welfare (Lee & Yun, 2015; Van Doorn & Verhoef, 2011). These aspects can be conveyed to the consumer through visual cues of the packaging design (Karnal, Machiels, Orth, & Mai, 2016). Packaging design is therefore not only important for attracting attention, but also for targeted product positioning by providing specific product information (Husić-Mehmedović et al., 2017; Lodorfos & Dennis, 2008). Considering the effect of more efficient information processing on the horizontal axis, on-packaging information (especially text) regarding the intended product positioning (e.g., information about product benefits) can be processed more efficiently when the packaging is aligned horizontally (rather than vertically) and may lead to higher value perception. Therefore, an organic food product with mainly utilitarian on-packaging information in horizontal (vs. vertical) aligned packaging should be perceived as more utilitarian.

Recent research on consumers buying motivation in the context of green marketing has shown that the purchase decision of organic food products is mainly driven by the perceived utilitarian value of the product (Gonçalves, Lourenço, & Silva, 2016). In this context, the functional and qualitative added value of organic food compared to non-organic food is specifically indicated as one of the primary reasons for purchase by consumers (Finch, 2006; Fotopoulos & Chryssochoidis, 2001). Accordingly, the avoidance of negative health consequences is also regarded as a determining utilitarian motive for the willingness to buy organic food (Magkos, Arvaniti, &

Zampelas, 2006). Therefore, we predict a positive effect of perceived utilitarian value on consumers' willingness to pay in the context of organic food products. In summary, horizontal (vs. vertical) packaging of an organic food should lead to more efficient consumer perception of product-specific information (claims of utilitarian benefits) on the packaging, resulting in a more utilitarian perception of the product as a whole. Since it is assumed that the utilitarian value of an organic food has a significant impact on the consumer's buying behaviour, consumers are expected to pay more for an organic food in horizontal (vs. vertical) packaging.

Based on these remarks, we may formally state the following:

**H1.** A horizontal (vertical) packaging alignment leads to a higher (lower) willingness to pay for an organic food product.

**H2.** The effect proposed in H1 is mediated by utilitarian value perception.

### **Study 1 (pilot study)**

A fundamental assumption for our derived hypotheses refers to possible differences in the efficiency of information processing between horizontally and vertically aligned content. Research on visual processing ability has shown that information on the horizontal axis tends to be perceived more efficiently than information on the vertical axis. To test in a first step whether the findings can also be applied to our research context of marketing organic food, we conducted a pilot study.

#### *Stimuli and design*

For the empirical investigation of our theoretical rationale, a standardized product description (50 words in total) of an organic food product (avocado) was first created. This product description

was used as the basis for the stimulus material of a between-subject online experiment. There were two experimental groups, with one group having the text shown in a vertical alignment and one group in a horizontal alignment.

### *Sample and data collection*

One hundred and fifty-six participants took part in our pilot study (51.3% female,  $M_{\text{age}} = 27.20$ ,  $SD = 11.30$ , age ranging from 17 to 84 years). Upon their prior agreement, the participants were invited to participate in an online study. The respondents were first randomly shown one of the two product descriptions (vertically vs. horizontally aligned) and asked to read the respective product description. After a few filler tasks, the test persons were presented with the product description previously shown in the form of a gap text and asked to enter the missing terms correctly. This method serves as a common approach from psychological research to measure participants' recall of a certain stimulus. Subsequently, the subjects were finally asked to provide socio-demographic data, they were thanked and debriefed.

### *Results*

Overall, the results of a chi-square test show that subjects who saw the horizontally aligned product description gave significantly more correct answers in the gap text than subjects who saw the vertically aligned product description ( $\text{Proportion}_{\text{horizontal}} = 69.7\%$  vs.  $\text{Proportion}_{\text{vertical}} = 53.7\%$ ;  $\chi^2 = 12.96$ ,  $p \leq 0.01$ ). Therefore, the results of the pilot study empirically confirm the relevance of differences in horizontal and vertical information processing for the research context of organic food.

## **Study 2**

As a fundamental rationale of our hypotheses could be empirically confirmed by the pilot study, we proceeded by testing the hypotheses in the following main study.

### *Stimuli and design*

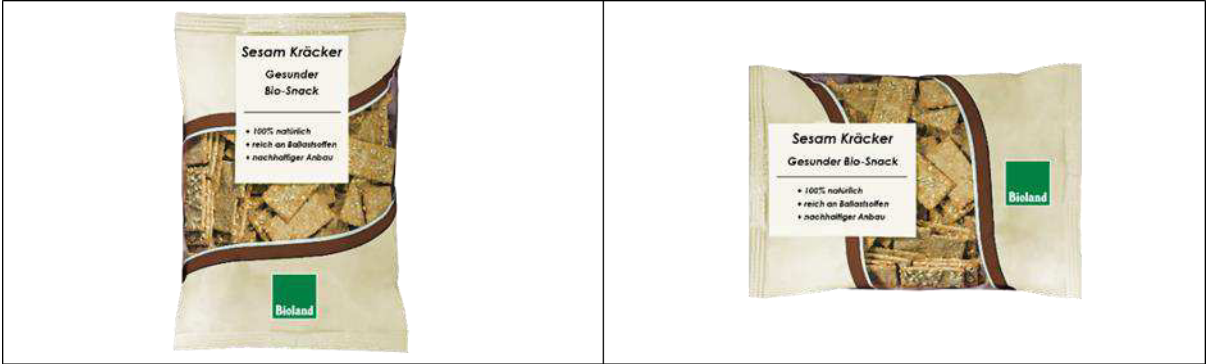
To test the two proposed hypotheses, we conducted a between-subjects online experiment with two conditions (vertical vs. horizontal packaging alignment). As the target product of investigation, we chose an organic snack (sesame crackers). This specific product category fits our research purposes for the two following reasons. First, the chosen sesame crackers belong to the category of organic food products. Second, organic snacks normally come in rectangular packages (Robertson, 2016), which is an important condition for our hypothesis testing.

Using commercial photo editing software, we generated two images of product packages of identical size, which varied only in the alignment of the packaging (vertical or horizontal). For the most realistic product impression, real products from the product category inspired the design of the packaging. However, to avoid the risk of existing brand associations, a brand name or brand logo was not included in the packaging design. Figure 1 illustrates the two product stimuli used in the study.

Insert Figure 1 About Here



**FIGURE 1** Stimuli: vertical (left) and horizontal (right) aligned product package.



### *Sample and data collection*

The sample of the study consisted of 699 participants (51.5% female,  $M_{\text{age}} = 30.02$ ,  $SD = 12.80$ , age ranging from 16 to 80 years). The participants were invited to evaluate a new organic food product. Upon agreement, the participants responded to an online questionnaire. Each participant was randomly assigned to one of the two conditions (vertical vs. horizontal packaging alignment). After some introductory questions, we asked for the participant's general liking of organic snacks. We included this question to control for this factor because a person's general liking of a product is mostly positively correlated with the willingness to pay (Stefani, Romano, & Cavicchi, 2006). Then, one of the products in either the vertical or horizontal packaging alignment was shown. The participants rated the utilitarian value of the presented product and stated how much they would be willing to pay for the product in euro. Finally, participants gave information on their socio-demographic attributes before they were thanked and debriefed.

### *Measures*

For the measurement of utilitarian value perception, we used the five items of Voss, Spangenberg, and Grohmann (2003) on nine-point semantic differential scales with the anchors *ineffective/effective*, *unhelpful/helpful*, *not functional/functional*, *unnecessary/necessary*, and *impractical/practical*. A confirmatory factor analysis indicated satisfactory measurement properties (i.e., measure of sampling adequacy of 0.89, 75% explained variance, factor loadings between 0.82 and 0.92). Scale reliability was ensured by a Cronbach's alpha of 0.92. For willingness to pay, we used an open-ended question (Barber, Kuo, Bishop, & Goodman, 2012). Thus, the participants were able to enter any possible answer in the open field, but were asked to provide their willingness to pay (in euro) in numbers. All answers were coded – that is, letters were

converted into numbers (e.g., “two” into “2.00”) and ranges into mean values (e.g., “1-2” into “1.50”), so that we finally obtained a metric variable for further analyses. In addition, the general liking of organic snacks was captured based on common practice in food marketing research using hedonic scores (Stefani et al., 2006). Thus, the participants were asked how much they liked to eat organic snacks. They answered this question on a five-point semantic differential scale with the anchors *dislike extremely/like extremely*.

### *Results*

To investigate the effects of packaging alignment on the consumer, we performed an analysis of covariance (ANCOVA) to test for H1 and a mediation analysis to test for H2. All analyses were performed with IBM SPSS 24. For the mediation analysis, we used the PROCESS macro (model 4) by Hayes (2018), including 5000 bootstrap samples and 95% confidence intervals (CI).

Prior to hypothesis testing, we applied a preliminary ANCOVA to examine in a first step whether packaging alignment affects utilitarian value perception as the basic assumption of the research hypotheses. Accordingly, packaging alignment with the two characteristics of vertical and horizontal was used as the independent variable and utilitarian value perception was used as the dependent variable. In the analysis, we controlled for a person’s general liking of organic snacks as a potential interference factor with regard to the presumed effect. Therefore, general liking of organic snacks was included as a covariate. Levene’s test revealed no significant results ( $p > 0.05$ ), which satisfies the homoscedasticity assumption. Thus, we were able to conduct the ANCOVA to test for the presumed effect. We assumed that people would perceive the graphic and written content on the horizontal package more efficiently through more fluent and easier information processing and that they would therefore perceive a better fit between the product and

the intended positioning. Hence, people should associate a higher utilitarian value with the horizontally packaged product in contrast to the vertically packaged product. The results of the ANCOVA were in line with our assumptions. People gave significantly higher utilitarian ratings in the condition of the horizontal packaging design ( $M_{\text{vertical}} = 5.59$  vs.  $M_{\text{horizontal}} = 5.86$ ,  $F(1,697) = 4.89$ ,  $p \leq 0.05$ ). The effect of liking was significant ( $F(1,697) = 31.07$ ,  $p \leq 0.01$ ). To control for any interaction between packaging alignment and liking with regard to utilitarian value perception, a two-way ANOVA was performed. The interaction effect was found to be insignificant ( $F(3,695) = 0.001$ ,  $p > 0.1$ ).

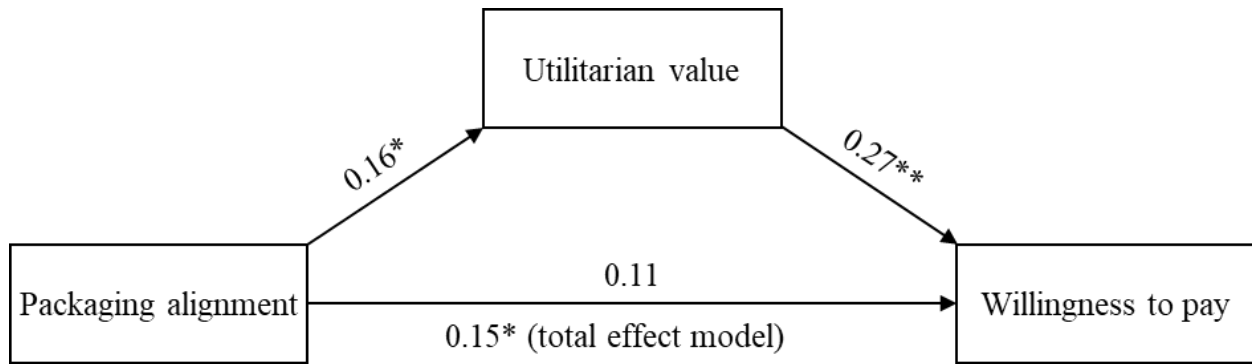
Because the basic assumption on the direct effect of packaging alignment received empirical support, the two research hypotheses addressing the effects on willingness to pay were tested. First, we tested H1 by addressing the main effect of packaging alignment on willingness to pay. H1 is based on the assumption that the positive effect of a higher utilitarian value leads to a higher willingness to pay in the case of the horizontal package. To test H1, an ANCOVA with packaging alignment as the independent variable, willingness to pay as the dependent variable, and liking as the covariate was conducted. The findings were in line with our expectations. On average, people were ready to pay more for the product with the horizontal package in comparison to the product with the vertical package ( $M_{\text{vertical}} = 1.78$  vs.  $M_{\text{horizontal}} = 1.92$ ,  $F(1,697) = 4.14$ ,  $p \leq 0.05$ ). The effect of the covariate was not significant ( $F(1,697) = 0.12$ ,  $p > 0.1$ ).

Based on these results, the effect of packaging alignment on willingness to pay was analysed in greater depth. H2 proposes that the effect of packaging alignment on willingness to pay is mediated by the underlying effect of utilitarian value (i.e., horizontal packaging leads to higher utilitarian value and thus higher willingness to pay). To test H2, we performed a mediation analysis with packaging alignment as the independent variable, willingness to pay as the dependent variable,

utilitarian value as the mediator, and general liking of organic products as a covariate. To obtain comparable coefficients, all variables (except for packaging alignment, measured on a nominal scale) were standardized. Figure 2 illustrates the results. First, the initial evidence for the direct effect of packaging alignment of the preliminary ANCOVA were supported by the mediation analysis; packaging alignment (0 = vertical, 1 = horizontal) had a significant positive effect on utilitarian value ( $b = 0.16$ ,  $SE = 0.07$ ,  $CI = [0.02, 0.31]$ ). Further, willingness to pay was positively affected by utilitarian value ( $b = 0.27$ ,  $SE = 0.04$ ,  $CI = [0.20, 0.34]$ ). As a result, there is a significant mediating effect passing through utilitarian value ( $b = 0.04$ ,  $SE = 0.02$ ,  $CI = [0.01, 0.09]$ ). With regard to the main effect of packaging alignment on willingness to pay, the total effect model and the mediation model were considered. In the first case, when neglecting the mediator, the effect was significant ( $b = 0.15$ ,  $SE = 0.08$ ,  $CI = [0.01, 0.30]$ ). In the latter case, when the mediator was included, the effect became insignificant ( $b = 0.11$ ,  $SE = 0.07$ ,  $CI = [-0.03, 0.25]$ ). Referring to the role of consumers' general liking of organic snacks as a covariate, the same effects as in the ANCOVAs were found. Thus, the only case in which the covariate became significant was with regard to the effect of packaging alignment on utilitarian value ( $b = 0.21$ ,  $SE = 0.04$ ,  $CI = [0.13, 0.28]$ ).

Insert Figure 2 About Here

**FIGURE 2** Mediation analysis (H2).



*Note:* Coding of packaging alignment: 0 = vertical, 1 = horizontal; \* $p \leq 0.05$ , \*\* $p \leq 0.01$ .

## **General discussion**

### *Discussion of the results*

The presented results provide new insights into the impact of packaging alignment on consumer perception and subsequent intended behaviour. More precisely, the findings show that for an organic food product, a horizontal (vs. a vertical) packaging alignment leads to more favourable intended consumer behaviour in terms of willingness to pay a higher price. The horizontal package leads to a higher utilitarian value perception of the product compared to the vertical package. Corresponding to the literature on cognitive information processing, the reason may be found in the more efficient perception of the positioning-related content in the case of the horizontal alignment. As a result, consumers value a horizontally packaged product higher than a vertically packaged product. Furthermore, the effects of packaging alignment on willingness to pay are robust even when considering different levels of consumers' general liking of organic snacks. Even though general liking was a significant covariate with regard to the perceived utilitarian value, no significant interaction effect between liking and packaging alignment was found. People who liked organic snacks more rated the utilitarian value generally higher ( $M_{\text{vertical}} = 5.74$ ,  $M_{\text{horizontal}} = 5.99$ ) than did those who stated lower liking ratings ( $M_{\text{vertical}} = 5.19$ ,  $M_{\text{horizontal}} = 5.44$ ). This result is in line with the literature on consumer research, which states that higher product liking accompanies higher value perception (Mano & Oliver, 1993). However, because the interaction effect was not significant in the case of utilitarian value perception and liking was not a significant covariate in the cases of willingness to pay, we can conclude that the established effects of packaging alignment on the consumer are, in principle, unaffected by the general liking of organic snacks.

### *Theoretical implications*

Researchers have stressed the importance of investigating the effects of packaging alignment on consumer perception and behaviour (e.g., Crilly, Moultrie, & Clarkson, 2009; Fenko, Lotterman, & Galetzka, 2016; Raghurir & Greenleaf, 2006). In line with this argument, this paper addresses the impact of rectangular product packaging on consumers' willingness to pay in the context of organic food products. Our results provide empirical evidence for such a relationship and therefore provide an important contribution to research on packaging design (e.g., Krishna et al., 2017; Orth & Malkewitz, 2008; Rundh, 2009). Additionally, we extend the existing literature by showing the relevance of an underlying effect with regard to consumers' product packaging perception. Our findings add knowledge to research on consumer information processing (e.g., Childers, Houston, & Heckler, 1985; Deng et al., 2016; Veryzer, 1999) by demonstrating that horizontal aligned packaging information leads to more efficient information processing and thus to higher product value perception. Moreover, the results significantly add new insights to research on the determinants of value perception for utilitarian products (e.g., Dhar & Wertenbroch, 2000; Huettl & Gierl, 2012), especially in the organic food sector (e.g., Mishra & Mishra, 2011; Van Doorn & Verhoef, 2011). Importantly, the findings emphasize the relevance of an efficient utilitarian value perception supported by the packaging design for the consumer's willingness to pay.



### *Practical implications*

The results of our research provide evidence for the considerable importance of packaging alignment to enhance the relevant success factors of a product (here: utilitarian value and willingness to pay a higher price) and thus provide several practical implications. The findings confirm that horizontal as opposed to vertical information processing (e.g., reading the claims on the package) works more fluently and easily, so horizontal packaging can strengthen product positioning. In the case of an organic food product, the perceived utilitarian value can thus be intensified in the consumer's mind. The effect of a greater value perception leads to a higher willingness to pay. Therefore, marketing managers may carefully consider which packaging alignment to use rather than leaving it to chance by following common practice in a particular product category. In fact, for marketing practice in general, it is essential to understand the effects of packaging alignment on consumer perception and to determine which effects are most important to achieve favourable behaviour toward the product. For organic food companies, it may be promising to switch to horizontal packaging where vertical packaging is typical. Consumers are willing to pay more money for the same product because it is packaged in a different alignment. As a result, marketing managers may gather profound knowledge about how their packaging design influences the consumer's perception of their product and take these effects into account to choose the right packaging alignment, which may be a decisive factor in achieving market success.

The findings can also offer valuable insights for public health related issues, since horizontal packaging can improve the transmission of information to consumers. Through this effect, the efficient perception of health claims on product packaging can be specifically strengthened. In this way, the benefits of healthy products can be brought more into the focus of consumers, which may lead to an increase in the likelihood of buying.

### *Limitations and further research*

Although our research offers new insights into the effects of packaging alignment on consumer perception and intended behaviour, it has some limitations that offer opportunities for future research. First, our data relate to organic food products. However, it is not unlikely that the findings are applicable to other food products and consumer goods. Further studies investigating the effects of horizontal versus vertical packaging for other industries may be helpful to extend knowledge in that field. On the one hand, future research may investigate other utilitarian products (e.g., medical products) in a similar study design and check whether the results can be confirmed in a different context. Further, our research has focused on the utilitarian value as a mediator as it is of primary importance for organic food products. However, for other (food) products (e.g., junk food or luxury products), the hedonic value is certainly also of great importance and might represent an interesting research variable. Thus, on the other hand, future research may also consider the hedonic value as a mediator. Analogous to our results, we assume that if a product packaging promotes hedonic product benefits, the hedonic value will be higher in the case of a horizontal alignment compared to a vertical alignment.

Against the backdrop of the practical relevance of rectangular packaging, we have focused on vertical and horizontal elementary alignments. It would be insightful for future research to analyse the effects of different proportions (different width-to-height ratios). In addition, the investigation of completely different forms (e.g., cylinder, pyramid) would reveal whether there is a positive effect on consumer perception and behaviour that is strong enough to eliminate the negative effect of possible logistical disadvantages. Furthermore, our study was constructed as an online survey to test the effects on the basis of a large sample. For this reason, the product stimulus was limited

to visual inspection. The visual sense is of primary relevance when examining product packages (Clement, 2007). However, when searching for more information, consumers often make use of other senses, such as touch (Peck & Childers, 2003). Hence, future studies may involve actual product experience to test the impressions of packaging design at additional sensory levels. Moreover, we considered general product liking as a possible interference factor. Depending on the research context, future studies may include further relevant moderating variables (e.g., centrality of visual product aesthetics, need for touch). Finally, we focused in a first step on the internal validity to ensure that the experiment is conducted in a sound way. However, the generalizability of the results is of course a very important point. Thus, future research might also focus on the ecological validity (e.g., taking into account the different positioning of pictures in horizontal and vertical packaging).

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**A5:**

**How to best promote my product? Comparing the effectiveness of sensory, functional  
and symbolic advertising content in food marketing**

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# **How to best promote my product? Comparing the effectiveness of sensory, functional and symbolic advertising content in food marketing**

## **Abstract**

**Purpose** – Advertising is one of the most important components of food marketing. However, there is uncertainty over the optimal means of convincing consumers to buy a product. The purpose of this paper is to examine the effectiveness of advertising content comprising text (sensory, functional and symbolic messages) and pictures (product image) on food product evaluation.

**Design/methodology/approach** – Two online experiments investigating strawberry advertisements were performed. Study 1 incorporated only text, whereas Study 2 investigated combinations of text and pictures. Analyses of variance were conducted to determine any significant differences among the three texts (sensory, functional and symbolic) and among the combinations of text and pictures.

**Findings** – Study 1 revealed no significant differences. All three texts were well received, which shows the relevance of all the product benefits – sensory, functional and symbolic – for food products. In contrast, Study 2 identified significant differences. The data analysis indicated that advertising effectiveness increases with the complementarity of the text and picture. Notably, the combination of the product picture and symbolic text was scored the highest for effectiveness.

**Originality/value** – The findings provide new insights into advertising design that food firms can use to enhance consumer product evaluations in terms of expected taste, perceived experience and quality, overall attitude and purchase intention. Further, the results contribute

to the research stream of food product benefits by highlighting the relevance of sensory, functional and symbolic design elements.

**Keywords:** Advertising design, Advertising effectiveness, Advertising content, Food marketing, Food products, Product evaluation, Product design, Sensory, Functional, Symbolic

**Paper type:** Research paper

## Introduction

Advertising is one of the most important means of appealing to consumers (Sethuraman *et al.*, 2011) and providing product information (Nelson, 1974; Koetz *et al.*, 2017). In marketing practice, there is often uncertainty concerning whether advertising is used most effectively (Aaker and Carman, 1982; Tellis, 2003). Additionally, in the marketing literature, the effectiveness of advertising is a popular topic (e.g., Frazer *et al.*, 2002; Gallagher *et al.*, 2001; MacKenzie *et al.*, 1986; Petty *et al.*, 1983; Woodside, 2016), particularly in the field of food products (e.g., Kareklas *et al.*, 2014; Parker, 2003; Schifferstein *et al.*, 2013; Theocharous, 2015; van Kleef *et al.*, 2005; Vlachvei *et al.*, 2009; Zandstra *et al.*, 2017). One key recurring question in advertising design relates to the content of ads. The content forms associations with the product (Lane, 2000) and is thus essential for the evaluation of the product. By establishing effective advertising messages, firms may improve the perceptual and attitudinal components of product perception (Olney *et al.*, 1991) and may elicit actual purchase behaviours (Resnik and Stern, 1977). Nonetheless, what kind of advertising messages are most effective in the context of food products?

The objective of this paper is to examine the influence of advertising content (in terms of sensory, functional and symbolic advertising designs) on food product evaluation (in terms of gustatory perception, product experience, product quality, attitude towards the product and purchase intention). For this purpose, two exploratory studies are performed to analyse the differences among the three conditions. In line with McQuarrie and Mick (1999) and Pieters and Wedel (2004), this paper considers text and pictures as the two key advertising elements to examine. The first study considers only advertising text. However, because a picture in an advertisement can change consumer perceptions (Edell and Staelin, 1983; Wang, 2013), a second study investigates the combination of three different advertising texts with a picture of the product, which in this paper is strawberries. Using this exploratory approach, this study

examines how the two advertising elements are best assembled to achieve the strongest effect. The paper is organized as follows. First, it provides the theoretical background addressing advertising design in food marketing that leads to the research question. The subsequent section presents the methodology for both studies by providing information on the research design, measures, procedure and stimulus material, which is developed based on two preliminary studies. Then, the findings of Study 1 and Study 2 are presented. Finally, the paper presents the discussion of the results, followed by the conclusion, implications, limitations and future research suggestions.

## **Theoretical background**

Recent elaborations in the field of product design suggest that people essentially value a product's appearance based on three different design dimensions. In detail, these design dimensions are perceived aesthetics, functionality and symbolism (Brunner *et al.*, 2016; Candi, 2007; Homburg *et al.*, 2015; Ulrich, 2011). Aesthetics relates to the perceived beauty of a product and the general hedonic pleasure that a consumer receives from its sensory attributes (Desmet and Hekkert, 2007). Functionality indicates the perceived utilitarian value of a product's design (Bloch, 2011). Symbolism captures all aspects of the meanings, messages and associations that the design of a product transfers to the consumer (Kumar and Noble, 2016). With regard to food products, all of these dimensions are essential in a consumer's product perception and product choice, as recent research showed (Grunert *et al.*, 2000). First, appearance is very important for the holistic evaluation of a food product (Imram, 1999). Accordingly, Michel *et al.* (2014) showed that the perception of a food product's beauty and attractiveness can be a relevant factor for food product evaluation. Second, the functional aspects of food are considered to be very important from a consumer perspective and have been



the focus of several past studies. For instance, van Kleef *et al.* (2005) provided insights into the impact of functional food benefits on consumers' food evaluations. Moreover, Siró *et al.* (2008) wrote a review paper on functional foods that highlighted the impacts of functional benefits on food product perception. Finally, symbolic benefits are significant for food product evaluation as well (Zandstra *et al.*, 2017). For instance, Robinson and Higgs (2012) showed that social information about how much a popular group likes a specific orange juice influences consumers' expectation of whether they will like that orange juice. Moreover, Magnier *et al.* (2016) demonstrated that food packaging that is associated with sustainability leads to higher perceived product quality. Additionally, in her overview paper on the decisive factors for food product evaluations, Jaeger (2006) identified symbolic aspects, such as branding and social issues.

In the literature, sources of the product evaluation process are typically divided further into intrinsic and extrinsic product factors. Intrinsic factors are inextricably linked to the product, including specific sensory attributes such as the colour or texture of a food product. Conversely, extrinsic factors include all context influences that are somehow related to the product, such as the packaging, point of sale and all other sources of information provided by advertising (Krishna *et al.*, 2017; Mueller and Szolnoki, 2010; Piqueras-Fiszman and Spence, 2015). As previously mentioned, advertisement is a powerful tool to influence consumer perceptions of a product in general. Accordingly, previous research in this area has investigated different relationships between advertising design and subsequent product evaluation (e.g., Boerman *et al.*, 2017; Chang and Yen, 2013; Friedman *et al.*, 1976; Wilkinson *et al.*, 1975). Among others, one important factor in advertisement is the content design. In particular, the wording of an advertisement, either written or spoken, affects the generated frame in which the product is perceived (Decrop, 2007). Correspondingly, in their research on transformational advertisement appeals, Naylor *et al.* (2008) found evidence regarding the influence of

advertising messages on hedonic, functional and symbolic product benefits. For food products, hedonic and aesthetic benefits are mainly based on the sensory attributes of the product (Schifferstein, 2015). Moreover, utilitarian and functional benefits predominantly emerge from the nutrients and ingredients of the food (Siró *et al.*, 2008). However, further contextual information about a food's origin and methods of manufacturing are the main drivers of symbolic benefits (Troye and Supphellen, 2012).

Based on the seminal framework of food acceptance by Cardello (1994) and the model of food information processing by Cardello and Wright (2010), contextual factors such as advertisement messages are also highly relevant for consumers' food perceptions. In accordance, recent findings have further emphasized the importance of contextual aspects for food product evaluation. For example, Schifferstein *et al.* (2013) found differences in consumers' food perceptions among the various stages of user-product interaction, such as choosing a product on a supermarket shelf and unpacking the product at home. Moreover, research from Piqueras-Fiszman *et al.* (2012) and Velasco *et al.* (2013) provided evidence for contextual and environmental effects on perceived taste. Piqueras-Fiszman *et al.* (2012) demonstrated that the colour of the plate that a food is served on influences the taste perception, such as the sweetness of the food. Similarly, Velasco *et al.* (2013) showed the contextual effects on perceived taste by varying the atmosphere in terms of multisensory attributes. Amid this background of contextual effects and with regard to food advertisements, Jaeger and MacFie (2000) showed, based on the MECCAS (Means-End Conceptualization of the Components of Advertising Strategy) framework, how different contents of health-related advertisements can influence consumer perception and behaviour. Furthermore, Kareklas *et al.* (2014) found positive effects of specific advertisement claims on organic food perception. However, because research on the relationship between advertising design and food product evaluation is still scarce, there remains a need to focus on investigating the general effectiveness of different

advertising content designs (e.g., sensory, functional and symbolic product information) on food product evaluation (Jaeger and MacFie, 2001; Wyer *et al.*, 2008). Based on these remarks and the aforementioned three-dimensional model of product design, the general research question of this paper is postulated as follows:

**RQ:** Do significant differences exist between sensory, functional and symbolic advertising designs with regard to food product evaluation?

## **Methodology**

### *Research design*

To explore the research question, quantitative data analysis was chosen for the present studies. The findings are based on two online studies carried out in Germany. The studies investigate two different scenarios with regard to advertising design. The first study considers only advertising text with sensory, functional and symbolic messages and tests for differences in food product evaluation. The second study considers the combinations of the three advertising texts with a product picture (here, an image of strawberries) and again checks for differences in food product evaluation. This approach is used to identify how the two advertising elements (i.e., text and pictures) are best arranged to achieve the greatest possible effectiveness. Before the research question was investigated, two preliminary studies were conducted to establish the stimulus material for the main studies. Therefore, an association task based on the MECCAS model and a subsequent manipulation check were used to develop the three advertising texts (i.e., sensory, functional and symbolic).

## *Measures*

For the two main studies, the same questionnaire was applied (differing only with regard to the stimulus material). The questionnaire assessed the variables gustatory perception, product experience, product quality, attitude and purchase intention because they have been identified as relevant key factors in the context of food product evaluation (e.g., Paul and Rana, 2012; Raghunathan *et al.*, 2006; Spence and Piqueras-Fiszman, 2014). To measure gustatory perception, the sensory perception item set (SPI) established by Haase and Wiedmann (2017) was applied. The measurement of product experience relied on the original scale of Brakus *et al.* (2009), and product quality was measured via the scale of Low and Lamb (2000). The measurement of the other two outcome variables was based on single-item scales. To capture the attitude towards the product, the statement “I have a positive attitude towards the product” from Burton *et al.* (1998) was used. Purchase intention was measured by the item “I intend to buy the product in the future” according to Esch *et al.* (2006). All items were specified to the product context of strawberries. Finally, they were rated using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), except for product quality, which was assessed using an eleven-point semantic differential (e.g., 1 = insufficient, 11 = excellent). To increase the quality of the main studies, five independent subjects checked and confirmed the final questionnaire with regard to its readability, comprehensibility and length (Hunt *et al.*, 1982).

## *Procedure*

For data collection, the questionnaire for Study 1 and Study 2 was sent out via an online link by marketing students in exchange for course credit. The structure of the questionnaire was as follows. The first section included introductory questions regarding, for example, the participants’ familiarity and involvement with strawberries. Next, by random selection, either one of the three advertising texts (Study 1) or a combination of one of the three advertising

texts and the product picture (Study 2) was shown. Subsequently, the second and main section included inquiries about the given test variables. Based on the advertisement shown, subjects evaluated the described product (i.e., the strawberries) with regard to their gustatory perception, perceived product experience, product quality, attitude towards the product and purchase intention. Finally, the third section contained social demographics (e.g., age and gender).

### *Data analysis*

All analyses were conducted with the software SPSS 24.0. For the selection of the stimulus material and the description of sample characteristics, the frequencies and means of the participants' responses were computed. For the investigation of possible differences and/or similarities across the three advertising texts, the measurement models were first checked for validity and reliability based on a series of confirmatory factor analyses. In this regard, several quality criteria (i.e., factor loadings, average variance extracted (AVE) and Cronbach's alpha) were used for the evaluation. Then, analyses of variance (ANOVAs) were conducted to determine the significant differences between the three groups.

### *Stimulus material*

To develop and select the stimulus material, two preliminary studies were conducted, one for the text generation and another for the manipulation check. First, to investigate the effectiveness of different advertising contents with regard to consumer product evaluation, three different advertising texts appealing to the consumer in a sensory, functional or symbolic way were developed. Therefore, our approach followed the established MECCAS paradigm for creating text advertisements. Using the MECCAS model, the elements of the means-end chain (MEC) for the product of interest are collected and translated into strategic MECCAS elements in terms of message elements with consumer benefits. These elements provide a

framework for communicating important product characteristics in a targeted manner (Reynolds and Whitlark, 1995). Accordingly, for text generation, 40 marketing students who were recruited in exchange for course credit completed a word association task. A sample primarily consisting of students was chosen to obtain a balanced set of data with regard to age, education and other demographic characteristics (Agrawal *et al.*, 2001; Dawar and Parker, 1994). The students were asked to provide as many positive attributes of strawberries as they could think of. In total, 301 associations were received (e.g., sweet, rich in vitamins, and natural). Next, the respective attributes were assigned to the sensory, functional or symbolic category by two independent researchers. With frequency analyses for each category, the attributes that were most frequently associated with strawberries were selected and thus included in the advertising texts. In detail, 15 attributes (five per text) were specifically implemented. Each text consisted of a catchy heading and a slogan touting strawberries in a sensory, functional or symbolic way. The sensory text emphasized the good taste, juiciness, sweet aroma, fruity scent and intense red colour of the strawberries. The functional text highlighted the quality and excellence, the value for the money, and the richness in nutrients and vitamins. The symbolic text created a context around the strawberries by describing them as an organic food product and emphasized the sustainable and local cultivation, naturalness, and fresh harvest from the farmer. A second preliminary study conducted with 36 marketing students tested for the successful manipulation of the three advertising texts. The participants were randomly assigned to one of the three text conditions. After exposure to the advertisement, they were asked to rate the degree to which the shown advertisement delivered sensory, functional and symbolic value. The measures were assessed using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). A mean comparison was applied to check for the intended effect of each text. The results revealed satisfactory values. The sensory,

functional and symbolic perceptions of the promoted strawberries were the strongest when the respective text was read.

The three texts were used for both Study 1 and Study 2. In addition, for Study 2, a picture of the product was combined with the three texts (see Figure 1). The picture showed strawberries as they can also be found in the supermarket display. As a result, the stimuli used are more realistic, increasing the practical relevance of this study.

Insert Figure 1 about here.

## **Results**

### *Study 1*

The first study tests for significant differences between the three advertising texts with regard to food product evaluation. Marketing students recruited the respondents in exchange for course credit. In total, 157 respondents participated in the study (see Table 1). The ages ranged from 17 to 61 years with an average age of 29.34 years. The gender distribution was nearly equal (47.1% female, 52.2% male).

Insert Table 1 about here.

First, the measurement models were checked by means of different quality criteria (Henseler *et al.*, 2009). The results revealed satisfactory values for all factors. The factor loadings ranged from 0.676 to 0.928, thus exceeding the critical limit of 0.5 (Bagozzi and Yi, 1988). Moreover, the AVE surpassed the limit of 50%, showing a minimum value of 52.4% (Fornell and Larcker, 1981). Finally, Cronbach's alpha values ranged from 0.695 to 0.881, which is above the limit of 0.5 (Nunnally, 1967). Subsequently, one-way ANOVAs were conducted to check the research question. For this purpose, advertising content was the independent variable, and the five factors representing food product evaluation mentioned above were the dependent

variables. The results are reported in Table 2. The data analysis shows that the participants do not significantly differ in their product evaluation ( $p > 0.1$ ). Thus, the product itself has been well evaluated for each text since it has a mean value above 8.4 for product quality and mean values primarily above 4 for the other constructs.

Insert Table 2 about here.

### *Study 2*

The use of a picture in an advertisement can alter consumer perception (Edell and Staelin, 1983; Wang, 2013). Thus, a second study was conducted to analyse the combinations of the three advertising texts with a picture of the product. Similar to Study 1, marketing students recruited the respondents in exchange for course credit. In total, the sample consisted of 165 respondents (see Table 3). The participants' ages ranged from 16 to 79 years, with an average age of 27.18 years. With regard to gender, 46.1% were female, and 53.3% were male.

Insert Table 3 about here.

The results of the factor analyses showed satisfactory values for all variables. The factor loadings were between 0.641 and 0.943, and the AVE values were between 0.54 and 0.727. Finally, the minimum Cronbach's alpha was 0.716, indicating reliability for all factors. Thus, as the measurement models are valid and reliable, the research question can be tested in the following. The results of the one-way ANOVAs are presented in Table 4. In this case, the data analysis revealed significant differences between the different groups in all variables. In detail, advertising content (i.e., sensory, functional or symbolic) has a significant impact on gustatory perception ( $F(2, 162) = 4.956, p \leq 0.05$ ), product experience ( $F(2, 162) = 2.863, p \leq 0.1$ ), product quality ( $F(2, 162) = 3.329, p \leq 0.05$ ), attitude towards the product ( $F(2, 162) = 3.232, p \leq 0.05$ ) and purchase intention ( $F(2, 162) = 2.488, p \leq 0.1$ ). To identify significant differences between single groups, Scheffé post hoc tests were conducted. For all five factors, the results



indicated significant differences between the sensory and symbolic advertising text. In addition, for gustatory perception, the perception of the strawberries also significantly differed between the sensory and functional text. With regard to the magnitude of the measures, both the functional and symbolic groups showed greater values than the sensory group ( $M_{\text{sensory}} = 3.878$  vs.  $M_{\text{functional}} = 4.257$ ,  $p \leq 0.05$ ;  $M_{\text{sensory}} = 3.878$  vs.  $M_{\text{symbolic}} = 4.240$ ,  $p \leq 0.05$ ). Furthermore, participants with symbolic text also rated the product experience significantly higher than those with sensory text ( $M_{\text{sensory}} = 2.667$  vs.  $M_{\text{symbolic}} = 3.068$ ,  $p \leq 0.1$ ). The same applied for product quality ( $M_{\text{sensory}} = 8.519$ ,  $M_{\text{symbolic}} = 9.224$ ,  $p \leq 0.05$ ), attitude towards the product ( $M_{\text{sensory}} = 3.722$  vs.  $M_{\text{symbolic}} = 4.145$ ,  $p \leq 0.1$ ) and purchase intention ( $M_{\text{sensory}} = 3.722$  vs.  $M_{\text{symbolic}} = 4.091$ ,  $p \leq 0.1$ ).

Insert Table 4 about here.

## **Discussion and conclusions**

### *Discussion of the results*

The two presented studies provide new insights into the effectiveness of advertising design for food products. Study 1, which focused on advertising text, shows that the perception of the strawberries was not significantly different regardless of whether the sensory, functional or symbolic advertising messages were provided. However, in terms of the descriptive statistics, in all three text conditions, the test persons were convinced about the product. Regarding product experience, the mean evaluation of the strawberries was in the middle range. For the other four outcome variables (gustatory perception, product quality, attitude and purchase intention), the means were all clearly in the field of agreement. Hence, it appears that all three product design dimensions (sensory, functional or symbolic) are important in the context of food products and that it makes no crucial difference which type of product benefits in

particular are emphasized. Hence, no single dimension comes to the foreground. This finding applies to the case when only text is considered.

However, because a picture in an advertisement can change the consumer's perception, a further study that included a product picture next to the three text conditions was performed. In contrast to Study 1, Study 2 showed significant differences between the groups. In combination with the picture, the sensory and symbolic texts now produced significantly different product evaluations for all five outcome variables. In the case of gustatory perception, the analysis even found an additional significant difference between the sensory and functional text. In terms of the descriptive statistics, it was generally evident that the sensory text scored worse than both the functional and symbolic text. Except for gustatory perception (in which the functional text performed slightly better than the symbolic text), the symbolic text consistently led to the best product evaluation. Hence, when a picture is added, it makes a notable difference concerning which product design dimension the accompanying text appeals to. The picture itself already provides information about the product and thus partially forms the consumer's perception (Steenkamp, 1990). In the present case of the food product, the picture particularly appeals to the sensory dimension because it directly displays sensory attributes (e.g., red colour and firm shape) or indicates them (e.g., fruity scent and fresh taste). The sensory advertising text only confirms the impressions evoked by the picture, which makes it less informative from a consumer perspective and consequently less effective. Thus, an effect of mutual enhancement was not found. Concerning the functional dimension, the picture provides only a partial idea of the features (e.g., of quality but not of nutritional values). This result explains why functional advertising text performs better. Referring to the symbolic dimension, the picture provides no information about the symbolic product benefits (e.g., organic farming). Consequently, symbolic advertising text works best. These findings are also in line with assumptions from former literature. Jaeger and MacFie (2001) stated that

advertising texts and images may provide different information, which nevertheless should fit together and thus further strengthen each other in order to have a stronger positive influence on the consumer. This effect is grounded in consumers' tendency to reduce uncertainty in their buying decisions. Consumers generally prefer decision-making situations where they can feel certain about the expected value of the decision outcome. Relevant decision information can therefore help to reduce uncertainties with regard to the expected product benefits (Dodds *et al.*, 1991; Urbany *et al.*, 1989).

### *Conclusion*

The aim of this paper was to determine whether there are significant differences among sensory, functional and symbolic advertising designs with regard to food product evaluation. When considering text as the only advertising element (Study 1), the findings show no significant differences among the three groups. Because the product evaluation was generally positive, all three product design dimensions were found to be important in the case of food products. When a picture of the product was added to the advertisement (Study 2), however, significant differences were found among the three text conditions. More precisely, the data analysis indicated that the effectiveness of the advertisement increases with the complementarity of the two advertising elements, the text and the picture. Accordingly, alongside the primarily sensory picture, the symbolic text providing the most new information led to the best evaluation of the food product, whereas sensory text that was redundant to the picture scored the worst. To conclude, an intelligent combination of a picture and text is essential to optimize the effectiveness of food product ads. In marketing practice, a visual impression of the product is frequently present. Therefore, the findings emphasize the importance for marketers to be aware of the messages that non-textual cues transfer to the consumer. Based on this knowledge, it is possible for marketers to use advertising text

effectively to provide consumers with additional information about product benefits. In addition, pictorial information is much easier to process than textual information. Hence, the integration of a product picture is a valuable means of efficiently communicating further relevant information about the product that may be crucial to the consumer decision process. Through this approach, firms can improve consumer perception in terms of the expected taste, the perceived product experience and quality and the overall attitude towards the product. Finally, consumers will likely show much stronger intentions to purchase the product, which ultimately contributes to market success.

### *Theoretical implications*

This research contributes in several ways to the existing literature. The results show that for food products, all of the three investigated product design dimensions (i.e., sensory, functional and symbolic) are of high relevance in consumers' decision process. Therefore, the findings emphasize the importance of considering the three product design dimensions when analysing product value perception in the context of food products (e.g., Homburg *et al.*, 2015). Furthermore, this paper adds new insights to existing research on food advertisements (e.g., Kareklas *et al.*, 2014; Parker, 2003; Schifferstein *et al.*, 2013; Theocharous, 2015; van Kleef *et al.*, 2005; Vlachvei *et al.*, 2009; Zandstra *et al.*, 2017). In particular, the findings extend the current literature on the use of texts and images in advertisements (e.g., Jaeger and Macfie, 2000; McQuarrie and Mick, 1999; Pieters and Wedel, 2004) by taking into account the interaction between these two elements. The results indicate that when only text is included in the advertisement, there is no difference in product evaluation depending on the product design dimension emphasized by the advertisement. When a product picture is added, however, there actually is a significant difference in product evaluation depending on which product design dimension the accompanying text appeals to. Thus, the findings also relate to consumers' value

perceptions under uncertainty (Dodds *et al.*, 1991; Urbany *et al.*, 1989). The more relevant the information is provided by the two different advertising elements (text and image), the more effective the influence on product evaluation is. When the product benefits indicated by the picture are confirmed only by text, such an advertisement as a whole is less effective than an advertisement with complementary elements. In contrast to the possible considerations in the field of (multi)sensory marketing, there is no effect of mutual enhancement in the current context (Lwin *et al.*, 2010). Instead, the reduction in uncertainty seems to be the main driver in this case.

### *Managerial implications*

The results provide some interesting managerial implications. First, as the product evaluations for all three texts (without picture) were rated equally high, it appears to be primarily important to communicate product benefits in some way. For food products, sensory, functional and symbolic product benefits are all important. Thus, firms must generally highlight product benefits so that consumers can feel confident about making an intelligent decision in the marketplace in favour of the product (Resnik and Stern, 1977). In the context of strawberries, it appears to make no crucial difference whether sensory, functional or symbolic product benefits are especially emphasized when the advertisement consists solely of text. Furthermore, when food firms want to use more elements than just text in advertising – for example, a product picture – the information given in the text needs to be carefully selected. Advertisements are most effective when the advertising elements differ in the information they provide; the text should provide additional positive information that goes beyond the product presentation of the picture. In fact, more information on the different product benefits reduces consumers' uncertainty, improves their product evaluations and encourages them to make a decision in favour of the product (Dodds *et al.*, 1991; Urbany *et al.*, 1989). In summary, for the

effective application of food product ads, the two elements of text and pictures may be combined in a complementary rather than mutually enhancing way.

### *Limitations and future research*

This paper has study limitations that provide interesting possibilities for future research. First, the paper focused on the food industry and used strawberries as the specific product studied. Therefore, it would be insightful to examine the relationships for other food products and sectors. Moreover, the paper considered text and pictures as key advertising elements. Notably, other advertising elements (e.g., brand logos) can also have a crucial influence on consumer perception. Hence, subsequent studies may analyse the effectiveness of further combinations with diverse advertising elements to extend the knowledge regarding powerful advertising design. In addition, the picture used in the second study was a simple photo of the product. Examining the effectiveness of other picture types (e.g., enhanced by different cues or showing a situation with happy people eating the product or a friendly farmer in the fields) per se and in combination with the different advertising texts may be an interesting research opportunity for future studies. When investigating the perception of pictures in more detail, the subconscious mind comes to the foreground. In contrast to the processing of text, which often involves significant mental effort, the processing of pictures is primarily automated and unconscious (Mueller *et al.*, 2010). As a consequence, in addition to direct measures, future studies could also incorporate indirect measures to capture the consumer's unconscious perception (e.g., reaction time measurement and electroencephalography) and hence to gain an even better understanding of the processing of advertisements. Finally, the data analysis was limited to group comparisons using one-way ANOVAs. To examine the effect of advertising design on product evaluation, the application of other statistical analysis methods (e.g.,

structural equation modelling to investigate causal relationships between the attitude towards the advertisement and product-related outcomes) may provide further interesting results.

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## Tables

**Table 1: Demographic profile of the sample (Study 1)**

<b>Variable</b>	<b>Characteristics</b>	<b>n</b>	<b>%</b>
Age	17 – 20 years	48	30.6
	21 – 30 years	68	43.3
	31 – 61 years	41	26.1
Gender	female	74	47.1
	male	82	52.2
	no answer	1	0.6
Marital status	single	120	76.4
	married	28	17.8
	divorced	7	4.5
	widowed	2	1.3
Education	pupil	2	1.3
	junior high school diploma	12	7.6
	senior high school diploma	87	55.4
	university degree	56	35.7
Occupation	scholar	2	1.3
	trainee	1	0.6
	student	97	61.8
	full-time employee	48	30.6
	part-time employee	5	3.2
	retired	2	1.3
	unemployed	2	1.3
Income	very low income (< 1000 €)	29	18.5
	low income (1000 – 2000 €)	26	16.6
	middle income (2000 – 3000 €)	26	16.6
	high income (3000 – 4000 €)	19	12.1
	very high income (> 4000 €)	32	20.4
	no answer	25	15.9
<b>Total sample size</b>		<b>157</b>	<b>100.0</b>

**Table 2: Results of the one-way ANOVAs testing the effects of advertising content (sensory, functional and symbolic) on food product evaluation (Study 1)**

<b>Dependent Variables</b>	<b>Means (standard deviations)</b>			<b>F</b>	<b>p</b>
	<b>Sensory (n = 51)</b>	<b>Functional (n = 54)</b>	<b>Symbolic (n = 52)</b>		
Gustatory perception	4.129 (0.942)	4.252 (0.692)	4.208 (0.731)	0.318	0.728
Product experience	2.995 (0.846)	2.982 (0.934)	2.928 (0.903)	0.082	0.922
Product quality	8.726 (1.591)	8.469 (1.699)	8.968 (1.350)	1.363	0.259
Attitude	4.137 (0.980)	4.074 (0.908)	4.096 (0.891)	0.062	0.939
Purchase intention	4.039 (1.095)	4.037 (1.027)	4.096 (0.891)	0.058	0.944

**Table 3: Demographic profile of the sample (Study 2)**

<b>Variable</b>	<b>Characteristics</b>	<b>n</b>	<b>%</b>
Age	16 – 20 years	61	37.0
	21 – 30 years	69	41.8
	31 – 79 years	35	21.2
Gender	female	76	46.1
	male	88	53.3
	no answer	1	0.6
Marital status	single	138	83.6
	married	21	12.7
	divorced	5	3.0
	widowed	1	0.6
Education	pupil	6	3.6
	junior high school diploma	15	9.1
	senior high school diploma	98	59.4
	university degree	45	27.3
	no degree	1	0.6
Occupation	scholar	7	4.2
	trainee	3	1.8
	student	102	61.8
	full-time employee	40	24.2
	part-time employee	4	2.4
	retired	5	3.0
	unemployed	2	1.2
	housewife/househusband	2	1.2
Income	very low income (< 1000 €)	38	23.0
	low income (1000 – 2000 €)	23	13.9
	middle income (2000 – 3000 €)	25	15.2
	high income (3000 – 4000 €)	21	12.7
	very high income (> 4000 €)	31	18.8
	no answer	27	16.4
<b>Total sample size</b>		<b>165</b>	<b>100.0</b>




**Table 4: Results of the one-way ANOVAs testing the effects of advertising content (sensory, functional and symbolic) on food product evaluation (Study 2)**

Dependent Variables	Means (standard deviations)			F	p
	Sensory (n = 54)	Functional (n = 56)	Symbolic (n = 55)		
Gustatory perception	3.878 (0.870) <sup>a,b</sup>	4.257 (0.649) <sup>b</sup>	4.240 (0.586) <sup>a</sup>	4.956	0.008
Product experience	2.667 (0.920) <sup>c</sup>	2.839 (0.892)	3.068 (0.823) <sup>c</sup>	2.863	0.060
Product quality	8.519 (1.500) <sup>d</sup>	8.708 (1.647)	9.224 (1.267) <sup>d</sup>	3.329	0.038
Attitude	3.722 (1.071) <sup>e</sup>	4.036 (0.808)	4.145 (0.803) <sup>e</sup>	3.232	0.042
Purchase intention	3.722 (0.940) <sup>f</sup>	3.929 (0.871)	4.091 (0.776) <sup>f</sup>	2.488	0.086

**Note:** Same letters (a, b, c, d, e, f) indicate significantly different means for that dependent variable based on Scheffé post hoc tests. For gustatory perception and product quality, the differences are significant at the  $p < 0.05$  level (a:  $p = 0.031$ ; b:  $p = 0.022$ ; d:  $p = 0.048$ ). For product experience, attitude and purchase intention, the differences are significant at the  $p < 0.1$  level (c:  $p = 0.061$ ; e:  $p = 0.052$ ; f:  $p = 0.087$ ).

## Figures

**Figure 1: Advertisement with sensory (top left), functional (top right), and symbolic (bottom) text**

<p><b>Probieren Sie unsere leckeren Erdbeeren!</b></p> <p>Sie sind sehr saftig, haben ein süßes Aroma, sind von kräftig roter Farbe und verströmen einen fruchtigen Duft.</p> 	<p><b>Probieren Sie unsere hochwertigen Erdbeeren!</b></p> <p>Sie sind von bester Qualität, bestechen durch einen guten Preis, sind reich an Nährstoffen und haben viele Vitamine.</p> 
<p><b>Probieren Sie unsere Bio-Erdbeeren!</b></p> <p>Sie sind 100 % natürlich, haben eine regionale Herkunft, sind frisch vom Land-Bauern geerntet und stammen aus nachhaltigem Anbau.</p> 	

**A6:**

**Sensory stimuli in print advertisement – Analyzing the effects on selected performance indicators**

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## Sensory Stimuli in Print Advertisement – Analyzing the Effects on Selected Performance Indicators

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### ABSTRACT

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#### Keywords:

Sensory perception, Product design, Brand experience, Brand perception, Consumer behavior, Print advertisement

The multisensory marketing approach is often associated with the creation of memorable consumer experiences. In contrast, the broad field of advertisement is increasingly struggling to appeal effectively to the consumer. Thus, the implementation of multisensory aspects in traditional advertisement activities might be promising. In the given context of the print advertisement, the empirical results of this research provide evidence that the application of multisensory stimuli is an important success factor in creating experiences and influencing the perception of product design. As there is great potential in the haptic and olfactory senses, marketing managers can appeal to consumers by using, for example, singular scents or special materials. However, to address consumers effectively, marketing managers must be aware of both the explicit and implicit effects when implementing different sensory stimuli to ensure that there is no conflict between the perception levels.

### 1. Introduction

Today, it is becoming increasingly difficult for marketing practitioners to appeal effectively to the consumer. The rapidly growing number of products with the same characteristics and the unsatisfying effects of conventional marketing techniques have led to a demand for more innovative approaches (Lee & Lee, 2004; McNally, Akdeniz & Calantone, 2011). Looking for new ways to differentiate products and brands from competitors, sensory marketing has recently gained growing popularity with both marketing researchers and managers (Krishna & Schwarz, 2014). In addition, a multisensory marketing approach is increasingly shifting into focus to create memorable experiences for the consumer (Lindstrom, 2005). Accordingly, several studies have already investigated the utility of sensory stimuli in terms of a specific consumer approach, particularly in the context of advertisement (Krishna, Cian, & Sokolova, 2016). For instance, evidence is provided for the impact of the salience of touch (e.g., Peck & Childers, 2006), store scent (e.g., Spangenberg, Sprott, Grohmann, & Tracy, 2006), and background music (e.g., Milliman, 1986) on consumer behavior. As a result, some companies have already transferred these insights to traditional print advertisements (Hultén, 2009). It is widely recognized that print advertisement is still a useful and relevant communication medium in today's world, more than ever before, because other advertisement formats, such as TV spots and online ads, are often questioned with regard to their impact on the consumer (Liu & Shrum, 2013; Yoon & Kim, 2001). Therefore, the implementation of, for example, haptic elements, scented stripes, and music-related QR codes to print ads seems to correlate with the aforementioned findings and underlines the broad innovation potential of print advertisement in terms of a multisensory

marketing approach. Although recent studies have helped to provide a better understanding of how specific sensory cues affect consumer perception, there is still much to learn about the causal relationships between sensory perception and brand-related outcomes (e.g., Spence, 2012; Streicher & Estes, 2016). Hence, as sensory cues may be perceived on an explicit or implicit level, it is important to focus on both types of consciousness to assess specific relationships with the product- and brand-related key factors (Krishna, 2012). Moreover, there is still a great need to investigate the aspects underlying the relationship between sensory perception and consumer behavior (Underwood & Klein, 2002). As marketing literature has detected product design and brand experience as relevant factors determining consumer perception and behavior (e.g., Brakus, Schmitt, & Zhang, 2014; Moon, Park, & Kim, 2015), this paper focuses on both constructs to examine their potential mediating role. As deduced from these remarks, the objective of the present study is to close the outlined gaps in the context of potential effects of sensory cues in print advertisement.

The paper is organized as follows: The next chapter provides the theoretical background, including the conceptual framework, outlines the relevant constructs, and deduces the research hypotheses. In the subsequent section, the methodology of the empirical study is described. Next, partial least squares structural equation modeling yields the findings. Finally, the paper provides a discussion and conclusions with an outlook toward future research opportunities.

## 2. Theoretical Background and Hypothesis Development

The conceptual framework is displayed in Figure 1. In the following section, the constructs and relationships of explicit and implicit sensory perception, product design, brand experience, brand perception and consumer behavior are explained in detail.

Sensory perception represents the initial driver of the conceptual model. In this paper, sensory perception is considered the consumer's evaluation of an object (e.g., product or brand) in terms of its appeal to the senses (i.e., visual, acoustic, haptic, olfactory, and gustatory). According to the well-established two-system approach of cognitive psychology (e.g., Kahneman, 2003; Neys, 2006; Slovic, 2002; Stanovich & West, 2002), consumers can form these evaluations in their subconscious (implicit) or conscious (explicit) mind. The implicit system (System 1) generally works quickly, automatically, associatively, and effortlessly. In contrast, the explicit system (System 2) operates slowly, deliberately, sequentially, and with more effort (Kahneman, 2003; Slovic, 2002). Furthermore, consumer choice is always based on both conscious and nonconscious processes; the influence of the nonconscious is particularly central. People perceive numerous stimuli in their environment unconsciously (Fitzsimons, Hutchinson, & Williams, 2002), whether it be music in a commercial, the scent in a store or the way a product feels. Consumers are perpetually confronted with product stimuli, of which only a fraction is actually noticed on an explicit level. People can concentrate on selected stimuli only, and their attentional resources are restricted (Smith & DeCoster, 2000). Although most product information is thus not accessible to the consumers' conscious mind, it can absolutely influence decision processes (Frieze, Wänke, & Plessner, 2006). In fact, due to the spontaneous functioning of System 1 and the comparatively very limited capacity of System 2, the latter often adopts the intuitive suggestions of the former (Kahneman, 2011). Positive implicit memory content can, therefore, lead to an equally positive explicit perception (and vice versa) in terms of a compensation of missing conscious information or a justification of the spontaneous suggestion. Thus,

H1: Implicit sensory perception has a positive effect on explicit sensory perception.

In addition to environmental factors (e.g., atmospherics) or individual differences (e.g., gender), a product's intrinsic factors (e.g., color or taste) represent core elements of a perceived product design and impact consumer perception (Krishna, Cian, & Aydinoglu, 2017; Piqueras-Fiszman & Spence, 2015; Zampini, Wantling, Phillips, & Spence, 2008). In fact, there are three dimensions of product design: aesthetics, functionality, and symbolism (Homburg, Schwemmler, & Kuehnl, 2015). Aesthetics indicate the level of the perceived beauty of an object (Desmet & Hekkert, 2007), functionality describes the assumed utility of the product based on design properties (Bloch, 2011), and symbolism explains the degree of identification and meaning a consumer associates with a certain design (Kumar & Noble, 2016). Empirical work in this area suggests relationships between sensory perception and all dimensions of product design (e.g., Aslam, 2006; Hoegg & Alba, 2011; Peck & Childers, 2003; Veryzer & Hutchinson, 1998). Accordingly, the perception of product design can potentially be influenced by both explicit and implicit sensory perception (Veryzer, 1999). Thus, it is influenced by all sensory cues sent out from the product itself (Schifferstein & Desmet, 2008). Therefore, it is assumed that

H2a: Implicit sensory perception has a positive effect on product design.

H3a: Explicit sensory perception has a positive effect on product design.

Whether processed on an implicit or explicit level, the consumer's sensory perception of a product or brand may contribute to a memorable

experience (Hirschman, 1984; Hultén, 2011). According to Brakus, Schmitt, and Zarantonello (2009, 53), the term brand experience can be defined as "subjective, internal consumer responses (sensations, feelings, and cognition) and behavioral responses evoked by brand-related stimuli that are part of a brand's design and identity, packaging, communications, and environments". Companies have various opportunities to build outstanding experiences by appealing to the five senses, for example, through striking pictures that make consumers think, pleasant scents that evoke positive emotions, or exciting music that creates an arousing atmosphere. Moreover, the separate stimuli that a company uses to stimulate the consumer merge into an overall impression (Hultén, 2011; Lindstrom, 2005). For this reason, and to establish a strong holistic experience, sensory marketing must use sensory stimuli coherently and in a mutually reinforcing way to transmit a consistent brand promise (Guzman & Iglesias, 2012). This phenomenon is known as the superadditive effects of sensory stimuli (Lwin, Morrin, & Krishna, 2010). However, brands must also prevent sensory overload. Hence, the amount, content and intensity of sensory stimuli play a major role in creating an ideal brand experience (Krishna, 2012). Thus, we propose

H2b: Implicit sensory perception has a positive effect on the brand experience.

H3b: Explicit sensory perception has a positive effect on the brand experience.

Marketing research has already found evidence for the causal relationship between product design and key indicators of marketing success (Bloch, 1995; Homburg et al., 2015; Montana, Guzman, & Moll, 2007). In short, the creation of a superior product design can significantly enhance customer experience (Brakus et al., 2014). Thus, research from Morgan-Thomas and Veloutsou (2013) has shown that an appropriate design can foster a consumer's entire brand experience. Consequently, several researchers found a strong relationship between the design of a company's products and overall brand perception (e.g., Brunner, Ullrich, Jungen, & Esch, 2016; Mishra, 2016; Wang, 2013). Thus, product design plays a major role in general consumer behavior (Landwehr, Wentzel, & Herrmann, 2012). Accordingly, studies provide evidence for the impact that product design has on different aspects of consumer behavior, such as product and brand choice (e.g., Lim, Kim, & Cheong, 2016) as well as purchase intention (e.g., Beneke, Mathews, Munthre, & Pillay, 2015). Therefore, it is hypothesized

H4a: Product design has a positive effect on the brand experience.

H4b: Product design has a positive effect on brand perception.

H4c: Product design has a positive effect on consumer behavior.

To embed brands deeply in a consumer's mind, the concept of brand experiences has become an important component in marketing communication. Superior experiences are thus created through offering brand-related stimuli as part of, for example, a brand's design, packaging or advertisement, at any time during the encounter (Cliffe & Motion, 2005; Klaus & Maklan, 2007). Research in the field of experience marketing has already shown that brand experiences are highly subjective, vary in strength, intensity, and valence, and engage the customers at different levels (Brakus et al., 2009; Gentile, Spiller, & Noci, 2007; Iglesias, Singh, & Batista-Foguet, 2011; Pine & Gilmore, 1999; Schmitt, 1999). Therefore, we divide the construct into four dimensions: affective, behavioral, cognitive, and sensory (Brakus et al., 2009). The affective component refers to the emotional responses (e.g., fun or pleasure) that are generated through marketing communication. Behavioral experiences are action-oriented and result in physical actions and bodily experiences. The cognitive component aims for mental processes, such as the enhancement of consumer' creativity or the



engagement in deep thinking. Finally, sensory experiences appeal to the five senses, which can further cause excitement and pleasure (Aaker, 1997; Gentile et al., 2007; Schmitt, 1999). Based on the literature, it is argued that a superior brand experience results in differentiation from other brands and builds a positive customer-brand relationship (Chang & Chieng, 2006; Nysveen, Pedersen, & Skard, 2013). Thus, it is assumed that the experience, which is assumed to be stored in a consumer's memory for long-term, promotes strong emotional responses, further leading to a positive brand perception, for example, in terms of brand image and satisfaction. Besides, the experience may also affect future-directed responses. Customers are more likely to be faithful to the brand, have a higher willingness to recommend the brand to others, and intend to buy the brand's products or services (Guzman & Iglesias, 2012; Ha & Perks, 2005; Iglesias et al., 2011). Therefore,

H5a: Brand experience has a positive effect on brand perception.

H5b: Brand experience has a positive effect on consumer behavior.

The existing marketing literature has also shown that brand perception, which is understood as the consumer's general perception of and feeling about a brand, is considered to be a key driver of brand equity and thus has the potential to influence consumer behavior (e.g., Belén del Rio, Vazquez, & Iglesias, 2001; Esch, Langner, Schmitt, & Geus, 2006; Faircloth, Capella, & Alford, 2001; Keller, 1993). Therefore, in the given context of the print advertisement, it is suggested that positive brand perception leads to such behavioral outcomes as consumer willingness to buy the product, to pay a premium price, and to offer positive recommendations. Thus,

H6: Brand perception has a positive effect on consumer behavior.

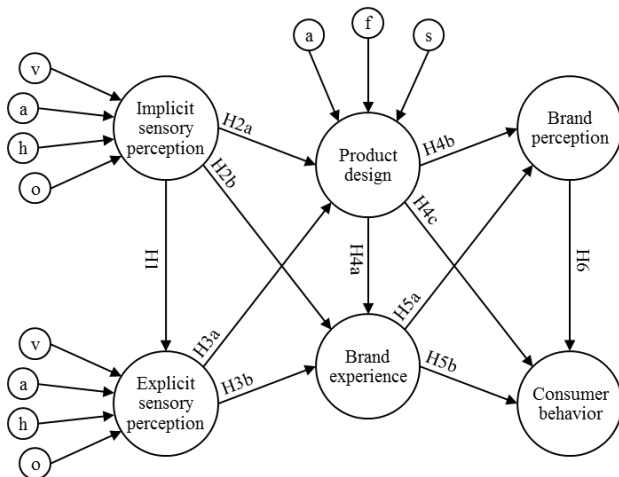


Figure 1: Conceptual model

### 3. Methodology

#### 3.1 Measures

The introduced conceptual model consists of three formative (i.e., implicit sensory perception, explicit sensory perception, and product design) and three reflective (i.e., brand experience, brand perception, and consumer behavior) measurement models (see Figure 1). In particular, to capture implicit and explicit sensory perception, we adapted the sensory perception items (SPI) developed by Haase and Wiedmann (2017). To measure the three dimensions of product design (i.e., aesthetic, functionality, and symbolism), the original scale of Homburg et al. (2015) was adopted. For measuring the four dimensions of brand experience (i.e., sensory, affective, behavioral, and intellectual), the item set developed by Brakus et al. was applied (2009). The measurement of brand perception

(i.e., image, satisfaction, and trust) and consumer behavior (i.e., loyalty, price premium, and willingness to buy) employs items developed by Wiedmann, Hennigs, Schmidt, and Wuestefeld (2011). Finally, all items were specified to an advertisement context and rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

#### 3.2 Data Collection and Sample

To test the introduced conceptual model, a laboratory experiment was conducted in July 2016. The main objective was to investigate the sensory perception of a specially prepared print ad promoting both a female and a male fragrance. To achieve a haptic effect, a self-adhesive foil highlighting the perfume bottles and brand logo was incorporated. In addition, a QR code playing the advertising jingle when activated was added for acoustics, and the corresponding perfume was sprayed on the print ad to appeal to the olfactory sense. The initial part of the study included direct stimulus contact, where participants had to absorb the sensory stimuli from the print ad. Next, the subjects were asked to evaluate the perfume, the men rating only the male fragrance and the women only the female fragrance. First, the participants completed a forced-choice implicit association test. Subsequently, a questionnaire was filled out: the first section asked introductory questions on, for example, the participants' familiarity with perfumes and the brand; the second and main section included queries about the test variables (i.e., implicit and explicit sensory perception, product design, brand experience, brand perception, and consumer behavior); and the third section contained social demographics.

In total, 77 subjects participated in the study. Table 1 presents the corresponding characteristics of the sample. The participants' age ranged from 19 to 82, having an average age of 35.25 years. Most of the respondents were female (50.6%), single (64.9%), had a university degree (46.7%), were students (42.9%) and had a monthly income of either between 2000€ and 3000€ (20.8%) or higher than 4000€ (20.8%), respectively.

#### 3.3 Data Analysis

The analysis software SPSS 24.0 was applied for the descriptive analysis of the demographic sample characteristics (i.e., means and frequencies) and for some aspects of the evaluation of the measurement models (i.e., Pearson correlation coefficient, Cronbach's alpha, and variance inflation factor). For hypotheses testing, partial least squares structural equation modeling (PLS-SEM) was used, as the conceptual model contains reflective and formative indicators. The data analysis follows a two-step approach involving the evaluation of first the measurement models and second the structural model (Henseler, Ringle, & Sinkovics, 2009). For that purpose, the SmartPLS 2.0 analysis software was applied (Ringle, Wende, & Will, 2005) including the PLS algorithm (path weighting scheme) and bootstrapping and blindfolding and procedure (individual sign changes).

**Table 1:** Sample Characteristics

Variable	Characteristics	n	%
Age	18 – 24 years	23	29.9
	25 – 49 years	35	45.5
	> 50 years	19	24.7
Gender	female	39	50.6
	male	38	49.4
Marital status	single	50	64.9
	married	25	32.5
	divorced	2	2.6
Education	junior high school diploma	15	19.5
	senior high school diploma	26	33.8
	university degree	36	46.7
Occupation	scholar	1	1.3
	trainee	1	1.3
	student	33	42.9
	full-time employee	32	41.6
	part-time employee	4	5.2
	housewife/househusband	1	1.3
	retired	5	6.5
Income	< 1000 €	13	16.9
	1000 – 2000 €	14	18.2
	2000 – 3000 €	16	20.8
	3000 – 4000 €	13	16.9
	> 4000 €	16	20.8
	no answer	5	6.5
<b>Total sample size</b>		<b>77</b>	<b>100.0</b>

## 4. Findings

### 4.1 Evaluation of the Measurement Models

Prior to hypothesis testing, the measurement models are first checked to ensure reliability and validity (Henseler et al., 2009). With regard to the formative constructs (i.e., implicit sensory perception, explicit sensory perception, and product design), Table 2 presents the respective quality criteria. As required by Hair, Sarstedt, Ringle, and Mena (2012), all items show outer weights higher than 0.1. Except for the implicit visual and acoustic perception, all items have t values above 1.645 and are thus, at least on a 10% level, significantly important for the respective measurement model. Further, the maximum variance inflation factor (VIF) is 1.834, far below the limit of 10, so there are no multicollinearity problems (Diamantopoulos, Riefler, & Roth, 2008).

Referring to the reflective measurement models (i.e., brand experience, brand perception, and consumer behavior), Table 3 shows the values checking for quality. The criteria are satisfied throughout. The factor loadings, with a minimum value of 0.785, all exceed the limit of 0.7. Accordingly, indicator reliability is given (Hair, Ringle, & Sarstedt, 2011). The average variance extracted (AVE) clearly exceeds the 50% requirement, as it shows a minimum amount of 74.2%. This confirms convergent validity. Moreover, the AVE is always higher than the highest squared correlation with another latent variable. Thus, the Fornell-Larcker-criterion for discriminant validity is satisfied (Fornell & Larcker, 1981). Finally, the composite reliability shows its minimum at 0.901 and Cronbach's alpha at 0.833, both of which are far above the limits of 0.7 and 0.6, respectively. Consequently, internal consistency reliability is also fulfilled (Bagozzi & Yi, 2012; Churchill, 1979; Peterson, 1994).

**Table 2:** Evaluation of the formative measurement models

	Weights	t value	VIF
<b>Implicit sensory perception</b>			
Visual	0.191	1.154	1.555
Acoustic	0.135	1.096	1.378
Haptic	0.591	3.579	1.834
Olfactory	0.311	1.923	1.722
<b>Explicit sensory perception</b>			
Visual	0.508	3.895	1.335
Acoustic	0.278	2.389	1.188
Haptic	0.335	2.881	1.490
Olfactory	0.263	2.161	1.339
<b>Product design</b>			
Aesthetics	0.406	3.480	1.520
Functionality	0.301	2.644	1.397
Symbolism	0.547	5.900	1.295

**Note:** VIF = variance inflation factor.

**Table 3:** Evaluation of the reflective measurement models

	Loadings	AVE	$\alpha$	$\rho_c$	FLC (AVE > r <sup>2</sup> )
Brand experience	0.844–0.884	0.742	0.884	0.920	0.742 > 0.480
Brand perception	0.862–0.910	0.790	0.867	0.918	0.790 > 0.625
Consumer behavior	0.785–0.909	0.752	0.833	0.901	0.752 > 0.625

**Note:**  $\alpha$  = Cronbach's alpha; AVE = average variance extracted; FLC = Fornell Larcker criterion;  $\rho_c$  = composite reliability; r<sup>2</sup> = highest latent variable correlation squared.

To preclude common method bias, Harman's one-factor test for the explicit measures was used. The explained variance for the single factor is at 35.14%. As this value clearly remains under the upper limit of 50%, the data are not biased by the source of the measurements (Podsakoff & Organ, 1986).

### 4.2 Evaluation of the Structural Model

In addition to the measurement models, the quality of the structural model must be tested. Table 4 shows the respective values of two prediction-oriented and nonparametric measures, the coefficient of determination (R<sup>2</sup>) and the cross-validated redundancy measure (Q<sup>2</sup>). R<sup>2</sup> ranges from 0.372 to 0.667. Thus, the results indicate a satisfactory goodness of fit (Chin, 1998). Furthermore, Q<sup>2</sup> reveals a minimum value of 0.309. Hence, all values are positive, which confirms the model's predictive relevance (Geisser 1974; Stone 1974).

**Table 4:** Evaluation of the structural model

	R <sup>2</sup>	Q <sup>2</sup>
Explicit sensory perception	0.551	-
Product design	0.372	-
Brand experience	0.440	0.309
Brand perception	0.557	0.400
Consumer behavior	0.667	0.453

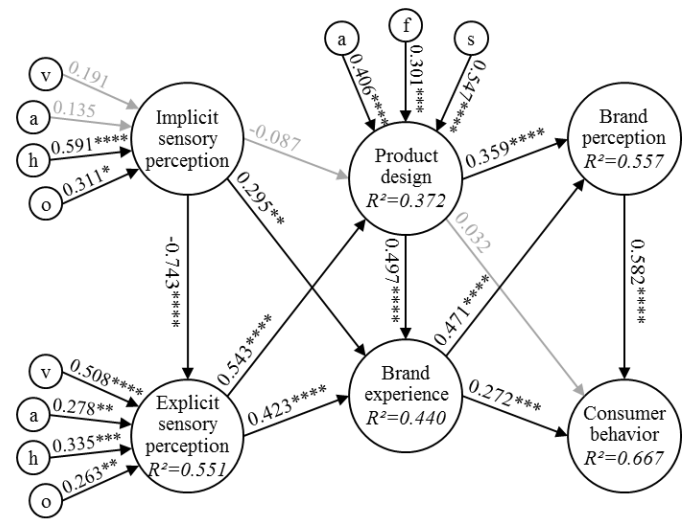
Finally, the research hypotheses can be verified. Table 5 shows the t values and path coefficients representing the significance and strength of the structural relations between the latent variables.

**Table 5:** Bootstrapping results for the causal relationships

			Original sample	Sample mean	SD	t value	
<b>H1:</b>	ISP	→	ESP	-0.743	-0.753	0.068	10.867
<b>H2a:</b>	ISP	→	PD	-0.087	-0.131	0.091	0.955
<b>H2b:</b>	ISP	→	BE	0.295	0.293	0.122	2.414
<b>H3a:</b>	ESP	→	PD	0.543	0.566	0.111	4.874
<b>H3b:</b>	ESP	→	BE	0.423	0.437	0.123	3.433
<b>H4a:</b>	PD	→	BE	0.497	0.490	0.068	7.353
<b>H4b:</b>	PD	→	BP	0.359	0.355	0.079	4.560
<b>H4c:</b>	PD	→	CB	0.032	0.066	0.050	0.644
<b>H5a:</b>	BE	→	BP	0.471	0.475	0.073	6.441
<b>H5b:</b>	BE	→	CB	0.272	0.278	0.088	3.095
<b>H6:</b>	BP	→	CB	0.582	0.570	0.088	6.635

**Note:** SD = standard deviation; ISP = implicit sensory perception; ESP = explicit sensory perception; PD = product design; BE = brand experience; BP = brand perception; CB = consumer behavior.

With reference to the first hypothesis, which covers the influence of the implicit on the explicit system, the results actually reveal a highly significant effect, although it is negative ( $b = -0.743$ ,  $p \leq 0.001$ ). However insightful, hypothesis H1 in its above-postulated form must be rejected. The next four hypotheses address the driving role of sensory perception for product design and brand experience. The findings show that perceived product design is driven only by the explicit component of sensory perception ( $b = 0.543$ ,  $p \leq 0.001$ ), not by the implicit one ( $b = -0.087$ ,  $p > 0.1$ ). Moreover, the experience with a brand is significantly affected by both explicit sensory perception ( $b = 0.423$ ,  $p \leq 0.001$ ) and implicit sensory perception ( $b = 0.295$ ,  $p \leq 0.05$ ). Hence, hypothesis H2a is rejected, while hypotheses H2b, H3a, and H3b find full empirical support. Further, the following three hypotheses address the effect of product design on brand-related outcome variables. More specifically, the study provides evidence for a highly significant impact on brand experience ( $b = 0.497$ ,  $p \leq 0.001$ ) and brand perception ( $b = 0.359$ ,  $p \leq 0.001$ ). By contrast, consumer behavior is not directly enhanced by product design ( $b = 0.032$ ,  $p > 0.1$ ). Consequently, hypothesis H4c is rejected, but hypotheses H4a and H4b are confirmed. Moreover, the effect of brand experience on brand-related outcome variables is tested. The results indicate that a positive experience with a brand contributes to a better overall perception of that brand ( $b = 0.471$ ,  $p \leq 0.001$ ) and a more favorable behavior of the consumer toward that brand ( $b = 0.272$ ,  $p \leq 0.01$ ). Thus, both hypotheses H5a and H5b are verified. Finally, the last hypothesis contains the effect of brand perception on consumer behavior. Correlating with former research, the findings show a highly significant and strong causal relationship ( $b = 0.582$ ,  $p \leq 0.001$ ). Overall, the results reveal that eight of the eleven hypotheses find full empirical support, so a causal chain of direct and indirect effects from sensory perception to consumer behavior is detected (see Figure 2).



**Figure 2:** Empirical model

**Note:** \*\*\*\*  $p \leq 0.001$ ; \*\*\*  $p \leq 0.01$ ; \*\*  $p \leq 0.05$ ; \*  $p \leq 0.1$ .

## 5. Discussion

The data analysis confirms a major part of the theoretically based model. The results reveal that sensory perception is an important driver of product- and brand-related outcome variables in the chosen context of the print advertisement. Specifically, the incorporation and coherent use of several sensory stimuli lead to positive consumer behavior. The findings show a positive, indirect effect of explicit sensory perception on both brand perception and consumer behavior. In this context, product design and brand experience work as mediators. On an explicit level, all sensory drivers show significant results. The visual perception is the most important driver ( $b = 0.508$ ,  $p \leq 0.001$ ). Haptic perception plays a substantial but less significant role ( $b = 0.335$ ,  $p \leq 0.01$ ), followed by acoustic and olfactory perception, which have almost equal effects ( $b = 0.278$ ,  $p \leq 0.05$ ;  $b = 0.263$ ,  $p \leq 0.05$ ). The findings correlate with existing marketing literature, highlighting visual perception as the strongest driver in most contexts (Schiffstein, 2006). However, our results also point to the importance of the other senses. With regard to the implicit level, only two of the four drivers are significant. Haptic perception is the most powerful driver ( $b = 0.591$ ,  $p \leq 0.001$ ). Olfactory perception plays a lesser but still significant and essential role ( $b = 0.311$ ,  $p \leq 0.1$ ). The reason for the strong effect of haptic perception on an explicit and implicit level might be found in the nature of print ads: as they are usually integrated into advertising materials made of paper (e.g., in journals), contact with the ad is often accompanied by physically touching it. This is why haptic perception might have such a strong, positive influence. For olfactory perception, the value for the implicit perception is higher than for the explicit perception. Therefore, it can be assumed that the olfactory sense is perceived more strongly on an implicit level and that the dominant implicit perception causes an inferior explicit effect. In fact, haptic and olfactory perception might also be influenced by imagery induced by, for example, the visual cues of the advertisement (Deng & Kahn, 2009; Krishna, Morrin, & Sayin, 2013). However, the direct effect of implicit on explicit sensory perception is negative. A potential reason for this result could be that the participants were implicitly averse to the print ad, which was rather indecent in terms of showing a half-naked man touching an attractive woman. However, the respondents did not express this reluctance explicitly. Because the print ad promotes a renowned luxury brand, this contradiction might be explained by the participants' generally positive attitude toward that brand, regardless of the print ad. Thus, if marketing managers implement different sensory stimuli, they must be

aware of both the explicit and implicit effects and, to make the advertisement more effective, should ensure that there is no conflict between the perception levels.

The study reveals the significance of various senses on an explicit and implicit level, providing evidence for the importance of a multisensory marketing approach in which the appeal of all senses is paramount. Moreover, the results confirm a positive and strong effect of explicit sensory perception on perceived product design, whereas implicit sensory perception shows only an indirect effect through explicit sensory perception. All dimensions of product design reveal significant results. Symbolism seems to be the strongest driver ( $b = 0.547, p \leq 0.001$ ), followed by aesthetics ( $b = 0.406, p \leq 0.001$ ) and functionality ( $b = 0.301, p \leq 0.01$ ). These findings correlate with recent insights emphasizing the importance of the symbolic dimension when examining aspects of product design. In the specific case of the print advertisement, the sensory stimuli perceived from the print ad mainly promote the appearance of the product and communicate symbolic value but only partly explain the functional aspects. Thus, marketing managers should always be aware of the specific positioning context in which they are operating and further conclude from this which product design dimensions might be of increased importance for an overall evaluation. Additionally, to address a specific dimension, the product itself must be created in a multisensory way to provide additional information on a conscious or subconscious level. Moreover, for brand experience, the results indicate a positive direct effect from implicit and explicit sensory perception and perceived product design as well as an indirect effect from implicit sensory perception, where explicit sensory perception and product design work as mediators. In the given context of print ads, the composition of different sensory stimuli and the promotion of the product itself can be used to implement a holistic experiential marketing concept that evokes positive feelings or engages consumers in deep thinking and attracts behavioral options.

The question arises of how sensory stimuli can be designed to be fully effective in addressing the different experience components. In addition, the sensory perception has an indirect impact on perceived product design. This is why the use of sensory stimuli can be linked to the promoted product to achieve a strong effect, for example, through special haptic, olfactory or acoustic elements highlighting the specific product within the ad. Moreover, product design and brand experience show a strong and positive impact on brand-related outcomes. Because brand perception also positively influences consumer behavior, there are partial mediator effects in both cases. First, the perceived product design has no direct impact on consumer behavior but has an indirect impact on brand experience and brand perception. Second, brand experience influences consumer behavior both directly and indirectly through brand perception. Thus, when consumers perceive product design and brand experience well, their behavior becomes more favorable, and they experience a positive overall assessment of the brand. Accordingly, to build a positive relationship between the customer and the brand with the help of a multisensory marketing concept, special attention should be paid to the mediation of strong product design and brand experience. These can be seen as important drivers, as they explain 55% of the variance of brand perception and 66% of the variance of consumer behavior.

To conclude, in the given context of print ads, the data analysis shows that implicit and explicit sensory perception is relevant success drivers for the implementation of a brand experience and for strengthening the perceived product design, which in turn leads to a satisfied and loyal customer. To gain a positive overall assessment of a brand in terms of

brand image, trust, and satisfaction and to make customers buy the brand's products, an appealing product design and an integrated experiential marketing approach are crucial. Accordingly, the implementation of different sensory stimuli seems to be a promising brand management tool for creating effective print ads. Hence, our results broaden conventional thinking that has focused on the visual sense as the only one to appeal to.

## 6. Conclusions and Outlook

The aim of this paper was to analyze the potential of sensory cues in the context of the print advertisement. The results confirm the assumption that addressing different sensory modalities in a congruent way can have a positive influence on brand-related outcome variables. In particular, the study provides new insights into the effects of both explicit and implicit sensory perception on product design, brand experience, brand perception, and consumer behavior. Furthermore, it has been shown that product design and brand experience act as mediating factors between the consumer's sensual stimulation and response.

Moreover, our results provide an opportunity for further research, especially in the field of sensory marketing. First, it would be interesting to determine which sensory modalities have the strongest impact. Therefore, a group comparison study with different amounts of sensory stimuli per group would be necessary. In addition, the use of various sensory stimuli with different characteristics would add even more insights to this topic. Second, the impact of demographic, cultural, and situational aspects as moderator variables could be assessed to gain more insights into the underlying relationships. Third, the conceptual model can be used as a foundation in the context of (print) advertisement and in many other areas (e.g., product policy). Although there is still a great need for more research to understand the underlying relationships, these findings will also help brand managers, especially in the field of print advertisement, to manage sensory stimuli effectively and succeed in a competitive market. To this end, the results also emphasize that when implementing a successful multisensory marketing strategy, "how" things are done is more important than "whether" something is done.

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**A7:**

**Sensory imagery in advertising: How the senses affect perceived product design and  
consumer attitude**

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# Sensory imagery in advertising: How the senses affect perceived product design and consumer attitude

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## ABSTRACT

Research in sensory marketing provides evidence for the significant potential of sensory imagery to create sensory consumer experiences. Particularly in the context of food and beverage advertising, the targeted appeal of the senses through sensory imagery appears to be promising. However, research gaps remain concerning the concrete effect sizes of sensory appeals and possible mediators such as perceived product design. This paper aims to close these gaps by focusing on two different research issues. First, it investigates the effects of sensory imagery on marketing-related key performance indicators (i.e., sensory perception, perceived product design, and attitude) using analysis of variance. Further, the paper examines underlying causal relationships between these potential market success factors by applying partial least squares structural equation modeling (PLS-SEM). The findings support the usefulness of sensory imagery in advertisements, as it appears to be a valuable approach to address specific senses and to positively affect consumer perception. Moreover, the results reveal a causal chain of several direct and indirect effects between relevant performance indicators. Implications for marketing managers can be derived from this research on how to design powerful advertisements and effectively appeal to all five human senses by relying on sensory imagery.

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## Introduction

Research on the effectiveness of advertising has a long history in marketing literature (e.g., Frazer, Sheehan, and Patti 2002; Gallagher, Foster, and Parsons 2001; MacKenzie, Lutz, and Belch 1986; Wells 2014). Specific attention has been given to the design of advertisements. Advertisement design leads to specific associations with the product and is thus of significant importance for product perception and actual purchase behavior (Lane 2000; Olney, Holbrook, and Batra 1991; Resnik and Stern 1977). However, uncertainty remains in marketing management regarding whether company advertising activities are chosen and used most effectively (Aaker and Carman 1982; Tellis 2003). Therefore, marketing practitioners are increasingly seeking innovative advertising strategies because traditional marketing approaches may frequently lead to unsatisfying and undesirable consumer responses (Lee and Lee 2004; McNally,

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Akdeniz, and Calantone 2011). In this regard, the selective utilization of sensory cues to attract consumers and provide memorable experiences has gained notable interest from a theoretical and practical point of view (Krishna and Schwarz 2014; Lindstrom 2005). Particularly in the field of food and beverages, advertisements that effectively appeal to consumers' senses appear to be promising, as all five human senses (vision, hearing, touch, olfaction, and taste) are potentially of high importance for product evaluation (Schifferstein 2006). In principal, an advertisement can appeal to consumers' senses in two ways, directly or indirectly through sensory imagery (Krishna, Cian, and Sokolova 2016). Correspondingly, advertisements which transfer real sensory cues and therefore directly target consumers' senses have been developed in recent times. This approach includes, for instance, the implementation of a scented strip in a perfumery advertisement to appeal to the olfactory sense or the use of haptic elements to provide a specific experience of touch (Wiedmann et al. 2017). Moreover, the phenomenon of sensory imagery has been highlighted in marketing literature as an effective opportunity to create sensory consumer experiences. Sensory imagery is induced, for instance, by an image when the viewer perceives to have a specific sensory experience without actually perceiving related sensory cues (Elder et al. 2017). Although there are different manifestations of sensory imagery, the majority of research has focused on visual imagery (Dahl, Chattopadhyay, and Gorn 1999; Escalas 2004; Hung and Wyer 2011). However, there is also evidence regarding the existence of other types of sensory imagery related to the nonvisual senses (Krishna, Morrin, and Sayin 2014; Larson, Redden, and Elder 2014; Peck, Barger, and Webb 2013; Unnava, Agarwal, and Haugtvedt 1996). Furthermore, in the context of advertisement, some studies have already empirically shown the significant potential of sensory imagery (e.g., Elder and Krishna 2012). Although research provides evidence for the generally positive effects of sensory imagery on attitude toward the product, uncertainty remains regarding the concrete effect sizes and possible mediator variables (such as perceived holistic product design). Therefore, this paper addresses two different research issues. On the one hand, it examines the effect of sensory imagery on marketing-related key performance indicators in terms of sensory perception, perceived product design, and attitude (H1). On the other hand, it investigates the subsequent causal relationships between the marketing-related key performance indicators (H2–H4). For the first part, we apply one-way analyses of variance (ANOVAs); for the second part, we use partial least squares structural equation modeling (PLS-SEM). The object of investigation is an advertisement showing lemonade in two versions: a simple picture evoking a low level of imagery and an enhanced picture eliciting a high level of imagery. This paper is structured as follows. In the next section, we provide further theoretical background leading to the derivation of our hypotheses. Then, we present the methodology of our study, followed by the results. Finally, we discuss our findings and suggest implications for marketing management and future research.

## Theoretical background

The majority of sensory imagery research in marketing focuses on single sensory experiences (Elder et al. 2017), such as creating a vivid imagining of a cookie's smell in the consumer's mind by presenting an advertisement picture of a cookie (Krishna,

Morrin, and Sayin 2014). There is also empirical evidence for multisensory imagery (Maclinnis and Price 1987). However, findings predominantly suggest modality-specific patterns of imagery, as self-report studies show that there is no reason to believe in the existence of a holistic factor of general sensory imagery (Andrade et al. 2014). Based on these insights, it appears to be a reasonable approach for marketers to specifically target the senses separately through sensory imagery induced by advertisement design. This thesis is further supported by the assumption of the multisensory enhancement effect, which is expected to appear when different sensory modalities are appealed to in a congruent way (Hultén 2011). This should lead to a better consumer experience and therefore positively influence consumer perception (Joy and Sherry, Jr. 2003). Furthermore, the targeted sensory approach may affect consumer perception in various ways. On the one hand, the approach can increase the respective modal-specific consumer liking (Lwin, Morrin, and Krishna 2010). On the other hand, the enhancement of sensory stimulation might also lead to a better overall perception and liking (Krishna, Elder, and Caldara 2010). In the context of products, the overall perception of a product is primarily explained by the perception of product design. Therefore, we conceptualize product design from a gestalt theoretical viewpoint as a set of constitutive elements of a product that are perceived by the consumer and processed as a multidimensional construct (Homburg, Schwemmler, and Kuehnl 2015). In the literature, the perception of product design is generally divided into three subdimensions, that is, esthetics, functionality, and symbolism. Esthetics is linked to the hedonic pleasure of a product (Desmet and Hekkert 2007), whereas functionality indicates the perceived utilitarian value the product conveys through its design (Bloch 2011). Symbolism refers to the level of identification and meaning the product design transfers to the consumer (Kumar and Noble 2016). In line with the aforementioned descriptions, studies have already provided evidence for a strong relationship between sensory appeal and all dimensions of product design (e.g., Hoegg and Alba 2011; Peck and Childers 2003; Veryzer and Hutchinson 1998). Additionally, the perception of product design plays an important role in general consumer behavior and thus can significantly influence key factors of marketing success such as consumer attitude (Bloch 1995; Landwehr, Wentzel, and Herrmann 2012; Montana, Guzman, and Moll 2007). In the specific case of advertisements, research has further confirmed the positive effect of consumers' attitudes toward the ad on consumers' general attitudes toward the promoted product (MacKenzie, Lutz, and Belch 1986; Shimp 1981). Thus, in a first step, we hypothesize:

H1: The more senses are appealed to by an advertisement through sensory imagery, the better the (a) sensory perception (i.e., visual, acoustic, haptic, olfactory, and gustatory), (b) perceived product design (i.e., esthetics, functionality, and symbolism), and (c) attitude (i.e., toward the ad and toward the product) becomes.

In addition, we expect the following causal relationships between the identified factors:

H2: Sensory perception (i.e., visual, acoustic, haptic, olfactory, and gustatory) has a positive effect on perceived product design (i.e., esthetics, functionality, and symbolism).

H3: Perceived product design (i.e., esthetics, functionality, and symbolism) has a positive effect on attitude (i.e., toward the ad and toward the product).

H4: Attitude toward the ad has a positive effect on attitude toward the product.

## Methodology

To test the research hypotheses, we conducted a quantitative study involving an experiment and an online survey. As the object of investigation, we used an advertisement promoting lemonade. For the experiment, we created two versions of the advertisement, a simple and an enhanced one (see Figure 1). The simple version showed the product only (the lemonade bottle) and an ordinary advertising slogan. The enhanced version showed the same product and slogan but was supplemented by several elements appealing to the five senses to enhance the imagery processing in the consumer's mind (e.g., condensation drops running down the bottle to communicate freshness, speech bubbles with the words 'mmmh' to evoke an impression about the good taste and 'zisch' to illustrate the sound when opening the sparkling beverage). The online survey began with a brief introduction and preliminary questions (e.g., frequency of lemonade consumption, general liking of lemonade). Then, each subject was presented with the stimulus, that is, either the simple or the enhanced advertisement. The assignment of the test persons to the respective groups was made randomly. After the stimulus contact, the questionnaire sequentially inquired about the degree of imagery processing, the consumers' sensory perception of the product, the perceived product design and the attitude toward the ad and toward the product. Finally, the subjects were asked to provide information on their sociodemographic characteristics.

The sample included 407 participants (44.7% male, 55.3% female) with a mean age of 30.56 years (from 16 to 77 years). Most respondents drink lemonade at least once a week (50.6%), followed by respondents who drink lemonade at least once a month (33.2%). Further, the sample shows a mean liking of lemonade of 5.60 (SD = 2.34) on a 9-point hedonic scale, where the modal value is 7 (19.9%). Furthermore, most participants are single (77.9%), have a university degree (56.0%), are students (42.3%), and have a monthly net income below 2000 € (56.7%), respectively. Moreover, the two groups



Figure 1. Simple (left) and enhanced (right) advertisement.

(simple ad:  $n = 198$ , enhanced ad:  $n = 209$ ) show very similar values with respect to their affinity for lemonade (e.g., mean liking of 5.58 and 5.61), all sociodemographic attributes such as gender distribution (44.9% male, 55.1% female; 44.5% male, 55.5% female), and age (mean age of 30.52 and 30.59 years). Consequently, the data are perfectly suitable for comparison testing.

For the measurement of the test variables, we used diverse scales. The consumers' sensory perception of the product was measured by the sensory perception item set established by Haase and Wiedmann (2017). For each sense, we adopted four adjectives to determine how well the lemonade appealed to the consumer on a visual, acoustic, haptic, olfactory, and gustatory level. With regard to perceived product design, we applied the measurement scale of Homburg, Schwemmler, and Kuehnl (2015) with three items for each dimension (i.e., esthetics, functionality, and symbolism). All of the mentioned items were rated on 5-point Likert scales (1 = strongly disagree, 5 = strongly agree). Moreover, to capture the attitude toward the ad and the attitude toward the product, we relied on the measurement of Grohmann (2009) using 9-point semantic differential scales with the anchors 'negative/positive', 'dislike/like', and 'unfavorable/favorable'. In addition, for the subsequent manipulation check, we applied the measurement of communication-evoked mental imagery according to Babin and Burns (1998). To maintain a moderate length for the questionnaire, we integrated one statement per dimension, namely, the item that was identified as the strongest indicator variable having the highest factor loading for the respective dimension. Thus, we used 'vivid' for vividness, 'I imagined a number of things' for quantity, and 'I imagined what it would be like to use the product advertised' for elaboration. The items were again rated on 5-point Likert scales (1 = strongly disagree, 5 = strongly agree).

To test the manipulation of the advertisement used in our experiment, we conducted a one-way ANOVA with the group variable (simple ad vs. enhanced ad) as the independent variable and the three dimensions of imagery (vividness, quantity, and elaboration) as the dependent variables. The results indicate that the enhanced advertisement (e) scored significantly better on all three dimensions compared to the simple advertisement (s), that is, on vividness ( $M_s = 2.535$  vs.  $M_e = 3.191$ ;  $F_{1, 405} = 33.977$ ,  $p < 0.001$ ,  $\eta^2 = 0.077$ ), quantity ( $M_s = 2.242$  vs.  $M_e = 2.694$ ;  $F_{1, 405} = 16.109$ ,  $p < 0.001$ ,  $\eta^2 = 0.038$ ), and elaboration ( $M_s = 3.227$  vs.  $M_e = 3.498$ ;  $F_{1, 405} = 4.623$ ,  $p = 0.032$ ,  $\eta^2 = 0.011$ ). Hence, as intended, the enhanced advertisement evoked a stronger level of imagery.

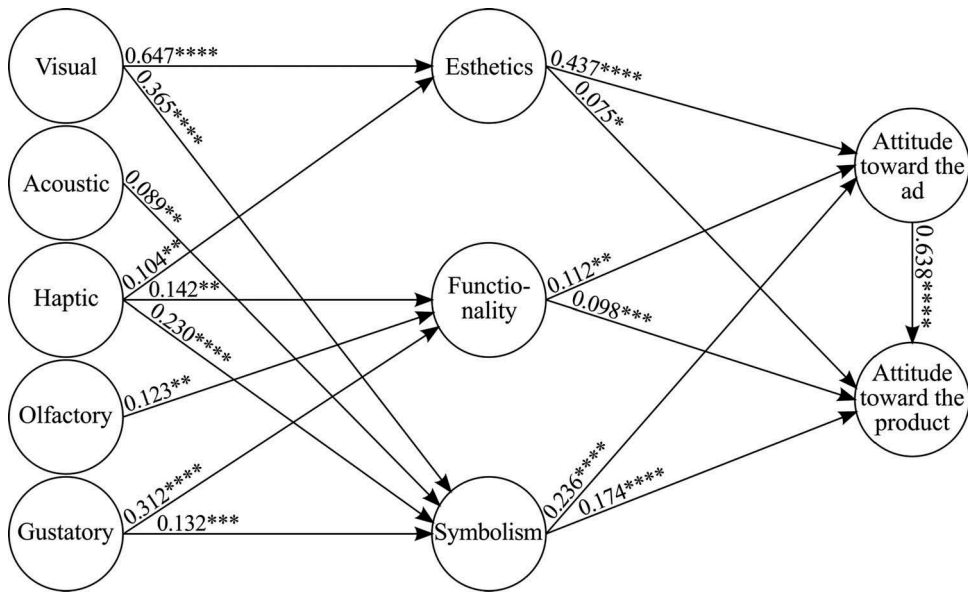
## Results

To test hypothesis H1, we conducted one-way ANOVAs. As recommended, we considered a one-sided confidence interval for a difference between means (i.e., alpha of 0.10 instead of 0.05) due to the one-sided directionality of the hypothesis (Cho and Abe 2013). The two groups (simple ad vs. enhanced ad) were compared with regard to 10 dependent variables: (a) visual, acoustic, haptic, olfactory, and gustatory perception (sensory perception); (b) esthetics, functionality, and symbolism (perceived product design); and (c) attitude toward the ad and attitude toward the product (attitude). Referring to sensory perception, there were significant differences for the olfactory ( $F_{1, 405} = 3.564$ ,  $p = 0.060$ ,  $\eta^2 = 0.009$ ) and gustatory perception ( $F_{1, 405} = 3.960$ ,  $p = 0.047$ ,  $\eta^2 = 0.010$ ). The enhanced advertisement led to a better assessment of the lemonade's

aroma in terms of scent ( $M_s = 3.133$  vs.  $M_e = 3.298$ ) and taste ( $M_s = 3.376$  vs.  $M_e = 3.548$ ). Interestingly, the visual manipulation of the ad did not affect the visual perception ( $F_{1, 405} = 1.893$ ,  $p = 0.170$ ,  $\eta^2 = 0.005$ ). In addition, the acoustic and haptic perception were not significantly influenced ( $F_{1, 405} = 0.394$ ,  $p = 0.530$ ,  $\eta^2 = 0.001$ ;  $F_{1, 405} = 1.380$ ,  $p = 0.241$ ,  $\eta^2 = 0.003$ ). Moreover, with respect to perceived product design, only esthetics shows significant differences between the two groups ( $F_{1, 405} = 5.986$ ,  $p = 0.015$ ,  $\eta^2 = 0.015$ ). Again, the group that was stimulated with the enhanced advertisement evaluated the product better ( $M_s = 2.534$  vs.  $M_e = 2.775$ ). Functionality and symbolism were not significantly affected ( $F_{1, 405} = 1.585$ ,  $p = 0.209$ ,  $\eta^2 = 0.004$ ;  $F_{1, 405} = 0.005$ ,  $p = 0.944$ ,  $\eta^2 = 0.000$ ). Further significant differences were detected in the case of attitude, in the form of both the attitude toward the ad ( $F_{1, 405} = 3.625$ ,  $p = 0.058$ ,  $\eta^2 = 0.009$ ) and the attitude toward the product ( $F_{1, 405} = 3.001$ ,  $p = 0.084$ ,  $\eta^2 = 0.007$ ). Again, the subjects with the enhanced advertisement showed higher values compared to the subjects with the simple advertisement, that is, a better evaluation of the ad ( $M_s = 5.099$  vs.  $M_e = 5.451$ ) and the product ( $M_s = 5.396$  vs.  $M_e = 5.695$ ). Consequently, hypotheses H1a and H1b found partial support and H1c received full empirical support.

With regard to hypotheses H2–H4, we applied PLS-SEM. First, the measurement models were checked for reliability and validity. Following the recommendations of Hair et al. (2012) and Henseler, Ringle, and Sinkovics (2009), the data revealed satisfactory values for the relevant quality criteria. Across all measurement models, the factor loadings ranged from 0.703 to 0.972 and thus surpassed the critical value of 0.7. Moreover, the average variance extracted (AVE) showed its minimum at 61.2%, clearly above the critical share of 50%. Further, the Fornell–Larcker criterion was fulfilled, as the AVE was higher throughout than the construct's highest squared correlation with any other construct (Fornell and Larcker 1981). In addition, each indicator's loadings were higher than all of its cross loadings. Finally, the composite reliability had a minimum value of 0.863 and Cronbach's alpha of 0.787, both far above the lower limit of 0.7. Second, the structural model was evaluated. The coefficient of determination ( $R^2$ ) ranged from 0.276 (functionality) to 0.708 (attitude toward the product), indicating a satisfactory goodness of fit (Chin 1998). The cross-validated redundancy measure ( $Q^2$ ) ranged from 0.188 (functionality) to 0.649 (attitude toward the product), verifying the model's predictive relevance (Geisser 1974; Stone 1974).

In a further step, the causal relationships between the test variables were evaluated. Figure 2 illustrates the findings. Between the five dimensions of sensory perception and the three dimensions of product design, there were several significant positive effects. Esthetics was mainly driven by visual perception ( $b = 0.647$ ,  $p \leq 0.001$ ) and slightly influenced by haptic perception ( $b = 0.104$ ,  $p \leq 0.05$ ). Functionality was affected by gustatory ( $b = 0.312$ ,  $p \leq 0.001$ ), haptic ( $b = 0.142$ ,  $p \leq 0.05$ ), and olfactory perception ( $b = 0.123$ ,  $p \leq 0.05$ ). Symbolism was formed by all senses except for the olfactory sense, that is, by visual ( $b = 0.365$ ,  $p \leq 0.001$ ), haptic ( $b = 0.230$ ,  $p \leq 0.001$ ), gustatory ( $b = 0.132$ ,  $p \leq 0.01$ ), and acoustic perception ( $b = 0.089$ ,  $p \leq 0.05$ ). Furthermore, the results confirmed all of the proposed effects from perceived product design on attitude, where the direct impact on the attitude toward the ad is always stronger than the one on the attitude toward the product, that is, in the case of esthetics ( $b = 0.437$ ,  $p \leq 0.001$ ;  $b = 0.075$ ,  $p \leq 0.1$ ), functionality ( $b = 0.112$ ,  $p \leq 0.05$ ;  $b = 0.098$ ,  $p \leq 0.01$ ) as well as symbolism ( $b = 0.236$ ,  $p \leq 0.001$ ;  $b = 0.174$ ,  $p \leq 0.001$ ). Finally, the attitude toward the



**Figure 2.** Results of the PLS-SEM.

ad showed a strong and highly significant positive effect on the attitude toward the product ( $b = 0.638$ ,  $p \leq 0.001$ ), mediating the effects of perceived product design. All in all, the majority of the proposed causal relationships were confirmed. As a result, it can be stated that hypotheses H2–H4 found empirical support.

## Discussion

The findings suggest that the modification of a purely visual advertising medium in the form of supplemented elements that enhance sensory imagery is a valuable approach to addressing other senses and positively affecting consumer perception in terms of perceived product design and attitude. First, the one-way ANOVAs (considering two groups, one with a simple and another with an enhanced advertisement) provided evidence for the presence of sensory imagery as the transfer of the visual cues to olfactory and gustatory perception. Interestingly, the impact on visual perception was insignificant. However, this result makes sense when remembering that the modification of the advertisement, even though purely visual, was only focused on appealing to the other four senses. In fact, this affirms the potential of visual cues to influence nonvisual perception, but without interfering with visual perception. Further, the acoustic and haptic perception could not be improved by the enhanced advertisement. This result may be explained by different factors. First, compared to the other three senses, sound and touch play a subordinate role in the specific product category of beverages (Schifferstein 2006). Accordingly, the moderate visual changes may have been insufficient to induce a conscious improvement of these two factors. Another possible reason may be found in the style of the elements. The condensation drops running down the bottle and the word ‘zisch’ illustrating the sound of the sparkling beverage obviously

were not enough to establish an effective positive haptic and acoustic impression of the lemonade. With regard to product design, perceived esthetics, which relates to hedonic pleasure resulting from the interaction of all senses (Desmet and Hekkert 2007; Homburg, Schwemmler, and Kuehnl 2015), was significantly affected. Conversely, functionality and symbolism showed no significant differences. Functionality refers to the satisfaction of utilitarian needs and is thus based on factual information or related to specific situations for which the product can provide a specific benefit. Both are not given by the modifications in this experiment. Symbolism represents the consumer's identification with the product. The lemonade, as intended, had an ordinary appearance representing an average product in the sector of beverages. As a result, the product per se was not able to evoke a feeling of identification. This may be more a question of either outstanding products with very specific features providing the opportunity to express the consumer's identity or brands that represent a certain image. Again, both aspects were deliberately not included in the advertisement. Furthermore, the two essential outcome variables, consumer attitude toward the ad and the product, were improved. This may be explained by the fact that both the advertisement and the product become more interesting through the small but effective changes. The several improvements altogether translate into a positive overall perception of the product.

Second, the PLS-SEM has provided new insights into the effects of sensory perception, which is elicited by the purely visual advertisement, on perceived product design and attitude. With respect to the causal relationships between the five dimensions of sensory perception and the three dimensions of product design, it can now be determined which senses best appeal to which product design dimension. In the context of beverages, as expected, functionality is primarily driven by gustatory perception, because taste represents the most important sensory modality in the usage of beverages (Schifferstein 2006). Esthetics, although resulting from all five senses, as stated above, is primarily formed by visual perception as it represents the dominant sense in this regard (Blijlevens, Creusen, and Schoormans 2009). Symbolism appears to be a conglomerate that is affected by a mixture of the senses, which seems plausible when considering that consumers may have diverse reasons to identify themselves with a product, due to a specific look of the product, an outstanding form or a particular taste. Moreover, the results have shown that product design directly influences the attitude toward the ad, and less intensively, the attitude toward the product. Further, because the attitude toward the ad strongly affects the attitude toward the product, aligning with established research, partial mediator effects are detected. Accordingly, before the attitude toward the product can be improved, the attitude toward the ad is formed. Hence, the consumer first evaluates the advertising medium as such and then, based on this, conceives an opinion in terms of an overall evaluation of the product. All in all, the study reveals a causal chain of several direct and indirect effects from sensory perception, across product design and the attitude toward the ad, finally to the attitude toward the product.

This paper provides valuable knowledge for marketing managers regarding how to design powerful advertisements and effectively appeal to all five human senses by using the visual sense. First, marketing managers may draw on the given results to successfully appeal to consumers' senses, for example, to know which senses may be addressed to achieve the improvement of specific dimensions of perceived product design. For the



most effective consumer approach, for example with regard to holistic product design that comprises all three dimensions, the strength and number of the elements used in the ad must be considered. Compared to the presented study, further ad elements also may be applied. For instance, a scene at which the product provides a specific benefit may be shown to improve the functional dimension (e.g., a sweating girl who worked out on a sunny day is refreshed by drinking the lemonade) or a brand logo representing the image that the target group can identify with to improve the symbolic dimension. Moreover, the finding that an advertisement design that stimulates sensory imagery in consumers' minds can significantly improve attitude is highly beneficial for marketing managers. Minor changes in the ad may suffice to substantially enhance consumers' attitude toward both the ad and the product. The former is particularly important in recent times, where consumer resistance to advertising represents a significant challenge (Pilelienė and Grigaliūnaitė 2016). Using interesting sensory-enhancing elements, companies may increase the chance that consumers are positive about the ad, which can lead to a positive attitude toward the product. Numerous studies have provided evidence regarding the impact of attitude on consumer behavior (e.g., Homer and Kahle 1988). Consequently, the improvement of attitude is a core objective of marketing managers and an important step for market success, which may be achieved using the provided insights of this paper.

The study features several limitations that offer interesting possibilities for future research. First, we focused on the product level and deliberately eliminated any reference to a brand to exclude existing associations and brand-related preferences. However, as stated above, the brand and the related image are certainly not unimportant in the given context, especially with regard to constructs such as symbolism. As a result, further studies may also include brand-related information (e.g., brand logo or brand-specific design elements). In addition, our findings relate specifically to lemonade. Nevertheless, the results may be applicable to other food products and consumer goods as well. Hence, the study may be replicated for different products and industries. Further, we have used specific elements in our ad (e.g., condensation drops, speech bubbles). Future research may also test other ad elements (e.g., specific scenes, brand-related information). Referring to the illustration of acoustic and haptic features, the analysis has detected difficulties. Thus, further elements may be implemented and examined (e.g., a hand grabbing the bottle or more interesting bottle shapes for haptic perception). From an analytical point of view, future studies may consider analyzing possible moderating effects such as individual differences and context factors. Finally, the study was limited to the explicit (conscious) level of cognitive processing. However, the implicit (subconscious) level of perception may also be of significant interest, especially with regard to the senses that play a secondary role and that consumers may not explicitly think about. Consequently, future research could also measure the test variables on an implicit level (e.g., using reaction time measurement) and examine whether the visual advertisement manipulation leads to an improvement in consumer perception in the subconscious mind. This approach would provide further valuable insights, as the implicit system often provides the initial impetus for behavior (Kahneman 2011) and can thus essentially influence consumers' decision processes (Frieze, Wänke, and Plessner 2006).

## Disclosure statement

No potential conflict of interest was reported by the authors.

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**A8:**

**Brand logo symmetry and product design: The spillover effects on consumer inferences**

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# Brand logo symmetry and product design: The spillover effects on consumer inferences

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## ABSTRACT

This paper addresses the relationship between brand logo symmetry and product design inferences. By relying on the theoretical concepts of consumer self-congruity and spillover effects, we propose that brand logo associations should be in congruence with the consumer's self-concept to have a positive effect on logo liking and, consequently, on product design inferences. Consumers tend to associate asymmetry, not symmetry, with excitement and compare their own self-concept with these perceived associations. Due to self-congruity effects, consumers have higher preferences for a brand logo if the brand logo's associations match their own self-concept. Based on their logo liking, consumers are able to make attitude-based product design inferences. The impact on product design inferences varies with regard to the dimensions of product design. More specifically, the findings demonstrate that inferred product aesthetics and symbolism are, in fact, more strongly affected in comparison to inferred product functionality.

## 1. Introduction

Brand logos are key assets in companies' communication efforts (Henderson, Cote, Leong, & Schmitt, 2003) and important tools to differentiate brands from their competition (Melewar & Saunders, 2000). In particular, logos are often the first exposure to a brand or company when they appear on a product, in an advertisement or in another way. Thus, a logo contributes to the process of building consumers' brand image (Cian, Krishna, & Elder, 2014). Firms recognize the importance of brand logos (Phillips, McQuarrie, & Griffin, 2014) and spend large amounts of their marketing budget on brand logo creation (Hagtvedt, 2011). Classically, brand logos can incorporate various elements that designers can use in the creation of a brand logo, such as specific shapes, images, sizes, typographies or colors (Celhay, Boisselle, & Cohen, 2015; Hynes, 2009). However, little is known about how a brand logo's design elements affect consumer perception (Bottomley & Doyle, 2006; Guido, Pichierri, Natarajan, & Pino, 2016; Salgado-Montejo, Velasco, Olier, Alvarado, & Spence, 2014). Specifically, brand logo symmetry, as an important design factor, has recently gained interest in marketing research (Bajaj & Bond, 2018; Marsden & Thomas, 2013). Symmetry is typically defined as the level of reflection of an image around its vertical axis (Wagemans, 1997). In this context, prior research has focused on the relationship between brand logo symmetry and brand logo perception (Henderson & Cote, 1998; Miceli,

Scopelliti, Raimondo, & Donato, 2014). Other empirical studies have found effects of symmetry in brand logo design on perceived brand personality and on brand equity (Bajaj & Bond, 2018; Luffarelli, Stamatogiannakis, & Yang, 2015). However, a brand logo provides information not only about the brand itself but also about the products of a brand. In fact, brand logos can even fuel consumers' expectations about actual product appearances (Henderson & Cote, 1998). Although an appealing product appearance (e.g., a well-perceived product design) may significantly impact consumer behavior and is therefore highly important from a marketing perspective (Bloch, 1995; Kristensen, Gabrielsen, & Zaichkowsky, 2012), prior research has largely neglected the relationship between brand logo design and belonging product perception, but research has recently called for empirical investigations in this context (e.g., Bajaj & Bond, 2018). We take up this call and contribute to this important topic by investigating the effects of brand logo symmetry on product design inferences. In this regard, we also consider consumer self-concept as an important impact factor in the relationship between brand logo symmetry and product design inferences. This approach builds on existing literature linking asymmetry to associations of arousal and excitement (e.g., Berlyne, 1971; Luffarelli et al., 2015). By taking into account the concept of consumer self-congruity, we further propose an impact of brand logo symmetry on logo liking depending on the consumer's self-concept. Our findings demonstrate the relevance of including consumer self-concept

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in this relationship. Importantly, we show that different levels of an exciting self-concept influence the effects of brand logo symmetry on logo liking and, consequently, on product design inferences.

The rest of the paper is structured as follows. First, we provide a theoretical background addressing the underlying assumptions of the effects between brand logo symmetry and product design inferences, leading to the research hypotheses. In the next sections, we present three empirical studies (i.e., a pilot study and two main studies) in succession. For each study, the methodology is first described. Then, a subsequent section presents the results of the study in detail and further provides a discussion of the findings. This paper ends with a general discussion in which the results are put into a wider context and implications for marketing theory and practice as well as future research directions are derived.

## 2. Theoretical background and hypotheses

### 2.1. Brand logo symmetry and self-congruity effects

Companies utilize logos to identify their own brands and the products belonging to their brands (Bresciani & Del Ponte, 2017). Generally, a logo is considered a graphic design that may include an icon that is an image, an illustration or a symbol (Melewar & Saunders, 2000; Salgado-Montejo et al., 2014). Moreover, a logo can incorporate other elements, such as the brand's name and a logotype, as in the cursive Coca-Cola logo (Kilic, Miller, & Vollmers, 2011). From a designer perspective, a logo can be created on the basis of various design factors (Henderson & Cote, 1998). In this paper, we specifically focus on logo symmetry. Three basic types of symmetry exist: translational, rotational, and reflectional, also called mirror symmetry (Wagemans, 1995). Translational symmetry describes the coincidence of an object when moved along a vector, whereas rotational symmetry is present when an object coincides with itself when rotated around a vertex. Mirror symmetry is defined as symmetry around a plane that divides a figure into two identical images (Turoman, Velasco, Chen, Huang, & Spence, 2017). The most frequently studied form of symmetry is mirror symmetry, and for people in general, mirror symmetry is the easiest to detect and to evaluate of the three types of symmetry (Bertamini, Friedenberg, & Argyle, 2002; Palmer & Hemenway, 1978). Therefore, we focus on mirror symmetry in our research and use the terms mirror symmetry and symmetry synonymously. Psychological research has shown that symmetric objects are easier for humans to process than asymmetric objects. The reason for this is the smaller number of different elements in symmetric objects and thus the usually lower complexity of the objects (Bertamini & Makin, 2014). Lower processing fluency in the perception of asymmetric objects compared to symmetric objects also leads to higher subjective arousal, which is a psychobiological state of excitement or alertness (Blijlevens, Carbon, Mugge, & Schoormans, 2012). Accordingly, in the literature, symmetry is often linked to specific feelings and associations that relate to the effects of symmetry on perceptual fluency and arousal. Specifically, symmetric forms may lead to the impression of attributes such as structure and calm (Creusen, Veryzer, & Schoormans, 2010), whereas asymmetric forms normally create a higher level of arousal and are related to excitement and uniqueness (Krupinski & Locher, 1988; Schmitt & Simonson, 1997). Transferring these considerations to the perception of symmetry in brand logos and taking into account that certain affective states and associations result in correspondingly consistent judgements (Pham, 2004), consumers should perceive asymmetric brand logos as generally more exciting than symmetric brand logos (Stamatogiannakis et al., 2015). To explain the influence of the associations and images that an object creates on the viewer's liking for the object, the theory of self-congruity may be applied. Self-congruity refers to the congruence between the self-concept of the consumer and the perceived image of a stimulus such as a product or a brand (Sirgy, Lee, Johar, & Tidwell, 2008). In this regard, consumers are assumed to prefer products and

brands that create images similar to their own self-concept (Sirgy, 1982). Researchers from the field of marketing and consumer research have provided wide empirical support for this assumption by reporting positive effects on various aspects of consumer perception and behavior if the consumer's self-concept is in congruence with brand- or product-related associations (e.g., Dolich, 1969; Graeff, 1996; Hosany & Martin, 2012; Kressmann et al., 2006; Malhotra, 1988; Sirgy, 1985). Hence, according to the assumptions of self-congruity theory, an object associated with excitement should be preferred by people who perceive themselves as exciting (that is, who have a high exciting self-concept) rather than by people with a low exciting self-concept. In our context of brand logo symmetry, we may formally state this as follows:

**H1.** A symmetric (asymmetric) brand logo is likely to result in perceptions of higher logo liking than an asymmetric (symmetric) brand logo when consumers have a less (more) exciting self-concept.

### 2.2. Spillover effects on product design inferences

In general, consumers often draw inferences based on limited information and knowledge of products and brands to make their decisions in the market (Kardes, 1993). Existing research on brand logos indicates that logo-based inferences are made, particularly for the product or brand to which the logo is attached (Rahinel & Nelson, 2016). Moreover, consumers are able to mentally imagine product inferences in terms of specific attributes based on all sorts of product-related information (Elder, Schlosser, Poor, & Xu, 2017). Researchers have investigated the impact of mental imagery in various consumer contexts and have provided evidence for the existence and relevance of such effects (e.g., Jiang, Gorn, Galli, & Chattopadhyay, 2015; Peck, Barger, & Webb, 2013; Underwood, Klein, & Burke, 2001). Through this phenomenon of mental imagery, consumers are able to imagine how a product looks without actually seeing the product and are thus able to make specific product design inferences (Krishna, Morrin, & Sayin, 2013). Product design has been defined in various ways in the marketing literature but is generally considered a three-dimensional construct comprising the dimensions of aesthetics, functionality, and symbolism (Candi, Jae, Makarem, & Mohan, 2017). Aesthetics refers to the general pleasure that a consumer receives from the sensory product attributes (Liu, Li, Chen, & Balachander, 2017) and to the perception of product beauty (Hoegg, Alba, & Dahl, 2010). Functionality indicates the perceived utilitarian value of a product based on its design properties (Bloch, 2011). Symbolism involves the level of identification and meaning the product design conveys to the consumer (Kumar & Noble, 2016). Importantly, all products incorporate characteristics of all three design dimensions, and empirical research has provided evidence for the significant impact of all three dimensions on relevant factors of consumer behavior (Homburg, Schwemmler, & Kuehnl, 2015). When inferring specific attributes such as a product's design dimensions based on a related stimulus, consumers often use their overall liking of the related stimulus and transfer this assessment to the inferences. This phenomenon is also known as attitude-based inference or halo effect (Kardes, Posavac, & Cronley, 2004). Empirical research provides further evidence for this thesis in the context of logo-based inferences because consumers typically transfer feelings evoked by a brand logo design to closely connected aspects, such as the brand itself or the products of the brand (Cian et al., 2014; Van Riel & Van den Ban, 2001). By building on the presumptions of H1 and further applying these considerations to the relationship between brand logo symmetry and product design inferences, the following two hypotheses may be derived:

**H2.** A symmetric (asymmetric) brand logo is likely to result in perceptions of more positive inferences on product design (i.e., aesthetics, functionality, and symbolism) than an asymmetric (symmetric) brand logo when consumers have a less (more) exciting self-concept.



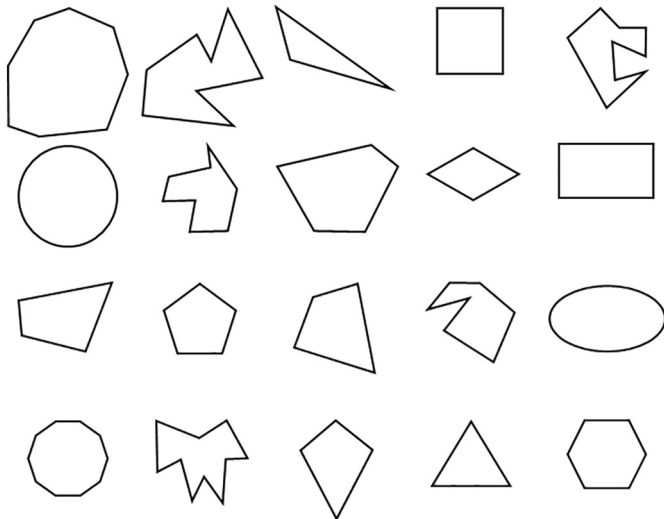


Fig. 1. Stimuli (pilot study).

**H3.** The effects proposed in H2 are mediated by the perceptions of logo liking.

### 3. Pilot study

In deriving our hypotheses, we assume that asymmetric objects are more difficult to process and cause increased arousal, while symmetric objects are easier to process and are more relaxing and therefore less arousing. These effects should lead to the perception of asymmetric objects as more exciting than symmetric objects. We investigated this theoretical claim with the help of a pilot study.

#### 3.1. Materials and methods

For the pilot study, we relied on an online questionnaire and created 20 abstract shapes, 10 perfectly symmetric and 10 asymmetric. Sixty-five undergraduates from a major German university ( $M_{\text{age}} = 22.3$  years, 52.3% females) participated in the pilot study in exchange for course credit. For every question, participants were shown all objects at once in randomized order (see Fig. 1 for an example). Then, participants were asked in succession to choose the five objects they perceived as (1) most fluently, (2) most arousing, and (3) most exciting.

#### 3.2. Results and discussion

In line with our theoretical considerations, participants significantly chose more symmetric objects when asked about perceptual fluency ( $M_{\text{symmetry}} = 4.85$  vs.  $M_{\text{asymmetry}} = 0.15$ ;  $t = 33.45$ ,  $p < .01$ ) and more asymmetric objects when asked about perceived arousal ( $M_{\text{symmetry}} = 0.14$  vs.  $M_{\text{asymmetry}} = 4.86$ ;  $t = -28.91$ ,  $p < .01$ ) and excitement ( $M_{\text{symmetry}} = 1.14$  vs.  $M_{\text{asymmetry}} = 3.86$ ;  $t = -6.41$ ,  $p < .01$ ). The results of this pilot study support our basic assumption of the conceptual argument that asymmetry (symmetry) in objects leads to lower (higher) processing fluency and increased (lower) arousal and thus to stronger (weaker) associations with excitement. Next, we test our hypotheses and examine the effects of symmetry in brand logos on product design inferences.

### 4. Study 1

Since one of the main theoretical rationales for our hypotheses could be empirically supported by the pilot study, study 1 investigated whether initial empirical support for the hypotheses can be found.

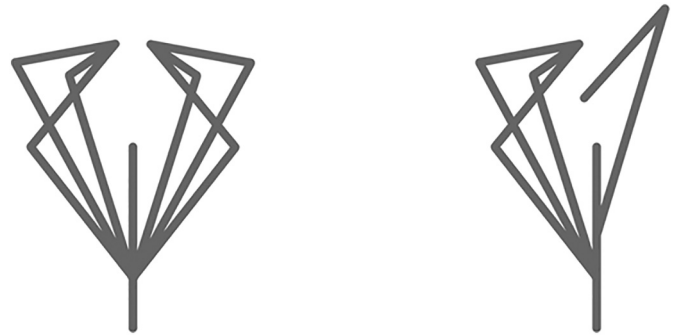


Fig. 2. Stimuli (study 1).

#### 4.1. Materials and methods

To test the proposed hypotheses, an online experiment with two treatment conditions was conducted. As target stimuli, two brand logos (symmetric vs. asymmetric) for a new fictitious brand of sunglasses were designed (Fig. 2). We decided on sunglasses as the target product because this product has been previously used in studies in a similar context (e.g., Bajaj & Bond, 2014). Moreover, sunglasses belong to the group of durable goods, for which the importance of all product design dimensions has been empirically proven (Homburg et al., 2015). The logos were created based on different requirements according to our research objectives. First, we relied on mirror symmetry; thus, the symmetric logo was a perfect mirror image in relation to the vertical axis. Second, only simple and mostly similar elements were included in the logo design to ensure the same logo style. Third, the stimuli were created in black and white, as suggested by previous studies (Bajaj & Bond, 2014; Salgado-Montejo et al., 2015), to avoid possible interferences of color associations. Fourth, we created fictitious brand logos to eliminate any possible brand associations with existing brands (Machado, de Carvalho, Torres, & Costa, 2015) because we focused on the pure effect of brand logo symmetry.

Before proceeding with the study, we conducted a pre-test to check the suitability of the created stimuli for our research purposes. In total, 38 undergraduate students participated in the pre-test in exchange for course credit. The participants were randomly shown either one of the logos and were asked to rate perceived symmetry (“perfectly asymmetric/perfectly symmetric”) and liking (“do not like/do like”) on two nine-point scales. Furthermore, the participants were asked to state whether they were familiar with and had seen the logo anywhere before. Importantly, familiarity with an object can affect participants’ arousal and may therefore influence associations with the object (Berlyne, 1960; Paasovaara, Luomala, Pohjanheimo, & Sandell, 2012). Therefore, we included this question to avoid biased results due to the participants’ familiarity with the logo. Group comparison tests revealed adequate results with regard to the intended manipulation. More precisely, participants perceived a significant difference in the level of symmetry ( $M_{\text{symmetry}} = 8.05$  vs.  $M_{\text{asymmetry}} = 1.84$ ;  $F_{1, 36} = 371.86$ ,  $p < .01$ ) and no difference in terms of liking ( $M_{\text{symmetry}} = 5.32$  vs.  $M_{\text{asymmetry}} = 5.05$ ;  $F_{1, 36} = 0.21$ ,  $p > .1$ ). Additionally, none of the participants was familiar with either of the two logos. As a result, the two brand logos fulfilled all the requirements and were considered for the study.

Two hundred fourteen participants ( $M_{\text{age}} = 36.8$  years, 58.4% females) participated in this study (Table 1). The experiment consisted of two treatment conditions (symmetric logo vs. asymmetric logo) to which participants were randomly assigned. Before the stimulus contact, subjects rated their own self-concept with regard to the attribution of an exciting personality. To measure the attribution of the personality factor of excitement, we used four items (“exciting”, “young”, “unique”, “up-to-date”;  $\alpha = 0.79$ ) adapted to the context of human personality from the brand personality scale of Aaker (1997). Participants indicated

**Table 1**  
Demographic profile of the sample (study 1).

Variable	Characteristics	n	%
Age	16–20 years	14	6.5
	21–30 years	107	50.0
	31–40 years	20	9.4
	41–50 years	14	6.5
	51–60 years	34	15.9
	61–70 years	22	10.3
	> 70 years	3	1.4
Gender	Female	125	58.4
	Male	89	41.6
Education	None	5	2.4
	Junior high school diploma	24	11.2
	Senior high school diploma	79	36.9
	University degree	106	49.5
Occupation	Pupil	6	2.8
	Trainee	2	0.9
	Student	72	33.6
	Full-time employee	81	37.9
	Part-time employee	29	13.6
	Housewife/househusband	7	3.3
	Retired	15	7.0
	Unemployed	2	0.9
	Total sample size		214

the fit of the traits to their own self-concept on a five-point scale (1 = “not at all”, 5 = “to a great extent”). Although this scale was originally intended to measure brand personality, the scale builds on general human characteristics, and the personality traits of the dimension of excitement are found to be an innate part of human personality (Buss & Barnes, 1986; Eisend & Stokburger-Sauer, 2013; Lin, 2010). In addition, this scale has been used previously to capture consumer personality in terms of self-concept (Branaghan & Hildebrand, 2011), and researchers have provided evidence for the application of the same personality scale to a consumer and brand context (Huang, Mitchell, & Rosenbaum-Elliott, 2012). Therefore, we relied on one item from each personality facet of excitement to best capture this personality factor (Aaker, 1997). Then, one of the two brand logos was presented. The brand logo was introduced to the participants as a brand logo of a new brand of sunglasses. Subsequently, participants were asked to visually imagine a product of the brand and to indicate the vividness of the product image on a scale ranging from 1 = “no image present at all” to 7 = “perfectly clear and vivid”, adapted from Sheehan (1967). Participants then rated their inferences of the product’s design based on the three belonging dimensions of aesthetics ( $\alpha = 0.88$ ), functionality ( $\alpha = 0.84$ ), and symbolism ( $\alpha = 0.88$ ). For this measurement, we adapted the scale of Homburg et al. (2015) to the context of product design inferences (Table 2). All items of the product design dimensions were assessed on five-point scales ranging from 1 = “strongly disagree” to 5 = “strongly agree”. At the end, subjects were asked the same three questions from the pre-test

**Table 2**  
Measurement items of product design inferences (study 1).

Product design inferences	
Aesthetics	I expect a product from this brand to be good looking.
	I expect a product from this brand to be visually striking.
	I expect a product from this brand to look appealing.
Functionality	I expect a product from this brand to perform well.
	I expect a product from this brand to be capable of doing its job.
	I expect a product from this brand to be functional.
Symbolism	I expect a product from this brand to help me in establishing a distinctive image.
	I expect a product from this brand to be helpful to distinguish myself from the mass.
	I expect a product from this brand to accurately symbolize or express my achievements.

about perceived symmetry, general liking, and familiarity of the logo, were asked to guess the purpose of the study, and reported socio-demographic information.

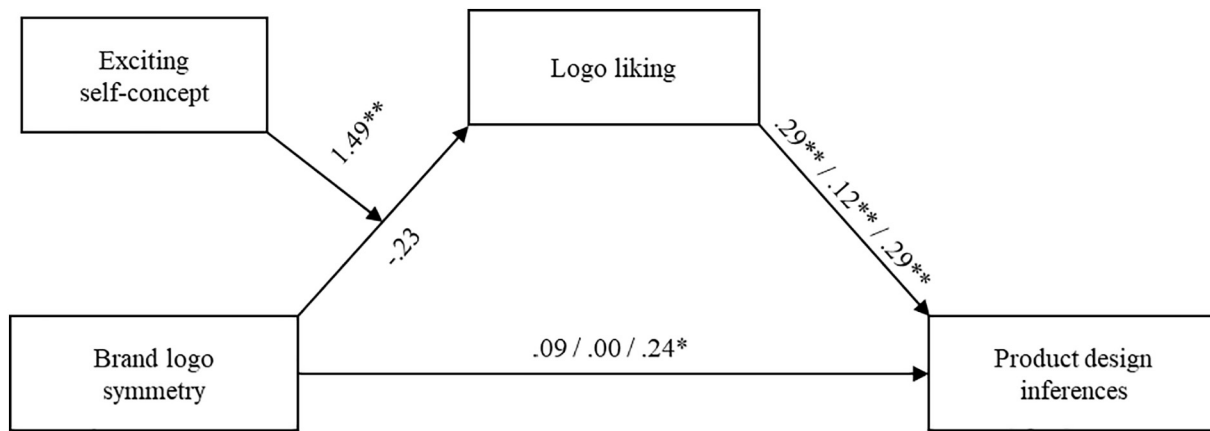
**4.2. Results and discussion**

First, a manipulation check was applied to ensure the intended perception of brand logo symmetry, liking and familiarity. The results were in line with the findings of the pre-test and again showed a significant difference in symmetry perception ( $M_{\text{symmetry}} = 7.60$  vs.  $M_{\text{asymmetry}} = 3.44$ ;  $F_{1, 212} = 186.82, p < .01$ ) but no significant difference in general liking ( $M_{\text{symmetry}} = 5.28$  vs.  $M_{\text{asymmetry}} = 5.07$ ;  $F_{1, 212} = 0.41, p > .1$ ). Moreover, none of the participants stated that they were familiar with any of the logos, and no participant correctly guessed the purpose of the study. Next, we performed one-way between-subjects ANOVAs with brand logo symmetry (symmetric vs. asymmetric) as an independent variable and inferred product aesthetics, functionality, and symbolism as dependent variables. We found no significant differences with regard to any of the dependent variables ( $ps > .1$ ). In addition, both logos evoked very similar levels of imagery, and a group comparison test indicated no significant difference in this regard ( $M_{\text{symmetry}} = 4.37$  vs.  $M_{\text{asymmetry}} = 4.00$ ;  $F_{1, 212} = 2.39, p > .1$ ). In sum, the manipulation check provided very satisfactory results. Thus, we proceeded to test for the presumed hypotheses.

For the main analysis, we conducted PROCESS moderated mediation analysis with SPSS 24 according to Hayes (2018) to test for the proposed effects of brand logo symmetry on logo liking (H1) and product design inferences (H2) as well as for the mediating role of logo liking in this regard (H3). Three separate moderated mediation analyses were conducted to examine the effects on each of the product design dimensions. For this purpose, we used PROCESS model 7 with a 5000 bootstrap method and bias-corrected confidence intervals of 95%. In each case, brand logo symmetry was used as the independent variable (symmetric coded as 0, asymmetric coded as 1), logo liking as the mediator, and exciting self-concept as the moderator. Additionally, one of the product design dimensions (inferred product aesthetics, functionality, or symbolism) was used as the dependent variable.

In support of H1, we found a significant interaction effect of brand logo symmetry and exciting self-concept on logo liking ( $B = 1.49, t = 3.84, p < .01$ ). Specifically, a spotlight analysis focusing on the values one standard deviation below and above the mean of the moderator revealed that participants with a lower exciting self-concept preferred the symmetric logo ( $B_{-1SD} = -1.46, CI: -2.34; -0.57$ ), whereas a higher exciting self-concept led to a stronger preference for the asymmetric logo ( $B_{+1SD} = 0.99, CI: 0.10; 1.88$ ). The findings revealed no effect at mean levels of exciting self-concept ( $B_{\text{mean}} = -0.23, CI: -0.86; 0.40$ ). Moreover, the results provide empirical evidence for H2 and H3. All three inferred product design dimensions were affected by brand logo symmetry. However, the direct effect was significant only in the case of inferred symbolism, whereas the indirect effects through logo liking were all significant according to our hypothesized assumptions (please see Fig. 3 for exact details). Interestingly, the index of moderated mediation was significant for all three inferred product design dimensions, and the index of inferred product functionality (index: 0.18, CI: 0.08; 0.31) was clearly smaller than the indices of inferred product aesthetics (index: 0.44, CI: 0.19; 0.69) and product symbolism (index: 0.43, CI: 0.19; 0.67).

In sum, the data analysis provides initial evidence for the assumed effects of brand logo symmetry on product design inferences. However, the effect on inferred product functionality was considerably weaker in relation to the other two product design dimensions. In fact, study 1 leaves open the possibility that the two specific logos or the selected product category had a decisive influence on the findings. Therefore, study 2 examines the hypotheses in a broader context using various realistic brand logos while considering different product categories.



Note. All coefficients reported are unstandardized effects. The order of effect sizes on product design inferences shown is: Aesthetics, Functionality, Symbolism. \* =  $p < .05$ , \*\* =  $p < .01$ .

Fig. 3. Moderated mediation results (study 1).

### 5. Study 2

Based on the initial evidence for the assumed relationship between brand logo symmetry and product design inferences provided by study 1, we conducted a second study to attempt to replicate the findings of study 1 and to increase the generalizability of the results.

#### 5.1. Materials and methods

As stimulus material, we used six symmetric and six asymmetric professionally designed brand logos. Moreover, experts from a major brand management agency evaluated the brand logos to ensure the authentic design of the logos. In line with former research on brand logos, we relied on fictitious brand logos, as a study with real brand logos would contain the risk of many possible interference factors such as brand awareness (e.g., Cian et al., 2014; Fajardo, Zhang, & Tsiros, 2016; Hagtvedt, 2011; Rahinel & Nelson, 2016). In fact, study 2 should further validate the generally assumed effects and test in a next step whether the effects from study 1 can be found for different product categories and realistic brand logos. The suitability of the brand logos for the study was first checked by a pre-test. Twenty-four undergraduates participated in this pre-test in exchange for course credit. Each logo was shown to each participant. For each logo, the participants indicated whether the logo was symmetric or asymmetric in their perception and how exciting the respective logo appeared to them on a seven-point scale (1 = “not exciting at all” to 7 = “very exciting”). In addition, the test persons indicated whether they associated the logos with an existing brand or logo. As a result, each logo was titled with the intended symmetry characteristic (i.e., either symmetric or asymmetric). Furthermore, the asymmetric logos were rated as significantly more exciting than the symmetric logos ( $M_{\text{symmetry}} = 2.83$  vs.  $M_{\text{asymmetry}} = 4.47$ ;  $t = -8.92$ ,  $p < .01$ ). Finally, two logos from each category were removed for further use in the main study due to frequently mentioned associations with existing brands. The four symmetric and four asymmetric logos that were ultimately used in study 2 are shown in Fig. 4.

One hundred forty-nine participants ( $M_{\text{age}} = 27.6$  years, 55.7% females) participated in the main study (Table 3). We used a within-participant experimental design for study 2. In detail, participants were randomly presented with two of the eight brand logos in the context of a specific product category. For each product category, one symmetric and one asymmetric logo were always shown. In addition to the product category “sunglasses”, categories of other durable goods were examined in study 2 (i.e., wristwatch, backpack, and sneakers) to test whether the

hypotheses could also be confirmed for a range of different product categories. Before the first brand logos were presented to the participants, the participants were asked to rate the level to which their self-concept was exciting. Here, we used the same four items ( $\alpha = 0.77$ ) as in study 1. Next, two of the brand logos were shown, and we asked for perceived excitement and liking of the logos. The participants were told that both logos were new brand logos for one of the specific product categories. Participants were then asked about their product design inferences based on the three dimensions of aesthetics, functionality, and symbolism. All participants answered the questions about all four product categories according to this procedure in succession, but the order of the product categories was randomized. Perceived logo excitement, logo liking, and product design inferences were all measured on single-item scales ranging from 0 to 100, where the minimum and maximum rating was anchored at the respective ends of the scale (e.g., “not exciting at all” and “very exciting” in the case of perceived logo excitement). This type of single-item scale has been successfully used and recommended for research examining various stimuli and using within-participant experimental designs (e.g., Simmonds, Woods, & Spence, 2018; Van Doorn et al., 2017; Velasco, Woods, Deroy, & Spence, 2015). Once the participants had completed all trials, they were asked to indicate their familiarity with any of the logos and to guess the purpose of the study. Finally, the participants reported socio-demographic data.

#### 5.2. Results and discussion

Before hypotheses testing, a manipulation check was applied. In line with our expectations, asymmetric brand logos were perceived as more exciting compared to symmetric brand logos ( $M_{\text{symmetry}} = 43.90$  vs.  $M_{\text{asymmetry}} = 51.47$ ;  $t = -4.16$ ,  $p < .01$ ). Moreover, none of the participants was familiar with any of the logos, and no participant guessed the purpose of the study correctly. Notably, we found a significant difference in logo liking independent of the self-concept of the participants. In this regard, asymmetric brand logos were preferred to symmetric brand logos ( $M_{\text{symmetry}} = 47.13$  vs.  $M_{\text{asymmetry}} = 54.52$ ;  $t = -3.96$ ,  $p < .01$ ). This general preference for asymmetric logos must therefore be taken into account when interpreting the results of the hypothesis tests that follow.

Similar to study 1, we relied on moderated mediation analysis to test the hypotheses (H1 – H3). However, the PROCESS macro we used in study 1 was exclusively programmed for between-participant research designs. Comparable tools for conducting moderation and mediation analyses for within-participant designs are still in the

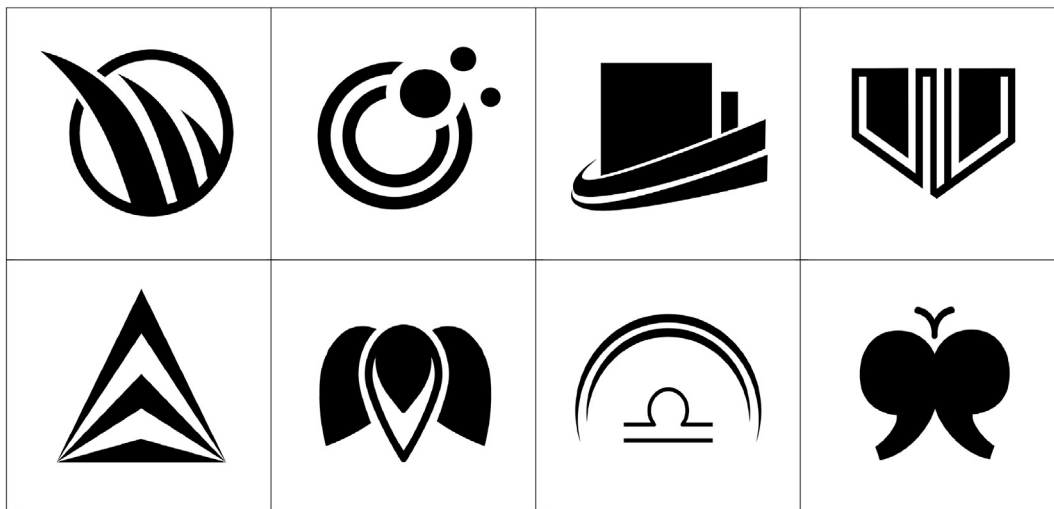


Fig. 4. Stimuli (study 2).

**Table 3**  
Demographic profile of the sample (study 2).

Variable	Characteristics	n	%
Age	18–20 years	8	5.4
	21–30 years	105	70.5
	31–40 years	24	16.0
	41–50 years	7	4.7
	51–60 years	4	2.7
	> 60 years	1	0.7
Gender	Female	83	55.7
	Male	66	44.3
Education	Junior high school diploma	24	16.1
	Senior high school diploma	82	55.0
	University degree	43	28.9
Occupation	Trainee	9	6.0
	Student	77	51.7
	Full-time employee	49	32.9
	Part-time employee	7	4.7
	Housewife/househusband	2	1.3
	Retired	4	2.7
	Unemployed	1	0.7
Total sample size		149	100.0

development phase. Although an analog tool exists to PROCESS for within-participant designs, which is called MEMORE, a moderated mediation analysis cannot be performed with this macro (Montoya & Hayes, 2017). For this reason, an Mplus code was created following the suggestions of Montoya (2018) that allowed us to conduct a moderated mediation analysis specifically for our research purposes. To examine the assumed general effects according to the hypotheses, the following analyses were conducted independently of a respective product category or a specific logo, which represents an established procedure for such a case (Cheema & Patrick, 2008). As in study 1, we used a 5000 bootstrap method and relied on confidence intervals of 95%. Moreover, we considered the same structural relationships between the variables.

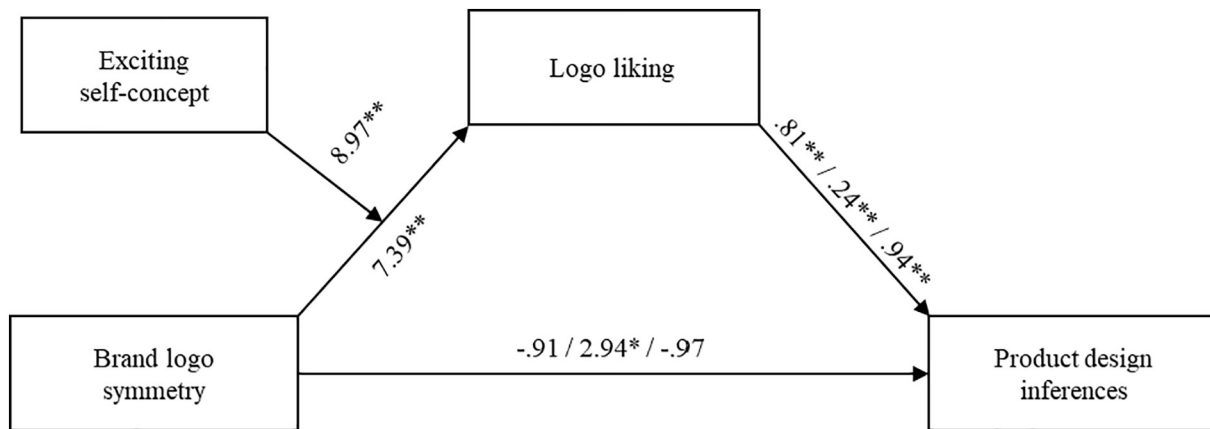
Consistent with the assumptions of H1, the results yielded a significant impact of exciting self-concept on the effect of brand logo symmetry on logo liking ( $B = 8.97, t = 3.52, p < .01$ ). Because a general preference was found for the asymmetric logos in our sample ( $B_{\text{mean}} = 7.39, CI: 4.64; 10.26$ ), we expected the subsequent spotlight analysis to reveal an even higher impact in the case of participants with high exciting self-concepts and a very weak or even no impact in the case of participants with low exciting self-concepts. Indeed, the spotlight analysis showed that the impact became stronger when considering participants with a high exciting self-concept ( $B_{+1SD} = 16.46, CI: 11.49; 21.23$ ) and much weaker, in fact insignificant, for

participants with a low exciting self-concept ( $B_{-1SD} = -1.67, CI: -6.76; 3.75$ ). In addition, we found empirical support for H2 and H3. In the case of inferred product aesthetics and symbolism, the direct effect was insignificant, whereas we found a significant direct effect on inferred product functionality. However, the indirect effect through logo liking for each design dimension was in accordance with our assumed hypotheses of a stronger significant effect for participants with a high exciting self-concept (compared to the effect of participants with an average exciting self-concept) and an insignificant effect when considering participants with a low exciting self-concept. For specific details, please see Fig. 5. In line with these results, the index of moderated mediation was significant for each inferred product design dimension. However, the results again presented a similar pattern to the results of study 1 because the index was clearly higher in the case of inferred aesthetics (index: 7.30, CI: 3.37; 11.20) and symbolism (index: 8.47, CI: 3.92; 12.94) relative to the index of inferred functionality (index: 2.11, CI: 0.93; 3.28).

Study 2 replicated the findings of study 1 and therefore provided additional empirical evidence for our theorizing. Specifically, while study 1 considered only one pair of brand logos for one specific product category, study 2 tested our theoretical claims, taking into account several less standardized and realistic brand logos for different product categories. Thus, study 2 supports the robustness of the assumed effects between brand logo symmetry and product design inferences.

## 6. General discussion

In accordance with our assumptions, the results of the two main studies provide evidence for the effect of brand logo symmetry through logo liking on product design inferences when exciting self-concept is included as a moderator. In the course of our research, we found empirical support for our theoretical claim that asymmetry in logos is associated with excitement, whereas symmetry is not. Based on the theory of consumer self-congruity, our research shows a positive effect on logo liking when consumers' self-concept is in congruence with brand logo associations. As a result, consumers transfer positive spillover effects from their perception of logo liking to their inferences of product design if the associations related to the brand logo's symmetry match their own self-concept. Interestingly, we found varying degrees of the effect of brand logo symmetry in relation to the three different product design dimensions. In particular, the effects on inferences of product aesthetics and product symbolism were generally stronger than the effect on product functionality. These findings may be interpreted and explained in light of former marketing and consumer research.



**Note.** All coefficients reported are unstandardized effects. The order of effect sizes on product design inferences shown is: Aesthetics, Functionality, Symbolism. \* =  $p < .05$ , \*\* =  $p < .01$ .

Fig. 5. Moderated mediation results (study 2).

First, the functional value of a product mainly refers to problem solving, whereas product aesthetics and symbolism are strongly connected to emotions and affective perception (Bloch, 1995; Holbrook, 1980). Although certain design principles evoke a more aesthetic perception, the beauty of an object often varies in the eye of the beholder (Kumar & Garg, 2010). Additionally, the symbolic design dimension involves the degree of self-identification with a product and further indicates the fit of the consumer's self-expression with the product's design (Brunner, Ullrich, Jungen, & Esch, 2016; Mittal, 2006). Preferences for functional product features are thus less heterogeneous because they are more objective and cognitively driven (Holbrook, 1986; Holbrook & Hirschman, 1982). Second, research findings suggest that functionality judgements of a product are in large part driven by real product experiences (Homburg et al., 2015). Third, functional product features are more difficult to imagine than, for example, the aesthetic properties of a product and should thus be less influential on mentally imagined product inferences (Schnurr & Scholl-Grissemann, 2015). Fourth, research has shown that the perception of social identity-based attributes (e.g., symbolic value) of products may be more strongly influenced by positive spillover effects than is the case for functionally based product attributes (Rahinel & Nelson, 2016; Schlosser, 1998). Taking these considerations into account, the findings of our research showing that effects on logo-based inferred product functionality are not as strong as on inferred product aesthetics and product symbolism seem reasonable.

### 6.1. Theoretical implications

The need for new insights into the impact of brand logos has been emphasized by various researchers (e.g., Cian et al., 2014; Hagtvedt, 2011; Henderson, Giese, & Cote, 2004; Park, Eisingerich, Pol, & Park, 2013). Thus, the aim of this paper was to investigate the effects of brand logo symmetry on product design inferences. The results of our work provide empirical evidence for the relationship between brand logo symmetry and inferences of product design. Therefore, this study provides an important contribution to the research stream of brand logo design (e.g., Henderson & Cote, 1998; Jiang et al., 2015) and, more generally, to the literature on the influences of visual cues on consumer responses (e.g., Deng & Kahn, 2009; Hagtvedt & Patrick, 2008). Our findings extend the existing literature by systematically investigating the effects of visual symmetry on consumer response in terms of product design inferences. In addition, the findings demonstrate the importance of consumer self-concept and logo liking with regard to the effects of brand logo symmetry. These results add significant insights to the literature on self-congruity and spillover effects in consumer

research (e.g., Jiang et al., 2015; Peck et al., 2013; Underwood et al., 2001) by showing that if the associations related to a brand logo's symmetry match the consumer's self-concept, logo liking can be enhanced and, consequently, inferences of product design can be positively influenced. The occurrence of this effect can also be partly explained by the underlying mechanism of mental imagery because consumers are able to mentally imagine the product's design based on all types of related information and cues, such as a brand logo. Moreover, the results indicate that the effects of brand logo symmetry vary in relation to the three dimensions of product design. These findings further support the relevance of the approach of considering product design along the three dimensions of aesthetics, functionality, and symbolism (Candi et al., 2017; Homburg et al., 2015).

### 6.2. Managerial implications

At a more practical level, the findings provide several implications for brand and product management. First, consumers are able to make inferences about a product's design based on the brand logo design. Consequently, managers should keep this in mind when making brand- or product-related changes. Brand positioning and the design of a brand logo should be well thought out because they have a significant impact on the perception of the brand's products. Second, the effects of brand logo symmetry on product design inferences highly depend on the consumer's self-concept. Therefore, managers should recognize the importance of their target group's self-concept when planning the creation of a brand logo. Extending this line of reasoning, a vital implication for brand logo design could be to match design properties in terms of congruency. Attention to the associated meanings of a brand logo and the selection of a design that corresponds well with the target group enables marketers to avoid logos with unintended conveyed meanings. Third, our results provide reasons to at least question popular opinions, for example, that symmetry always leads to higher aesthetics and preferences. In fact, managers must truly understand consumers' inferences of their brands and products rather than relying on such general assumptions. Our research contributes more specific guidance by differentiating the effectiveness of visual symmetry in brand logos with regard to dependence on consumer self-concept. Ultimately, only those firms that have accurate knowledge of the impact of various brand logo design factors can use them optimally and create a brand logo that can offer the company essential added value.

### 6.3. Limitations and future research

This paper makes several theoretical and practical contributions. Nevertheless, our findings may be used as a starting point for future research because several unexplored topics remain in this area. In this study, we focused on brand logo symmetry, whereas other design elements such as complexity (Van Grinsven & Das, 2016) and angularity (Jiang et al., 2015) also offer broad research potential. Additionally, we solely included an exciting self-concept as a personality factor grounded in prior research linking asymmetry with associations of excitement. However, other relationships between consumer self-concept and brand logo design associations may be worth investigating. Future work might also consider investigating more realistic and less controlled scenarios. For instance, the environmental context of brand logo presentation can vary greatly (e.g., advertisement, packaging). On a further note, more information could be provided on the brand, and the respective logo or familiar brand logos may be used. By relying on such research variations, effects on important variables of consumer behavior, such as purchase intention and word of mouth, could be detected because all product design dimensions have been previously shown to significantly influence these variables (Candi et al., 2017; Homburg et al., 2015). Furthermore, by using real brand logos in future studies, the effects of potential impact variables, such as existing brand associations or brand awareness, could be investigated in order to gain further insights regarding causal relationships in this context (Cian et al., 2014). In addition, the application of measurement instruments from neuroscience, such as fMRI, could provide further interesting insights into the relationships and potential underlying interaction effects between inferences of the three product design dimensions (Chattaraman, Deshpande, Kim, & Sreenivasan, 2016; Stoll, Baecke, & Kenning, 2008).

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## **Evidence of co-authorship and definition of responsibilities**

The presented research articles were jointly developed by co-authors. All content is completely based on collective and collaborative elaboration, whereby the following responsibilities were defined within the respective modules:

### **Module 1: Sensory design elements and design benefits in the context of product design**

Responsibilities of “*Taking a closer look at the relevance of design benefits for product choice from an international perspective: A correspondence analysis*”: Jannick Bettels: Purpose, methodology, findings, implications and originality; Klaus-Peter Wiedmann: Supervision.

Responsibilities of “*It’s not all about function: Investigating the effects of visual appeal on the evaluation of industrial products using the example of product color*”: Klaus-Peter Wiedmann: Supervision; Janina Haase: Methodology, findings, limitations and further research; Jannick Bettels: Introduction, literature review and hypothesis development, discussion and implications; Christian Reuschenbach: Support in data collection.

Responsibilities of “*Multisensory product design – An eye-tracking experiment on driving safety and product evaluation*”: Klaus-Peter Wiedmann: Supervision; Janina Haase: Methodology, results, discussion, managerial implications; Jannick Bettels: Introduction, theoretical background, limitations and further research.

Responsibilities of “*Shaping consumer perception: Effects of vertical and horizontal packaging alignment on the evaluation of organic food products*”: Jannick Bettels: Introduction, theoretical background, study 1 (pilot study), study 2, discussion of the results, theoretical implications; Klaus-Peter Wiedmann: Supervision; Janina Haase: Practical implications, Limitations and further research.



## **Module 2: Sensory design elements and design benefits in the context of communication design**

Responsibilities of *“How to best promote my product? Comparing the effectiveness of sensory, functional and symbolic advertising content in food marketing”*: Janina Haase: Introduction, results (study 2), discussion of the results, conclusion, limitations and future research; Klaus-Peter Wiedmann: Supervision; Jannick Bettels: Theoretical background, theoretical implications; Franziska Labenz: Methodology, results (study 1), managerial implications.

Responsibilities of *“Sensory stimuli in print advertisement – Analyzing the effects on selected performance indicators”*: Franziska Labenz: Theoretical background and hypothesis development (H2b, H3b, H5a, H5b, and H6), methodology, discussion; Klaus-Peter Wiedmann: Supervision; Jannick Bettels: Introduction, theoretical background and hypothesis development (H2a, H3a, H4a, H4b, and H4c), conclusion and outlook; Janina Haase: Theoretical background and hypothesis development (H1), findings.

Responsibilities of *“Sensory imagery in advertising: How the senses affect perceived product design and consumer attitude”*: Janina Haase: Methodology, results, discussion; Klaus-Peter Wiedmann: Supervision; Jannick Bettels: Introduction, theoretical background.

Responsibilities of *“Brand logo symmetry and product design: The spillover effects on consumer inferences”*: Jannick Bettels: Introduction, theoretical background and hypotheses, pilot study, study 1, study 2, general discussion; Klaus-Peter Wiedmann: Supervision.

## Further publications

Wiedmann, K.-P., Haase, J., & **Bettels, J.** (2018). Sensory imagery in the context of beverages: How the senses affect product design and attitude. Article presented at the 2018 AMS World Marketing Congress, Porto, Portugal, June 27-29.

Wiedmann, K.-P., Haase, J., & **Bettels, J.** (2018). Challenges of exploring the perception and impact of sensory communication. Article presented at the 2018 AMS World Marketing Congress, Porto, Portugal, June 27-29.

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