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Semantic congruence effects across olfactory and visual stimuli on product perception: An implicit and explicit approach

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Table of Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

e.g.	Exempli gratia (lat.): for example
cf.	Confer
Ppb	Parts per billion
fMRI	Functional magnetic reasoning imaging
EEG	Electroencephalogram
EMG	Electromyogram
IAT	Implicit Association Test
CVPA	Centrality of Visual Product Aesthetics
vs.	Versus
H	Hypothesis
M	Mean value
N	Number of participants
SD	Standard deviation
P	Significant level
p.	Page
et al.	Et alii
fig.	Figure
T	Time point

1 Introduction

1.1 Motivation and Scope

Innovation is the driver of any major consumer goods company, making the difference between long-lasting growth and major failure (Shiu, Walker, and Cheng 2006). However, although necessary, innovation is also a risky business because of its high costs and low success rate. Only two out of ten new products are successful on the market; sometimes it is even just one out of ten products (Keller 2003). Therefore, it seems increasingly important for companies to find cost-effective innovation techniques that help their products stand out and ultimately persuade shoppers to buy them. One possibility is the usage of sensory marketing in order to deliver a more complete sensory experience as it aids brands or products in being distinctive and successful (Lindström 2005). Research in the emerging field of sensory marketing has established that while vision appears to be the key modality (e.g. Schifferstein and Cleiren 2005; Schifferstein 2006), stimulating other senses can enhance the overall evaluation of products, leading to more favorable intention and long-term memory (Bone and Jantrania 1992; Krishna, Elder, and Caldara 2010; Lwin et al. 2010; Morrin and Ratneshwar 2003; Peck and Childers 2006).

The bulk of research has focused on studying effects of a single sensory stimulus on consumer response. Examples include the impact of scent on product characteristics (Churchill et al. 2009), or memory (Krishna, Lwin, and Morrin 2010), the impact of touch on purchase intention (Peck and Childers 2006), and the effect of product visual proportions on aesthetic judgment (Raghubir and Greenleaf 2006). Research suggests that stimulating more than one sensory modality at a time may yield more favorable results (Spence 2002). Yet, only a few studies have examined cross-modal stimulation in marketing context. Examples include interactive effects of scent and touch on product evaluation (Krishna, Elder, and Caldara 2010) and of scent and vision on memory for a product (Lwin, Morrin, and Krishna 2010).

Cue Congruence is one of the major theories explaining consumer response to different stimuli. Cue Congruence, for example, moderates the response between a scent and the product, category, shopping theme, or input received through another sensory modality. In particular, semantic congruence shows to be a highly relevant construct when analyzing

cross-modal interactions. Semantic congruence means that individuals evaluate the fit based on semantic associations between stimuli properties. Congruent associations eventually lead to an enhanced product evaluation as well as enhanced perception of the semantic meaning (Krishna, Elder, and Caldara 2010).

The impact of semantic congruence in sensory research can be measured in various ways. In contrast to the almost exclusive use of explicit measures, extant research shows that employing implicit measures can yield different outcomes (Greenwald, McGhee, and Schwartz 1998). The advantage of implicit measurement is that it reduces the individuals' capacity to consciously strategically control the response (Nosek, Greenwald, and Banaji 2007). This hallmark of implicit measurement is particularly interesting when focusing on olfaction. Many studies that did not find any effect of scent on product evaluation used explicit measures. Explicit approaches may have biased the responses by directing attention to a scent, prompting participants to respond merely to the valence of the scent and thus simply transfer it to the object (Ellen and Bone 1999).

There is a knowledge gap in cross-modal stimuli interactions being used to influence consumers' decision making. There are many studies focusing on the effect of either scent or vision, but few cross-modal studies especially those that focus on olfaction and vision in a marketing context. Therefore, the main objective of this thesis is to focus on the interaction of olfaction and vision in products and the influence on the consumers' decision making using the concept of semantic congruence. This work aims at integrating implicit and explicit methods to learn about consumer's processing of cross-modal product packages.
To close the presented gaps, following studies are carried out:

Study 1 measures the effect of semantic congruence implicitly using the Implicit Association Test. This test gauges the semantic congruence of three product categories based on response latency. Study 2 and 3 focus on how olfactory and visual stimuli influence consumer evaluation. This cross-modal approach may provide insights into how purchase intention as well as product package memory can be enhanced. The proposed hypotheses suggest that the visual and olfactory stimuli of a product package selected depending on the semantic meaning influence the product key benefit, which influences the purchase intention. Also, memory of the product package can be enhanced by scent (see fig. 1-1).

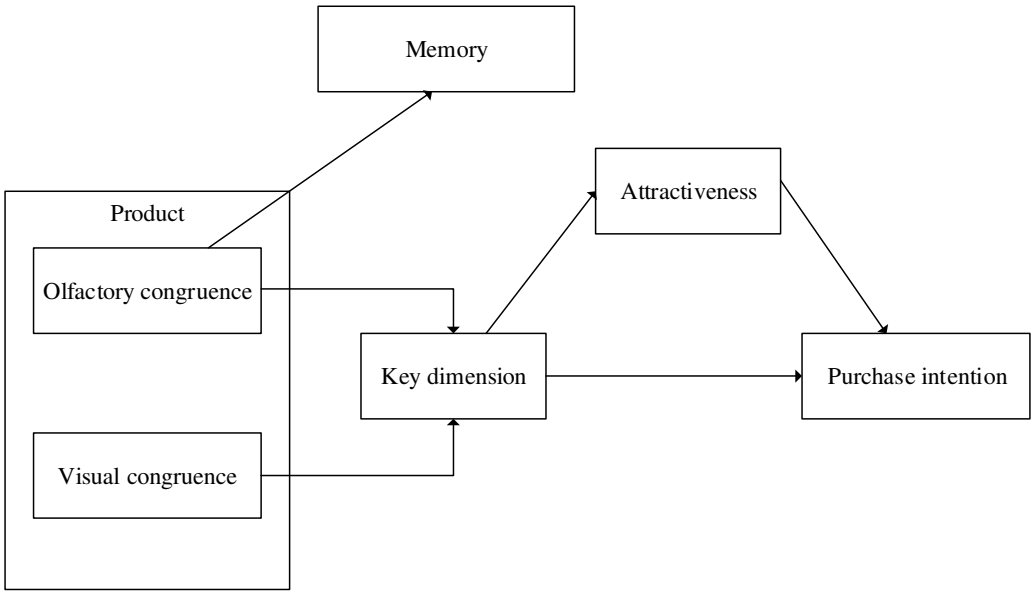


Fig. 1-1: Proposed effects on semantic congruence of olfactory and visual stimuli on product evaluation

1.2 Organization

The structure of this thesis is as follows:

After this introduction, chapter 2 provides a brief overview of sensory marketing and describes in particular the use of visual cues in marketing. Considering research into scent in marketing is fairly new compared to vision more attention is paid to olfaction in the following chapters.

Chapter 3 starts with a description of the special characteristics of neurological olfactory processing and the formation of olfactory preferences. The neurological pathways are the basis for the usage in marketing.

Chapter 4 presents an extensive literature review, which describes the impact of scent alone as well as cross-modally with other senses in a sensory marketing context. The emphasis is on the interaction of olfaction and vision. Afterwards, the existing consumer processing models are discussed as well as the moderators 'cue congruence' and 'individual differences'. The chapter ends with a description of different sensory research methodologies and relevant ethical concerns.

Chapter 5 introduces the conceptual framework and hypotheses. Methodologies and results of three conducted studies are presented and separately discussed. Chapter 6 is a general

discussion split into three sections: advances of theory, managerial implications, research limitations and future research.

Chapter 7 and chapter 8 summarize the thesis in English and German. The appendix encloses all the questionnaires used and stimuli pretested in the studies.

2 Vison in sensory marketing

Since this work focuses on the cross-modal interaction of olfactory and visual cues in sensory marketing context, the first chapter starts of with the introduction of sensory marketing, followed by an overview about the impact of a selection of visual cues on consumers. As research about vision is already very advanced, please note that this chapter does not claim completeness on that topic but aims to outline the most important factors in relation to consumer response to visual cues.

2.1 Sensory marketing

Krishna (2012) defines sensory marketing as 'marketing that engages the consumers' senses and affects their perception and behavior' (p. 332). Consumers are exposed to hundreds of advertisements and new products every day, making it important for companies to distinguish their brands or products. Sensory marketing can be used to distinguish a products or brands appeal to the consumers. It is not aimed at mass marketing but to create and deliver a full sensory and emotional individual experience (Hultén, Broweus, and Dijk 2009 p. 16). Using different senses can help to establish a strong brand identity (Lindström 2006). The researcher claims that in terms of the usage of senses in marketing '2+2=5', meaning that they have a potentiating effect.

One example for good sensory marketing is the coffee shop chain Starbucks. In the early 1980's, Starbucks created a complete sensory experience for consumers in order to strengthen their brand. They created a comfortable shop interior that invites the customer to sit down and read or meet friends. This is mainly due to the green and brown colors, the lighting, and the comfortable sofas and chairs. The combination of visual cues creates a soothing and restful visual experience. Additionally, the music is carefully selected to create the 'sound of Starbucks' – relaxing as well. Furthermore, the smell and the taste of the fresh coffee completes this sensory experience (Hultén, Broweus, and Dijk 2009 p. 3).

From a managerial perspective, stimulating the human senses can be a powerful tool to create sublime triggers to influence consumer perceptions of abstract notions of the product (e.g. its quality, novelty, elegance etc.). Additionally, it can be used to influence the

perceived quality of an abstract property like color, shape, taste, sound or smell (Krishna 2013).

From a researchers' perspective, Krishna (2012) proposes that sensory marketing requires an understanding of how sensation and perception drives consumer behavior. How do different modalities (either in isolation or interacting with each other) affect consumer evaluation? What is the best implementation to drive consumer behavior? One of the most advanced research fields is sensory research is vision, which is introduced in the next section.

2.2 Visual cues in sensory marketing

Despite the fact that all five modalities are important systems for sensory marketing, most research has focused on vision. One of the reasons that most research has been carried out on vision is that it is 'the most seductive sense of all' (Lindström 2005 p. 18) and often dominates the other modalities. Additionally, when approaching an object vision provides the largest amount of information at the shortest amount of time (Schifferstein and Cleiren 2005; Schifferstein and Desmet 2007). Therefore, vision is the key modality at the point of sale, when consumers have to compare multiple slightly different products for an optimal decision-making (Fenko, Schifferstein, and Hekkert 2008).

Research has focused on a broad range of visual cues and its influence on the consumer. For example, it has been shown that visual cues of websites (Gorn et al. 2004; Mandel and Johnson 2002), advertisement (Childers, Houston, and Heckler 1985; Hirschman 1986; Lee and Mason 1999), logos and typefaces (Childers and Jass 2002; Henderson and Cote 1998; Henderson, Giese, and Cote 2004), product packages (Bloch 1995; Garber, Burke, and Jones 2000; Orth and Malkewitz 2008; Raghubir and Greenleaf 2006), and the store environment (Areni and Kim 1994; Bellizzi, Crowley, and Hasty 1983; Orth, Heinrich, and Malkewitz 2012; Summers and Hebert 2001) have an impact on consumers' perception, judgment and behavior.

2.2.1 Color

One of the most important design elements in sensory marketing is color. Grossman and Wisenblit (1999) propose that due to associative learning certain colors are connected to certain experiences. This concept is used to explain human physiological responses to color.

For example, dark blue is associated with nights and passivity and bright yellow with sunlight and arousal (Lüscher 1969). Therefore, dark colors like blue and green are considered as calming and warm colors like red and orange are considered arousing (Berlyne 1960; Costigan 1984).

In marketing, these associations have been exploited in a retail settings for example the use of 'red' in casinos to stimulate gambling (Grossman and Wisenblit 1999). Accordingly, Bellizzi, Crowley, and Hasty (1983) tested the effect of color on perception in a furniture store and found that warm colors were more exciting and cool colors more calming.
Associations with colors are culturally dependent. In western societies, green, for example, is associated with hopefulness, white with purity, and red with love. Black is associated with mourning and yellow with hatred. In China, white is linked with righteousness and yellow is linked with trustworthiness. In India, black is connected to dullness and stupidity, red with ambition and desire (Kreitler and Kreitler 1972).
When it comes to color preference, it really depends on product type. Cars are preferably blue, grey, red, white and black. For carpeting, upholstered furniture and paint beige is preferred (Grossman and Wisenblit 1999).

In product packaging, colors are used for (a) drawing attention, (b) creating aesthetic experiences and (c) delivering communication (Kauppinen-Räisänen and Luomala 2010).
For drawing attention, it is the most essential visual cue as it is the first cue noticed by the consumer (Danger 1987a; b). But also it has the power to maintain attention (Schoormans and Robben 1997). In particular, when the consumer is seeking variety in their brand choice bright, novel and warm colors are emphasized (Garber, Burke, and Jones 2000; Schoormans and Robben 1997).

The role of color in product design has morphed from being purely functional to meet an aesthetic appeal as consumers make brand choices (Bloch 1995; Bloch, Brunel, and Arnold 2003; Hekkert 2006). Certain design elements that contribute to the product appearance have an impact on the overall perception i.e. attractiveness (Bloch 1995). These aesthetic experiences created by colors can influence purchase intention as extensive studies have shown (Bellizzi and Hite 1992; Stoll, Baecke, and Kenning 2008).

The third function of color is communication. Research suggests that color implies product quality, product attributes, and product meaning (Garber, Burke, and Jones 2000). It helps consumers to categorize products (e.g. light products are usually lighter color) and recognize brands (Garber, Burke, and Jones 2000). For companies, it is an opportunity to create a brand identity (Underwood and Klein 2002). One example for that is the usage of the colors white and red from Coca-Cola. That brand colors even had an impact on how Santa Claus is dressed today. Santa was traditionally green until Coca-Cola began to use him for heavy promotion. Until this day, Santa wears Coke colors in Western society (Lindström 2005 p. 20).

Summarizing, color is used in various ways in sensory marketing. It proves to be one of the most powerful design elements.

2.2.2 Size and shape

Following color, much research has focused on the products size and shape (Folkes and Matta 2004; Raghubir and Greenleaf 2006; Wansink 1996; Wansink and Van Ittersum 2003). Finding the optimal package size is limited due to practical usage. For example, a big bottle or box can look attractive in the shelf but loses its charm when it is too big to fit in the car, if it is too difficult to pour, or the content goes bad before it can be finished. Conversely, a small package can lose its charm when the content does not meet the quality demands or the content is immediately consumed (Raghubir and Krishna 1999; Wansink and Van Ittersum 2003). Therefore, shape is usually manipulated to influence the perception of size. Taller packages are usually perceived as bigger than shorter packages (Raghubir and Krishna 1999; Wansink 1996), a rectangle is perceived as bigger than a square (Krider, Raghubir, and Krishna 2001), and bottles are perceived as containing more volume than cans (Yang and Raghubir 2005). Also, shapes can be used as branding components. Lindström (2005) proposes that certain shapes ‘clearly speak of their brand’ (p. 48). For example the Coke bottle, Chanel No. 5, the golden arches of Mc Donalds and Mac computers. All of these brands use certain shapes to generate brand recognition.

2.2.3 Pictures, words, logos, typeface

The usage of pictures and wordings in marketing is important. This is due to the fact that in almost all formats of marketing (e.g. packages, displays, and advertisement) a combination

of verbal as well as nonverbal communication is used to receive the attention of the consumer and communicate a message (Houston, Childers, and Heckler 1987). One key element is the relative picture:word ratio. If there is a higher word content, it is called 'documentary layout' and aims at consumers reading and examining it. In contrast, advertisements with a higher pictorial content are those that attract consumers attention more likely (Raghubir 2010 p. 203). Testing congruent and incongruent pictures with the advertisement message showed that incongruent pictures can enhance memory and irrelevant pictures block memory. Therefore, unexpected interactions of pictures and wordings are enhancing consumers memory (Heckler and Childers 1992; Lee and Mason 1999).

Logos (Henderson et al. 2003; Henderson and Cote 1998) and typefaces (Childers and Jass 2002; Henderson, Giese, and Cote 2004) are important design elements. According to Henderson and Cote (1998), high-recognition logos should be natural, harmonious and moderately elaborate, low-investment logos (false sense of knowing, a positive affect) are supposed to be less natural and very harmonious, and high image logos (professional look, strong positive image) should be moderately elaborate and natural. For typefaces similar guidelines exist as every typeface projects an individual and specific message. For example, if a manager decides to use a natural design to communicate a pleasant and decent image the typeface should highlight many natural aspects as possible as e.g. hand written, curved or skewed (Henderson, Giese, and Cote 2004).

2.2.4 Holistic package design

According to Gestalt theory, all effects of visual cues are not perceived individually. Instead, all elements work together to form one holistic design (Orth and Malkewitz 2008). The consumer perceives the visual elements and organizes them into more complex components of factors of design. These are then gathered during perception and deliver particular characteristics to consumers (Veryzer 1999). The holistic package design can influence the consumer's evaluation and the purchase intention of a product or brand (Creusen and Schoormans 2005; Orth and Malkewitz 2008; Schoormans and Robben 1997). For example, Orth and Malkewitz (2008) found that the selection of a wine product design could be simplified using five different holistic design types: natural, delicate, massive, contrasting, and nondescript designs. These five generic holistic package designs are systematically linked to certain impressions. Their research suggests that sincere brands should use natural

package designs, competent brands should use delicate designs, sophisticated brands should use natural or delicate designs, rugged brands should use contrasting or massive designs, and exciting brands should use contrasting designs.

Having outlined a small selection of visual stimuli, its' effect on consumers and their usage in sensory marketing, the following chapter will continue focusing on olfaction. Because olfaction in comparatively new in the context of sensory marketing, it is described more in detail. The next chapter starts with the explanation of olfactory processing since this is the base for the usage of scent in marketing.

3 Scent processing, perception and preferences

Human kind perceives the world through five sensory modalities: sight, touch, auditory, olfactory and gustatory. To a certain degree the sensory perception of all senses is similar. A chemical or physical stimulus activates the sensory receptors triggering sensory neurons to transmit that signal to the central nervous system that causes a sensation. In combination with individual memories and associations the sensation creates a personal sensory experience (Lawless 1990 p. 79).

The sense of smell is peculiar in comparison to the other senses. Because smells are processed differently than the other senses, it is more closely associated with eliciting emotions and memories. Scents can elicit emotions and autobiographical memories like no other modality (e.g. Chu and Downes 2000; Herz and Schooler 2002; Willander and Larsson 2007). This association makes scent interesting for marketing (Herz 2010 p. 91). Experiential marketing (i.e. the use of emotions in marketing) is of importance because consumers often make decisions impulsively, rather than rationally (Weinberg and Gottwald 1982).

In order to get a better understanding of the connection of scent, emotion, and memory, the following chapter describes the basics of olfactory neurological processing, as well as the effective properties, and the development of odor preferences. These basics are essential when looking at olfaction in a sensory marketing context.

3.1 Scent neurological processing

The sense of smell is unique in many ways. Firstly, it is considered to be the “slowest” sense when it comes to information processing. On average, it takes approximately 400 milliseconds from inhaling a scent until it registers in the brain; visual information, in contrast, takes only about a tenth of that time (Herz 2010). Secondly, the sense of smell reacts to chemical stimuli rather than electromagnetical or mechanical stimuli as in the sense of vision or acoustics. With regards to evolution, chemoreceptors evolved earlier than the other sensory receptors partly due to its importance for survival, hunting, verification of the edibility of food and the search for sexual partners (Burdach 1988 p. 9; Hatt 1990 p. 93).

Additionally, the sense of smell is closely associated with eliciting emotions and memories more than any other modality (Herz 2010 p. 91). This connection is explained by the odor processing structure.

Sniffing pulls the inhaled air through the nares (*orthonasal*), and eating food leads air from the back of the mouth up to the nasal chamber in the reverse direction, through the nasopharynx (*retronasal*). When humans perceive the flavor of food in their mouth, it is the retronasal smell they recognize and not the taste (Cardello and Wise 2008 p. 101). Anatomically, smelling starts in the olfactory epithelium found in the nasal cavities with six to ten million receptor cells (Doty 2001). In humans there are about 350-400 different types of olfactory receptors. However, humans can differentiate between 2000 and 4000 different scents since different permutations of receptor activation correspond to the perception of specific scents (Buck and Axel 1991; McPherson and Moran 1994).

The molecules are detected and bound to cilia, in the mucosa layer. Cilia are the extension of the olfactory receptor neurons. (Lledo, Gheusi, and Vincent 2005). The bond of receptor and odor induces an action potential in the receptor neuron (Buck and Axel 1991). Within the olfactory nerve, the receptors project the information via axons to the olfactory bulb in the brain. Here, the axons form synapses with mitral cells, which receive the olfactory information. About 1000 olfactory neurons end up in one mitral cell sharpening the olfactory information. The axons of the mitral cells lead the information via the olfactory tract to the olfactory trigone where the information is split into five major parts of the cerebrum (see fig. 3-1).

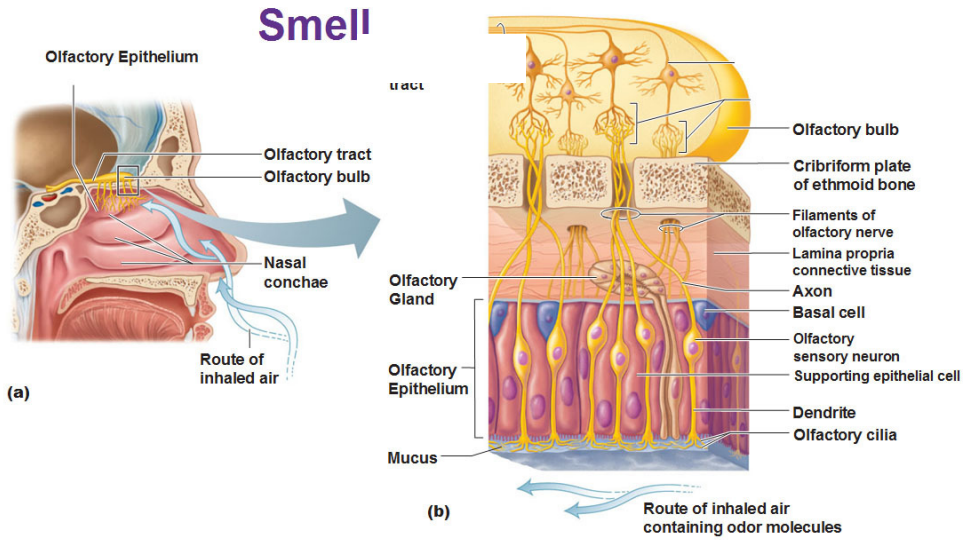


Fig. 3-1: Olfactory anatomy (Marieb 2006 p. 291)

Some axons end up in the *anterior olfactory nucleus.* They terminate in the contralateral olfactory bulb, inhibiting it. However, most of the axons enter the lateral and medial olfactory stria. The axons in the medial olfactory stria projects to the *olfactory tubercule (1)* that end up in the septal area, which functions as an important connective link between emotion, memory, and vegetative control.

The axons from the lateral olfactory stria run from the *amygdala,* via the *hypothalamus* and end up in the lateral *orbitofrontal cortex* (2), which is in charge of motivation and sexuality. Additionally, the axons run as well to the *prepiriform area* to the *thalamus*, and project on the *central orbitofrontal cortex (3),* which identifies and discriminates the odors. The *prepiriform area* also projects to the *hippocampus (4)* (see fig. 3-2; Legrum 2011 p. 8f.).

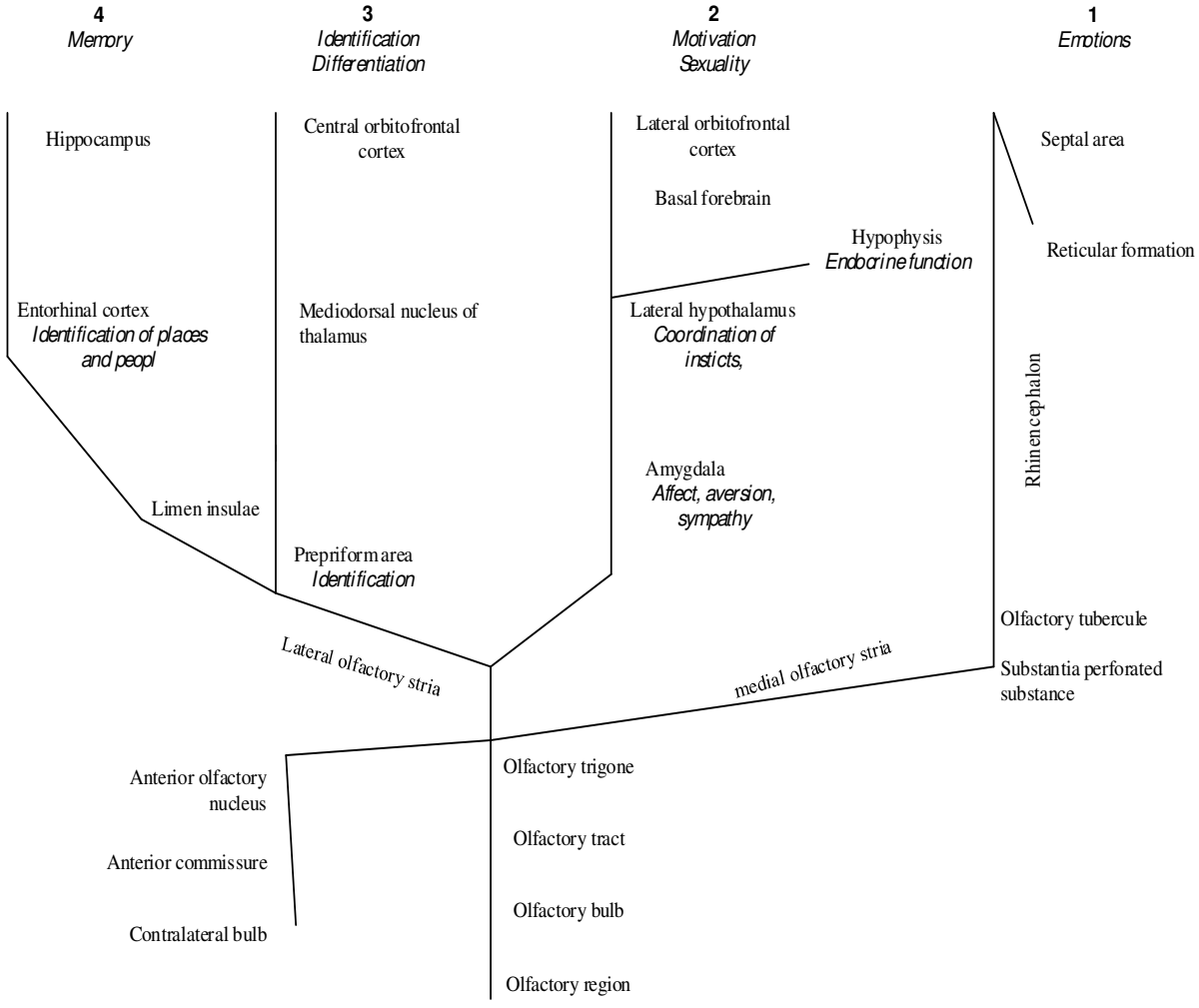


Fig. 3-2: Schematic image of the distribution of the olfactory information coming from the olfactory region to the four target regions (Legrum 2011 p. 9). These are described in the text. Side runs are not presented

This processing of scent is the major difference to the processing of all the other senses. Input obtained through all other senses is first routed to the thalamus, the principal integration locus for sensory information (Herz 2010), which then relays the information to other areas of the nervous system. Additionally, the close connection of the target regions one and two are essential for the emotional processing of odor information. The amygdala and hypothalamus are critical for the expression and experience of emotion and emotional memory (Aggleton and Mishkin 1986; Cahill et al. 1995), and play a key role in classical conditioning (LeDoux 1998), and associative learning (Rolls et al. 1996). The hypothalamus is connected to sexuality and can induce endocrine functions (hormone dissemination) of the hypophysis (Legrum 2011 p. 8). The target region four ends up in the hippocampus, which is a key player in short-term and long-term memory and is involved in a variety of declarative memory functions (Herz 2010). Furthermore, the hippocampus is where most of the cross-modal integration takes place, that is, the combination of information obtained through two or more sensory modalities (Doop et al. 2006; Eichenbaum 2001). Finally, there is evidence pointing to olfaction and emotion as being intimately connected during neuro-evolution. Both brain areas involved in the processing of scent, amygdala and hippocampus, evolved of tissue that was formerly olfactory cortex; this indicates that structures now dedicated primarily to emotion and associative learning, were previously used exclusively to process olfactory information (Lledo, Gheusi, and Vincent 2005).

3.2 Effective properties and preferences

When using scent in marketing, it is important to understand how preferences are formed. In psychology and the cognitive sciences, perception is the process of acquiring, interpreting, selecting, and organizing sensory information (Peck and Childers 2008). What exactly is it that makes people react to scent, specifically, what are its effective properties? Research points at five properties that trigger consumer response to scent: (1) threshold, (2) character/identity, (3) pleasantness, (4) familiarity, and (5) intensity.

Threshold

In order to be able to perceive a scent at all, the scent has to reach a certain detection threshold. This is the basic measurement parameter that is defined as the amount of a scent that has to be present in the air for a person to be able to notice that scent. It is measured in parts per billion (ppb) and can vary, depending on the scent, from 1 to over 100,000 ppb. It

is important to differentiate between the detection and recognition threshold, which is the concentration in which the odor can actually be identified.

Character/Identity

That recognition threshold is usually much higher in comparison to the detection threshold because humans are not proficient when it comes to identifying and characterizing a scent. They need visual or other contextual cues for better identification (Yeshurun and Sobel 2010). If, for example, a lemon scent is presented in combination with a lemon, there most likely will not be a problem identifying the lemon scent. The name is overlearned and is usually triggered fast and automatically. But when being asked for the scent in the absence of the lemon naming performance decreases considerably, although most people still consider it a familiar scent (Jönsson and Olsson 2012 p. 115). Similar results showed in an experiment in which subjects had to name the scent of daily used product items (e.g. household products). The identification rate was less than 50% (Cain 1979; Lawless and Engen 1977; de Wijk, Schab, and Cain 1995). The rate of success improves when the familiarity of the scent increases, but, very commonly, people experience a feeling of recognition and familiarity while being unable to voice a verbal description or assign a semantic label. This is called the 'tip-of-the-nose' phenomenon (Homewood and Stevenson 2001). This difficulty in naming a scent is thought to derive from various reasons. One reason could be that in our evolutionary past naming an odor has not been essential for survival. Storing the information non-specifically, it is usually enough to detect scents, discriminate between them, and recognize them as either familiar or unfamiliar (Köster 2002). Our incompetence in naming odors may be because it is not evolutionarily essential. An alternative explanation is that in everyday life odors most frequently occur within a context. Therefore, the weak performance in odor naming tasks might be due to a lack of context (Jönsson and Olsson 2012 p. 118). A third explanation for our lacking ability to name scents might be the relatively weak link between an odor and its name. If an odor is presented without any context, the problem is not based on the inability to perceive the odor but based on the inability to retrieve the information of the name from the memory. The brain provides the information for identification of the odor, but the odor can only be named when the information is received from the memory (Cain 1979). It is conceivable that the verbal areas of the brain are weakly associated with the olfactory processing areas; weaker than for other modalities (Engen 1991). Additionally, odor processing and language processing engage identical cortical resources (Lorig 1999). Accordingly, simultaneous

processing of language and olfaction may lead to a competition for processing resources, hereby making it difficult to name odors (Yeshurun and Sobel 2010).

Pleasantness, familiarity, and intensity

An important parameter is the scent's pleasantness, as the identification of scents seems to be difficult. In daily life people routinely and quickly distinguish if they like an odor or not, which can lead to approach or avoidance behavior (Herz, Beland, and Hellerstein 2004). Consumer research even suggests that odor perception primarily occurs in terms of its pleasantness or unpleasantness, the individually and positively evaluated stimulation of the olfactory senses (Ehrlichman and Halpern 1988).

Beyond pleasantness, individuals perceive and respond to a scent's *familiarity* and *intensity*. Pleasantness is highly correlated to familiarity; familiar scents are evaluated as more pleasant and vice versa. Familiar odors are liked more than unfamiliar odors; also, pleasant odors are often found to be more familiar.

The relationship between pleasantness and intensity is more complex (Moskowitz, Dravnieks, and Klarman 1976; Sulmont, Issanchou, and Köster 2002) and can often be characterized by an inverted-U shaped function. A perfume smells good, perhaps even better as the intensity increases, but only up to a certain point. Beyond that point the scent becomes so intense that it becomes unpleasant. Yet, with some scents, the relationship between intensity and pleasantness may be linear rather than bell-shaped: Whereas a light cheese odor may be acceptable, the evaluation may become continually more unpleasant as the intensity increases (Herz 2010).

There remains a continuous debate if the preferences in human perception of scents are innate or learned. On the one hand, support for the claim that the hedonic discrimination is innate derives from research on taste perception, which suggests that this mechanism is mostly hardwired (Perl et al. 1992). For example, Steiner (1979) found that infants, like adults, show more facial negative responses to rotten eggs and fishy odors in comparison to odors like vanilla, banana or butter. Recent research demonstrates that new born brains are fit to support odor-based preferences and to execute them in behavior from the very first minute after birth (Schaal 2012). On the other hand, Engen (1988) discovered that infants and young children have different odor preferences than adults, including an indifference to some odors that adults find offensive. There is also evidence that humans begin to learn odor

preferences prenatally, which makes it difficult to distinguish between innate odor preferences and early learning (Schaal 2012 p. 261).

Regardless of the nature-nurture debate in relation to odor preferences, learning and context play a major role later in life (Cardello and Wise 2008 p. 106). This is evident in studies focusing on odors that are associated with either positive or negative experiences. Here, one item (e.g., a scent) becomes connected to another (e.g., the judgment of pleasantness) as a function of an individual's past experience (Wasserman and Miller 1997). This theory is known as the *associative learning theory* (Engen 1991). Over a life time, odors are bound to experiences and emotions, and hedonic responses are developed (Herz, Beland, and Hellerstein 2004). For instance, if people are always exposed to a scent of lavender while getting massages, the scent might get connected with the sensation of relaxation. In case of exposure outside the context of a massage, lavender can still elicit the feelings of relaxation. Therefore, the hedonic perception may depend on individual experiences but also cultural differences (Krishna 2013 p. 85). A closer description of individual differences follows in section 4.4.2.2.

3.3 Marketing relevant indications of olfactory processing

The unique structure of olfactory processing and preference learning indicates that no other sense has such an instantaneous and explicit connection to the brain areas related to memory and emotion. Therefore, three main functions of olfaction ban be employed in a marketing context:

1. Scents are associated to semantic information that is partly due to knowing the source of a scent. Semantic memory is limited to pure knowledge without any spatial or chronological reference (Hehn and Silberer 2008).
2. Episodic memory saves spatial and chronological memories and connects them to happenings and objects. This connection makes it possible to 'relive' experiences from the past. To connect a scent to an experience (positive or negative) is of importance since it determines the affective load (Herz, Beland, and Hellerstein 2004). Therefore, for a product or brand the experience that is connected to the brand/product scent is most relevant; not the fact that the package is scented with a certain scent.

3. The emotional function is closely connected with the episodic memory. Scents are learnt within a context, and the affective conditioning happens within this context. Emotions judge stimuli so that humans can approach pleasant odors and avoid unpleasant ones to maximize survival. Emotions automatically initiate this behavior and function as motivation for decisions and behavior (Trommsdorff and Teichert 2011 p. 102) Thus, scents automatically drive approach and avoidance unconsciously.

Summarizing, the unique modality processing of olfaction and its link to emotion and memory makes it particularly interesting. The next chapter focuses on using scent in sensory marketing.

4 Olfaction in sensory marketing

The previous chapter explained the distinct connection of scent to emotions and memories. This chapter will look at olfaction within a sensory marketing context. Following there will be a description of market research on the effects of scent on a) affect, b) evaluative judgment, c) memory, d) behavior and intention. Although the experiments of this work focus on the effects of product scent, this chapter includes effects of ambient scent for completeness as well.

Considering the focus of this thesis is on cross-modal interaction, section 4.3 describes cross-modal effects with a particular focus on the scent and vision. Section 4.4 proposes scent processing models followed by a description of implicit and explicit testing methods follows. This chapter closes with an ethical evaluation on the use of scent in marketing.

4.1 Using scent in marketing

Scent marketing, a part of sensory marketing, is defined by Vlahos (2007 p. 70) by the use of scents 'to set a mood, promote products or position a brand'. This definition indicates a variety of possibilities to use scent marketing related. For simplification, Morrin (2010) differentiates between products and services that use scent in marketing: (1) a primary product attribute, (2) a secondary product attribute, (3) part of a promotional effort, and (4) ambient scent.

1) Scent is considered a *primary product attribute* when it represents the major driver of consumer purchase such in perfumes or deodorants (Milotic 2003).

2) Scent is considered a *secondary product attribute* when it is used for enhancing certain product attributes in an unconscious evaluation or for distinguishing the product from alternative options. Scent enhances key information about the product such as a lotion's soothing quality or a cleansers' effectiveness. Scent distinguishes brand, Rolls Royce being one of the first brands to develop a specific brand scent after complaints that newer models after 1965 did not quite live up 'to their illustrious predecessors' (Lindström 2005 p. 93). The company discovered that this was because of the interior smell of the new model. The interior of the old models smelled like natural materials (e.g. wood, wool, leather etc.) but these had to be

changed to plastic because of new safety regulations. Eventually, the company analyzed the old smell and developed an artificial formula that is used up to today to recreate the classic Rolls-Royce smell. 'Dove' uses a signature scent across multiple product categories including body wash, deodorant, hair care, and body spray. Despite slight scent variations between each product the consumer can still recognize the undertone Dove scent and connects it to the brand experience (Maiwald et al. 2013).

3) Scent is used in *advertisements and sales promotion* to communicate knowledge, attitudes and consumer behavior. This can happen directly by influencing the purchase behavior at the point of sale e.g. bakery scent in supermarkets can elicit spontaneous purchases. Indirect techniques use scented displays to position the brand or product. In 2006, advertisers attached scented paper stripes to 'Got Milk' billboards to promote dairy products amongst commuters at various bus stations in San Francisco. The stripes emitted the scent of freshly baked cookies to entice consumers. Similarly, in 2012, McCain launched a campaign involving scent to promote a baked potato product to shoppers in Great Britain. By pressing a button on a bulging 3D-baked potato, consumers could smell the product and receive a money-off coupon for their purchase (see fig. 4-1). Japan is a pioneer in scent marketing and has produced most of the recent technical research in this field. Some of the latest developments are mobile phones or even television sets, which emit fragrances during advertisement breaks. Using scent over the internet is predicted to be ready for scent marketing by 2015 (Gaye 2010).

Fig. 4-1: 3D potato at bus stop (Quay 2012)

4) Perhaps the most common use of scent in marketing is as an *ambient cue* i.e. a scent that cannot readily be associated to a particular object but is present in the environment. The usage of ambient scent is not a new technique but the objective used to be a different one. Celebrated processions in ancient Mesopotamia, Babylon and Egypt about 5000 years ago (Ohloff 1996 p. 25) were thought to have used scent. Nowadays, ambient commercial scent is widely used in various kinds of environments ranging from movie theatres, trade shows, hotel lobbies, to shopping centers, casinos, airlines, and hospitals (Holland, Hendriks, and Aarts 2005). The goal is the increase sales, enhance well-being, and mask or neutralize unpleasant odors (Knoblich, Scharf, and Schubert 2003 p. 130).

Although scent in marketing is increasingly used, some effects of consumer response are not yet scientifically proven and therefore not fully understood with some topics creating heated debate (e.g. Bone and Ellen 1999). The following section looks into research findings of consumer responses to ambient and product scent, including changes in affective states, evaluative judgment, intention, behavior, and memory.

4.2 The impact of scent on the consumer

4.2.1 Change in affective states

Human affective states are separated into 'emotion' and 'mood' (Siemer 2005). Emotions are more intense, short-term, and object-related, and incorporate some element of cognitive processing; in other words, emotions are 'moderately mediated' by cognition (Beedie, Terry, and Lane 2005). Moods, in contrast, are less intense, longer lasting and largely unintentional in that they occur in the absence of a referent object. Emotion and mood are similar in that they feature experience, expression and physiology (Lang 1979). However, marketing researchers commonly distinguish both concepts by dimension intensity, durability, and reference (Luomala and Laaksonen 2000). General affect is often measured in terms of the "pleasure" and "arousal" dimensions of the PAD scale developed by Mehrabian and Russell (1974).

Affective states are relevant in marketing because customers tend to make decisions impulsively rather than rationally, especially since consumerism is getting more emotional (experiential marketing) because of saturated markets (Weinberg and Gottwald 1982). The Dispositional Theory of Moods and the Affect-as-Information Paradigm recognize emotions and mood for their impact on consumer behavior. Emotions and mood can influence decision making, as well as function as moderators and mediators (Bagozzi, Gopinath, and Nyer 1999; Baun and Gröppel-Klein 2003; Schwarz and Clore 2003; Siemer 2005; Young et al. 2011)

There are mixed reports on the effect of scent on shifting consumer mood and general affect (Baron 1990; DeBono 1992; Ehrlichman and Halpern 1988; Knasko 1992; Ludvigson and Rottman 1989). Lindström (in: Maiwald et al. 2013) stated that 75% of human emotions are evoked by smell. However, a review of twenty-two studies on ambient scent in retailing and consumer services, Bone and Ellen (1999) found large variance amongst a large number of consumer reactions. Only three studies demonstrated a significant effect of the presence of ambient scent on consumer mood. Other studies similarly failed to provide corroborating evidence (Morrin and Ratneshwar 2003; M. Morrin and Ratneshwar 2000; Spangenberg, Crowley, and Henderson 1996), providing little to no support for what the popular press repeatedly refer to as the myth of seducing shoppers through ambient scent (Stephens 2007;

Vlahos 2007). Strong negative evidence is further provided in Chebat and Michon's (2003) study which showed that shoppers' positive mood was unrelated to ambient scent and pleasure did not mediate the effects of ambient scent on behavior. They concluded that effects initially attributed to ambient scent may, in fact, be due to an interaction between scent and other factors rather solely scent (Chebat and Michon 2003; Kirk-Smith and Booth 1987; Knasko, Gilbert, and Sabini 1990). Consistent with this interpretation, Orth and Bourrain (2005) showed that the pleasantness of an ambient scent enhances the influence of consumer affective states (e.g., mood) on behavior, hereby stimulating exploratory tendencies such as the exploration of unfamiliar offers and consumer acquisition of radically new offers. Summarizing, it would appear that the effect of scent on shifting consumer mood and general affect is dependent on an interaction with other factors.

Despite the lack of evidence in shopping contexts, the direct influence of scent on mood has been one of the major principles in aromatherapy. Certain fragrances even trigger physiological reactions (e.g. change in heart rate) in close correspondence with shifting moods (Herz 2009). Experimental (but not field) studies have generated corroborating evidence. For example, Field et al. (2005) found a relaxation effect of cleansing gel scented with lavender. Also, Field et al. (2008) showed a higher relaxation and decrease in cortisol levels in mothers and infants when the mothers gave their infants a bath. Warrenburg (2005) found a special type of relaxing fragrance called Myo-relax®, which can reduce stress-induced muscle tension. Measuring the trapezius EMG stress response proved that relaxation effect. Additionally, Knasko (1992) found that, when completing a mood questionnaire in a room scented either with lavender and lemon (pleasant scents) or Dimethyl sulfide (unpleasant scent), panelists in the pleasantly scented condition reported significantly more positive moods than did panelists in the unpleasantly scented condition. In line with this finding, women seated in a dentist waiting area exhibited more positive moods when the room was scented with an orange aroma than when it was not scented (Lehrner et al. 2000). Contrasting the majority of retailing studies, Doucé and Janssens (2013) did find a positive effect on consumer mood (i.e., greater pleasure and higher arousal) when an upscale clothing store was scented with a minty lemon aroma. The authors emphasize, however, that their findings are likely to be explained by the fact that they are examining high-involvement products (prestigious clothing) rather than the low-involvement products studied in previous research (e.g., school supplies, decor items, toiletry and household cleaning products). This process is more closely discussed in section 4.4.1.

Summarizing, changes in affective state are not always directly due to scent. Although some studies have been conducted in realistic settings such as casinos (Hirsch 1995), a fashion store (Doucé and Janssens 2013), or a shopping mall (Chebat and Michon 2003), most research has been conducted in artificial laboratory situations (Bosmans 2006; Morrin and Ratneshwar 2003) with differences in findings suggesting that effects may depend on additional individual or situational factors (Doucé and Janssens 2013; Ludden and Schifferstein 2009).

4.2.2 Memories

Inducing involuntary autobiographical memories is a possible mechanism for successful marketing (Muehling and Pascal 2011). One of Ebbinghaus's three basic kinds of memory is involuntary memory. Involuntary memories are of personal experiences, which come to mind spontaneously—that is with no preceding attempt at retrieval (Berntsen 2010). Distinct from voluntary recall (deliberately retrieving memories), the activation of involuntary memories involves little executive control (Levine, Lench, and Safer 2009) as implicit memories are brought to mind automatically by a variety of cues including scent (e.g. Herz and Engen 1996; Willander and Larsson 2007). When implicit memory becomes accessible, the resulting experience shares many of the properties of the original experience. It is vivid, accompanied by subjective feelings and physiological changes, and commandeers attention, thought, and behavior (Levine, Lench, and Safer 2009).

In the book 'Swann's way' (Proust 2013 p. 53), written in the beginning of the 21st century, the smell of madeleine biscuits dipped into tea elicits intense joy and memory of the childhood of the author. Often called the 'Proust phenomenon', this experience is the foundation for the hypothesis that odor-evoked memories are more emotional than memories triggered by any other sense. Due to their unique processing, scents are considered superior to other sensory input in evoking vivid and complex memories (Doop et al. 2006; Herz and Schooler 2002). Helen Keller once said: 'Smell is a potent wizard that transports us across thousands of miles and all the years we have lived' (in: Gaye 2010).

Research supports this experience: Implicit memories triggered by olfactory cues are usually highly personal, consist of fewer cognitions, and are accompanied by strong affective charges (Hinton and Henley 1993). In comparison to autobiographical memories evoked by visual cues, scent-evoked memories trace back further into one's past (Chu and Downes

2000), and are accompanied by more and stronger feelings (Herz and Schooler 2002). Integrating research on atmospherics with autobiographical memories, Orth and Bourrain (2005) investigated the influence of scent-evoked nostalgic memories on consumer exploratory behavior in a laboratory environment scented with natural and manmade odors. The findings indicate that ambient scent evokes nostalgic memories, which in turn positively influence consumer sensation seeking with downstream effects extending onto exploratory tendencies, namely risk taking, variety seeking and curiosity-motivated behaviors.

Accompanying an *advertisement* with a pleasant and appropriate scent (i.e. diffusing rose or sandalwood aroma during a commercial promoting a Spa in a movie theatre) enhanced consumer recall of attributes (unaided as well as aided) compared to a no scent condition (Lwin and Morrin 2012). Similarly, when seated in a room with a pleasant ambient scent versus no scent, consumers recalled unfamiliar brand names better. Further analysis suggested that this finding relates to a scent's pleasantness increasing attention as consumers spent more time evaluating the offer (Morrin and Ratneshwar 2003). Some companies already try to scent commercials in cinemas. In a real-life setting, the brand Nivea used this technique for advertising sun lotion. According to the scent marketing company that carried out this promotion, enhancement of the unaided recall of this commercial was about 40%, meaning that it was five times as high than a non scented commercial (Grill 2007). However, this number is not scientifically proven.

Most of marketing and consumer research has concentrated on examining scent as a secondary product attribute and as a means to promote brands. Scenting *products* with an appropriate scent can enhance individuals' memory for information about the product as well as associated attributes (Krishna 2012). For example, Krishna et al. (2010) tested effects of product scent (common vs. uncommon vs. no scent) on memory for a pencil and its product information. Subjects received a booklet with information about a pencil and the pencil itself which the subjects were supposed to "touch, smell and feel". Using unaided recall, the information of the unscented pencil was remembered less in the initial as well as in the short delay and the long delay condition. The recall after two weeks was about one fourth of the initial recall. For the common scented pencil, there was no significant decrease in the first two periods of recall. The long delay condition showed a significant decrease in recall. Nonetheless, the recall was still about three quarters of the initial recall, meaning that there was comparatively little forgetting of product information over time. For the

uncommonly scented pencil, there was no significant decline in recall among all the delay conditions. 91.8% of the initial recall was still remembered after two weeks, concluding that memories are longer present when products or their information are infused by scent. The results suggest that information encoded with an uncommon scent is more resistant to decay over time than information encoded with a common scent. The authors tried to explain this result with the *distinctiveness theory*. Distinctive stimuli experienced in the environment tend to attract attention and tend to be remembered better because of the better encoding (Green 1958; Meyers-Levy and Tybout 1989).

In general, the literature advocates that both ambient and product-related scent relate to consumer memories and impact behavior. Specific effects, however, hinge on the individual recollection of, and personalized meaning attached to, scent-evoked memories.

4.2.3 Evaluative judgments

Conveying meaning to consumers is one of the central objectives in marketing. To convey meaning (such as a product's quality, a brand's personality, or a store's price level) retailers, service scape and brand managers around the globe employ a variety of visual, haptic, auditory, and olfactory cues. Quality is important because it represents the cognitive evaluation of an offer's intrinsic core benefit (Teas and Agarwal 2000). At times when this functional benefit is difficult to judge, consumers employ extrinsic cues - including scent - to infer quality (Creusen and Schoormans 2005). Brand personality is important because it systematically captures and categorizes facets of brands in terms of generalizable symbolic benefits (Aaker 1997), enabling consumers to express themselves (Grohmann 2009), and assisting managers in differentiating offers (Sung and Tinkham 2005). Companies that succeed in conveying a certain meaning enjoy advantages in terms of heightened consumer attention (Schoormans and Robben 1997), better recognition (Karjalainen and Snelders 2010), more favorable behavioral intentions (Bloch 1995; Creusen and Schoormans 2005; Henderson, Giese, and Cote 2004; Orth and Malkewitz 2008), more advantageous positioning (Chan Choi and Coughlan 2006; Van Der Lans, Pieters, and Wedel 2008; Kaul and Rao 1995), and superior financial performance (Hertenstein, Platt, and Veryzer 2005). Although marketers – in principle – recognize the potential of conveying meaning through scent, research investigating this topic is still limited, with the majority of studies focusing on scent as a secondary product attribute, and only a few studies examining ambient scent.

Focusing on *scent as a secondary product attribute*, research on evaluative responses has commonly examined effects of consumer judgment on product attributes and overall quality (Bone and Ellen 1999). In pioneering research in this field, Laird (1932) instructed housewives to rate the quality of silk hoses in a home use test. Three of the hoses were lightly scented (i.e., aromas of flowers and fruits); the fourth was not. Regardless of the specific scent, study participants rated the scented hoses significantly better in terms of quality (i.e., as more durable, pearly sheen, and stronger); an effect that extended to higher preference. In addition, differences between the scents emerged as half of the participants preferred the panty scented with a narcissus scent.

Focusing on the question whether or not a scent has to fit the product to elicit positive evaluation, Bone and Jantrania (1992) discovered that consumers, in fact, evaluated a product more favorable when a scent was appropriate. In this study, sun lotion was rated more positive when scented with coconut scent instead of a lemon scent or no scent. No difference showed between the lemon scent and no scent.

Examining consumer response to *ambient scents*, researchers selected scents according to their affective charge (pleasant, unpleasant) for use in a laboratory experiment. The scents were diffused in a room designed to resemble a 'one-stop' shopping outlet for students with merchandise consisting primarily of household items and school supplies. Adding a scent significantly improved visitor ratings of merchandise quality compared to the no-scent condition (Spangenberg, Crowley, and Henderson 1996). This finding was later replicated in a field study where the presence of a pleasant scent improved consumer perception of an actual shopping mall and increased the amount of money spent by shoppers (Chebat and Michon 2003). Merging research on ambient scent with studies of scent as a secondary product attribute, and extending the focus to brands, Morrin and Ratneshwar (2000) requested subjects to rate familiar and unfamiliar brand names in the presence of selected ambient scents. The findings indicate that consumers evaluated the brands more positively when a pleasant scent was present.

Considering that in retail stores competing products/brands are located next to each other, Maiwald et al. (2013) examined how a brand scent (in this case: Nivea) affects the brand perception itself but also how it affects the private label perception (Balea). The results demonstrate an effect for both brands in similar dimensions of the brands perception. In particular, results show a positive effect in trust, image and likeability. The authors call this a

'hijacking effect' of the private label. They suggest keeping these results in mind when using scent in a store.

Nonetheless, not all experiments support the impact of scent on judgment. A number of studies were unable to predict the exact impact of scent quality characteristics on product perception and liking (e.g. Ludden and Schifferstein 2009; Schifferstein and Michaut 2002). Ludden and Schifferstein (2009) claim that olfaction is still important for product evaluation. However, Köster (2003) claims that for measuring the effects of scents, it might be important not to ask directly for the scent, because that draws the attention to the scent. Therefore, he suggests that it might be good to set up tests for testing the impact of scent less explicitly, and rather testing implicitly by, for example, observing behavior or other techniques. The topic of explicit versus implicit testing in sensory research is described in more detail in section 4.5.

Overall, there is extensive research substantiating the ability of scent to influence consumer evaluative judgment related to products, brands, and shopping environments. Differences in researchers' focus on effective scent properties (i.e., presence, valence, aroma), contexts (i.e., products, brands, environments), and dependent variables (i.e., overall quality, specific attributes) make it difficult, to compare and deduct broad conclusions. Also, when subjects were aware of scents during research on scent properties they often generate exaggerated or skewed findings (Ludden and Schifferstein 2009).

4.2.4 Behavior and Intention

One of the key effects of olfactory stimuli is their directive function. Ambient scents alert the organism to the existence of agents in the air, to check their quality for guidance of behavior on the basis of previous encounters, to avoid or approach certain states (Hvastja and Zanuttini 1991). This capacity of scents to heighten awareness is thought to be the primary cause for people's basic approach and avoidance responses (Spangenberg, Crowley, and Henderson 1996). Given that perceiving odors requires little, if any, cognitive effort (Ehrlichman and Halpern 1988), no conscious attempt is required for fundamental behavioral responses, such as taking a deeper breath when a pleasant scent is present or holding the breath in the presence of an unpleasant scent (Levine and McBurney 1986).

The literature holds ample evidence for the influence of ambient scent on consumer behavior. Behavioral responses assessed by researchers center on approach-avoidance, with specific measures including the length of a person's stay in an environment, spending, and behavioral intention. For example, in the presence of a pleasant and congruent scent, the amount of time consumers spent in a store, increased in comparison to an incongruent pleasant scent condition (Mitchell, Kahn, and Knasko 1995). Congruency is a concept very important in sensory research as well as for this thesis. It means the degree of fit between two stimuli. Because of its importance, the section 4.4.2.1 pays particularly attention to it.
The results of prior studies similarly holds for restaurants, where a pleasant lavender ambient scent links to consumers staying for a longer time, and spending larger amounts of money (Guéguen and Petr 2006). In casinos, using an ambient scent increased the amount of gambling (Hirsch 1995).

More recent findings, however, suggest that ambient scent can exert divergent effects depending on what type of shopping behavior is examined. While ambient chocolate scent facilitates general approach behavior and increases the amount of money consumers spend in a bookstore, it also leads to less goal-directed behavior. Specifically, the positive effects of chocolate scent occur only when the product is thematically congruent with the scent. Accordingly, the sales of congruent books increased (e.g. cooking or baking guides), whereas the sales of incongruent books decreased (e.g. thrillers) (Doucé et al. 2013). Further support for the possibly important role of congruence stems from Fiore, Yah and Yoh's (2000) study testing the effect of ambient scent on consumer response to a product display. Their findings indicate that consumers exhibited a significantly higher purchase intention and were willing to pay a higher price when the scent was both pleasant *and* congruent with the product displayed compared with a no scent condition and a pleasant scent only condition.
Summarizing, the presence of an ambient scent can impact consumer behavior in terms of the time spent in the environment and the amount of money spent. Yet, some scholars caution that studies not always support these results (Schifferstein and Blok 2002). Particularly the psychological mechanisms of the reported effects on approach-avoidance behavior are not well understood and need further investigations (Morrin and Ratneshwar 2000).

4.3 Cross-modal effects

The previous sections have focused on the individual effects of olfaction but also of visual cues. However, sensory marketing involves the integration of different senses at the same time. Also, looking at one sense individually does not completely represent the reality to consumers, who experience the world through all of their five senses. For example, for perceiving a peach, not only the information of taste and smell are received and processed, but also the information about shape, color and surface (Knoblich, Scharf, and Schubert 2003 p. 46).

In the marketplace, individual judgments about a store, its products, and even its personnel, are driven by a concert of smells encountered, things heard, objects touched, tastes experienced, and things seen. Because of this complexity, it is imperative to consider cross-modal effects involving scent.

Although vision is considered the most informative and olfaction a less informative modality, the relative importance (‘sensory dominance’) of each modality depends on the individual situation (Schifferstein and Cleiren 2005). For example, olfaction is important for providing information about a product being clean and safe, and lack of olfactory input negatively impacts consumers’ product experience (Schifferstein and Desmet 2007; Schifferstein 2006). In many cases (such as with the color and scent of food) specific product properties need to co-occur to signal safe use. Due to experience, people have an intuitive idea about which type of stimuli should occur with another one and which should not. Input association received through two or more sensory modalities is termed ’cross-modal correspondence’ remains an emerging topic in consumer behavior research (Schifferstein and Spence 2008).

Initial studies in this area have focused on the interaction of two sensory modalities for example: color and scent (Demattè, Sanabria, and Spence 2006; Gilbert, Martin, and Kemp 1996; Kemp and Gilbert 1997), music and scent (Belkin et al. 1997; Crisinel and Spence 2012). Schifferstein and Spence (2008 p. 133). The studies suggest that stimulating more than one modality at a time leads to more favorable product experiences in consumer. However, only a few studies have started examining multisensory effects in marketing contexts. For example the interactive effects of scent and touch on product evaluation (Krishna, Lwin, and Morrin 2010) or the interactive effect of scent and vision on memory for a product (Lwin, Morrin, and Krishna 2010).

As this work focuses on two modalities the next section describes sensory dominance and cross-modal correspondence. Although the focus is on the cross-modal effects of olfaction and vision other senses will also be described in more detail.

4.3.1 Comparing senses and sensory dominance

Each sensory modality is sensitive to a different type of information. Since every modality can be considered a different information channel, not all of the received information translates into the same message. For example, some messages only provide information about certain tasks, whereas others induce memories, associations or emotions. However, all of the modalities in combination create the product perception (Schifferstein and Spence 2008 p. 134).

When people make buying decisions, they compare products to identify the optimal option in a short period of time. In order to do so, they need the maximum amount of relevant information possible. Visual information is generally available quickly, faster processed and denser than any other sensorial information (Herz and Engen 1996). It takes about 45 milliseconds until a picture gets to the visual cortex after it has been identified in the retina; in contrast, it takes about 400 milliseconds from inhaling a scent to the registration in the brain (Herz 2010 p. 100). It is believed that information travels more slowly from olfactory neurons to brain neurons because olfactory neurons are unmyelinated (Herz and Engen 1996).Vision being the most important modality at the moment of a buying decision, leaves fewer resources available for processing information received from other modalities (Fenko et al. 2009; Herz 2010 p. 100).

Olfaction, in comparison to vision, has a more functional role. For example, when determining if food is safe to eat or if people, objects or spaces are safe are not (e.g. Engen 1991).

Schifferstein and Cleiren (2005) used a split-modality approach to learn about the similarities and differences of senses. Here, they presented products to people through a single modality. Comparing all modalities, vision showed the highest identification performance [near 100%] followed by touch [95-96%]. Acoustics and olfaction showed a performance rate of 55% [range 4-100%, SD 31%] and 39% [range 0-85%, SD 24%]. Respectively, Schifferstein and Desmet (2007) had a similar approach testing participants' perception of everyday products while blocking one sense. By covering the eyes or hands, the information about product functionality got blurred, whereas, blocking ears or nostrils

did not interfere with product functionality identification. However, blocking ears and nostrils minimized the perception of intensity, stimulation or of the product in general; apparently affecting consumers' emotional product perception.

Due to the good and fast identification performance of vision, one could assume that vision dominates the overall product perception. Heller (1982) suggested that vision directs exploratory behavior involving the other senses. However, the sensory dominance changes and depends on the product category, its usage and the stage of ownership. (Fenko, Schifferstein, and Hekkert 2008; Schifferstein 2006).
Regarding natural conditions, the sort of information perceived connects always to a particular sensory modality. Therefore, whether a particular sensory modality is perceived as important depends on the modality and if it can project important information or not (Schifferstein and Spence 2008 p. 153). Schifferstein (2006) assumes that the dominance of vision also relates to the peoples' tendency to judge visual input as important when evaluating its role during product usage. He concludes that the role of the modalities most likely depends on the specific product usage, the frequency, and the significance related to the activities performed.
Additionally, the importance of vision has possibly changed in the western society because of product innovations. For example, communication products like television, internet etc., demand a major visual input. Because of the integration of these products in daily life, it is very likely that the importance of vision has increased (Schifferstein 2006) .

In conclusion, it seems essential to understand the relative importance of the different modalities for different products as well as the stages of ownership. Vision seems to be the most dominant modality. However, research has mostly been explicit. Effects of olfaction happen more unconsciously and should not be overlooked. Eventually, the overall perception of a product is a mix of all different messages perceived through all modalities.

4.3.2 Cross-modal correspondence

Certain product characteristics can be perceived by multiple sensory modalities. People have an intuitive idea about which type of stimuli occur with another one and which do not, based on past experience. In addition to these learned associations of prior experience, people might perceive some similarities among the modalities, because some dimensions of sensory

experience are shared across all modalities (e.g. weak - strong) (Schifferstein and Spence 2008 p. 143).

Schifferstein and Spence (2008 p. 143) differentiate cross-modal correspondence from synthesia, although they are related. Synesthesia is a phenomenon that certain people experience in which impressions from one modality (e.g. color) are adopted by another modality (e.g. odor). People that experience synesthesia, for example, experience numbers or letters also as colors.

Synesthesia is rare but occurs globally with a frequency of 1 to 1000/2000 (Knoblich, Scharf, and Schubert 2003 p. 49f). The difference between cross-modal correspondence and synesthesia is that in synesthesia each individual has their own specific associations that are stable throughout their life. In cross-modal correspondence the associations are less specific and more malleable making it interesting for marketing. Cross-modal associations are also more common (Felser 2007 p. 133).

Table 4-1: Cross-modal correspondence of color (Frieling 1980)

Vision/color	Sound	Touch	Smell	Olfaction/Taste
Red	Loud/trumpet	Firm	Warm/hot	Strong
Rose	Tender/quiet	Fine		Sweet/mild
Orange	Loud/major key	Dry	Warm	Hearty
Brown	Dark/minor key	Dry/muddy		Musty
Yellow	Piercing/ major key	Smooth		Sour
Green	Damped	Smooth to moist	Cool	Sour-juicy
Green/blue	Soft	Soft-smooth	Cold	Fresh to salty
Blue	Distant/flute to violin	Smooth to untouchable	Cold	Neutral
Purple	Sad/minor key	Velvety		Dry-bitter

Table 4-1 illustrates common cross-modal correspondence effects related to colors (Frieling 1980 p. 29ff). For example, people tend to associate the red with a strong odor and flavors as well as high temperature. Cross-modal correspondence effects between visual and olfactory stimuli are very common. In the next section, specific cross-modal effects of olfaction and other modalities are described more closely.

4.3.2.1 Olfaction and vision

Past sensory research converge on the findings that the sense of vision dominates the other modalities. This is also the case in the interaction between visual and olfactory stimuli. Although there is large variance in effective properties for both scent and vision research has mainly focused on the interaction of scent aroma and object color. Two streams of research relate to (1) color cues influencing scent perception, and (2) visual and olfactory cues jointly influencing individual evaluation of and response to products.

Although the influence of one sensory modality (e.g., vision) on another modality's (e.g., scent) input is not a straightforward marketing issue, much research has been dedicated to the interaction of color on scent perception, yielding some important insights for marketing (Demattè, Sanabria, and Spence 2009). When scented liquids are combined with colors closer to the object producing the scent, they are more likely to identify the scent. For example cherry-scented liquid is more likely to be correctly identified when it is colored red than if it is colored green (Zellner, Bartoli, and Eckard 1991). This finding holds not only for abstract stimuli, but also extends to consumer products. For example, wine experts use descriptors that are typical for red wine when describing a white wine, which is colored red (Morrot, Brochet, and Dubourdieu 2001).

According to Demattè, Sanabria, and Spence (2006, 2009) the dominance of the sense of vision over olfaction is so strong that people are biased by color even when explicitly instructed to ignore visual cues. For example, when tasked with identifying scents and ignoring visual cues (color) presented jointly with the olfactory cue, study participants' responses were biased so that their identification of scents depended on the color. The strong association between certain colors and scents has been shown to be very robust across individuals (Schifferstein and Tanudjaja 2004). Additionally, this biasing effect of color not only applies to scent identification, but also extends to individual judgment of scent intensity as visual lightness and odor intensity, as well as odor pleasantness appear to correlate (Djordjevic et al. 2007; Kemp and Gilbert 1997).

Investigating possible causes for the biasing capacity of vision, researchers posit that the interaction of color and scent takes place at the perceptual level (Schifferstein and Tanudjaja 2004). Functional magnetic resonance imaging corroborates this view, indicating that the

brain regions activated for processing pairings of scent and color vary as a function of the perceived congruence of these pairings (Österbauer et al. 2005).
Labeled a "perceptual illusion", the concept reflects the fact that – following sensory input – a higher level of information processing (i.e., at the semantic level) relates to divergent olfactory perception (de Araujo et al. 2005; Herz 2003; Herz and von Clef 2001).
Furthermore, adding to the evidence of vision-scent congruence effects at the semantic level, individuals evaluated an identical scent as more pleasant when the label was positive (e.g. "cheddar cheese") rather than when it was negative (e.g. "body odor"). In the latter case, the scent was also rated as more strong in terms of intensity (Djordjevic et al. 2007).

Package color has been identified as an especially effective tool for steering shopper expectations regarding levels of scent intensity (intense: dark red; less intense: pastel green), sweetness (sweet: dark red; not sweet: pastel green) and freshness (fresh: pastel green; not fresh: dark red) (Scharf and Volkmer 2000). Cross-modal correspondence between visual and olfactory cues has been applied via careful coloring of the liquid, packaging and advertising in perfumes (Schifferstein and Spence 2008) and deodorants (Schifferstein and Spence 2008).

Although visual cues affect olfactory performance, less is known about the influence of olfactory stimuli on visual performance. Recent research suggests that olfaction can influence vision as well. For example, scent can affect visual perception and processing by drawing the visual attention towards congruent objects (Seo et al. 2010), affecting visual processing by facilitating the odor sources' identification (Seigneuric et al. 2010).
Additionally, scent can influence the evaluation of neutral pictures positively (if scent is pleasant), but can also influence the perception of pleasant pictures negatively (if scent is unpleasant) (Banks, Ng, and Jones-Gotman 2012).
For certain product categories (e.g. soft drinks and dishwashing liquid) scent in comparison to color is the main determinant of key benefits such as freshness (Fenko et al. 2009).
Furthermore, scents can control people's movements. Castiello et al. (2006) tested cross-modal interaction between olfaction and vision during human grasping. When a visual target is small (e.g. a strawberry) but the scent suggests a larger object (e.g. an orange) the time and amplitude of maximum hand aperture is greater, and vice versa. A conflict between visual and olfactory information could have a negative effect on the product (Ludden and Schifferstein 2009).

Lwin, Morrin, and Krishna (2010) showed that combining pictures and scent might make it possible to enhance verbal recall. While visual images are important for linking sensory inputs, using scent enhances these links. The authors refer to this 'as the potentiating effect of scent on pictures' ability to enhance memory for verbal information' (2010 p. 325) and emphasize the importance of the results in marketing context.

Summarizing, research shows that cross-modal effects of olfaction and vision are bidirectional depending on the scenario.

4.3.2.2 Olfaction and other sensory input

There are fewer studies looking into other senses than vision and they tend not to be directly related to marketing. A few studies have examined the cross-modal interaction of scent with auditory input (obtained through the sense of hearing) and haptic input (obtained through the sense of touch). As with the sense of vision, most studies focus on very basic relationships between sensory properties; only few examine outcomes more directly related to marketing.
Paralleling the previously discussed congruence effects between color and scent, a similar phenomenon has been established for the interaction between scent and auditory pitch:
Qualitatively different odors correspond to different levels of pitch and sound volume. Fruity scents, for example, relate to a higher pitch, and the volume of a sound is positively associated with the perceived concentration of a scent (Persson 2011). More directly relevant to marketing environments, music in combination with scent (i.e., their stimulating quality) leads visitors to rate an environment significantly more positively, with effects further extending to approach and impulse buying behavior, and an increase in satisfaction (Mattila and Wirtz 2001; Morrison et al. 2011). Spangenberg, Grohmann, and Sprott (2005) attribute these findings to the moderating effect of background music. In their study, consumer evaluations of a store were more favorable when the scent was congruent with the music (Christmas scent - Christmas music). Combining an identical scent with incongruent music (Christmas scent - non-Christmas music), however, lead to less favorable evaluations. Overall, carefully combining music and ambient scent may lead to an enhanced shopping experience and more profitable retail. Again, stimulus semantic congruence appears to be the key.

Research on the cross-modal interaction of olfactory and haptic stimuli (touch) is scarce.

Initial findings hint at the existence of a cross-modal link between scent and haptic stimuli similar to the previously discussed interaction effects of scent involving color and music (2006). Presenting a soft versus rough piece of cloth, jointly with either a lemon or animalistic scent yielded softness ratings that varied significantly depending on the scent (i.e., were higher for the lemon scent). While this outcome was obtained using explicit measures (i.e., psychometric scales), a subsequent experiment confirmed that this effect also held when associations were assessed implicitly (i.e., using an implicit association test) (Demattè, Sanabria, and Spence 2007). Adding different scents to a shampoo yielded a significant effect of scent on the perception of haptic dimensions as participants - while washing their hair with the shampoo – evaluated both the fluid and their hair as softer. Similarly, using different scents influenced a product's haptic characteristic such as thickness, creaminess and foaminess (Churchill et al. 2009). Further strong evidence for scent's capacity to affect haptic stems from research by Krishna, Elder, and Caldara (2010). Scenting a cold versus a hot gel pack with a "hot" (pumpkin cinnamon) versus "cold" (sea-island cotton) scent elicited more positive evaluations of the gel pack with consumers when the scent matched the temperature. Perhaps even more important, participants evaluated the packs as more effective and faster in treating pain (sea-island scented cold pack) and as more effective in warming one's hands (pumpkin-cinnamon scented hot pack).

Concluding, the existing studies involving scent yield that a major driver of consumer response is the cue congruence between olfactory input and sensory information obtained through other modalities.

4.4 Consumer processing model of scent

4.4.1 Consumer behavior and scent processing model

After describing the impact of scent on emotions, memory and behavior and also cross-modal interactions, it is important to focus on the actual processing model. Chapter 3 describes the neurological processing of scent, however, it does not propose an actual processing model of the influencing impact of scent on consumer behavior

The existing processing models focus on ambient scent only and not on product scent. There are two different models explaining scent processing, distinguished by a focus on affective reactions or cognition.

Model 1: Affective Reactions

Many marketing researchers have agreed on the *S-O-R Model* from Mehrabian and Russell (1974) as explaining mechanism for ambient scents. In the mood is a mediating factor between environmental cues and behavior. The environmental stimulus (S) such as scent, elicits an affective reaction (O) which in turn determines whether the consumer approaches or distances from the environment (R) (Peck and Childers 2008 p. 196). Using the S-O-R model as a base, Gulas and Bloch (1995) developed another model of ambient scent effects, which has been modified since its creation (Davies, Kooijman, and Ward 2003; Ward, Davies, and Kooijman 2003). This processing model states that perception of an ambient scent depends on the objectivity and acuity of the consumer, which is determined by his or her characteristics (e.g. age, gender). Perceived ambient scent combined with individual preferences raise an affective response in the consumer. However, other atmospheric cues and also congruency of scent and environment may moderate this process. The affective responses then mediate approach or avoidance responses within the consumer. Different studies support this model (e.g. Hansen, Bruun-Christensen, and Schauman 2006; Morrison et al. 2011).

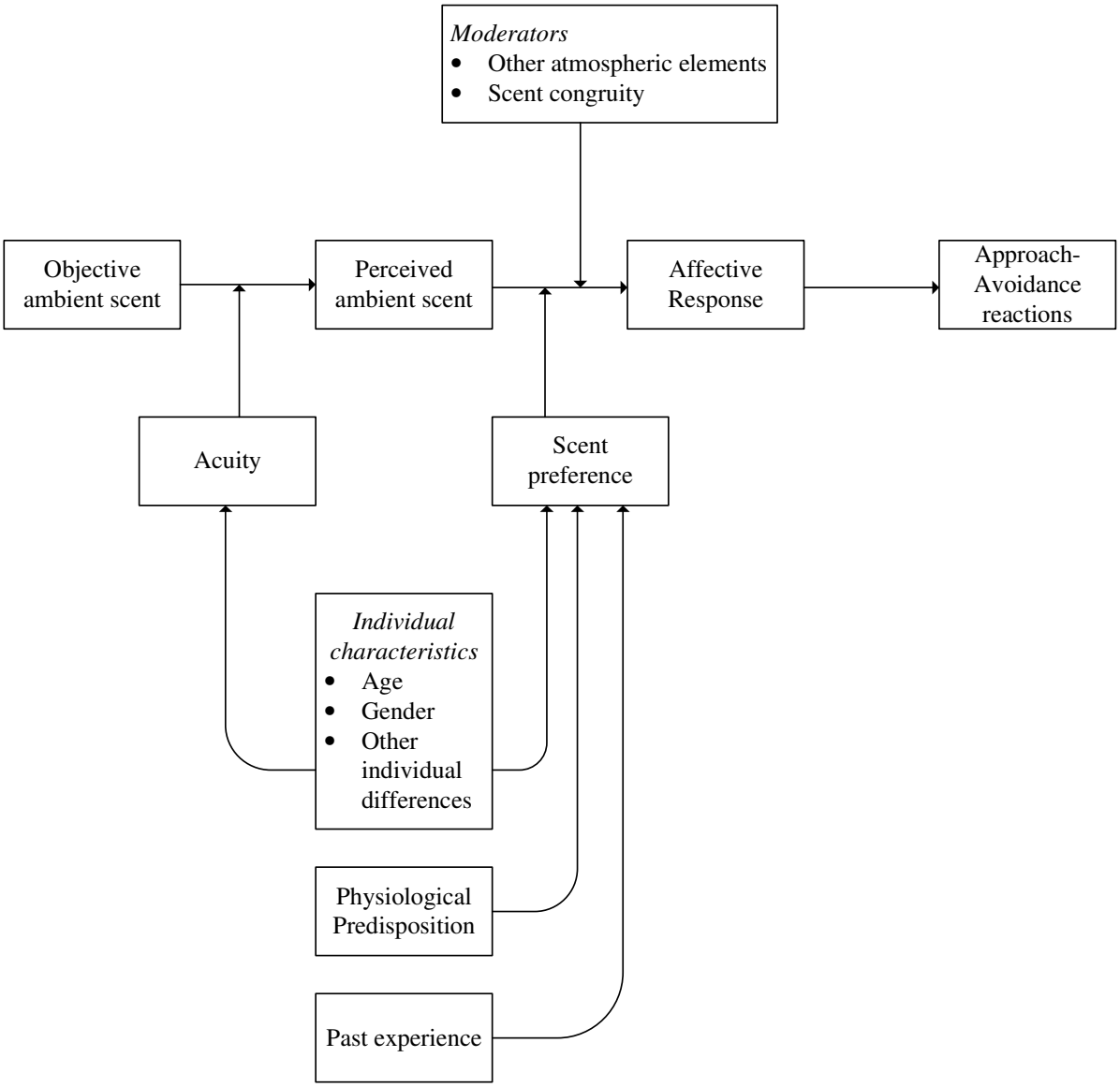


Fig. 4-2: Processing model according to Gulas and Bloch (1995)

Model 2: Cognitive

As described earlier, results about the impact of scent on mood are cause for heated debate. In their review article, Ellen and Bone (1999) discovered that only a few studies (16.1%) found an impact of scent on mood. Different authors suggest that scent directly influences cognition without the mediation of mood (e.g. Bone and Ellen 1999; Chebat and Michon 2003; Hansen and Beckmann 2007; Peck and Childers 2008 p. 196). Studying the hierachy of emotions and cognitions, Chebat and Michon (2003) compared the *emotion-cognition model* from Zajonc and Markus (1984) with the *cognitive theory of emotions* from Lazarus (1991) in a scented shopping mall. In the emotion – cognition model, ambient scent induces positive emotions influencing shoppers' perception of their environment and product quality.

The second model proposes that ambient scent influences the perception of the shopping environment and product quality, which leads to an enhancement of shopper's mood, and finally to an enhancement of shoppers' spending. Results show a better fit for the model based on Lazarus' work. The results indicate that mood does not influence shoppers spending at all, or at least negligibly. Ambient scent influences mall perception and product quality directly. Mall perception mediates shoppers' arousal and perception of product quality mediates pleasure. However, shoppers' spending is not strongly influenced by emotions but mainly mediated by the perception of product quality (see fig. 4-3).

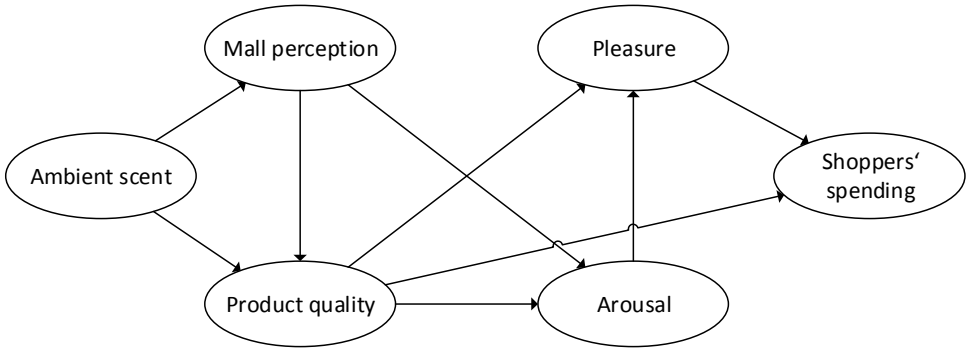


Fig. 4-3 Tested model according to Lazarus (Chebat and Michon 2003)

With conflicting results, both models could be valid depending on the consumer involvement. Doucé and Janssens (2013) propose that most studies that did not find an effect of scent on mood, used low involvement products e.g. school supplies and books (Spangenberg, Crowley, and Henderson 1996), and toiletry and household cleaning products (Morrin and Ratneshwar 2003). According to Bruner (1990), atmospheric elements like music have the biggest effect on consumer behavior when they are either low cognitively involved or high affectively involved with the product. Being also an atmospheric element, it seems possible that scent has the most impact on consumers during low involved with the purchase or when they purchase products based on emotional motives. In the first case, motivation of the consumer for information processing is only little and evaluation of the store and the products takes place based on the peripheral cues (Petty and Cacioppo 1986; Petty and Wegener 1999). The shopping atmosphere (e.g. scent, music, visual elements) can function as such, hence impacting the consumer evaluation without altering the consumer

mood. However, when purchasing products with psychological benefits (i.e. high affective involvement), emotions increasingly direct the consumer (Doucé and Janssens 2013).

4.4.2 Influencing factors

Having described the two processing models of ambient scent, the next paragraphs takes a closer look at main influencing factors in processing: Congruence and individual differences on scent preferences.

4.4.2.1 Congruence

A recurring issue in studying how scent influences consumer behavior is the possibility that effects may depend on the congruence of the scent with other stimuli (e.g. Bone and Jantrania 1992; Mattila and Wirtz 2001; Spangenberg, Grohmann, and Sprott 2005). Therefore, it is important to describe it here in detail.

Cue congruence is defined as the degree of fit or match among salient properties of two or more stimuli. Of the many theoretical accounts put forward to explain consumer response to scent, the vast majority acknowledges that responses may be moderated by the scent-product congruence, the category, the shopping theme, or input received through another sensory modality. When analyzing cross-modal interactions, cue congruence is a highly relevant construct (e.g. Krishna, Elder, and Caldara 2010).

The congruence theory stems from research on memory and attitude and assumes that humans are generally searching for harmony and consistency between their thoughts, feelings, attitudes and behavior (e.g. Kirmani and Shiv 1998; Mandler 1982; Stangor and McMillan 1992). Accordingly, Ellen and Bone (1998) use Mandler's (1982) schema to explain the congruency effect between scents and products. The general idea is that if a stimulus is congruent expectation the consumer responds with "a primitive positive evaluation" (Mandler 1982 p. 13). Incongruence between stimuli and expectation "sets the stage for emotional experience" (p.14). For example, consumers may have a general expectation (or a schema in Mandler's terms) for scents used in products or product categories. Accordingly, a yellow liquid soap with a lemon printed on the package with a mint scent could induce a discrepancy with the consumers' schema.

Experiencing incongruence in a product can have different consequences. Firstly, incongruence may lead to a surprise reaction, followed by a positive (i.e. amusement or interest) or negative (i.e. irritation) emotion (Ludden, Schifferstein, and Hekkert 2006).

Secondly, incongruence may affect product evaluation negatively or positively (Ludden, Schifferstein, and Hekkert 2008). And thirdly, it may enhance memory because of the distinctiveness (Krishna, Lwin, and Morrin 2010). In line with this *distinctiveness theory*, scent (in)congruence may have an impact on product information recall. Congruent scent enhances long-term recall in comparison to no scent, but incongruent scent enhances memory even more because its uncommonness (Krishna, Lwin, and Morrin 2010). However, not all research supports this thesis.
Research suggests moderate incongruence in product design for inducing curiosity and interest in the consumer and a positive overall evaluation (Mandler 1982 p. 22). This line of thinking is a possible area of future research.

However, research has focused on (in)congruence effects. Bone and Jantranias (1992) reported *product congruence* effects of scent. Sunscreen lotion scented with coconut received more positive evaluations of product beliefs and attitude than with a lemon scent. Similarly, lemon scented household-cleaning product were more appealing than coconut scented ones. In both products approach behavior towards the product was enhanced by higher product-scent congruence. Additionally, Hansen, Bruun-Christensen, and Schauman (2006) showed that the approach behavior towards a product was enhanced due to a congruent scent.

Regarding *congruence with other sensory input* music has received much of the attention in research. Results indicate that higher congruence between music and scent leads to more positive evaluation of the shopping environment, an enhanced shopping experience, a higher level of approach behavior and more impulse buying in a shopping mall. For example, studies on retail atmospherics indicate that when ambient scent and background music match in terms of arousing quality (i.e., high/high or low/low), consumers experience increased pleasure, evaluate the store more positively, and ultimately exhibit approach behavior (Mattila and Wirtz 2001). By setting up an experiment in a lab, Spangenberg, Grohmann and Sprott (2005) manipulated scent (no scent vs. Christmas scent) and music (non Christmas music vs. Christmas music) in a retail store. Christmas scent and music congruence led to a more positive evaluation of the store environment, its merchandise and a greater intention to shop. The incongruent condition led to the opposite effect.

A special case of congruence exists when consumers explicitly assess the fit in terms of semantic associations among stimulus properties (Krishna, Elder, and Caldara 2010).
Individuals assign sensory stimuli a semantic meaning. Semantic congruence research is distinct because it focuses on a cognitive processing level rather than perceptive. For example, Krishna, Elder, and Caldara (2010) tested feminine versus masculine scents in combination with rough versus soft paper. The semantic congruence of rough versus soft moderated the effects of the bimodal sensory input. Another example relates back to a similar study using hot/cold packs. Gel packs were evaluated more positively with greater effectiveness when combined with a semantically congruent scent. Additionally, the key benefit was enhanced when the product was appropriately scented, namely the packs were rated warmer (cooler) when combined with the 'warm' (cold) scent. This is a key study highly relevant for this thesis.

Concluding, cue congruence, especially semantic congruence, seems to be a key concept in understanding consumer response to scent. Therefore, semantic congruence is the base of this thesis looking into visual and olfactory interaction.

4.4.2.2 Individual differences in scent perception

A second influencing factor in the processing of scent is the individual difference of scent perception. There are a number of individual differences between the perception and impact of scent depending on: demographic variables (e.g., age, gender), chronic tendencies (e.g., personality traits) and individual states (e.g. mood). Although the impacts are minor for this particular thesis, it is important to mention and keep in mind.

Perception

Regarding scent perception, a substantial body of evidence shows that people differ in their ability to smell, that is, in their capacity to detect and identify olfactory input (Hasin-Brumshtein, Lancet, and Olender 2009). Individuals differ in their olfactory abilities, that is, their capacity to detect and identify olfactory input (Hasin-Brumshtein, Lancet, and Olender 2009). This individual difference can be explained by a combination of genetic and environmental factors such as smoking habits and age. Smoking (Frye, Schwartz, and Doty 1990) and aging (Stevens, Bartoshuk, and Cain 1984) reduces the number and sensitivity of olfactory receptors. Gender, in contrast, has no effect; women and men appear equally

capable of detecting and identifying olfactory input (Larsson, Finkel, and Pedersen 2000). The individual perception influences of course the scent preferences.

Preferences

Preference is not systematically fixed (Rouby, Pouliot, and Bensafi 2009) and odor intensity and familiarity play major roles (Jellinek and Köster 1983; Moskowitz, Dravnieks, and Klarman 1976) as well as gender and hormonal status. For example, men are more likely to choose fragrances for romance and social motives and women select fragrances for inner-directed and emotional motives (Bain 1997). In regard to the hormonal status, women in the ovulatory phase perceive androsterone (male hormone) as less unpleasant as during the other phases (Grammer 1993).

Aging modulates the odor pleasantness perception. The identification of unpleasant odors in age does not change, however the identification of pleasant rated odor decreases in older people (Konstantinidis, Hummel, and Larsson 2006).

Previous semantic knowledge can influence odor perception. Pleasantness ratings increase when participants can identify the source of odor or are provided with a pleasant name for the scent (Ayabe-Kanamura, Kikuchi, and Saito 1997). Even smelling the same odor with a different label e.g. cheese or body odor shows not only significant differences in the hedonic judgment; but also in the processing in the orbito-frontal-cortex (de Araujo et al. 2005), proving that unpleasant and pleasant odors are processed differently.

Lastly, the cultural background modulates the odor preferences. The fact that in every culture children grow up in a different environment of different flavors and odors could be the explanation (Haller et al. 1999). Therefore, different odor experiences lead to different categorization across countries and to a different hedonic perception across the cultures (Chrea et al. 2004; Schaal et al. 1997).

Ambient scent impacts individual spending during a shopping trip more with young people than with older people (Chebat, Morrin, and Chebat 2009). Adopting a more holistic perspective, Davies, Kooijman, and Ward (2003) suggest that the ambient perception also depends on the objectively present ambient scent and the acuity of the consumers, which is influenced by individual characteristics such as age and gender. This view is consistent with Lehrner et al. (2000). The researchers found gender differences in mood shifts with men (no

change) and women (mood shift) seated in a dentist's waiting area scented with an orange fragrance.

4.5 Measurement methods: implicit versus explicit

The last sections described individual and cross-modal effects of scent on the consumer as well as the processing models of scent. In this chapter, the methodologies in cross-modal research are described.

Investigations of sensory research open the opportunity to use alternative methodologies. Previous sensory research has used explicit testing methods such as psychometric measures. Implicit measurements minimize respondent control through self-reflective, deliberative processes (Nosek, Greenwald, and Banaji 2007). This capacity sometimes leads to different results when compared with explicit methods (Greenwald, McGhee, and Schwartz 1998). Peck and Childers (2008) suggest using indirect methods as it could help to validate the psychometric assessments of new measures of individual scales and also to gain a deeper understanding of sensory processing.

Köster (2003) proposes that it might be important not to directly ask for the scent, in order not to draw the attention to scent. Therefore, he suggests implicit testing through behavior observation, fMRI, and heart rate.

Implicit sensory research has so far been mostly of basic nature. EEG (e.g. Field et al. 2008), EMG (e.g. Miltner et al. 1994), skin temperature, and blood pressure (Heuberger et al. 2001) have been used to measure the effect of scent on mood. Also, fMRI has been used to measure the effect of scent on memory (e.g. Herz et al. 2004; Zelano et al. 2009). Observational studies have been used to measure the effect of scent on behavior (Doucé et al. 2013; e.g. Doucé and Janssens 2013; Holland, Hendriks, and Aarts 2005).

Furthermore, in cross-modal research implicit measurement has gained in interest. Mostly studies that investigate olfaction and vision have integrated these methods. A variety of methods have been used so far. Examples here are the measurement of skin conductance (Banks, Ng, and Jones-Gotman 2012), the measurement of event-related potentials (Seo et al. 2010), eye-tracking (Seigneuric et al. 2010), and the measurement of hand kinematics (Castiello et al. 2006; Tubaldi et al. 2009) during visual and olfactory stimuli exposure.

A newer approach in sensory testing is the Implicit Association Test (IAT). As this test is the basis for the first experiment in this thesis, the next paragraph pays more detailed attention to the IAT.

Implicit Association Test

The IAT, commonly employed in consumer research, has not been integrated into multi-sensory research. IATs were initially developed to indirectly measure the strength of automatic associations among concepts (Greenwald, McGhee, and Schwartz 1998). IATs typically require a simple sorting task during which subjects have two response keys that are assigned to two of four concepts. The underlying assumption is that concepts that share strong associations trigger faster responses than concepts that do not share an association.

Greenwald et al. (1998) tested the attitude toward flowers and insects using names of those as well as pleasant and unpleasant words. Response latency (reaction time) was significantly lower when flowers were paired with pleasant words than with unpleasant words. Also, testing implicit attitude towards black people yielded that Caucasian subjects reacted faster to Caucasian peoples' names and pleasant words than African American peoples' names and pleasant words. Even though subjects would not admit it when explicitly prompted for prejudices, an implicitly negative attitude towards black people was evident (Greenwald, McGhee, and Schwartz 1998).

Similarly, testing the self-perception of people, individuals reacted faster to a combination of words describing themselves and positive words than to combination of words not describing themselves and positive words, indicating that people generally have a positive attitude towards themselves (Greenwald and Farnham 2000). Additionally, the performance of subjects was better overall (e.g. fewer mistakes) in congruent conditions (Greenwald, McGhee, and Schwartz 1998; Demattè, Sanabria, and Spence 2007).

The IAT, commonly employed in consumer research, has not yet been integrated into multi-sensory research. The IAT has been adapted to study effects of other modalities including auditory stimuli (Vande Kamp 2002). Demattè, Sanabria, and Spence (2006, 2007) were the first to integrate IAT and the concept of cue congruence with cross modal research. They developed a modified version of the IAT for olfactory and haptic stimuli, requiring subjects to respond to soft versus rough fabrics paired with lemon versus animal scents. Reaction time was faster for the congruent combinations than for the incongruent pairs. Consistent

findings emerged when using the IAT for testing colors and matching versus non-matching olfactory stimuli (Demattè, Sanabria, and Spence 2006).

Altogether, this literature review shows that the usage of implicit measurement methods is still limited in sensory testing. Peck and Childers (2008 p. 214) suggest that it should be integrated more for the deeper understanding of sensory processing. Considering this gap, this work includes implicit as well as explicit measurements for cross-modal research.

4.6 Ethical aspects regarding the usage of scent in marketing

Having understood the power of scent, ethical considerations about how this power should be used need to be taking into consideration. Ethics generally differentiate between the "right" or "good" and the “wrong” or “bad” (Smith and Quelch 1993). The following paragraphs are intended to raise awareness of a few of the challenges and pitfalls involved in (a) using scent for marketing purposes (marketing ethics) and (b) conducting research on consumer response to scent (ethics in consumer research).

Marketing ethics arise when companies come to market with products aimed at consumers (Tsalikis and Fritzsche 1989). Dissolving these issues then depends on the perspective taken, especially whether one adopts a more deontological or teleological viewpoint (Hunt and Vitell 1986). Often, resolving issues of marketing ethics also comprises governmental regulation. Critical voices have expressed very specific concerns about marketers using scent for misguidance, deception and manipulation of the consumer. For example, it has been argued that employing scent for enhancing consumer perception of product quality (Bone and Jantrania 1992) meets the standards of misguidance and deception because the product appears to be of better quality than it would ordinarily be (without scent). Another common practice involves dispensing a ‘new car’ fragrance in used cars to stimulate the perception of newness and possibly enhance consumers’ willingness to pay. Regarding marketing’s use of ambient scent, the argument could be that the effects established could seduce consumers into actions (e.g., spontaneous buying, exaggerated spending), they would not take if the scent was absent (Knoblich, Scharf, and Schubert 2003).

Issues of *ethics in consumer research*, by contrast, arise when researchers aspire self-interested goals, possibly at odds with the needs of those either undergoing or sponsoring

their study. These issues demand for the requirement to protect consumers against potentially harmful research practices and to maintain the integrity of findings intended to make a contribution to our knowledge. In many societies, there is an agreement that consumers are entitled to anonymity, peace of mind, candor, and freedom of choice; conversely, they agree that research practices deemed hurtful, deceptive, or treacherous should be outlawed (Holbrook & Schindler 1994). Breathing means the consumer inescapably is exposed to the scent, bringing up questions of choice. There are possible risks to health or well-being involving scent emission. Some substances used as fragrances are outright toxic or even carcinogenic (Knoblich, Scharf, and Schubert 2003), others have been identified as a major cause of allergies (Scheinman 1996). Given increasing numbers of people sensitive to scent, even relatively mild reactions such as headaches and asthma attacks (Senger 2011), need to be considered when conducting research on human response to scent.

Responding to the request for state or federal governmental regulation, a number of national and international systems arose including guidelines intended to regulate the identification and labeling of allergens in fragrances used in or on products. In addition to governmental regulation, industry associations such as the *International Fragrance Association* have issued a detailed code of good practice for their member companies. Most regulations focus on claiming and making consumers aware of possibly harmful ingredients. However, testing over seven hundred products marketed to consumers in Germany for twenty-six supposedly allergenic fragrances (according to Article 10.1 of the 7th Amendment, Guideline 2003/15/EC), Klaschka (2010) found about half of all cosmetics, washing, and cleansing products contained at least one mandatory label ingredient. Fourteen percent even contained strong allergens. Up to today, consumers are still buying these products; the effect of companies voluntarily labeling their products to decrease the number of allergenic substances seems small.

Employing scents in marketing, ethical values have to be established. It has to be used carefully in order not to risk any allergies or health consequences in the consumers. The industries are obliged here for a responsible handling. Possibly, the legislative needs to eventually interfere for consumer health.

Summarizing, the literature review shows that olfaction and vision, individually, do have a high impact on the consumer's evaluation, and behavior. Cross-modal studies are limited

and based on sensory research. This work will delve deeper into the cross-modal approach with sensory marketing focus. Three experiments will look into semantic effects of simultaneous olfactory and visual stimuli on product evaluation using implicit and explicit approaches.

5 Empirical studies

The following three experiments look into the impact of olfactory and visual stimuli on product evaluation using both implicit and explicit approaches. The experimental design is based on the theoretical base described in previous chapters.

Study 1 is the initial experiment. It measures the semantic congruence effect of visual and olfactory stimuli of three product packages. The stimuli are selected according to the product's key benefit. The semantic congruence of the cross-modal stimuli is measured implicitly using the IAT methodology. Experiment 2 and 3 focus on the interaction effect of the cross-modal semantic congruence of the key benefit on the consumer evaluation using an explicit measurement method.

The experiment presentation structure is: objectives, hypotheses (based on the existing literature), methodology, results and discussion.

5.1 Study 1: Implicit Experiment

5.1.1 Objective

The objective of experiment 1 is to integrate and custom-fit the IAT method for the test of semantic congruence between olfactory and visual stimuli. This is the first time the IAT will be used to test effects of semantic congruence of cross-modal stimuli within a product. The cross-modal stimuli of the product category that fits best will be selected for experiment two.

Semantic congruence has been shown to be one of the key concepts of cross-modal interaction. However, multi-sensory research shows that using explicit techniques can bias research results sometimes due the awareness of participants. In order to bypass any biasing effect, the initial study focuses on measuring semantic congruence implicitly of cross-modal stimuli of a product. The IAT as an implicit measurement method is selected to measure the strength of the automatic association within the semantic congruence.

5.1.2 Development of hypotheses

Cue congruence is defined as the degree of fit/match among salient properties of two stimuli or more (Krishna, Elder, and Caldara 2010). It is one of the major concepts when it comes to the cross-modal interactions (e.g. Krishna, Elder, and Caldara 2010).

The hedonic tone of a scent used to be the key concept for scent selection in studies. The thought behind this is to create a pleasant experience, which influences the mood and then induces enhancement of product evaluation. The idea is based on the concept that the primary dimension of the human scent perception is pleasantness, as well as that the processing of scents happens in the center of emotions of the brain. However, following example demonstrates the importance of congruence. When a nursery home wanted to improve the living environment via an ambient scent, they decided to use a flower scent as the smell of flower is usually liked. The inhabitants did not approve of the scent as it reminded them of funerals (Loniewscki 1991; in Bone and Jantrania 1992). This example suggests that odor effects depend on cognition. During their lifetime, humans learn to connect situations with certain scents (see section: 3.2.). This process of learning and processing scents is passive rather than active. Therefore, it may occur that when an individual is confronted with a product with an incongruent scent, this incongruence might influence the evaluation without the consumer being aware of it (Bone and Jantrania 1992).

Various studies have shown that cue congruence is the key concept for cross-modal interaction effects: The congruence of music and scent, for example, leads to a higher approach behavior as well as to an extension of the time of the stay (e.g. Mattila and Wirtz 2001; Spangenberg, Grohmann, and Sprott 2005) .
Additionally, it can lead to faster reaction times in recognition, enhanced information processing and to a faster neurological integration of the sensory inputs and to more accuracy on behavioral measures (Gottfried and Dolan 2003; Laurienti et al. 2002).
With regards to product packaging, it is fairly well known that a product communicates through each of the senses (Lindström 2005). The message of the different senses needs to be congruent in order to result into a positive overall product experience. Congruence in product design helps to clarify what a product is about and what it can do. Also, it positively influences consumer preferences (Schifferstein and Spence 2008 p. 148).

An interesting part of congruence is its determination by appropriateness of the semantic associations among properties (see section 4.4.2.1). Sensory stimuli obtain semantic meaning, because of their common associations with experiences (Krishna, Elder, and Caldara 2010). These semantic meanings become visible across sensory modalities (Meyers-Levy and Zhu 2010; Stevenson and Boakes 2003). Semantic congruence can influence perception and behavior (Holland, Hendriks, and Aarts 2005), and leads to a better evaluation of that semantic dimension and to a better overall evaluation in products (Krishna, Elder, and Caldara 2010).
However, Bone and Ellen (1998) point out the difficulty of measuring congruency or neutral odors among stimuli. In line with that, Ludden and Schifferstein (2009) emphasize the difficulties of measuring the effects of congruency in experiments particularly for odors. They suggest that subjects that are directed to the scent in an experiment answer differently as they would do in real-life conditions. Köster (2003) proposes to use rather implicit than explicit methods as implicit measurement techniques minimize the potential for subject's control thus reducing the role of self-reflective, deliberative processes.

For measuring semantic congruence of two stimuli implicitly, the Implicit Association Test (see section 4.5) can be used (Nosek, Greenwald, and Banaji 2007). The IAT is based on Donders. He discovered that the time needed to perform a mental computation uncovers how the mind processes thoughts. The idea is that the easier a mental task, the quicker a decision is made and the fewer mistakes are made (Donders 1868/1969). The IAT measures the strength of automatic associations between concepts via response latency in particular and was first used in the research area of social psychology. (Greenwald and Farnham 2000). It typically represents a simple sorting task during which participants have to respond to two response keys that are assigned to two out of four concepts. The assumption is that constructs that share strong associations trigger faster responses when seen than concepts that do not share an association. Greenwald, McGhee, and Schwartz (1998) were the first researchers using the IAT. In that experiment, the subjects were asked to sort each of a series of computer-presented words by quickly pressing a left or right side key of a computer keyboard. The different association between concept (e.g. flowers) and attribute (e.g. positive valence words) was measured by observing the response latency in conditions in which attribute (positive valence words) and concept (flowers) shared the same response key (usually fast responses) comparing to conditions in which flowers shared the same key with negatively valence words (usually slow responses). That IAT compared eventually the

strength of association between flowers-pleasant and insect-unpleasant with the strength of association of flower-unpleasant and insect-pleasant. The results indicated that the associations are stronger for flowers and pleasant valence words and for insects and unpleasant valence words. Additionally, the researchers found that subjects made fewer mistakes when reacting to stimuli in congruent key assignments in comparison to incongruent key assignments (Greenwald, McGhee, and Schwartz (1998).

Demattè, Sanabria, and Spence (2006; 2007) integrated the methodology of the IAT into sensory research. Using the IAT, they tested the cue congruence of colors and scent, and haptic (rough and soft textile patches) and scent. Participants reacted, for example, quicker in conditions in which congruent colors and scent shared the same response key (pink color and strawberry scent; turquoise color and spearmint scent) as in conditions in which incongruent stimuli shared the same key (pink color and spearmint scent; turquoise color and strawberry scent) (Demattè, Sanabria, and Spence 2006). Also, respondents made fewer errors in the congruent situations in comparison to the incongruent situations. Testing the IAT various times in sensory research, the researchers concluded that the method is very well suited for testing congruence within cross-modal stimuli (Demattè, Sanabria, and Spence 2006, 2007).

Furthermore, Piqueras-Fiszman und Spence (2011) used the IAT to test color and flavor congruence on chips, they supported prior findings as subjects were faster and did fewer mistakes when responding in congruent key assignments.

The following experiment extends the results of Demattè, Sanabria, and Spence (2006, 2007) as it uses the concept of semantic congruence of cross-modal stimuli in products (three different product categories). Additionally, the stimuli are selected according to the key benefit depending on the product category. Possibly, if a visual and an olfactory stimuli are semantically congruent in terms of their key benefit and are assigned to the same key on the key board, subjects respond faster in the IAT reaction task and make fewer mistakes in comparison to responding to semantically incongruent stimuli key combinations.

Hypothesis 1: Across the sensory modalities of vision and olfaction, the response latency will be faster when the stimuli are semantically congruent rather than incongruent.

Hypothesis 2: Across the sensory modalities, respondents will make fewer mistakes during the reaction test when the stimuli assigned to the response keys are congruent rather than incongruent.

Processing of senses highly depends on the sense. Vision is the fastest sense in terms of processing. Visual information becomes available quickly to decision makers and conveys more information-value than any other sense (Hultén, Broweus, and Dijk 2009 p. 89). When people evaluate products and make buying decisions, they strive to compare products to identify the best option in a short period of time. In order to do so, they need the most information available. The sense of vision provides large amounts of information within a minimal time frame, which makes it the most efficient modality at the moment of making a buying decision (Fenko, Schifferstein, and Hekkert 2009; Herz 2010, p.100). Compared with olfactory information, the processing of vision is much faster; while a picture takes about 45 milliseconds to reach the visual cortex after it has been projected onto the Retina; it takes a scent about 10 times longer from inhaling to the registration in the brain (Herz, 2010, p.100).
When Dematte, Sanabria, and Spence tested the congruence of haptic and olfactory stimuli (2007) and in a different test the congruence of visual (colors) and olfactory (2006), they found differences in the reaction time of the stimuli depending on the senses. Reaction times for visual stimuli were faster than for olfactory stimuli. Also, reaction times for olfactory stimuli were faster than for haptic stimuli.
In this study, reaction times of visual and olfactory stimuli are measured. Due to processing differences and prior findings of Dematte, Sanabria, and Spence (2006, 2007), it is to suspect that subjects will respond faster to visual stimuli in comparison to olfactory stimuli in this reaction task:

Hypothesis 3: Responses will be faster for visual stimuli in comparison with olfactory stimuli.

5.1.3 Methodology

5.1.3.1 Stimuli

The stimuli for the study were selected in a pre-test. The stimuli were selected from three different product categories according to following requirements:

- usually scented
- usually not scented
- from the food sector

For products that are usually scented toothpaste was selected. For products that are usually not scented pillows were selected. The last category was supposed to derive from the food sector. Therefore, chocolate was selected.

The semantic congruence in this thesis is based on the key benefit of the individual product category. The key benefit of the products was tested in a pretest and the stimuli were selected according to that key benefit.

For every selected product, six visual and six olfactory stimuli were tested on that particular key benefit (n=10 for each stimuli). One product picture scoring high and one product picture scoring low on the key benefit was selected. Also, a scent scoring high and one low on the key benefit was chosen. The results were as follows.

- For toothpaste, the core benefit was ‘freshness’. The scent selected for high freshness was menthol (M=4.2). The scent selected for low freshness was marzipan (M=1.1).
- For pillows, the key dimension was ‘comfort’. Scents selected were vanilla for high comfort (M=4.3) and menthol for low comfort (M=2.9).
- For chocolate, the key dimension was ‘pleasure/indulgence’. Scents were dark chocolate for high pleasure/indulgence (M=4.5) and peanut for low pleasure/indulgence (M=2.5).

All scents derived from the company Symrise AG and the company Drom fragrances GmbH & Co. KG.
See table 5-1 for the visual stimuli including their scores on the ratings of the key benefit. For the other pretested stimuli see table A-1 in the appendix.

Table 5-1: Selected visual stimuli for study 1

	'High' score in key benefit	**'Low' score in key benefit**
Toothpaste Key benefit: freshness	 M=5.2	 M=2.6
Pillow Key benefit: comfort	 M=4.7	 M=2.1
Chocolate Key benefit: pleasure/ Indulgence	 M=5.2	 M=2.3

5.1.3.2 Sample preparation

The scents were prepared with the headspace method, meaning that a certain amount of fluid was put on a pad. This pad was put in a 10l Nalophan®bag and filled with filtered neutral air. Nalophan® is a material that is allowed to be used for sampling in olfactory measurements (according to DIN EN 13725: 2003).

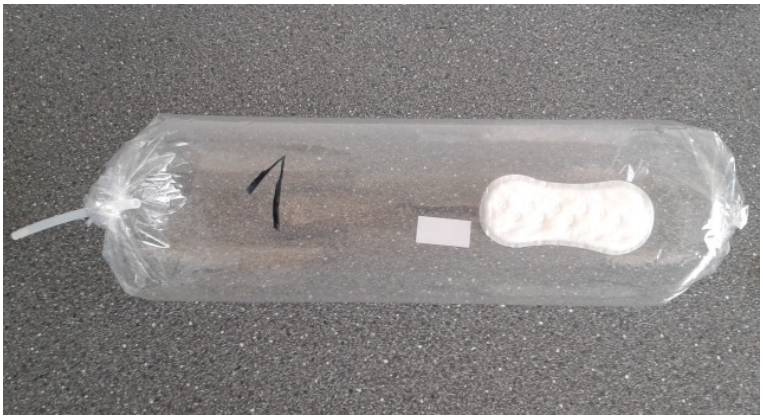


Fig. 5-1: Emission of scent in Nalophan®bag

After a certain emission time (depending on the scent) the air was transferred into a new Nalophan® bag. The new bags (two olfactory stimuli) were attached to the olfactometer for the study.

5.1.3.3 Participants

Seventy-two participants took part in the study (24 participants for each category). In total, it was forty-eight women and twenty-four men. The mean age was 25 years. The participants were all naive to the purpose of the study. They received 7 Euros for participating.
All participants were asked if they had any olfactory dysfunctions. Additionally, they had to rate their sense of smell as well as their sense of vision at that moment on a 7-point Likert scale (1:very good -7:very bad). The average rating on their own sense of smell was M=2.71. The average in the sense of vision was M=1.69. These ratings did not have an impact on the results.

5.1.3.4 Experimental test design and procedure

The study was set up very similarly to the Demattè, Sanabria, and Spence (2006, 2007) study in which cross-modal effects of touch smell, sight and smell were tested using the IAT-method.
This study here took place in the odor lab of the Odournet GmbH, Kiel, Germany. An olfactometer (TO-8S, Odournet GmbH) and a monitor for presenting the products were connected to a custom-designed software.
The flow rate of neutral and filtered air through the olfactometer was 20l/min, which is according to the guideline EN 13725:2003 for dynamic olfactometry.
The test design was a within-participants-repeated-measures design. The factors were the target stimulus ((in)congruent scent; (in)congruent product picture) and response mapping (semantic congruence vs. semantic incongruence). Each participant was assigned to only one product category.

The procedure was as follows:

1. The procedure was explained to the participants. Two olfactory and visual stimuli were introduced to the participants. It was clarified if the participant could easily discriminate the scents at the olfactometer from each other or if the dilution of the stimuli was either too high or too low. Due to individual sensitivity to scents in

general, individual changes were essential. This was different to Demattè et al. (2007). They used one concentration for all the subjects. However, for better scent discrimination, it was decided to do so here. This dilution adaption could be made within the software.

2. The participants sat in front the olfactometer and a monitor. The participants were told to find a comfortable position and place their nose into the nose mask (see fig. 5-2).
3. During the sorting task two stimuli (one of each modality: a visual cue and an olfactory cue) were assigned to the left key (STRG) on the keyboard; the other two stimuli were assigned to the right key (ALT) of the keyboard.
4. The monitor stated for 3000ms if an olfactory or visual cue would appear before presenting every stimulus.
5. When the participants recognized the stimulus they had to react as quickly as possible by sorting the stimulus using the assigned key using their forefinger.
6. The presentation ended once a response was made.
7. The interstimuli interval was 4000ms long to minimize a possible carryover effect from the presentation of the odors.
8. Stages 2 to 6 were repeated 24 times in four blocks of either congruent or incongruent conditions. The stimuli order and assigned response keys were randomized. The order of the semantic (in)congruent blocks was alternating.

Fig. 5-2: Experiment set up; study 1

5.1.3.5 Measures

The measure in this experiment was the reaction time of the panelists regarding the presented simuli. The reaction time was monitored by the software.

5.1.4 Results

The first of the four blocks was not included in the analysis as the participants needed to get accustomed to the olfactometer and the procedure. Additionally, Dematté at al. (2006) eliminated all answers that were wrong or those falling two and a half standard deviations from the participant's means. Here, all answers that fell two standard deviations or more from the participant's mean for each condition were excluded for further analysis.

Hypothesis 1 stated that across sensory modalities, responses would be faster when the stimuli were semantically congruent rather than incongruent.
The data was analyzed using a MANOVA calculating the response latency depending on congruence and category.
The results showed that semantic congruency had a significant effect on the response latency, supporting the hypothesis. Subjects responded quicker in congruent situations ($M_{congruent}$= 1515.6ms vs. $M_{incongruent}$= 1538.73ms; F(1,4455)=5.346; p=0.021). However, reaction time significantly differed within categories ($M_{toothpaste}$=1460.7ms; M_{pillow}=1484,9ms; $M_{chocolate}$=1649,13; F(2,4455)=168.05; p=0.001).
Therefore, the data was analyzed in the different categories using univariate analyzes.
For the toothpaste, the main effect (response latency depending on congruence) was significant
The subjects responded faster in the congruent condition in comparison to the incongruent condition ($M_{congruent}$= 1414.65ms vs. $M_{incongruent}$= 1511.31ms; F(1,1558)=4.75; p=0.030).
Afterwards, the data was looked at more differentiated depending on the modalities and the congruence. Reacting to the scents, as well as to the visual stimuli, subjects showed faster response latencies when the keys were assigned to congruent stimuli in comparison to the reaction time of the incongruent stimuli.
The mean value of the reaction time for scents in congruent conditions was $M_{scent\_congruent}$=2049.80ms. It was $M_{scent\_incongruent}$=2225.71ms for scents incongruent combinations (F(1, 1558)= 10.389; p=0.001). For the visual stimuli significant differences demonstrated as well in comparison of the conditions. The mean time for the congruent

condition was $M_{visual\_congruent}$=828.83ms vs. $M_{visual\_incongruent}$=888.67ms for the incongruent condition (F(1,1558)=3.86, p= 0.05).

In the pillow category, no significant main effect was found when the reaction time was analyzed depending on the congruence. However, when it was looked at the data more differentiated, the mean of the incongruent olfactory value was significantly smaller than the mean of the congruent olfactory value ($M_{scent\_congruent}$= 2381.52ms vs. $M_{scent\_incongruent}$= 2226.93ms; F(1, 1527)=6.40; p=0.012).

No significant results showed for the visual values (p>0.05).

For the chocolate category, no significant main effect showed analyzing the response latency depending on the congruence. However, when the time was analyzed depending on congruence and the modalities, the data showed significant results for the olfactory data ($M_{scent\_congruent}$= 2843.77 vs. $M_{scent\_incongruent}$= 2987.85; F(1,1482)=4.29; p=0.039). This was not the case for the visual stimuli. See table 5-2 for an overview of the results.

Table 5-2: Results of response latency depending on congruence and mode of the different product categories

Category	Mode	Congruence	Mean value in ms	SD	F	Significance
Toothpaste	Olfaction	Congruent	2049.80	751.11	10.389	0.001
		Incongruent	2225.71	727.03		
	Vision	Congruent	828.83	425.39	3.86	0.050
		Incongruent	888.67	447.91		
Pillow	Olfaction	Congruent	2381.52	805.96	6.40	0.012
		Incongruent	2226.93	810.39		
	Vision	Congruent	799.76	368.91	0.17	0.683
		Incongruent	789.38	362.86		
Chocolate	Olfaction	Congruent	2843.77	777.97	4.29	0.039
		Incongruent	2987.85	823.65		
	Vision	Congruent	834.46	416.18	1.81	0.179
		Incongruent	872.27	399.81		

To test H2 ‘Across both sensory modalities, respondents will make fewer mistakes when the stimuli assigned to the response keys are congruent rather than incongruent’; all categories were analyzed combined using an ANOVA. The subjects were more accurate in the congruent conditions than in the incongruent conditions; meaning there were fewer mistakes made ($F(1,4811)=11.523$; $p=0.001$), supporting H2.

H3 proposed that responses would be faster for visual stimuli in comparison to olfactory stimuli. Here, only the congruent data of all categories together was analyzed using an ANOVA. The results demonstrated significant results ($F(1,4455)=3418.52$; $p=0.001$) comparing vision response latency with the olfactory one ($M_{vision}=811.72$ vs. $M_{scent}=2374.07$).Therefore, H3 was supported.

5.1.5 Discussion

The main objective of this study was to test the sematic congruence between olfactory and visual stimuli of three different product categories using an implicit measurement method. The novel approach of using an IAT was successful and all hypotheses were supported by the results. Discussion of the results follows in the next paragraphs.

In spite of the variance of studies presented in the theoretical background, most of them are based on a single *method*, in particular, the explicit assessment of constructs with psychometric rating scales. Although often applied, those scales show limitations in terms of design, analysis, and interpretation (Louviere and Islam 2008). In order to bypass some of the limitations of scale-based surveys or experiments, a couple of exceptional studies are based on implicit measurement methods, e.g. the implicit association test (Demattè, Sanabria, and Spence 2007), and functional resonance imaging (Österbauer et al. 2005). Integrating these advanced techniques, study effects of scent or senses in general used for marketing, more information of the individual consumer can be revealed.

The results of study 1 support the existence of sematic congruence associations between olfactory and visual stimuli as the response latency of the participants was reduced in the sematic congruence condition in comparison to the semantically incongruent conditions. This construct of semantic congruency proves to be important for the selection of stimuli in cross-modal study and show to have an influence on stimuli processing. This is in agreement with Dematté et al (2006) and Krishna et al. (2010). Both studies show the impact of congruence on either reaction time or the enhancement of product evaluation.

However, not all product categories and their selected stimuli were found to be semantically congruent when measured using the IAT. There were differences between the categories. For example, the response latency of the toothpaste category was in line with the expectations, but stimuli of the pillow category differed. In the pillow category, the response latency decreased for incongruent situations relative to the congruent situations (key attribute: comfortable; thought to be congruent: red pillow/ vanilla scent; brown/metallic pillow/menthol scent). It is to suspect that in this category the subjects could not automatically associate the scent with the visual stimuli because pillows usually do not have a scent, thus an association did not exist beforehand. Therefore, the participant possibly

linked the olfactory and visual stimuli based on the known cross-correspondent construct of color and scent instead of the semantic association. Even though it was not asked, many subjects mentioned that they perceived the vanilla scent as a brown and therefore paired caramel/vanilla with the brown pillow. The menthol scent was perceived as pungent, so they paired it with the red pillow. Most of the time, they talked about pairing the stimuli up in these combinations in order for remembering the assigned key/stimuli combinations. Other studies support that the cross-modal correspondence of certain colors and scents are stable associations that are consistent over individuals (Gilbert, Martin, and Kemp 1996; Spence 2011).

Additionally, in the pillow and the chocolate categories, no significant differences for the visual stimuli were determined. Nonetheless, in both categories significant results in the olfactory stimuli were discovered. Interestingly, Demattè et al. (2007) found significant results for only one modality (haptic) even when data was more carefully differentiated. Perhaps this is due to the category or otherwise due to the level of cue congruence? Further research is required to find out the cause.

In the following study, an explicit approach will be used in a similar set up to see if the results match that of the implicit measurement method. Because the IAT does not produce valuable marketing output (e.g. numbers about the product evaluation, approach behavior or memory effects are received) it will be interesting to see if the results match that of the explicit approach. This would be useful because the implicit approach eradicates voluntary control of the participant and therefore could be considered more contextually relevant. The toothpaste stimuli are used because the results showed to be the most semantically congruent.

5.2 Study 2: Explicit Assessment

5.2.1 Objective

The aim of study 2 is to see if the explicit approach produces the same results as the implicit approach using the same experimental set up. This is in view of finding out if it is possible to induce consumer's judgment, purchase intention, and product memory due to the semantic congruence of these cross-modal stimuli. The focus shifts from measuring the semantic

congruence itself in study 1, to studying how two cross-modal semantically congruent stimuli in a product influence the consumer's perception in study 2. The stimuli in study 2 are either: congruent, incongruent or have no scent.

5.2.2 Development of hypotheses

In the following, hypotheses are developed. Fig. 5-3 gives an overview of the hypotheses of study 2.

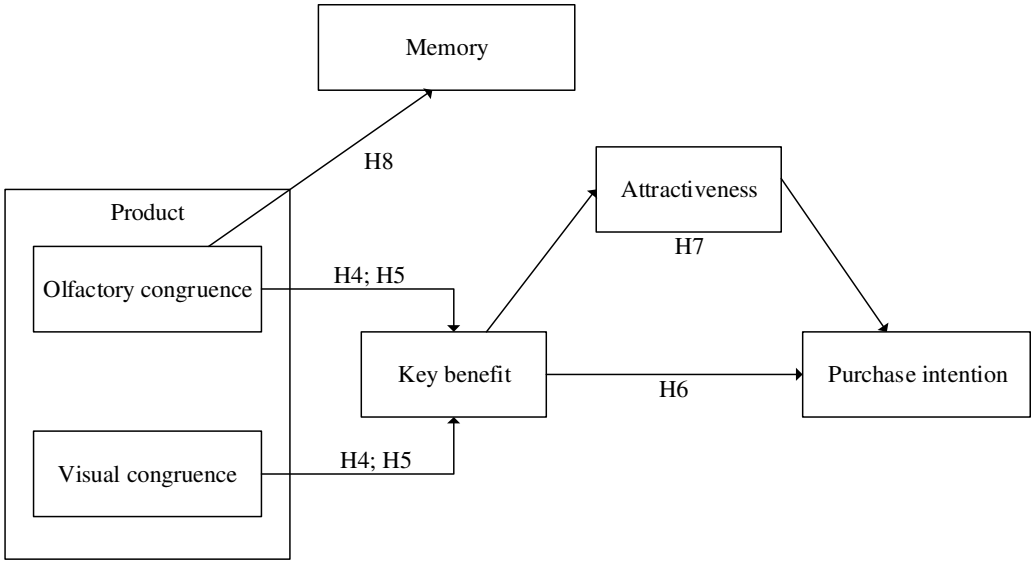


Fig. 5-3 Model with proposed hypotheses (own figure)

5.2.2.1 Semantic congruency effects key product benefit evaluation

Firstly, it is to investigate, how the key benefit is influenced by the different cross-modal semantically (in)congruent conditions. In a two similar experiment, Krishna, Elder, and Caldara (2010) presented semantically (in)congruent stimuli (haptic and scent) to subjects. They were able to show that when semantic congruence was present across two stimuli, the evaluation of the key benefit was enhanced in comparison to incongruent conditions. The same approach is applied here. Two stimuli, selected according to their score (high vs. low) on the key benefit of a product category, are presented to subjects simultaneously. Although in this study here, olfactory and visual stimuli are in focus, it is to suspect that the results will be similar. Accordingly, semantically congruent stimuli will score higher on the key benefit than semantically incongruent stimuli.

Additionally, in this study, olfactory and visual stimuli are presented in combinations scoring individually high or low on the key benefit. Therefore, a semantically congruent combinations can consists out of either two stimuli scoring high or low on the key benefit. For better differentiation, in the following, this is labeled as $congruent_{high}$ or $congruent_{low}$.
In regards to Krishna, Elder, and Caldara (2010), it is proposed that the $congruent_{high}$ combination will score highest on the evaluation of the key benefit. In the $congruent_{low}$ condition, both stimuli are scoring low on the key benefit. It is assumed that the evaluation of key benefit will be reduced in comparison to the other conditions:

Hypothesis 4a: When the cross-modal stimuli are semantically congruent and both scoring high on the key benefit, the evaluation of that key benefit will be enhanced in comparison to the other stimuli combinations.

Hypothesis 4b: When the cross-modal stimuli are semantically congruent and both scoring low on key benefit, the evaluation of that key benefit will be reduced in comparison to the other stimuli combinations.

5.2.2.2 Sensory dominance

Linström (2005) claims that different sensory modalities combine to induce the overall product packaging experience (see section 4.3). Every sense has a specific function. By blocking one sense at a time, researchers learned that when covering the eyes or hands, the information about product functionality got blurred, whereas, blocking ears or nostrils did not interfere with product functionality identification. However, blocking ears and nostrils minimized the perception of intensity, stimulation or of the product in general; apparently affecting consumers' emotional product perception (Schifferstein and Cleiren 2005).
However, due to the good and quick identification performance of vision, it is argued that that vision dominates the overall product perception (Schifferstein 2006). Heller (1982) proposes that vision directs exploratory behavior embedding the other senses. Nonetheless, the sensory dominance changes and depends on its usage, the stage of ownership, and the product category, (Fenko, Schifferstein, and Hekkert 2008; Schifferstein 2006). Several researchers claim that there are certain products in which olfaction plays a more dominant role in comparison to vision for example in beverages, and personal care products (Fenko et al. 2009; Schifferstein 2006).

The stimuli for this study were selected according to their freshness, as it is the determined key benefit of the selected product category (toothpaste). Therefore, it is proposed that the olfactory stimulus has a higher impact on the evaluation of the key benefit in comparison to the visual stimulus for the tested category here:

Hypothesis 5: The impact of olfaction on the evaluation of the key benefit *(freshness) will be stronger than the impact of vision.*

5.2.2.3 Effects on purchase intention

Having developed the hypotheses how the key benefit is influenced by the interaction of cross-modal stimuli, the next hypotheses are focused on the impact on the purchase intention.

When Spangenberg et al. (2006) tested the effect of gender-congruent ambient scent in a store, they found that it had a significant effect on actual shopping time, intention to visit the store, the number of items purchased as well as on the money spent in the store. Doucé et al. (2013) found that ambient scent in a bookstore enhances approach and buying behavior towards thematically congruent books and decreases approach and buying behavior towards incongruent books.

In this study, semantic congruence might influence the perception of freshness as the key benefit for toothpaste products (Fenko et al. 2009; Westerink and Kozlov 2004) and eventually influences the purchase intention.

Hypothesis 6: Emphasizing the key benefit through modifying stimuli will positively impact purchase intention.

In product design, consumers often base their purchase decision on the product's aesthetics (e.g. Bloch 1995; Fenko, Schifferstein, and Hekkert 2010). Sometimes symbolic or aesthetic qualities of the product package may steer the consumer's decision making (e.g. Creusen and Schoormans 2005). Sometimes, it is also the lack of information that drives the consumer to make a decision. In this cases, it allows the consumer to draw information from linking the visual aesthetics and its other sensory characteristics and qualities (Becker et al. 2011).

Product packaging can influence purchase intention (Orth, Campana, and Malkewitz 2010). Aesthetically attractive products are preferred when two products of the same quality and

price are compared (Creusen and Schoormans 2005). Attractive product packaging influences the quality evaluation by consumers (Peters-Texeira and Badrie 2005).
In the studies here, the fit of the visual and the olfactory stimulus form the evaluation of the key benefit and eventually the evaluation of the holistic package. Even though the particular association of the key benefit here is not aesthetically related, the assessment of whether the associations are congruent is, according to Hekkert (2006 p. 168), 'an aesthetic event'. He claims that it is exhilarating to find two stimuli congruent and displeasing to find them incongruent.
The next hypothesis is based on the facts that semantically congruent stimuli are more attractive and more attractive products are more likely to be bought. Therefore, it is proposed that a higher rating in the key benefit leads to a higher purchase intention in the consumers as they evaluate the holistic package as more attractive. Rephrased, judgment of attractiveness should function as a mediator between the key benefit and purchase intention:

Hypothesis 7: Attractiveness mediates the positive effect of the key benefit on purchase intention.

5.2.2.4 Memory effects

Recalling product information or brand names is very important for marketers. In that context, it is well known, that when more information is present during the time of object encoding or learning, the deeper and more elaborate the memory will be (e.g. Craik and Tulving 1975; Lwin, Morrin, and Krishna 2010). Different studies have shown that memories triggered by scent are usually highly personal, consist of fewer cognitions, and are accompanied by strong affective charges (Hinton and Henley 1993). Comparing autobiographical memories evoked by visual cues with scent-evoked memories, these trace back further into one's past (Chu and Downes 2000), and elicit more and stronger feelings (Herz and Schooler 2002). Furthermore, researchers showed that adding scent to products or advertisement can enhance in consumer recall (e.g. Lwin and Morrin 2012; Morrin and Ratneshwar 2003) (see chapter 4.2.2).

Krishna, Lwin and Morrin (2010) tested the influence of product scent and memory. By scenting a room while presenting a pen, it was found that scent enhanced product recall, particularly incongruent scents because of the distinctiveness. However, pens are not usually scented, and scenting a room is not the same as scenting a product. Still, it is expected that a

scent presented with the visual stimulus will lead to enhanced recall of the visual stimulus in comparison to no scent and that an incongruent scent in comparison to a congruent scent will enhance recall even more:

Hypothesis 8a: Presenting a product visually plus a scent versus no scent will enhance product recall.

Hypothesis 8b: Presenting a product visually plus an incongruent scent versus a congruent scent will enhance product recall.

5.2.3 Methodology

5.2.3.1 Stimuli

This study implements the stimuli of the toothpaste category of the first study as those stimuli pairs showed the best-fit regarding semantic congruence when measured implicitly in study 1.

Based on Ellen and Bone (1998) recommendations, a no-scent control group was added. The researchers did not find significant differences between congruent and incongruent groups and claimed that a control group would have been useful for comparison.
For a better overview, stimuli combinations are displayed in table 5-3.

Preparation of the scent stimuli was the same as in experiment 1. However, in this case an individual adoption was not possible.

Table 5-3: Stimuli combinations in study 2. Incongruent combinations were calculated together.

	Visual stimulus	Olfactory stimulus
Congruent$_{\text{high fresh}}$		 Menthol
Congruent$_{\text{low fresh}}$		 Marzipan
Incongruent		 Menthol
		 Marzipan
No Scent$_{\text{high fresh}}$		NO SCENT
No scent$_{\text{low fresh}}$		NO SCENT

5.2.3.2 Participants

192 participants took part in the study, 182 of which completed the study. Most participants were students of the University of Kiel. 128 women and 63 men participated with the mean age of 24,9 (range: 18-62 years old). Participants were reimbursed with 8€.

5.2.3.3 Test design and procedure

The test design was a 3x2 factorial test design (olfactory stimuli (high fresh vs. low fresh vs. no scent) x visual stimuli (high fresh vs. low fresh)).
The test took place at the odor laboratory of the Odournet GmbH, Kiel, Germany with the same experimental set up as in study 1. The participants were seated in front of an olfactometer and a monitor. The procedure was explained to them.
The participants had to put the nose into the nose mask and look on a monitor. In line with the study of Krishna, Elder, and Caldara (2010) a visual and olfactory stimulus (above the threshold or no scent/clean air in the control group) was simultaneously presented to them for 15 seconds. The participants' task was to watch the visual cues, breathe the olfactory cues.

After stimuli presentation, the participants were asked to fill in a questionnaire. Additionally, they were asked come in twice for the study with 10 days in between each visit. The first visit is referred to as t_0 and the second as t_1 in the following.

5.2.3.4 Measures/Scales

The questionnaire included following scales:

As *freshness* as the key benefit for the toothpaste category was of most interest, it was directly assessed using one item on a 7-point Likert scale ('The product is fresh: 1: I totally disagree -7: I totally agree).

Purchase intention was assessed on a 3-item 7-point Likert scale (' I would like to try that product once'; 'I would like to buy that product'; 'In comparison to other products of this kind, it is very probable that I would buy that product'; '1: I totally disagree - 7: I totally agree) (Hansen, Bruun-Christensen, and Schauman 2006). At t_0, the three items loaded on one factor, explaining 82.12 percent of the variance with Cronbach's alpha= .90.

Attractiveness was evaluated on a 1-item scale using a 7-point Likert scale (1: I find the product extremely unattractive – 7: I find the product extremely attractive) according to Förster (1997).

During $t_{1,}$ the participants did a *free recall* meaning they were asked to write down all the details they could remember from the package that they had seen on the first day.
Additionally, *freshness, attractiveness,* and *purchase intention* had to be rated again from memory on the given scales above. The three items of the purchase intention loaded again on one factor, explaining 80.41 percent of the variance with Cronbach's alpha = 0.88 (See appendix: Fig. A-2).

5.2.4 Results

Manipulation check: To check if the manipulation of olfactory and visual stimuli had been successful, a two-way ANOVA was conducted with the olfactory/the visual stimuli as independent and freshness as dependent variable. The 'fresh' product package was rated significantly fresher than the less fresh product ($M_{high\ fresh}$=5.23 vs. $M_{low\ fresh}$=4.24; F(1,189)=16.640; P=0.001). Also, the menthol scent was rated significantly fresher as the marzipan scent ($M_{menthol}$=5.71 vs. $M_{marzipan}$=4.08; F(1,189)=36.120; P=0.001). Therefore, manipulation of freshness was successful.

5.2.4.1 Congruence effect

H4a states that if stimuli are semantically $congruent_{high\ fresh}$, the ratings on the key benefit will be enhanced in comparison to other stimuli combinations. H4b proposes that if stimuli are semantically $congruent_{low\ fresh}$, scores on freshness will be reduced in comparison to other stimuli combinations.

An ANOVA was conducted for that analysis. The results show that when product package and scent are $congruent_{high\ fresh,}$ the freshness rating is significantly higher in comparison to incongruent stimuli, as well as $congruent_{low\ fresh}$ or no scent stimuli ($M_{congruent\_high\ fresh}$=5.91; $M_{incongruent}$=5.15; $M_{congruent\_low\ fresh}$= 3.45; $M_{no\ scent\_high\ fresh}$=4.94; $M_{no\ scent\_low\ fresh}$=3.77; F(4,186)=15.12; p=0.001). As post-hoc test the Tamhane's T2 multiple comparison test was carried out because the variance homogeneity was not given (tested with the Levene-test) (Field 2013 p. 459). The values significantly differ from each other. The $congruent_{high\ fresh}$ combination differs significantly from all other combinations in terms of freshness ($p<0.05$). Additionally, the incongruent combinations do not significantly differ from the fresh and no scent condition. The $congruent_{low\ fresh}$ combination differs significantly ($p<0.01$) from all other combinations except for the low fresh_no scent combination. This outcome is similar

for $t_{1,}$ although the rating for freshness slightly decreases ($M_{congruent\_high\ fresh}$ =5.56; $M_{incongruent}$=4.57; $M_{congruent\_lowfresh}$= 3.37; $M_{no\ scent\_high\ fresh}$ =4.70; $M_{no\ scent\_low\ fresh}$ =3.70; F(4,177)=9.93; p=0.001). According to Tamhane's T2 multiple comparison test the groups significantly differ from each other (see table 5-4 and fig. 5-4).

Table 5-4: Mean values of different visual and olfactory stimuli combinations on freshness; study 2

Congruence	Mean value, t_0	SD	Mean value, t_1	SD
$M_{congruent\_high\ fresh}$	5.91	1.00	5.56	1.05
$M_{congruent\_low\ fresh}$	3.35	2.00	3.37	1.85
$M_{incongruent}$	5.15	1.40	4.70	1.61
$M_{no\ scent\_high\ fresh}$	4.94	1.32	4.70	1.37
$M_{no\ scent\_low\ fresh}$	3.77	1.85	3.70	1.66

The $congruent_{high\ fresh}$ stimuli differ significantly from all other combinations in terms of freshness ($p<0.01$) except for the no $scent_{high\ fresh}$ combination. Additionally, the incongruent combinations only significantly differ from the $congruent_{low\ fresh}$ and no $scent_{low\ fresh}$ combination. The $congruent_{low\ fresh}$ combination differs significantly from all other combinations ($p<0.05$) except for the no $scent_{low\ fresh}$ combination. Therefore, Hypothesis 4a was supported but Hypothesis 4b was not. However, a tendency shows that a $congruent_{low\ fresh}$ combination scores lower than the no $scent_{low\ fresh}$ combination.

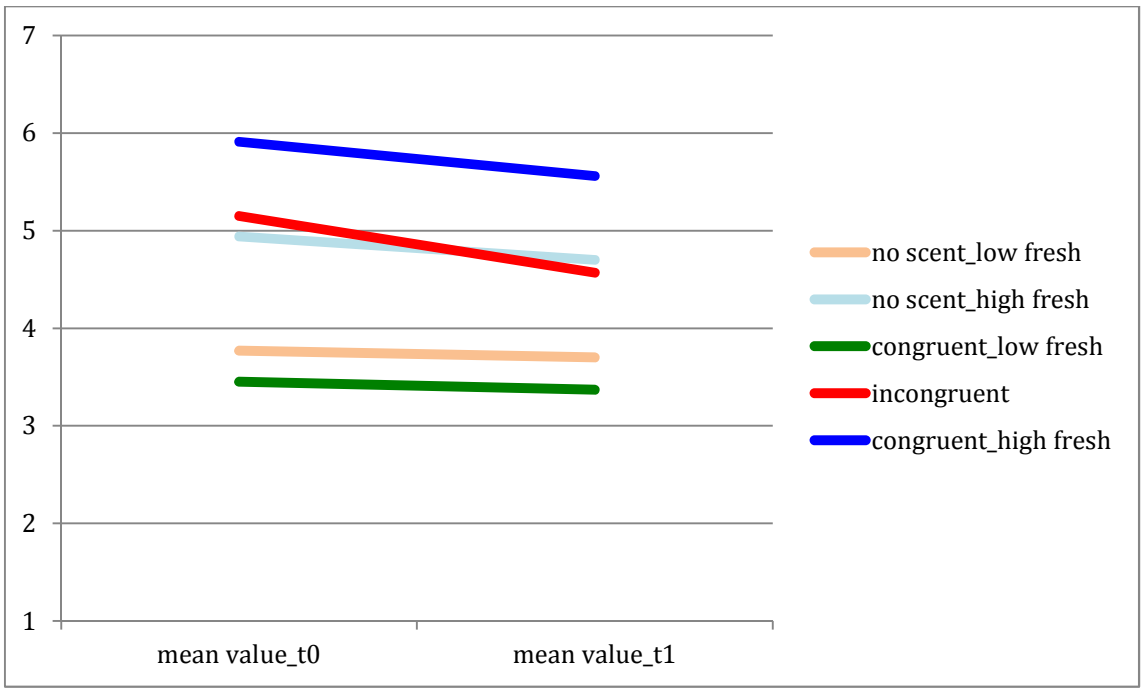


Fig. 5-4: Mean values of freshness for t0 and t1 as a function of congruence; study 2

5.2.4.2 Sensory dominance

Hypothesis 5 proposed that in this particular product category of toothpaste, the olfactory stimuli would be more dominant than the visual stimuli in the evaluation of the key benefit. First of all, an univariate analysis was conducted to test the general effect of visual and olfactory stimuli on freshness. It shows a significant influence of the visual ($F(1,185)=19.29$; $p=0.001$) as well as the olfactory stimuli ($F(2,185)=20.81$; $p=0.001$) on freshness.
There was no interaction effect of olfactory and visual stimuli.

To test the actual strength of the impact of olfaction and vision on freshness, a linear regression analysis was conducted. The results show a positive significant influence for both stimuli at t_0. The visual impact on freshness is a little smaller ($\beta=0.29$; $t=4.32$; $p=0.001$) than the olfactory impact ($\beta=0.32$; $t=4.97$; $p=0.001$). In total, both stimuli can explain 18% of the variance for freshness ($R^2=0.18$). At t_1, the visual stimuli have the bigger impact ($\beta=0.29$; $t=4.11$; $p=0.001$) on the freshness in comparison to the olfactory stimuli ($\beta=0.23$; $t=3.35$; $p=0.001$) explaining 13% of the variance for freshness (see table 5-5 for results). As the olfactory stimuli does not completely dominate the evaluation of the key benefit hypothesis 5 is only partly supported.

Table 5-5: Results of regression analysis estimating the impact of the visual and olfactory stimuli on freshness; study 2

	Independent variable	B	t	p	F	R^2
t_0	Visual stimuli	0.29	4.32	0.001		
	Olfactory stimuli	0.32	4.97	0.001	21.19	0.18
t_1	Visual stimuli	0.29	4.11	0.001		
	Olfactory stimuli	0.23	3.35	0.001	14.21	0.14

5.2.4.3 Effects on purchase intention

Hypothesis 6 states that the freshness influences the purchase intention positively. Linear regression analysis supports hypothesis 6 by demonstrating a positive impact of freshness on purchase intention at t_0 (β=0.23; t=5.67; p=0.001) explaining 23% of the variance on purchase intention. At t_1, the impact increases (β=0.60; t=9.94; p=0.001) explaining 35 % of the variance on purchase intension (see table 5-6). These results support hypothesis 6.

Table 5-6: Results of regression analysis estimating the impact of the freshness on the purchase intention; study 2

	Independent variable	B	t	p	F	R^2
t_0	Freshness	0.23	5.67	0.001	56.67	0.23
t_1	Freshness	0.60	9.94	0.001	98.84	0.35

5.2.4.4 Mediating effect of attractiveness

Hypothesis 7 focuses on the mediating impact of attractiveness on the relationship of the key benefit ‘freshness’ and the purchase intention. For this analysis the SPSS-Macro ‘Sobel’ for mediator analysis from Preacher and Hayes (2004) was used. A mediation analysis quantifies if a mediator can explain the mechanism within a relationship of a dependent and independent variable, and if so how big that impact is (Baron and Kenny 1986). The generated output permits the interpretation of the results according to Baron and Kenny (1986) and adds the Sobel test and a non-parametric bootstrapping of the sampling distribution. The bootstrapping supports the validity of the results because of resampling (Edwards and Lambert 2007). On the basis of 5000 (number of resampling) bootstrapping samples, the indirect effect, as well as the 95% confidence interval is calculated (Preacher

and Hayes 2004). When the value of '0' is not included in the confidence interval, the indirect effect is statistically significant (Preacher and Hayes 2008).

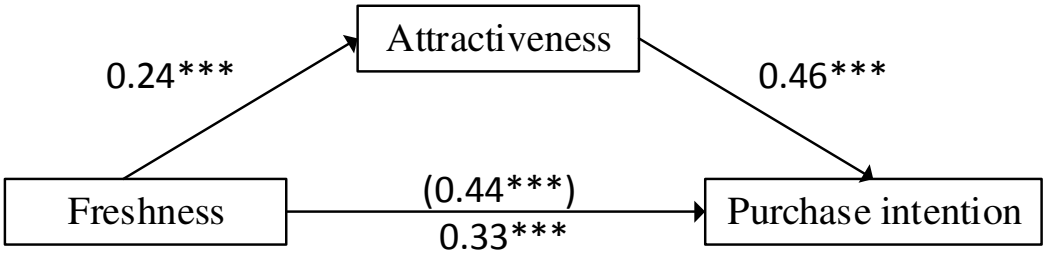
Table 5-7 shows the results of the Sobel test described above.

Table 5-7: Results of mediation analysis for the attractiveness at t0 and t1; study 2

	Dependent variable	**Independent variable**	**B[1]**	**t**	**p**
t_0	Purchase intention	Freshness	0.44	7.53	0.001
	Attractiveness	Freshness	0.24	4.59	0.001
	Purchase intention (controlled for fresh)	Attractiveness	0.46	6.12	0.001
	Purchase intention (controlled for attractiveness)	Freshness	0.33	5.86	0.001
t_1	Purchase intention	Freshness	0.58	9.94	0.001
	Attractiveness	Freshness	0.31	5.29	0.001
	Purchase intention (controlled for fresh)	Attractiveness	0.42	6.12	0.001
	Purchase intention (controlled for attractiveness)	Freshness	0.45	7.90	0.001

	z	**p**	**95% Co-Interval[2]**
Results of Sobel test t_0	3.64	0.001	0.05-0.18
Results of Sobel test t_1	3.97	0.001	0.07-0.21

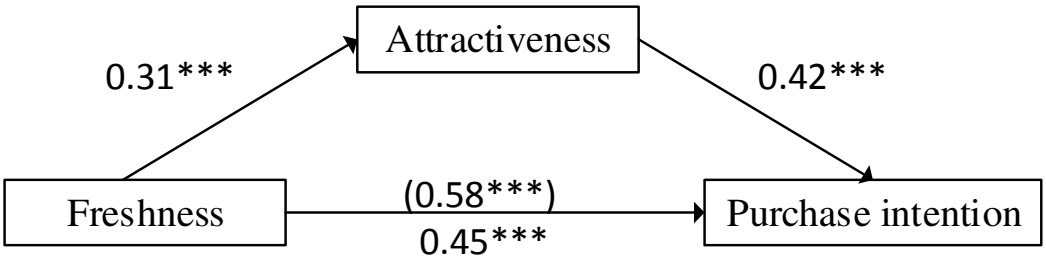
[1]B=not standardized regression coefficient; [2]Bootstrap=5000



***p <0.001

Fig. 5-5: Results of analysis of attractiveness as a mediator between freshness and Purchase intention at t0; study 2

Freshness evaluation significantly impacts purchase intention (B=0.44; t=7.53; p=0.001) as well as attractiveness (B=0.24; t=4.59; p=0.001). Attractiveness significantly influences purchase intention even when it is controlled for freshness (B=0.46; t=6.12; p=0.001). Freshness evaluation significantly decreases purchase intention when it is controlled for attractiveness but the impact is still significant (B=0.33; t=5.86; p=0.001). According to Baron and Kenny (1986), this is just a partial mediation. The Sobel test generated a significant z-value (z=3.64; p=0.001) and also a 95% confidence interval that does not integrate the value of '0'. Therefore, attractiveness explains only part of the effect of freshness on purchase intention during t_0 and t_1 (see fig. 5-5, fig. 5-6, table 5-7), supporting the original hypothesis 7.



*** p <0.001

Fig. 5-6: Results of analysis of attractiveness as a mediator between freshness and purchase intention on t1; study 2

5.2.4.5 Unaided recall

The hypothesis 8a proposed that when presenting a product visually and adding an olfactory stimulus recall would be enhanced. Hypothesis 8b stated that if the olfactory stimulus was incongruent with the visual stimulus, the recall would be enhanced even more. To test the recall, at t_1, the participants had to write down every attribute they could remember about the product they had seen at t_0. According to Krishna, Lwin, and Morrin (2010), an unaided

recall score was calculated for each participant on the total number of attributes (and brand name) correctly recalled (total possible number= 7).
An ANOVA was conducted to compare the recall of a scent vs. no scent condition. Subjects that were exposed to a scent at t_0 had a better recall score than those that were not (M_{scent}=3.40 vs. $M_{no\ scent}$=2.88; F(1,175)=12.03; p=0.001), supporting hypothesis 8a.

However, a conducted ANOVA analysis did not support hypothesis 8b. However, participants exposed to marzipan scent had a better recall score than those who were exposed to menthol ($M_{menthol}$: 3.21 vs. $M_{marzipan}$: 3.63; F(1,115)=5.21; p=0.024). The visual stimuli did not have any effect on the recall.

5.2.5 Discussion

The objective of this study was to test if the cross-modal semantic congruency effect that had been tested implicitly via response latency in study 1, showed also effects within an explicit study approach. It was of interest in what way the interaction of visual and olfactory stimuli (congruent, incongruent, no scent) influences the consumer's evaluation of the key benefit and eventually the purchase intention and the recall of a product. The following paragraphs discuss the results of study 2.

This study is the first one, testing the semantic congruence of olfactory and visual stimuli of a product. Prior research has focused more on basic congruency effects such as the effect of color and scent. Integrating products in this study is a more holistic and also realistic approach. Results can be transferred for product design development.
The results show that olfactory and visual stimuli that are semantically congruent$_{high\ fresh}$ significantly enhance the evaluation of the key benefit positively in comparison to any other stimuli combination. These results are supported by previous research. For example, Krishna, Elder, and Caldara (2010) tested how the evaluation of haptic and visual stimuli was influenced when stimuli presentation was congruent or incongruent. The evaluation of the semantic attribute was enhanced in congruent stimuli in comparison to incongruent stimuli. However, in this study here, a control group was included. This control group allows the comparison of semantic congruency effects with the regular product presentation. It shows that semantic congruence of cross-modal stimuli enhances product evaluation and eventually enhances purchase intention in comparison to just presenting a product visually.

Although scent plays the major role in personal care products (Schifferstein 2006), vision appears to be a dominant modality in this study. Fenko et al. (2009) even stated that scent dominates the perception of freshness in personal care products. Therefore, a dominant impact of the olfactory stimuli was expected. Conversely, the visual impact showed to be almost equally strong.

Additionally, this study is the first study that connects the semantic congruency of cross-modal stimuli in products with the purchase intention and even investigating on mediation effects of attractiveness. Prior research has focused mainly on the effects on the key benefit (e.g. Krishna, Elder, and Caldara 2010). As expected, freshness, as the key benefit, has a positive impact on the purchase intension. When enhancing the key product benefit i.e. freshness it increases purchase intension. This effect was more pronounced at t_1 with 23% at t_0 and 35% at t_1 of the variance of purchase decisions explained by freshness. Attractiveness is partially the mediating this effect, meaning that freshness has an impact on purchase intention even if the effect of attractiveness is controlled.

Participants in scented conditions remembered products more clearly than those in unscented conditions. This is in agreement with Lwin, Morrin, and Krishna (2010). They showed that pictures (in our case a product package) in combination with a scent enhance recall in comparison to presenting only pictures. They call this effect the 'super-additive effect' of scent and pictures. However, this study here showed no significant difference between congruent and incongruent conditions. Nevertheless, subjects that had been exposed to the marzipan scent, had an enhanced recall score in comparison to those who were exposed to menthol. Krishna, Lwin, and Morrin (2010) showed as well that participants had a better recall score when being exposed to a scent. Additionally, they showed that information about a product being presented in combination with an incongruent scent was even better remembered better. Incongruence between scent and product category seems to have a greater impact on memory clarity than incongruence between visual and olfactory stimuli. The later having been shown in previous studies such as Krishna, Lwin, and Morrin (2010), mentioned earlier. The distinctiveness of marzipan scent in relation to toothpaste enhanced recall. However, recall may lead to avoidance behavior and therefore could have a negative impact on marketing.

Enhancing the key benefit by semantic congruence enhanced purchase intention, and vice versa. Having established that scent enhances recall, it would seem advantages that the scent is congruent with the key benefit and product packaging so as to enhance purchase intention.

Overall, the results indicate that the semantic congruence of olfactory and visual stimuli can be helpful to support the perception of certain key benefits, which influence purchase intention. Also, adding scent to a product can enhance the recall of product details.

Having produced the results in a laboratory, it is important to transfer them to a more realistic scenario, as in study 3.

5.3 Study 3: Explicit assessment using real stimuli

5.3.1 Objective

Study 3 is a replication and extension of the second study. It validates the robustness of the tested effects of study 2. The major change in study 3 is that the stimuli presentation does not take place at the olfactometer and a monitor, but that the visual stimuli are real product packages. Therefore, the stimuli presentation is less obvious.

5.3.2 Hypotheses

As the main objective of experiment 3 is to replicate and extend study 2, the hypotheses 4-8 are adopted with an additional look into the role of mood in scent processing.

The influence of the affective state due to scent is still very much discussed (Baron 1990; DeBono 1992; Ehrlichman and Halpern 1988; Knasko 1992; Ludvigson and Rottman 1989). Based on Lindström (in: Maiwald et al. 2013) 75% of human emotions are evoked by smell. Nonetheless, reviewing twenty-two studies, Bone and Ellen (1999) found large variance amongst a large number of consumer reactions. Most studies failed to provide corroborating evidence to support any influence on mood due to scent (Morrin and Ratneshwar 2003; M. Morrin and Ratneshwar 2000; Spangenberg, Crowley, and Henderson 1996).

However, when it comes to scent processing, affective reactions are still very much discussed. Here, two different models are in focus. Based on the S-O-R model (Mehrabian

and Russell 1974), Gulas and Bloch (1995) developed a model in which mood mediates the processing of scent. Various researchers support this model (e.g. Davies, Kooijman, and Ward 2003; Ward, Davies, and Kooijman 2003). Conversely, different researchers claim that scent can influence cognition directly without a mediation of mood (e.g. Bone and Ellen 1999; Chebat and Michon 2003; Hansen and Beckmann 2007; Peck and Childers 2008 p. 196). Now, Doucé and Janssens (2013) propose that both models could work side by side, scent effects can be routed via affective reactions or influence cognition directly depending on the elaboration. They propose that if consumers are highly involved, it is most likely that effects are routed via affective reactions. If the involvement is low, the effects influence cognition directly. Considering the usage of toothpaste in this study, the prediction is that cognition is influenced directly as it is a low-involvement product. Therefore, it is proposed that scent will enhance product evaluation directly. To check this, mood was assessed here as well.

5.3.3 Methodology

5.3.3.1 Stimuli and sample preparation

Olfactory and visual stimuli were required for this study.

The olfactory stimuli (menthol and marzipan) for this study derived from prior studies as it was worked with toothpaste again. However, for menthol pellets instead of fluid was used but the scent was identical.

The doses of scent that were supposed to be used in the study were tested in a pretest. Due to the test design, the scents were now prepared in a box instead of an Nalophan bag.
Marzipan scent was put on a stripe, which was taped into the box that was used for the stimuli presentation. Menthol pellets were stuck to the box using a special apparatus. Emission time was 15 min. Trained sniffing experts from Odournet GmbH (n=5) were seated in front of the box and had to rate the intensity of the smell when opened. The used intensity scale is a 7-point scale from 0 (scent is not perceptible) to 6 (scent is extremely strong) (VDI 3882 Blatt 1:1992-10).
Three different amounts of scent were tested (see table 5-8) and evaluated. It was decided to use 0,7µl of Marzipan and 6 pellets of Menthol to receive a similar emission.

Table 5-8: Olfactory pretest for study 3

Scent	Tested amount	Intensity mean value on a scale from 0-6
Marzipan	0,5µl	2.5
	0,7µl	3.2
	1µl	3.8
Menthol	2	0.9
	4	2.2
	6	2.8

An additional pretest was carried out to establish which toothpaste package to use. Four different toothpaste packages (n=10/product) with the same brand (Marvis), size, and shape but different colors (blue, green, red, and purple) and tastes were used in the pretest (see table A-2 in appendix).

It was asked for freshness of the toothpaste using the 7 point-likert scale (0: the product is not fresh at all; 7: The product is extremely fresh). Also, it was asked for brand awareness (brand awareness Likert scale: 1: I don't know this brand at all; 7: I know this brand extremely well).

The red and the green package were selected as stimuli scoring high and low on freshness (M_{red}=3.00 vs. M_{green}=4.38).

Marvis is not a common product in Germany and can only be bought online. Therefore, when asked for brand awareness, it showed to be very low (M=1.58).

See table 5-9 for new offered stimuli combinations. Again, a control group without offering scent was integrated in the study (Ellen and Bone 1998).

Table 5-9: Stimuli combinations in study 3. Incongruent combinations were calculated as one.

	Visual stimulus	Olfactory stimulus
Congruent$_{\text{high fresh}}$		 Menthol
Congruent$_{\text{low fresh}}$		 Marzipan
Incongruent		 Menthol
		 Marzipan
No Scent$_{\text{high fresh}}$		NO SCENT
No scent$_{\text{low fresh}}$		NO SCENT

5.3.3.2 Participants

In total, 192 participants took part in the study. 180 of those participants completed the study. 150 women and 44 men took part. The mean age was 24.6 (range: 18-64 years old). Most participants were students of the University of Kiel. Participants were reimbursed with 8€.

5.3.3.3 Test design and procedure

The test design was a 3x2 factorial test design (olfactory stimuli (high fresh vs. low fresh vs. no scent) x visual stimuli (high fresh vs. low fresh)).

The study took place in the consumer lab of the A&F Marketing department of the University of Kiel. Before each participant came in, a box was prepared containing a scent and a toothpaste package, and then placed in an assigned position on the table. The participants sat in front of the box and followed questionnaire instructions. The instructions were to open the box, take the toothpaste out and inspect closely followed directly by a questionnaire. The box had to stay in the assigned spot and left open for scent exposure.

Fig. 5-7: Test set up; study 3

The participants were asked to come in twice for the study with 7 days in between each visit. The first visit is referred to as t_0 and the second as t_1 in the following.

5.3.3.4 Measures/Scales

The questionnaire was similar to the one in study 2, with a couple of additional questions (See appendix: Fig. A-3).

Purchase intention was assessed again on the 3-item scale from Hansen, Bruun-Christensen, and Schauman (2006). At t_0, the three items loaded on one factor with 79.85 percent of explained variable with Cronbach's alpha =0.87.

Mood was assessed on a four-item semantic differential scale (sad - happy, bad mood - good mood, irritable - pleased, depressed - cheerful) (Peterson and Sauber 1983). The items loaded on one factor with 67.54% of the explained variance with Cronbach's alpha=0.83.

The participants were asked to come in after again 7 days. They had to do a free recall and write down all details, they could remember about the product they had seen on t_0.
As in study 2, they had to answer questions about freshness, attractiveness, and purchase intention. For purchase intention, the 3 items loaded on one factor explaining 79.28 percent of the variance with Cronbach's alpha= 0.86 (See appendix: Fig. A-4).

5.3.4 Results

Manipulation check: To check if manipulation of the stimuli was successful, a two-way ANOVA was conducted with the olfactory and visual stimuli as independent and freshness as dependent variable. The fresh product package was rated significantly fresher than the less fresh product ($M_{high\ fresh}$=5.06 vs. $M_{low\ fresh}$=3.82; F(1, 193)=23.63; P=0.001). Also, the menthol scent was rated fresher as the marzipan scent ($M_{menthol}$=4.71. vs. $M_{marzipan}$=4.45.). However, the difference was not significant. Therefore, the manipulation was not quite successful for scent. Nonetheless, analyzes were continued.

5.3.4.1 Semantic congruence effect

To measure the semantic congruence effects, an ANOVA was conducted with freshness depending on the congruence. A significant influence of the semantic congruence showed at t_0 ($M_{congruent\_highfresh}$=5.41; $M_{incongruent}$=4.55; $M_{congruent\_lowfresh}$=3.81; $M_{no\ scent\_highfresh}$=4.71; $M_{no\ scent\_lowfresh}$=3.53; F(4,190)=5.50; p=0.001). Because the variance homogeneity was not given (tested using the Levene-test), the Tamhane's T2 multiple comparison test was carried out as a post-hoc test (Field 2013 p. 459). It only showed a significant difference between the groups $congruent_{high\ fresh}$ and $no\ scent_{low\ fresh}$ as well as between the groups $congruent_{high\ fresh}$ and $congruent_{lowfresh}$ ($p<0.05$).

Table 5-10: Mean values of different visual and olfactory stimuli combinations on freshness; study 3

Congruence	Mean value, t_0	SD	Mean value, t_1	SD
$M_{congruent\_highfresh}$	5.41	1.70	5.00	1.60
$M_{congruent\_lowfresh}$	3.81	1.815	3.67	1.99
$M_{incongruent}$	4.55	1.88	4.07	1.76
$M_{no\ scent\_highfresh}$	4.71	1.92	4.17	2.05
$M_{no\ scent\_\ lowfresh}$	3.53	1.63	3.27	1.62

At t_1, the values slightly decreased ($M_{congruent\_highfresh}$=5.00; $M_{incongruent}$=4.07; $M_{congruent\_lowfresh}$= 3.67; $M_{no\ scent\_highfresh}$=4.17; $M_{no\ scent\_low\ fresh}$=3.27; F(4,175)=3.79; p=0.006). At t_1, the Tamhane's T2 multiple comparison test showed the same significant differences as at t_0. Therefore, a significant difference ($p<0.05$) between the groups $congruent_{high\ fresh}$ and $no\ scent_{low\ fresh}$ as well as between the groups $congruent_{high\ fresh}$ and $congruent_{lowfresh}$ showed.
The results does not fully support hypothesis 4a, which states that $semantic\ congruence_{high\ fresh}$ stimuli significantly enhance the evaluation of the key benefit in comparison to the other stimuli combinations. The results are not significant but there is a general tendency.
Hypothesis 4b was not supported by the results, as the $congruent_{low\ fresh}$ stimuli do not score significantly lower than the other stimuli combinations.

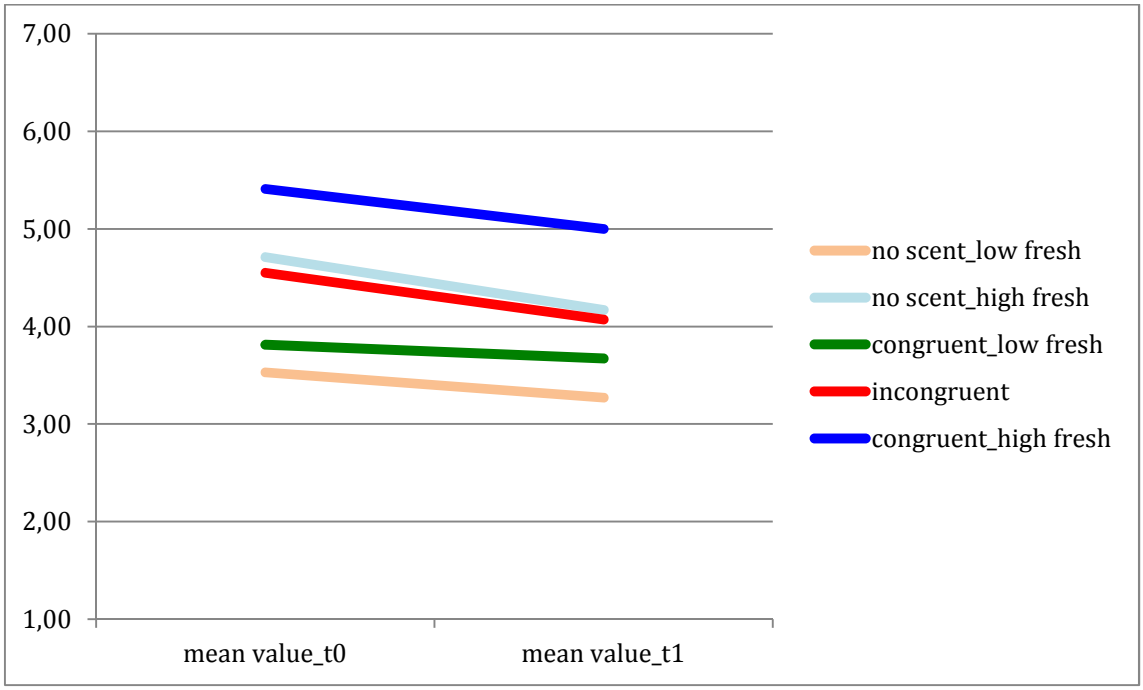


Fig. 5-8: Mean values of freshness for t0 and t1 as a function of congruence; study 3

5.3.4.2 Sensory dominance

To determine the sensory dominance, the marzipan scent was excluded for the following analysis and the menthol scent was only compared to the control group. An ANOVA was conducted to calculate the general effect of the visual stimuli and olfactory stimuli on freshness. A significant influence of the visual (F(1,127)=16.18; p=0.001) as well as the olfactory stimuli (F(1,127)=4.03; p=0.047) shows on freshness. These results replicated at t_1 (vision: F(1,116)=9.54; p=0.003; olfaction: F(1,116)=5.58; p=0.020).
There was no interaction effect of olfactory and visual stimuli.

The actual impact of olfaction and vision on freshness was assessed with a linear regression analysis. The results show a positive significant influence for both stimuli at t_0. The visual impact on freshness is a bigger (β=0.33; t=2.01; p=0.001) than the olfactory impact (β=0.17; t=4.05; p=0.001). In total both stimuli explain 14% of the variance for freshness (R^2=0.14). At t_1, the visual stimuli have the bigger impact (β=0.27; t=2.37; p=0.001) on the freshness as well in comparison to the olfactory stimuli (β=0.21; t=3.10; p=0.001) explaining 11% of the variance for freshness (see table 5-11). Since the results show a bigger impact of the visual stimuli in comparison to the olfactory stimuli on the evaluation of the key benefit, hypothesis 5 is not supported.

Table 5-11: Results of regression analysis estimating the impact of the visual and olfactory stimuli on freshness; study 3

	Independent variable	β	T	p	F	R^2
t_0	Visual stimuli	0.33	2.01	0.001		
	Olfactory stimuli	0.17	4.05	0.001	10.04	0.14
t_1	Visual stimuli	0.27	2.37	0.001		
	Olfactory stimuli	0.21	3.10	0.001	7.49	0.11

5.3.4.3 Effects on purchase intention

Identically to study 2, a linear regression analysis was conducted to test the effect of the key benefit on the purchase intension. At t_0, a positive influence of freshness shows on purchase intention (β=0.46; t=7.10; p=0.001) explaining 21% of the variance on the purchase intention. At t_1, the impact increases (β=0.56; t=9.06; p=0.001) explaining 32 % of the variance on the purchase intension (see table 5-12). These results support hypothesis 6.

Table 5-12: Results of regression analysis estimating the impact of the freshness on the purchase intention; study 3

	Independent variable	β	T	p	F	R^2
t_0	Freshness	0.46	7.10	0.001	50.35	0.21
t_1	Freshness	0.56	9.06	0.001	82.13	0.32

Similar to study 2, the mediator analysis testing if attractiveness mediated the effect of the key benefit on purchase intention was conducted using the Sobel test. The influence of freshness on purchase intention was still significant (B=0.44; t=7.51; p=0.001). Furthermore,

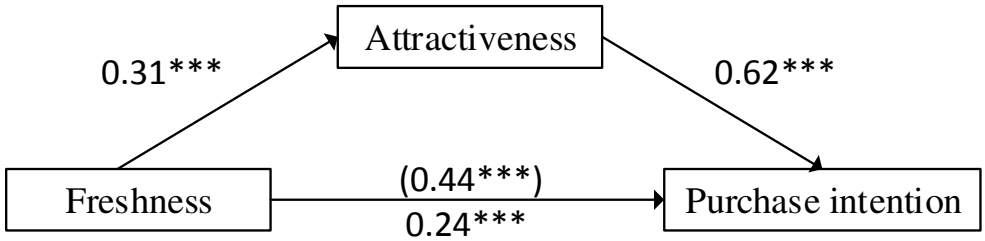
freshness significantly influenced attractiveness (B=0.31; t=4.80; p=0.001), which influenced the purchase intention significantly when it was controlled for freshness (B=0.62; t=12.12; p=0.001). Lastly, it showed that the impact of freshness on purchase intention decreased when it was controlled for attractiveness but the impact was still significant (B=0.24; t=4.93; p=0.001).

Table 5-13: Results of mediation analysis for the attractiveness at t0 and t1; study 3

	Dependent variable	**Independent variable**	**B[1]**	**t**	**p**
t_0	Purchase intention	Freshness	0.44	7.10	0.001
	Attractiveness	Freshness	0.31	4.80	0.001
	Purchase intention (controlled for freshness)	Attractiveness	0.62	12.12	0.001
	Purchase intention (controlled for attractiveness)	Freshness	0.24	4.93	0.001
t_1	Purchase intention	Freshness	0.53	9.29	0.001
	Attractiveness	Freshness	0.54	9.01	0.001
	Purchase intention (controlled for freshness)	Attractiveness	0.48	7.78	0.001
	Purchase intention (controlled for attractiveness)	Freshness	0.27	4.52	0.001

	z	**p**	**95% Co-Interval[2]**
Results of Sobel test t_0	4.45	0.001	0.11-0.28
Results of Sobel test t_1	5.87	0.001	0.17-0.35

[1]B=not standardized regression coefficient; [2]Bootstrap=5000



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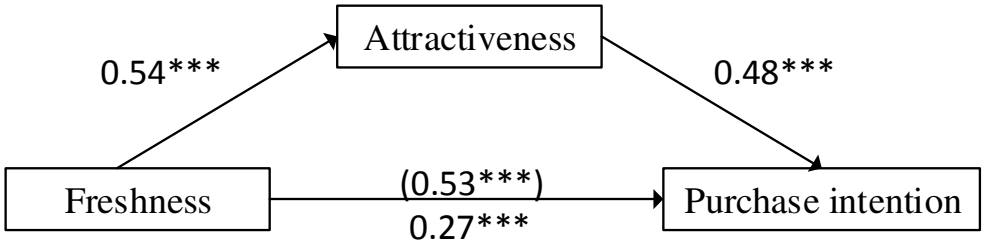
p<0.001

Fig. 5-9: Results of analysis of attractiveness as a mediator between freshness and purchase intention at t0; study 3

The Sobel test generated a significant z-value (z=4.45; p=0.001) and also a 95% confidence interval that does not include the value of '0', verifying this partial mediation. Therefore, the attractiveness is only explaining part of the effect of freshness on purchase intention. This partial mediation is also valid for t_1 (see table 5-13 and fig. 5-10). Therefore, the results support hypothesis 7.



***: =0.001

Fig. 5-10: Results of analysis of attractiveness as a mediator between freshness and purchase intention at t1; study 3

5.3.4.4 Unaided recall

Similar to study 2, the recall of the products in the participants was tested. The objective was to examine if scent in general in comparison to not scented products (hypothesis 8a) or a visual stimuli with a semantic incongruent scent in comparison to a visual stimuli with a semantic congruent scent (hypothesis 8b) did have an effect on the recall performance of the participants. Accordingly, a recall score was calculated for every participant (Max. points: 8). An ANOVA was carried out testing the effect of scent vs. no scent on the recall score. No effects showed. Additionally, the score was analyzed depending on the semantic congruence.

No effects showed as well; even when marzipan was excluded. Therefore, results do not support hypothesis 8a and 8b.

5.3.4.5 Mood

To analyze the mediation effect of mood between the stimuli and freshness a Sobel test was conducted. No significant effect showed. However, freshness significantly influenced mood ($F(1,193)=3.00$; $p=0.001$), but mood did not influence the purchase intention.

5.3.5 Discussion

The overall objective was to repeat and extend study 2 using 'real' visual stimuli.
The results did not completely correspond to those of study 2. Despite this, some of the hypotheses were supported.

In this study as well, the focus was on the set on the influence of semantic congruency on the key benefit. Results support only partially hypothesis 4a and 4b. $Congruent_{high}$, $congruent_{low,}$ and incongruent conditions resulted in a similar impact on evaluations of freshness as in study 2 even though differences in between most values were not statistically significant. However, this study was closer to a real life scenario then the other two studies as the scent was not presented through the olfactometer and the toothpaste was not presented only on a screen. Therefore, this study provides support that the concept of semantic congruence between stimuli is a highly relevant construct in cross-modal stimuli and proves the influence of the perception of key benefits due to this concept.

Hypothesis 5 was not supported by the data in study 3 and not strongly in study 2. Vision dominated the evaluation of freshness even more so than in study 2. Fenko, Schifferstein and Hekkert (2010) suggest that the dominance of the modality depends on period usage. Perhaps toothpaste scent is more important during usage rather than the moment of purchase. The results might have been different, if the participants would have had to brush their teeth with that toothpaste before evaluating.

As in study 2, hypothesis 6 and 7 are supported by data in study 3. Freshness influences purchase intention, an effect that strengthens over time: At t_0, freshness explains 21% of the variance of purchase intention and at t_1, it explains 32% of that variance. Attractiveness partially mediates the observed impact of freshness on purchase intention.

Scent did not affect recall, possibly because seven days is not long enough. In study 2, a 10 day period was used there were effects on recall. Having said this, Krishna, Lwin, and Morrin (2010) showed that participants had scent enhanced recall after only 24 hours. Possibly, the results can be explained by the failed olfactory manipulation.

As expected, stimuli do not influence mood but freshness does. Also, mood does not influence purchase intention. This is not in line with Gulas and Bloch (1995) and with Davies et al. (2003). According to their model mood should have been affected by the stimuli. However the results are in agreement with Chebat and Michon (2003) who suggest that cognitive processes induce shoppers behavior and not mood effects. In their case the perception of the product quality, and not mood, primarily influences shoppers spending. Additionally, in their model, product quality has an impact on mood. In this study, freshness, as the key benefit, influences purchase intention. Also, freshness, as an equivalent to product quality does influence mood.

Summarizing, study 3 does not replicate the results of study 2 exactly, but does lean towards the same tendencies. The results support the usage of the concept of semantic congruence in the interaction of multi-sensory stimuli in products.
Also, integrating scents in product packaging is suitable for application. Similarly as in study 2, a fresh product package and a fresh scent enhance the freshness evaluation, which influences purchase intention positively. The effect is partially mediated via attractiveness.

6 Discussion

The overall aim of this thesis was to test the cross-modal effect of olfactory and visual stimuli in sensory marketing context. There was a particular focus on product scent and semantic congruence. The methodologies used were both implicit and explicit. Following is a brief summary of each of the three parts of the thesis.

1. Implicitly tested the cross-modal effect of congruent and incongruent stimuli via the response latency using the IAT methodology.
2. Explicitly tested the effect of congruent/incongruent/no scent stimuli combinations in product packages explicitly emphasizing the direct effect on the key benefit and eventually on purchase intention.
3. Same as study two except real product packages were used instead of images on a screen.

The results supported the majority of the hypotheses, at least in parts. Below is a schema of all the hypotheses, with blue lines representing hypotheses that were fully supported by the results and red lines representing hypotheses that were only partly supported by the data.

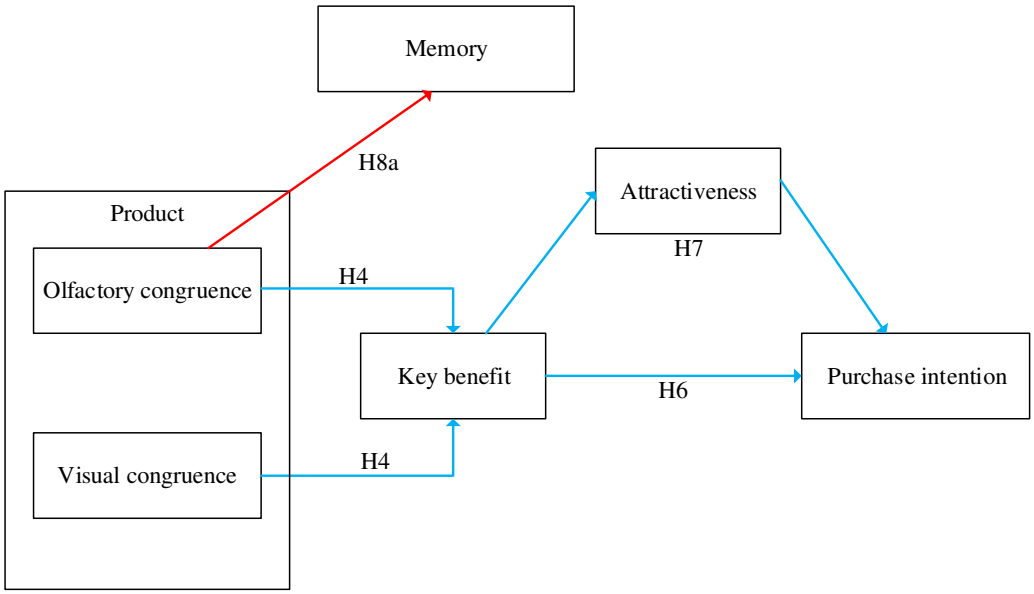


Fig. 6-1: Verified hypotheses (Supported hypotheses by study 2 and 3 are highlighted blue, hypotheses supported by only one study are highlighted in red)

A discussion of the results will be divided into three parts:

a) Advancement of theory

b) Managerial implications

c) Research limitations and future research

6.1 Advancement of Theory

Past marketing and consumer research has focused on classical means of communicating products and brands (i.e., through advertising) including visual aspects. Marketing scholars deemed vision the main source of consumer beliefs (Wright and Lynch 1995), but greatly ignored the potential contribution offered by sensory science. More recently, however, researchers have started to integrate the concept of experiential marketing, which states that a more holistic perspective may be suitable for a full understanding of consumer interaction with products (Bone and Jantrania 1992), brands (Morrin and Ratneshwar 2003), or service environments (Chebat and Michon 2003). The resulting multi-dimensional view of visual, tactile, olfactory, auditory, and taste input is considered to possess larger explanatory power.
Nonetheless, most sensory research, especially cross-modal research, has still been of basic nature. Most studies have focused on the interaction of scent and colors (Morrot, Brochet, and Dubourdieu 2001), touch (Demattè et al. 2006) or music notes (Crisinel and Spence 2012). Only a few studies have focused on marketing related topics (e.g. Bone and Jantrania 1992; Mattila and Wirtz 2001; Spangenberg, Grohmann, and Sprott 2005).
Additionally, shifting the focus to multi-sensory research new methods and analytics, other than psychometrical methods, are necessary for assessing the relationships between numerous variables. Research suggests that explicit methods sometimes lead to other results than implicit methods especially when scent is involved (Nosek, Greenwald, and Banaji 2007; Bone and Ellen 1999). One of these new and implicit methods is the Implicit Association Test. Demattè, Sanabria, and Spence (2006) integrated the IAT method into sensory research. They used it for measuring the congruence of colors and scent as well as touch and scent. In study 1, that IAT methodology was extended to measure the semantic congruence of actual products and olfactory stimuli via the response latency. Results indicate that IAT is a powerful tool for the measurement of semantic congruence implicitly in multisensory research, which proves to be a key construct between cross-modal stimuli. It also represents another important step towards the wide range of the IAT usage as it proved

to be a reliable method for measuring cross-modal concepts as the main usage has focused on uni-modal visual usage.

In study 2 and 3 results show that the olfactory and visual stimuli influence the key benefit (in this case: freshness). In agreement with Westerink and Kozlov (2003), the results show that consumers are looking for freshness in oral care products. The results indicate that the vision was dominant over olfaction during freshness evaluation, contradicting studies such Fenko et al. (2009). A possible explanation for this contradiction is that olfaction is dominant while using toothpaste rather than while buying toothpaste. Also, both olfactory and visual cues have a dominating but not interacting impact on freshness evaluation. This is surprising, as the multi-sensory stimuli of a product package are holistically perceived (Schifferstein and Spence 2008 p. 148) so it was suspected that the modalities would interact. Future research is needed to figure out the reason.

The key benefit is linked to purchase intention. In this case, freshness evaluation of oral care products is linked to purchase intention of that toothpaste. The studies here close a research gap, as sensory research has never linked cue congruence to purchase intention (Westerink and Kozlov 2003; Fenko et al. 2009).

Stimuli congruence leads to a higher attractiveness evaluation, even if the congruence is not related to aesthetics. This is supported by previous findings (Hekkert 2006). The studies demonstrate the key benefit has a positive impact on the purchase intention as consumers perceive them as more attractive and turn to a higher purchase intention. However, the studies imply only a partial mediation of attractiveness. This means that attractiveness explains only some, but not all, of the relationship the key benefit on the purchase intention. Additionally, it means that the key benefit also has a significant effect on the purchase intention by itself but also that there are other possible moderators (e.g. quality or individual factors) which needs to be investigated in future research.

Mood does not mediate the perception of the key benefit but the key benefit influences mood. Mood does not impact purchase intention. These results are in line with Chebat and Michon (2003). In their model based on Lazarus (1991), they demonstrate that an ambient scent influences mall perception and product quality directly which influence mood. Not mood but product quality perception then mainly has an impact on the shoppers' spending.

The results reinforce the fact that scent processing directly influences cognition without being routed via mood (at least for low-involvement products).

Overall, these three studies extend the basic findings of cross-modal research. As one of the first works, it integrates implicit and explicit methodologies in cross-modal research. Prior study only focused on one of these methods with a common emphasize on sensory science but not on sensory marketing. It is the first work that combines olfactory stimuli with visual product packages, selected on the basis of their semantic meaning. This is a new approach as semantic congruence proves to be a highly valuable concept for cross-modal interaction and sensory marketing. The semantic congruence influences the evaluation of the key benefit, which then leads to a higher purchase intention, partially mediated by attractiveness. This has never been tested before and is a big step for sensory marketing. Generally, the findings of all studies contribute to literature within consumer behavior and psychology on sight, smell, multisensory interactions, and the concept of multisensory semantic congruence.

6.2 Managerial Implications

A majority of purchase decisions are made in the grocery isle (Anonymous 2005). From a sales perspective it is essential to understand the cross-modal interactions that lead to this purchase decision to design the optimal product package in relation to other competing products.

Accordingly, $congruent_{high\ fresh,}$ $congruent_{low\ fresh,}$ incongruent, no $scent_{high\ fresh}$, and no $scent_{low\ fresh}$ stimuli combinations were examined here. This is a very extensive approach in sensory research since most studies have investigate control vs. scented conditions, or congruent vs. incongruent conditions (e.g. Bone and Jantrania 1992; Ellen and Bone 1998; Krishna, Elder, and Caldara 2010; Ludden and Schifferstein 2009). The results show that the semantic congruence of olfactory and visual stimuli can enhance the key benefit (here: freshness) of the product category, which enhances purchase intention. This finding is very valuable for producers. Integrating scents into product packaging, it can be an effective tool for enhancing purchase when used correctly. A popular example of a company that has already successfully integrated Proctor and Gamble have already used the method of scenting packages for their toothpaste products Cinnamon Rush, Fresh Citrus Breeze and Extreme Herbal Mint (Anonymous 2005).

In these studies here, the focus is set on toothpaste. Based on that, similar results are to expect for products from personal care or consumer goods with a scent e.g. deodorant, shampoo. These products are particularly interesting because the consumer has the opportunity to 'take a sniff' at the point of sale. The results indicate a higher purchase if scent and package are congruent for the key benefit. For food products, it is to suspect that the consumer would not accept scented products with scents that are not congruent with the package and the product category e.g. coffee needs to smell like coffee. In this category, only an enhancement of the natural scent is thinkable. For packaged food, producers are already using scent of the product itself by allowing the consumer to smell the product through a special designed package.

The results also show the visual stimuli (product package) are more important than scent in the moment of purchase for the toothpaste product category. This supports the proposal of sensory dominance of vision at the moment of the purchase decision as vision shows to be the more dominant scent in general (Zellner, Bartoli, and Eckard 1991; Morrot, Brochet, and Dubourdieu 2001). However, scent in toothpaste is still important as it also has an influence on freshness. It is to assume that the sensory dominance might change after having used the products as scent is essential for personal care products (Fenko, Schifferstein, and Hekkert 2008).

Moreover, results of study 2 demonstrate an enhancement of memory for product packages that are scented in comparison to unscented packages. Unfortunately, study 3 does not replicate these results. Nonetheless, literature (e.g. Krishna, Lwin, and Morrin 2010; Maureen Morrin and Ratneshwar 2000; Morrin and Ratneshwar 2003), as well as study 2, suggests to use scent to enhance memory of brands or product information. If certain products or product information stay in mind better due to scent enhancement, it is more likely that consumers actively look for them during shopping trips.

In the process of product development of a multi-sensory product, it seems crucial to select the right key benefit for selecting the semantically congruent stimuli. In that context of multi-sensory research, the IAT could be used for measuring and semantic congruency between stimuli and eventually help selecting the most congruent ones. Two variables that seem congruent explicitly are not automatically congruent when measured implicitly. Therefore, the IAT can help to make the best selection.

Additionally, results of the IAT measurement indicate that if products are scented that normally do not emit a scent, cross-modal stimuli are not automatically connected according to their semantic congruence. It seems important to connect that (key attribute enhancing) scent with that product within the consumer with an experience, linking that scent with an association. Using that scent in advertisement in magazines, as well as on displays or having the people try the product at events while being exposed to that scent could help to link scent and product experience.

In general, these studies demonstrate that the interaction of scent and vision in product packaging has a big potential for sensory marketing, as it can be a great tool for differentiation. It shows that scent in combination with the semantically congruent product package or possibly semantically congruent display, it can enhance purchase intention as well as memory in consumers. Further investigations, need to check these outcomes can be generalized. Nevertheless, Krishna, Lwin, and Morrin (2010) highly recommend companies to develop and to use corporate scents; also suggesting to have them legally protected as trademarks.

6.3 Research Limitations and Future Research

As in every study, there are different limitations here but also new impact for further research. Also, because the research direction of sensory marketing is still relatively young, much future research needed.

The IAT method provides more theoretical results and less marketing results relative to explicit methods. However, the effect of scent is very subconscious and if it is asked for scent evaluations directly answers can be biased. Therefore, there is a high potential for the usage of implicit methods including the IAT when scent is in focus. Different research fields (e.g. neuroscience, behavioral science and marketing) should collaborate to work interactively in multi-sensory research.

However, a limitation by using the IAT is that only two senses can be integrated in this specific testing method. Furthermore, only one key benefit can be tested with the IAT. However, some products might have more than one key benefit (e.g. pillows: comfortable

but possibly decorative). For test more senses or products with more key benefits at the same time, different implicit testing methods e.g. fMRI need to be used.

The fact that the tests were carried out in labs means that some real life context factors may have been lost, obscuring the results. It cannot be predicted how a scented package would be evaluated in a shelf next to other packages. The reaction also highly depends on the implementation of the scent. A scented package may not direct the consumers' attention to the package because of too many distractions in the 'real world'. Research suggests that scent can direct the visual attention of humans towards congruent visual objects (Seo et al. 2010) and can affect visual processing by assisting to identify the odor source (Seigneuric et al. 2010). But if many product packages of the same category are presented next to each other, could the consumer identify the source or would the scent generally enhance the key benefit evaluation? Maiwald et al. (2013) demonstrate that a brand scent can enhance the perception of that brand itself but also on a private label brand meaning that scent enhances perception of both, brand and private label. They call it the 'hijacking effect'. In that case, scenting the package with a scent that is just released by touch or using the scratch and sniff method could prevent that hijacking effect and direct all attention due to scent to the package.

A brand influences consumer perception. The toothpastes packages in the studies here were unknown and therefore no effects showed. Yet, it is interesting to investigate the effects with familiar and unfamiliar brands. Morrin and Ratneshwar (2000) demonstrated that brand evaluation and recall were especially enhanced for unfamiliar brands when participants had been exposed to an ambient scent.

Furthermore, due to the supported hypotheses, this thesis proposes a model for the semantic congruence effect of visual and olfactory stimuli in product packages. However, here it was tested for the cross-modal effect in the toothpaste category. Future research needs to examine if the results are consistent across different categories of products. High involvement products may be more greatly influenced by mood (Doucé and Janssens 2013). Additionally, what would the effects be if a category (e.g. pillows) that normally does not emit a scent? It is to assume that the association of scent and visual stimuli needs to be linked via experience within the consumer first.

A different aspect is the cultural influence. Would the model be consistent across different cultures? Even though the world has become more global, Overby, Woodruff and Gardinal (2005) propose that different cultures have different standards and therefore value different attributes in products. Therefore, it is to suspect that the key benefit for the product categories differs to consumers from different countries. Moreover, the association of scents (Chrea et al. 2004) and the perception of product design (Van den Berg-Weitzel and Van de Laar 2001) differs in between cultures. It would be interesting to extend research to different cultures.

Only two out of five senses were investigated. Calvert, Spence and Stein (2004 p. xi) claim that "there can be no doubt that our senses are designed to function in concert and that our brains are organized to use the information they derive from their various sensory channels cooperatively".
According to the principle of multi-sensory reinforcement, information that is routed to the brain via several sensory channels is processed faster and more intensely in comparison to one single incoming signal (Nölke and Gierke 2011). As a consequence, multisensory brands can potentially create more attention and information storage in the memory. Additionally, information processing improves (Maiwald et al. 2013). Further research is needed to investigate the impact multi-sensory integration of all senses and cross-modal interaction has on purchase intent.
However, does multi-sensory integration really equals better? Krishna (2012) claims that a sensory overload could possibly be reached as easy as an information overload, possibly covering all subtleties of the experience. Further research is needed on that topic.

The results of this thesis close a small but important gap in research of effects of semantic congruence between cross-modal stimuli in product evaluation. The discussion indicates that in the field of multi-sensory research, especially with focus on marketing, further research is needed.

7 Summary

Contribution

In a world abound with products; sales managers are searching for novel approaches to make their brands stand out from the crowd. Using more complete sensory experiences, that encompasses all five senses, is one of these novel approaches (Lindström 2005) (Spence 2002). Research in the emerging field of sensory branding has established that while vision appears to be the key modality (e.g. (Schifferstein and Cleiren 2005; Schifferstein 2006), stimulating other senses can enhance the overall evaluation of products, leading to more favourable intention and long-term memory (Bone and Jantrania 1992; Krishna, Elder, and Caldara 2010; Lwin, Morrin, and Krishna 2010; Morrin and Ratneshwar 2003); Peck and Childers 2006). Previous studies have looked into: scent and touch during product evaluation (Krishna, Elder, and Caldara 2010) and scent and vision during product recall (Lwin, Morrin, and Krishna 2010).

Scent is a particularly intriguing sense due to its raw primitive nature in driving behaviour. Scent can be used to impact the evaluation of product characteristics (Churchill et al. 2009) and product recall (Krishna, Lwin, and Morrin 2010). Previous research has tended to focus on ambient scent rather than product packaging.

Cue congruence is a term describing the degree of fit among stimuli properties (Krishna, Elder, and Caldara 2010). This study expanded into the novel field of cue congruence during multi-sensory stimulation in a marketing context. The impact of cue congruence between visual and olfactory stimuli on product package evaluation was investigated.

See fig. 7-1 for tested hypotheses.

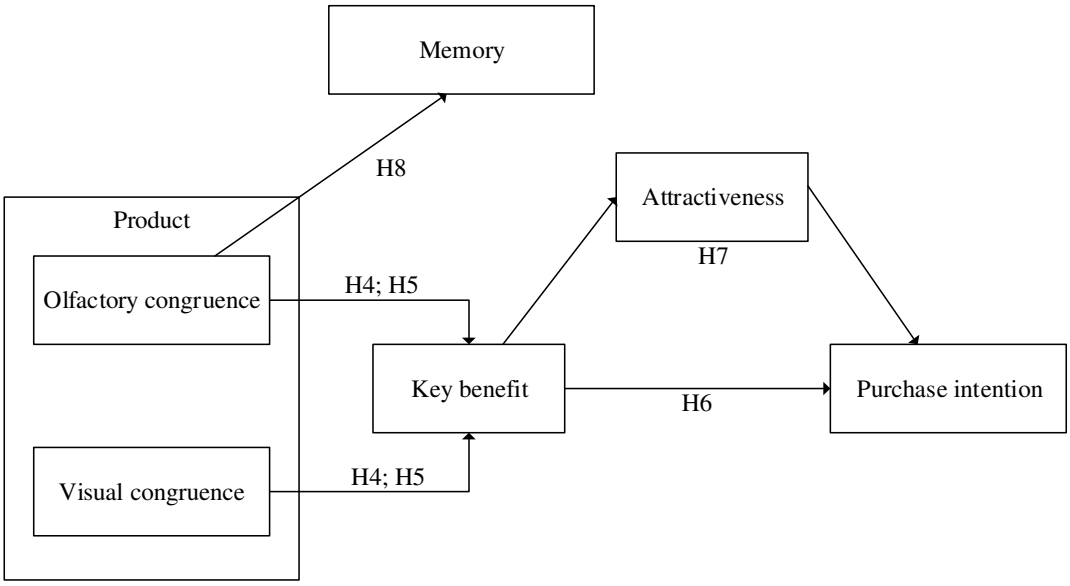


Fig. 7-1: Tested hypotheses (own figure)

Methodology and Results

Implicit tests are more subtle in approach and produce different results from explicit results, particularly when studying olfaction (Greenwald, McGhee, and Schwartz 1998 and Bone and Ellen 1999). However, implicit approaches do not give direct answers to marketing related questions. Therefore, a combination of implicit and explicit approaches was used for this study.

Study 1 one implicitly tested the cross-modal effect of congruent and incongruent stimuli via the response latency using the IAT methodology. In this test the congruence is measured via response latency. The response is quicker when stimuli are congruent in comparison to incongruent. The IAT originally derives from social psychology and was adapted to this concept. The test was carried out in front of an olfactometer and a monitor using a custom-made software. Three product categories were compared: 1) scented product (toothpaste) 2) uncommonly scented product (pillows) 2) food (chocolate). The results show that the IAT is an adequate tool for measuring congruence in sensory research implicitly. The toothpaste category matched best within semantic congruence. Participants answered significantly quicker in semantically congruent combinations in comparison with incongruent combinations.

Therefore, *study 2* explicitly tested the effect of congruent/incongruent/no scent stimuli combinations in toothpaste product packages explicitly emphasizing the direct effect on the key benefit and eventually on purchase intention. Participants sat in front of an olfactometer and a screen monitor that presented the stimuli in various combinations and were then asked to complete a questionnaire. Scent stimuli enhance the perception of the key product benefit, which increases purchase intention. Attractiveness rating is a partial mediator of this effect. Scent stimuli enhance product recall.

Study 3 replicates study 2 but using real product packages of the toothpaste category. Results mostly support the results of study 2 but lack significance. However, the results show equivalent tendencies.

Each of the hypotheses and results are summarized in table 7-1. All three studies focus on advancing the cross-modal research, in particular on the usage of scent in product packages, using implicit and explicit approaches. The implicit approach using the IAT is new in sensory marketing and has never been used before. It proved to be a good method to measure semantic congruence of cross-modal stimuli. Study 2 and 3 use an explicit approach in that context and also close a knowledge gap. The results show that the usage of a semantic congruent scent on a product package can enhance purchase intention in comparison to a package without a scent. However, both, scent and package need to be congruent and also score high on the key benefit to reach a higher purchase intention.

Table 7-1: Table of hypotheses

Hypotheses	Findings	Status
H1: Across the sensory modalities of vision and olfaction, the response latency will be faster when the stimuli are semantically congruent rather than incongruent.	Response latency is faster for semantic congruent stimuli.	Supported
H2: Across both sensory modalities, respondents will make fewer mistakes when the stimuli assigned to the response keys are congruent rather than incongruent.	Participants make fewer mistakes if response keys were assigned congruent.	Supported
H3. Responses will be faster for visual stimuli in comparison with olfactory stimuli	Response latency decreases for congruent visual stimuli than olfactory stimuli.	Supported
H4a: When the cross-modal stimuli are semantically congruent and both scoring high on the key benefit, the evaluation of that key benefit will be enhanced in comparison to the other stimuli combinations.	If the stimuli are semantic congruent and both scoring high on the key benefit, the overall evaluation of the key benefit is highest in comparison to all other stimuli combinations.	Supported

H4b: When the cross-modal stimuli are semantically congruent and both scoring low on key benefit, the evaluation of that key benefit will be reduced in comparison to the other stimuli combinations.	If the stimuli are semantic congruent and both scoring low on the key benefit, the overall evaluation of the key benefit is low but does not significantly differ to low scoring packages without a scent.	Not supported
H5: The impact of olfaction on the evaluation of the *key benefit* (freshness) will be stronger than the impact of vision.	The impact of olfactory and visual stimuli is about equal in study 2. In study 3, the visual stimuli dominate the impact on the key benefit.	Not supported
H6: Emphasizing the key benefit through modifying stimuli will positively impact purchase intention.	The key benefit does positively influence purchase intention.	Supported
H7: Attractiveness mediates the positive effect of the key benefit on purchase intention.	Attractiveness partially mediates the positive effect of the key benefit on purchase intention.	Supported
H8a: Presenting a product visually plus a scent versus no scent will enhance product recall.	Study 2 shows an influence of scent on memory. Study 3 does not.	Partly supported
H8b: Presenting a product visually plus an incongruent scent versus a congruent scent will enhance product recall.	Study 2 shows that olfactory stimuli that are incongruent with the category (and not with the visual stimulus) enhance recall. Study 3 does not show this effect.	Partly supported

8 Zusammenfassung

Hintergrund und Zielsetzung

Für Firmen, die Konsumgüter herstellen, sind Innovationen sehr wichtig. Leider sind diese oft eine sehr teure und risikobehaftete Angelegenheit: Nur zwei von zehn Innovationen haben Erfolg auf dem Markt. Deswegen sind viele Firmen immer auf der Suche nach neuen Alternativen, um ihre Marken und Produkte auf dem umkämpften Markt durch Marketingaktivitäten hervorzuheben.

Eine Möglichkeit bietet das sensorische Marketing (Sensory Marketing). In dieser besonderen Art des Marketings geht es darum, die Sinne des Konsumenten zu stimulieren und dadurch eine umfangreichere sensorische Erfahrung zu vermitteln (Lindström 2005). Bisher liegt der Schwerpunkt oft nur auf der visuellen Stimulation da bekannt ist, dass die visuelle Wahrnehmung bei der Aufnahme von Informationen (bei der Bewertung von Produkten und am Point of Sale) eine sehr wichtige Rolle einnimmt (z.B. Schifferstein und Cleiren 2005; Schifferstein 2006). Die anderen Sinne werden häufig vernachlässigt, obwohl auch die Stimulation von Gerüchen, Musik und Haptik die Bewertung von Produkten, die Einstellung, sowie die Langzeiterinnerung positiv beeinflussen können (Bone und Jantrania 1992; Krishna, Elder und Caldara 2010; Lwin et al. 2010; Morrin und Ratneshwar 2003; Peck und Childers 2006).

Bisherige Forschung konzentrierte sich hauptsächlich auf grundsätzliche Effekte einzelner Sinne u.a. von Geruch. Beispielsweise wurde der Einfluss von Duft auf Produkteigenschaften (Churchill et al. 2009) und die Erinnerung (Krishna, Lwin und Morrin 2010) untersucht.

Neuste Forschungsergebnisse legen aber nahe, dass das Ansprechen von mehr als einem Sinn zu einem Zeitpunkt möglicherweise zu noch besseren Ergebnissen führt (Spence 2002). Dieses Forschungsgebiet ist allerdings noch sehr jung und dementsprechend in seinen Erkenntnissen limitiert. Insbesondere fehlt vielen Studien noch der Marketingbezug. Einige wenige Studien untersuchten zum Beispiel die Interaktion von Geruch und Haptik und den Einfluss auf die Produktbewertung (Krishna, Elder und Caldara 2010). Lwin, Morrin und Krishna (2010) untersuchten wie die Interaktion von Geruch und Optik die Erinnerung an Produkte beeinflusst.

Um den Einfluss der Sinneseindrücke auf den Konsumenten zu erklären, wird häufig das Konzept der Kongruenz verwendet. Die Kongruenz sagt aus, wie gut die Eindrücke von zwei Sinnen zusammenpassen (Krishna, Elder und Caldara 2010). Die semantische Kongruenz ist ein besonderer Fall, in dem Stimuli auf Grund von Erfahrungen eine semantische Bedeutung zugeordnet werden. Das Konzept der semantischen Kongruenz nimmt in dieser Arbeit eine Schlüsselrolle ein.

Um die Effekte der semantischen Kongruenz in der sensorischen Konsumentenforschung zu untersuchen, wurden bisher hauptsächlich explizite Messmethoden verwendet. Es konnte jedoch gezeigt werden, dass die Anwendung von expliziten Methoden teilweise zu anderen Ergebnissen führt, als die Anwendung von impliziten Methoden. Das liegt vor allem daran, dass durch die Anwendung dieser impliziten Methoden die mentale Kontrolle über die Antworten bei den Versuchsteilnehmern reduziert wird und so zum Teil andere Ergebnisse als bei expliziten Methoden generiert werden (Greenwald, McGhee und Schwartz 1998). Besonders bei Studien, bei denen der Fokus auf dem Einfluss von Duft geht, scheint es entscheidend zu sein, ob die Probanden auf den Duft aufmerksam gemacht werden, oder nicht. Bone und Ellen (1999) deuten an, dass bei Studien, bei denen die Teilnehmer auf den Duft hingewiesen wurden, teilweise keine Ergebnisse erbracht wurden. Aus diesem Grund schließt diese Arbeit mit der ersten Studie auch eine implizite Methodik mit ein.

Der Nachteil von impliziten Messungen besteht darin, dass die produzierten Ergebnisse nicht unbedingt umgehend im Marketing verwendet werden können. Auf Grund dessen wurden zwei explizite Studien in dieser Arbeit durchgeführt.
Im Hinblick auf die Interaktion olfaktorischer und visueller Stimuli war es das Ziel zu verstehen, (a) wie die semantische Kongruenz der Stimuli die Produktbewertung beeinflusst und (b) ob ein Duft in der Kombination mit einer visuell kongruenten Produktverpackung die Kaufbereitschaft erhöhen kann.
Basierend auf dem Literaturrückblick wurden verschiedene Hypothesen entwickelt und in Studie 2 und 3 getestet:

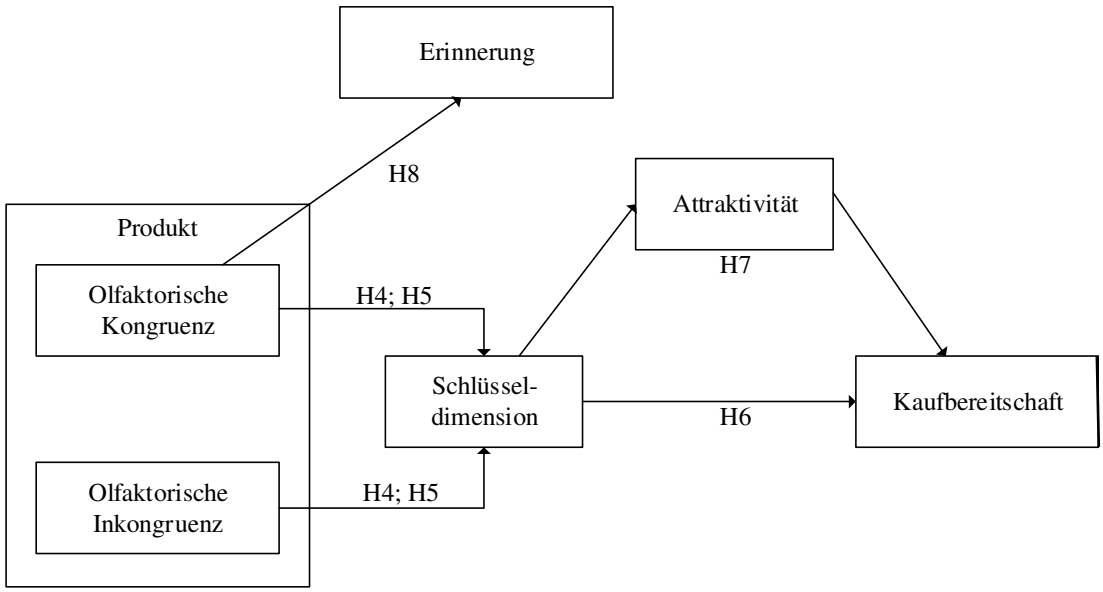


Fig. 8-1: Überprüfte Hypothesen (eigene Darstellung)

Methodik und Ergebnisse

Das Ziel von *Studie 1* war die implizite Messung der Effekte der semantischen Kongruenz von olfaktorischen und visuellen Stimuli. Genutzt wurde der Implizite Assoziationstest, welcher die Kongruenz mittels Reaktionszeit misst. Die Reaktionszeit ist schneller bei kongruenten Kombinationen als bei inkongruenten. Der IAT kommt ursprünglich aus dem Bereich der Sozialpsychologie und wurde für dieses Experiment dementsprechend angepasst.

Stimuli aus drei Produktkategorien wurden jeweils mit Hinblick auf die Schlüsseldimension der jeweiligen Kategorie ausgewählt: Zahnpasta als Produktkategorie, die einen eigenen Duft emittiert; Kissen als Kategorie, die normalerweise keinen eigenen Duft hat und Schokolade aus dem Lebensmittelsektor. 72 Probanden (24 Probanden /Kategorie) nahmen an dem Test teil. Die Ergebnisse beweisen, dass der IAT eine adäquate Methode ist, um Kongruenz in der Sensorik implizit zu messen. Die Ergebnisse zeigen ebenfalls, dass die Zahnpastastimuli semantisch kongruent sind und am besten zueinander passen.

Studie 2 verwendete die Stimuli aus der Zahnpastakategorie. Diese Stimuli waren anhand der Ergebnisse von Studie 1 semantisch kongruent/inkongruent. Die Studie 2 überprüfte den Effekt der semantischen (In)kongruenz vs. Stimuli ohne Duft auf die Kaufbereitschaft von

Konsumenten. Die Darbietung der Stimuli erfolgte simultan an einem Monitor sowie an einem Olfaktometer.
Die Ergebnisse bestätigen die meisten der aufgestellten Hypothesen: Die visuellen und olfaktorischen Stimuli beeinflussen unabhängig voneinander die semantische Dimension, die wiederum positiv die Kaufbereitschaft beeinflusst. Attraktivität ist hier ein partieller Mediator. Außerdem verbessert der Duft die Erinnerung an das gesehene Produkt im Vergleich zu einem Produkt, das ohne Duft dargeboten wird.
Studie 3 war eine Wiederholung und Erweiterung der zweiten Studie. Allerdings wurden echte Produktverpackungen verwendet. Obwohl an vielen Stellen die Signifikanz fehlt, unterstützen die Ergebnisse aus Studie 3 die Ergebnisse aus Studie 2, da die Ergebnisse die gleiche Tendenz aufweisen. Wie vorhergesagt, wird der Bewertungsprozess dieses Produkts und auch die Kaufbereitschaft von der Stimmung nicht beeinflusst.

Zusammenfassend festzustellen ist, dass die drei Studien zusammen die multi-modale Forschung wesentlich erweitern. Der besondere Fokus liegt hier auf den Effekten der semantischen Kongruenz von olfaktorischen und visuellen Stimuli auf die Produktbewertung und integrierte implizite und explizite Herangehensweise. Der speziell entwickelte IAT wurde in diesem Kontext noch nie verwendet. Es konnte gezeigt werden, dass dies eine adäquate Methode ist, um die semantische Kongruenz von zwei sensorischen Stimuli zu messen. Die Ergebnisse der expliziten Studien schließen ebenfalls eine Forschungslücke im Bereich des sensorischen Marketings von Produktverpackungen. Ebenfalls konnte gezeigt werden, dass ein Duft, dessen semantische Bedeutung dem visuellen Eindruck der Verpackung entspricht, die Kaufbereitschaft im Vergleich zu einer Verpackung ohne Duft verbessert. Die Stimuli müssen aber nicht nur semantisch kongruent, sondern auch einzeln positiv in der Schlüsseldimension bewertet werden.

References

Aaker, Jennifer L. (1997), "Dimensions of brand personality," *Journal of Marketing research*, 347–56.

Aggleton, John P., and Mortimer Mishkin (1986), "The amygdala: sensory gateway to the emotions," *Emotion: Theory, research and experience*, 3, 281–99.

Anonymous (2005), "The smell of success: olfactory packaging," *Packaging Digest*, 42(2), 52–55.

De Araujo, Ivan E., Edmund T. Rolls, Maria Inés Velazco, Christian Margot, and Isabelle Cayeux (2005), "Cognitive Modulation of Olfactory Processing," *Neuron*, 46(4), 671–79.

Areni, Charles S., and David Kim (1994), "The influence of in-store lighting on consumers' examination of merchandise in a wine store," *International Journal of Research in Marketing*, 11(2), 117–25.

Ayabe-Kanamura, Saho, Tadashi Kikuchi, and Sachiko Saito (1997), "Effect of verbal cues on recognition memory and pleasantness evaluation of unfamiliar odors," *Perceptual and motor skills*, 85(1), 275–85.

Bagozzi, Richard P., Mahesh Gopinath, and Prashanth U. Nyer (1999), "The role of emotions in marketing," *Journal of the Academy of Marketing Science*, 27(2), 184–206.

Bain, Hugh (1997), "Why people use perfumes," in *The Psychological Basis of Perfumery*, D. J. S. Jellinek, ed., Springer Netherlands, 232–39.

Banks, Sarah J., Victoria Ng, and Marilyn Jones-Gotman (2012), "Does good+ good= better? A pilot study on the effect of combining hedonically valenced smells and images," *Neuroscience Letters*, 514(1), 71–76.

Baron, Reuben M., and David A. Kenny (1986), "The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations.," *Journal of personality and social psychology*, 51(6), 1173.

Baron, Robert A. (1990), "Environmentally Induced Positive Affect: Its Impact on Self-Efficacy, Task Performance, Negotiation, and Conflict1," *Journal of Applied Social Psychology*, 20(5), 368–84.

Baun, Dorothea, and Andrea Gröppel-Klein (2003), "Joy and surprise as guides to a better understanding of impulse buying behaviour," *European advances in consumer research*, 6, 290–99.

Becker, Liza, Thomas J. L. van Rompay, Hendrik N. J. Schifferstein, and Mirjam Galetzka (2011), "Tough package, strong taste: The influence of packaging design on taste

impressions and product evaluations," *Food Quality and Preference*, 22(1), 17–23.

Beedie, Christopher, Peter Terry, and Andrew Lane (2005), "Distinctions between emotion and mood," *Cognition & Emotion*, 19(6), 847–78.

Belkin, Kira, Robyn Martin, Sarah E. Kemp, and Avery N. Gilbert (1997), "Auditory pitch as a perceptual analogue to odor quality," *Psychological Science*, 8(4), 340–42.

Bellizzi, Joseph A., Ayn E. Crowley, and Ronald W. Hasty (1983), "The effects of color in store design.," *Journal of retailing*, 59(1), 21–45.

———, and Robert E. Hite (1992), "Environmental color, consumer feelings, and purchase likelihood," *Psychology & marketing*, 9(5), 347–63.

Van den Berg-Weitzel, Lianne, and Gaston Van de Laar (2001), "Relation between culture and communication in packaging design," *The Journal of Brand Management*, 8(3), 171–84.

Berlyne, Daniel E. (1960), "Conflict, arousal, and curiosity."

Berntsen, Dorthe (2010), "The Unbidden Past Involuntary Autobiographical Memories as a Basic Mode of Remembering," *Current Directions in Psychological Science*, 19(3), 138–42.

Bloch, Peter H. (1995), "Seeking the ideal form: Product design and consumer response," *The Journal of Marketing*, 16–29.

Bloch, Peter H., Frédéric F. Brunel, and Todd J. Arnold (2003), "Individual Differences in the Centrality of Visual Product Aesthetics: Concept and Measurement," *Journal of Consumer Research*, 29(4), 551–65.

Bone, Paula F, and Pam S Ellen (1999), "Scents in the marketplace: explaining a fraction of olfaction," *Journal of Retailing*, 75(2), 243–62.

Bone, Paula Fitzgerald, and Swati Jantrania (1992), "Olfaction as a cue for product quality," *Marketing Letters*, 3(3), 289–96.

Bosmans, A. (2006), "Scents and sensibility: when do (in) congruent ambient scents influence product evaluations?," *Journal of Marketing*, 70(3), 32–43.

Bruner, Gordon C. (1990), "Music, mood, and marketing," *The Journal of Marketing*, 54(4), 94–104.

Buck, Linda, and Richard Axel (1991), "A novel multigene family may encode odorant receptors: a molecular basis for odor recognition," *Cell*, 65(1), 175–87.

Burdach, Konrad J. (1988), *Geschmack und Geruch.: Gustatorische, olfaktorische und trigeminale Wahrnehmung.*, Huber Hans.

Cahill, Larry, Ralf Babinsky, Hans J. Markowitsch, and James L. McGaugh (1995), "The amygdala and emotional memory," *Nature*, 377(6547), 295–96.

Cain, William S. S. (1979), "To know with the nose: Keys to odor identification.," *Science*,

203(4379), 467–70.

Calvert, Gemma A., Charles Spence, and Barry E. Stein (2004), "Introduction," in *The handbook of multi sensory processes*, G. A. Calvert, C. Spence, and B. E. Stein, eds., Cambridge, Ma: MIT press, xi – xvii.

Cardello, Armand V., and Paul M. Wise (2008), "Taste, smell and chemesthesis in product experience," in *Product experience*, Oxford, UK: Elsevier Ltd., 91–132.

Castiello, Umberto, Gesualdo M. Zucco, Valentina Parma, Caterina Ansuini, and Roberto Tirindelli (2006), "Cross-Modal Interactions between Olfaction and Vision When Grasping," *Chemical Senses*, 31(7), 665–71.

Chan Choi, S., and Anne T. Coughlan (2006), "Private label positioning: quality versus feature differentiation from the national brand," *Journal of Retailing*, 82(2), 79–93.

Chebat, Jean-Charles, and Richard Michon (2003), "Impact of ambient odors on mall shoppers' emotions, cognition, and spending: a test of competitive causal theories," *Journal of Business Research*, 56(7), 529–39.

———, Maureen Morrin, and Daniel R. Chebat (2009), "Does Age Attenuate the Impact of Pleasant Ambient Scent on Consumer Response?," *Environment and Behavior*, 41(2), 258–67.

Childers, Terry L., Michael J. Houston, and Susan E. Heckler (1985), "Measurement of individual differences in visual versus verbal information processing," *Journal of Consumer Research*, 12(2), 125–34.

———, and Jeffrey Jass (2002), "All dressed up with something to say: Effects of typeface semantic associations on brand perceptions and consumer memory," *Journal of Consumer Psychology*, 12(2), 93–106.

Chrea, C., D. Valentin, C. Sulmont-Rossé, H. Ly Mai, D. Hoang Nguyen, and H. Abdi (2004), "Culture and odor categorization: agreement between cultures depends upon the odors," *Food quality and preference*, 15(7-8), 669–79.

Churchill, Anne, Michael Meyners, Louisa Griffiths, and Pippa Bailey (2009), "The cross-modal effect of fragrance in shampoo: Modifying the perceived feel of both product and hair during and after washing," *Food Quality and Preference*, 20(4), 320–28.

Chu, Simon, and John J. Downes (2000), "Odour-evoked autobiographical memories: Psychological investigations of Proustian phenomena," *Chemical Senses*, 25(1), 111–16.

Costigan, Kelly (1984), "How color goes to your head," *Science Digest*, 92(12), 24.

Craik, Fergus IM, and Endel Tulving (1975), "Depth of processing and the retention of words in episodic memory," *Journal of experimental Psychology: general*, 104(3), 268–94.

Creusen, Mariëlle EH, and Jan PL Schoormans (2005), "The different roles of product appearance in consumer choice*," *Journal of product innovation management*, 22(1), 63–81.

Crisinel, Anne-Sylvie, and Charles Spence (2012), "A Fruity Note: Crossmodal associations between odors and musical notes," *Chemical senses*, 37(2), 151–58.

Danger, Eric Paxton (1987a), *The colour handbook: how to use colour in commerce and industry*, ldershot, Hants, England and Brookfield, Vt., U.S.A: Gower Technical Press.

——— (1987b), *Selecting colour for packaging.*, Gower Technical Press Ltd.

Davies, Barry J., Dion Kooijman, and Philippa Ward (2003), "The Sweet Smell of Success: Olfaction in Retailing," *Journal of Marketing Management*, 19(5/6), 611–27.

DeBono, Kenneth G. (1992), "Pleasant Scents and Persuasion: An Information Processing Approach1," *Journal of Applied Social Psychology*, 22(11), 910–19.

Demattè, M. Luisa, Daniel Sanabria, and Charles Spence (2006), "Cross-modal associations between odors and colors," *Chemical senses*, 31(6), 531–38.

———, ———, and ——— (2007), "Olfactory-tactile compatibility effects demonstrated using a variation of the Implicit Association Test," *Acta psychologica*, 124(3), 332–43.

———, ———, and ——— (2009), "Olfactory Discrimination: When Vision Matters?," *Chemical senses*, 34(2), 103–9.

———, ———, Rachel Sugarman, and Charles Spence (2006), "Cross-Modal Interactions Between Olfaction and Touch," *Chemical Senses*, 31(4), 291–300.

Van Der Lans, Ralf, Rik Pieters, and Michel Wedel (2008), "Eye-movement analysis of search effectiveness," *Journal of the American Statistical Association*, 103(482), 452–61.

DIN EN 13725: 2003 (n.d.), "Luftbeschaffenheit–Bestimmung der Geruchsstoffkonzentration mit dynamischer Olfaktometrie," Beuth.

Djordjevic, Jelena, Johan N. Lundstrom, Francis Clement, Julie A. Boyle, Sandra Pouliot, and Marilyn Jones-Gotman (2007), "A Rose by Any Other Name: Would it Smell as Sweet?," *Journal of Neurophysiology*, 99(1), 386–93.

Donders, F. C. (1969), "On the speed of mental processes," *Acta Psychologica*, 30, 412–31.

Doop, M., C. Mohr, B. Folley, W. Brewer, and S. Park (2006), "Olfaction and memory," *Olfaction and the brain*, 65–82.

Doty, Richard L. (2001), "Olfaction," *Annual Review of Psychology*, 52(1), 423–52.

Doucé, Lieve, and Wim Janssens (2013), "The Presence of a Pleasant Ambient Scent in a Fashion Store The Moderating Role of Shopping Motivation and Affect Intensity," *Environment and Behavior*, 45(2), 215–38.

———, Karolien Poels, Wim Janssens, and Charlotte De Backer (2013), "Smelling the

books: The effect of chocolate scent on purchase-related behavior in a bookstore," *Journal of Environmental Psychology*, 36, 65–69.

Edwards, Jeffrey R., and Lisa Schurer Lambert (2007), "Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis," *Psychological methods*, 12(1), 1–22.

Ehrlichman, Howard, and Jack N. Halpern (1988), "Affect and memory: Effects of pleasant and unpleasant odors on retrieval of happy and unhappy memories," *Journal of Personality and Social Psychology*, 55(5), 769–79.

Eichenbaum, Howard (2001), "The hippocampus and declarative memory: cognitive mechanisms and neural codes," *Behavioural Brain Research*, 127(1–2), 199–207.

Ellen, Pam Scholder, and Paula Fritzgerald Bone (1998), "Does it matter if it smells? Olfactory Stimuli as advertising executional cues," *Journal of Advertising*, 27(4), 29–39.

Engen, Trygg (1991), *Odor Sensation and Memory*, Greenwood Publishing Group.

Engen, Tygg (1988), "The acquisition of odour hedonics," in *Perfumery*, S. V. Toller and G. H. Dodd, eds., Springer Netherlands, 79–90.

Felser, Georg (2007), *Werbe- und Konsumentenpsychologie*, Berlin, Heidelberg: Spektrum Akademischer Verlag.

Fenko, Anna, Hendrik Schifferstein, Tse-Chia Huang, and Paul Hekkert (2009), "What makes products fresh: The smell or the colour?," *Food Quality and Preference*, 20(5), 372–79.

———, Hendrik N. J Schifferstein, and Paul Hekkert (2008), "Which senses dominate at different stages of product experience?," in *Undisciplined! Design Research Society Conference*, Sheffield Hallam University, Sheffield, UK.

———, Hendrik N.J. Schifferstein, and Paul Hekkert (2010), "Shifts in sensory dominance between various stages of user-product interactions," *Applied Ergonomics*, 41(1), 34–40.

Field, Andy (2013), *Discovering Statistics using IBM SPSS Statistics*, SAGE.

Field, Tiffany, Miguel Diego, Maria Hernandez-Reif, Wendy Cisneros, Larissa Feijo, Yanexy Vera, Karla Gil, Diana Grina, and Qing Claire He (2005), "Lavender fragrance cleansing gel effects on relaxation," *International Journal of Neuroscience*, 115(2), 207–22.

———, Tory Field, Christy Cullen, Shay Largie, Miguel Diego, Saul Schanberg, and Cynthia Kuhn (2008), "Lavender bath oil reduces stress and crying and enhances sleep in very young infants," *Early human development*, 84(6), 399–401.

Fiore, A. M, X. Yah, and E. Yoh (2000), "Effects of a product display and environmental fragrancing on approach responses and pleasurable experiences," *Psychology and*

Marketing, 17(1), 27–54.

Folkes, Valerie, and Shashi Matta (2004), "The effect of package shape on consumers' judgments of product volume: Attention as a mental contaminant," *Journal of Consumer Research*, 31(2), 390–401.

Förster, Jens (1997), "Effect of motor perceptions on affective judgment of attractive and unattractive portraits," *Zeitschrift fur experimentelle Psychologie: Organ der Deutschen Gesellschaft fur Psychologie*, 45(2), 167–82.

Frieling, Heinrich (1980), *Farbe hilft verkaufen: Farbenlehre und Farbenpsychologie für Handel und Werbung*, Muster-Schmidt Verlag.

Frye, Richard E., Brian S. Schwartz, and Richard L. Doty (1990), "Dose-related effects of cigarette smoking on olfactory function," *JAMA*, 263(9), 1233–36.

Garber, Lawrence L., Raymond R. Burke, and J. Morgan Jones (2000), "The role of package color in consumer purchase consideration and choice," *Working paper- Marketing Science Institut , Cambridge*.

Gaye, Morgaine (2010), "Advertising and the Advent of Olfactory Marketing," in *Texas A&M, AFCERC, FDRC Annual Conference*, Florida.

Gilbert, Avery N., Robyn Martin, and Sarah E. Kemp (1996), "Cross-modal correspondence between vision and olfaction: The color of smells," *The American journal of psychology*, 335–51.

Gorn, Gerald J., Amitava Chattopadhyay, Jaideep Sengupta, and Shashank Tripathi (2004), "Waiting for the web: how screen color affects time perception," *Journal of marketing research*, 41(2), 215–25.

Gottfried, Jay A., and Raymond J. Dolan (2003), "The Nose Smells What the Eye Sees: Crossmodal Visual Facilitation of Human Olfactory Perception," *Neuron*, 39(2), 375–86.

Grammer, Karl (1993), "5-α-androst-16en-3α-on: a male pheromone? A brief report," *Ethology and Sociobiology*, 14(3), 201–7.

Green, Robert T. (1958), "The Attention-Getting Value of Structural Change," *British Journal of Psychology*, 49(4), 311–14.

Greenwald, Anthoy G., and Shelly D. Farnham (2000), "Using the Implicit Association Test to Measure Self-Esteem and Self-Concept* 1," *Journal of Personality and Social Psychology*, 79(6), 1022–38.

———, Debbie E. McGhee, and Jordan L.K. Schwartz (1998), "Measuring Individual Differences in Implicit Cognition: The Implicit Association Test," *Journal of Personality and Social Psychology*, 74(6), 1464–80.

Grill, Stephanie (2007), "Dufte Kinowerbung," Werben & Verkaufen, (37), 34–35.

Grohmann, Bianca (2009), "Gender dimensions of brand personality," *Journal of Marketing Research*, 46(1), 105–19.

Grossman, Randi Priluck, and Joseph Z. Wisenblit (1999), "What we know about consumers' color choices," *Journal of marketing practice: Applied marketing science*, 5(3), 78–88.

Guéguen, Nicolas, and Christine Petr (2006), "Odors and consumer behavior in a restaurant," *International Journal of Hospitality Management*, 25(2), 335–39.

Gulas, Charles S., and Peter H. Bloch (1995), "Right under our noses: Ambient scent and consumer responses," *Journal of Business and Psychology*, 10(1), 87–98.

Haller, R., C. Rummel, S. Henneberg, U. Pollmer, and E. P. Köster (1999), "The influence of early experience with vanillin on food preference later in life," *Chemical senses*, 24, 465–67.

Hansen, Torben, and Suzanne C Beckmann (2007), "Consumers' Judgmental, Emotional and Intentional Responses to Scented Food," in *ANZMAC*.

———, Anders Bruun-Christensen, and Jonas Schauman (2006), "Consumers' emotions, cognition and approach/avoidance behaviour in relation to scented food products," in *The 5th International Congress Marketing Trends*.

Hasin-Brumshtein, Yehudit, Doron Lancet, and Tsviya Olender (2009), "Human olfaction: from genomic variation to phenotypic diversity," *Trends in Genetics*, 25(4), 178–84.

Hatt, Hans (1990), "Physiologie des Riechensund Schmeckens," in *Vom Reiz der Sinne*, A. Maelicke and H. M. Emrich, eds., Weinheim: Wiley VCH Verlag GmbH, 93–126.

Heckler, Susan E., and Terry L. Childers (1992), "The role of expectancy and relevancy in memory for verbal and visual information: what is incongruency?," *Journal of Consumer Research*, 18(4), 475–92.

Hehn, Patrick, and Günter Silberer (2008), "Wirkung von Duft in der Markenführung," in *Impulse für die Markenforschung und Markenführung*, C. Baumgarth, G. Kelemci Schneider, and B. Ceritoğlu, eds., Wiesbaden: GWV Fachverlage, 41–63.

Hekkert, P. (2006), "Design aesthetics: Principles of pleasure in design," *Psychology Science*, 48(2), 157.

Heller, Morton A. (1982), "Visual and tactual texture perception: Intersensory cooperation," *Perception & psychophysics*, 31(4), 339–44.

Henderson, Pamela W., and Joseph A. Cote (1998), "Guidelines for Selecting or Modifying Logos.," *Journal of Marketing*, 62(2).

———, ———, Siew Meng Leong, and Bernd Schmitt (2003), "Building strong brands in Asia: selecting the visual components of image to maximize brand strength," *International Journal of Research in Marketing*, 20(4), 297–313.

———, Joan L. Giese, and Joseph A. Cote (2004), "Impression management using typeface design," *Journal of Marketing*, 68, 60–72.

Hertenstein, Julie H., Marjorie B. Platt, and Robert W. Veryzer (2005), "The Impact of Industrial Design Effectiveness on Corporate Financial Performance*," *Journal of Product Innovation Management*, 22(1), 3–21.

Herz, Rachel (2010), "The Emotional, Cognitive, and Biological Basics of Olfaction: Implications and Considerations for Scent Marketing," in *Sensory Marketing - Research on the sensuality of products*, A. Krishna, ed., New York, London: Taylor and Francis Group, 87–108.

———, and Trygg Engen (1996), "Odor memory: Review and analysis," *Psychonomic Bulletin & Review*, 3(3), 300–313.

Herz, Rachel S. (2003), "The Effect of Verbal Context on Olfactory Perception," *Journal of Experimental Psychology: General*, 132(4), 595–606.

——— (2009), "Aromatherapy facts and fictions: a scientific analysis of olfactory effects on mood, physiology and behavior," *International Journal of Neuroscience*, 119(2), 263–90.

———, Sophia L. Beland, and Margaret Hellerstein (2004), "Changing odor hedonic perception through emotional associations in humans," *International journal of comparative psychology*, 17(4), 315–38.

———, and Julia von Clef (2001), "The influence of verbal labeling on the perception of odors: Evidence for olfactory illusions?," *Perception*, 30(3), 381–92.

Herz, Rachel S, James Eliassen, Sophia Beland, and Timothy Souza (2004), "Neuroimaging evidence for the emotional potency of odor-evoked memory," *Neuropsychologia*, 42(3), 371–78.

Herz, Rachel S., and Jonathan W. Schooler (2002), "A Naturalistic Study of Autobiographical Memories Evoked by Olfactory and Visual Cues: Testing the Proustian Hypothesis," *The American Journal of Psychology*, 115(1), 21–32.

Heuberger, Eva, Tapanee Hongratanaworakit, Carina Böhm, Ruth Weber, and Gerhard Buchbauer (2001), "Effects of Chiral Fragrances on Human Autonomic Nervous System Parameters and Self-evaluation," *Chemical Senses*, 26(3), 281–92.

Hinton, Patricia B., and Tracy B. Henley (1993), "Cognitive and affective components of stimuli presented in three modes.," *Bulletin of the Psychonomic Society*, 31(6), 595–98.

Hirsch, Alan R. (1995), "Effects of ambient odors on slot-machine usage in a las vegas casino," *Psychology and Marketing*, 12(7), 585–94.

Hirschman, Elizabeth C. (1986), "The effect of verbal and pictorial advertising stimuli on aesthetic, utilitarian and familiarity perceptions," *Journal of Advertising*, 15(2), 27–34.

Holland, Rob W., Merel Hendriks, and Henk Aarts (2005), "Smells Like Clean Spirit," *Psychological Science*, 16(9), 689–93.

Homewood, Judi, and Richard J. Stevenson (2001), "Differences in naming accuracy of odors presented to the left and right nostrils," *Biological psychology*, 58(1), 65–73.

Houston, Michael J., Terry L. Childers, and Susan E. Heckler (1987), "Picture-word consistency and the elaborative processing of advertisements," *Journal of Marketing Research*, 359–69.

Hultén, Bertil, Niklas Broweus, and Marcus van Dijk (2009), *Sensory Marketing*, Palgrave Macmillan.

Hunt, Shelby D., and Scott Vitell (1986), "A general theory of marketing ethics," *Journal of macromarketing*, 6(1), 5–16.

Hvastja, Loredana, and Luchia Zanuttini (1991), "Recognition of Nonexplicitly Presented Odors," *Perceptual and Motor Skills*, 72(1), 883–92.

Jellinek, Stephan J., and Egon P. Köster (1983), "Perceived fragrance complexity and its relationship to familiarity and pleasantness 2," *J. Soc. Cosmet. Chem.*, 34, 83–97.

Jönsson, Fredrik U., and Mats J. Olsson (2012), "Knowing what we smell," in *Olfactory Cognition*, G. M. Zucco, R. S. Herz, and B. Schaal, eds., Amsterdam, Philadelphia: John Benjamins B.V., 115–36.

Karjalainen, Toni-Matti, and Dirk Snelders (2010), "Designing Visual Recognition for the Brand*," *Journal of Product Innovation Management*, 27(1), 6–22.

Kaul, Anil, and Vithala R. Rao (1995), "Research for product positioning and design decisions: An integrative review," *International Journal of research in Marketing*, 12(4), 293–320.

Kauppinen-Räisänen, Hannele, and Harri T. Luomala (2010), "Exploring consumers' product-specific colour meanings," *Qualitative Market Research: An International Journal*, 13(3), 287–308.

Keller, Kevin Lane (2003), *Strategic brand management: building, measuring, and managing brand equity*, Prentice Hall.

Kemp, Sarah E., and Avery N. Gilbert (1997), "Odor intensity and color lightness are correlated sensory dimensions.," *The American journal of psychology*, 110(1), 35–46.

Kirk-Smith, M. D., and D. A. Booth (1987), "Chemoreception in human behaviour: experimental analysis of the social effects of fragrances," *Chemical Senses*, 12(1), 159–66.

Kirmani, Amna, and Baba Shiv (1998), "Effects of source congruity on brand attitudes and beliefs: the moderating role of issue-relevant elaboration," *Journal of Consumer Psychology*, 7(1), 25–47.

Klaschka, Ursula (2010), "Risk management by labelling 26 fragrances?: Evaluation of Article 10 (1) of the seventh Amendment (Guideline 2003/15/EC) of the Cosmetic Directive," *International Journal of Hygiene and Environmental Health*, 213(4), 308–20.

Knasko, Susan C. (1992), "Ambient odor's effect on creativity, mood, and perceived health," *Chemical Senses*, 17(1), 27–35.

———, Avery N. Gilbert, and John Sabini (1990), "Emotional State, Physical Well-Being, and Performance in the Presence of Feigned Ambient Odor1," *Journal of Applied Social Psychology*, 20(16), 1345–57.

Knoblich, Hans, Andreas Scharf, and Bernd Schubert (2003), *Marketing mit Duft*, München, Wien: R. Oldenbourg Verlag.

Konstantinidis, Iordanis, Thomas Hummel, and Maria Larsson (2006), "Identification of unpleasant odors is independent of age," *Archives of clinical neuropsychology*, 21(7), 615–21.

Köster, Egon Peter (2003), "The psychology of food choice: some often encountered fallacies," *Food Quality and Preference*, 14(5), 359–73.

Köster, Ego Peter (2002), "The specific characteristics of the sense of smell," *Olfaction, taste, and cognition*, 27–44.

Kreitler, Hans, and Shulamith Kreitler (1972), *Psychology of the Arts*, Duke University Press.

Krider, Robert E., Priya Raghubir, and Aradhna Krishna (2001), "Pizzas: π or square? Psychophysical biases in area comparisons," *Marketing Science*, 20(4), 405–25.

Krishna, Aradhna (2012), "An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior," *Journal of Consumer Psychology*, 22, 332–51.

——— (2013), *Customer Sense: How the 5 Senses Influence Buying Behavior*, New York: Palgrave Macmillan.

———, May O. Lwin, and Maureen Morrin (2010), "Product Scent and Memory," *Journal of Consumer Research*, 37(1), 57–67.

Krishna, Aradnha, Ryan S. Elder, and Cindy Caldara (2010), "Feminine to smell but masculine to touch? Multisensory congruence and its effect on the aesthetic experience,"

Journal of Consumer Psychology, 20(4), 410–18.

Laird, Donald A. (1932), "How the consumer estimates quality by subconscious sensory impressions.," *Journal of Applied psychology*, 16(3), 241.

Lang, Peter J. (1979), "A bio-informational theory of emotional imagery," *Psychophysiology*, 16(6), 495–512.

Larsson, Maria, Deborah Finkel, and Nancy L. Pedersen (2000), "Odor Identification," *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 55(5), P304–10.

Laurienti, Paul J., Jonathan H. Burdette, Mark T. Wallace, Yi-Fen Yen, Aaron S. Field, and Barry E. Stein (2002), "Deactivation of sensory-specific cortex by cross-modal stimuli," *Journal of Cognitive Neuroscience*, 14(3), 420–29.

Lawless, Harry (1990), "Applications of experimental psychology in sensory evaluation," in *Psychological Basis of Sensory Evaluation*, London-New York: Elsevier Applied Science, 69–91.

———, and Trygg Engen (1977), "Associations to odors: interference, mnemonics, and verbal labeling.," *Journal of Experimental Psychology: Human Learning and Memory*, 3(1), 52–59.

Lazarus, Richard S. (1991), *Emotion and adaptation*, New York: Oxford University Press.

LeDoux, Joseph (1998), "Fear and the brain: where have we been, and where are we going?," *Biological Psychiatry*, 44(12), 1229–38.

Lee, Yih Hwai, and Charlotte Mason (1999), "Responses to information incongruency in advertising: The role of expectancy, relevancy, and humor," *Journal of consumer research*, 26(2), 156–69.

Legrum, Wolfgang (2011), *Riechstoffe, Zwischen Gestank und Duft*, Wiesbaden: Vieweg Verlag, Friedr, & Sohn Verlagsgesellschaft mbH.

Lehrner, J., Christine Eckersberger, P. Walla, G. Pötsch, and L. Deecke (2000), "Ambient odor of orange in a dental office reduces anxiety and improves mood in female patients," *Physiology & behavior*, 71(1), 83–86.

Levine, John M., and Donald McBurney (1986), "Physical Appearance, Stigma, and Social Behavior: The Ontario Symposium," in *The role of olfaction in social perception and behavior*, 3, Hillsdale, NJ: LEA, 179–217.

Levine, Linda J., Heather C. Lench, and Martin A. Safer (2009), "Functions of remembering and misremembering emotion," *Applied Cognitive Psychology*, 23(8), 1059–75.

Lindström, Martin (2005), *Brand Sense: How to build powerful brands through touch, taste,*

smell, sight & sound, London, UK: Kogan Page Publishers.

Lledo, P. M., G. Gheusi, and J. D. Vincent (2005), "Information processing in the mammalian olfactory system," *Physiological Reviews*, 85(1), 281–317.

Lorig, Tyler S. (1999), "On the similarity of odor and language perception," *Neuroscience & Biobehavioral Reviews*, 23(3), 391–98.

Louviere, Jordan J., and Towhidul Islam (2008), "A comparison of importance weights and willingness-to-pay measures derived from choice-based conjoint, constant sum scales and best–worst scaling," *Journal of Business Research*, 61(9), 903–11.

Ludden, Geke D. S., and Hendrik N. J. Schifferstein (2009), "Should Mary smell like biscuit? Investigating scents in product design," *International Journal of Design*, 3(3), 1–12.

Ludden, Geke D.S, Hendrik N. J. Schifferstein, and P. Hekkert (2008), "Surprise as a design strategy," *Design Issues*, 24(2), 28–38.

Ludden, Geke D.S., Hendrik N. J. Schifferstein, and Paul Hekkert (2006), "Sensory incongruity: comparing vision to touch, audition and olfaction," in *Proceedings of the 5th Design and Emotion Conference, Göteborg, Sweden*, 27–29.

Ludvigson, H. Wayne, and Theresa R. Rottman (1989), "Effects of ambient odors of lavender and cloves on cognition, memory, affect and mood," *Chemical Senses*, 14(4), 525–36.

Luomala, Harri T., and Martti Laaksonen (2000), "Contributions from mood research," *Psychology & Marketing*, 17(3), 195–233.

Lüscher, Max (1969), *The Luscher Color Test*, Basel: Test-Verlag.

Lwin, May O., and Maureen Morrin (2012), "Scenting movie theatre commercials: The impact of scent and pictures on brand evaluations and ad recall," *Journal of Consumer Behaviour*, 11(3), 264–72.

———, ———, and Aradhna Krishna (2010), "Exploring the superadditive effects of scent and pictures on verbal recall: An extension of dual coding theory," *Journal of Consumer Psychology*, 20(3), 317–26.

Maiwald, Denise, Aaron Ahuvia, Björn S. Ivens, and Philipp A. Rauschnabel (2013), "The Hijacking Effect of Ambient Scent," *Marketing Review St. Gallen*, 30(2), 50–59.

Mandel, Naomi, and Eric J. Johnson (2002), "When web pages influence choice: effects of visual primes on experts and novices," *Journal of Consumer Research*, 29(2), 235–45.

Mandler, George (1982), "The structure of value: Accounting for taste," in *Affect and cognition: The seventeenth annual Carnegie Symposium on Cognition*, M. S. Clark and S. T. Fiske, eds., Hillsdale, NJ: L. Erlbaum Associates, 3–36.

Marieb, Elaine Nicpon (2006), *Essential of Human Anatomy & Physiology*, Pearson-Benjamin Cummings.

Mattila, Anna S., and Jochen Wirtz (2001), "Congruency of scent and music as a driver of in-store evaluations and behavior," *Journal of Retailing*, 77(2), 273–89.

McPherson, Ann, and Anne Moran (1994), "The significance of fragrance and olfactory acuity for the consumer household product market," *Journal of Consumer Studies & Home Economics*, 18(3), 239–51.

Mehrabian, Albert, and James A. Russell (1974), *An approach to environmental psychology.*, Cambridge, MA, US: the MIT Press.

Meyers-Levy, Joan, and Alice M. Tybout (1989), "Schema congruity as a basis for product evaluation," *Journal of Consumer research*, 16(1), 39–54.

———, and Rui Juliet Zhu (2010), "Gender differences in the meanings consumers infer from music and other aesthetic stimuli," *Journal of Consumer Psychology*, 20(4), 495–507.

Milotic, D. (2003), "The impact of fragrance on consumer choice," *Journal of Consumer Behaviour*, 3(2), 179–91.

Miltner, W., M. Matjak, C. Braun, H. Diekmann, and S. Brody (1994), "Emotional qualities of odors and their influence on the startle reflex in humans," *Psychophysiology*, 31(1), 107–10.

Mitchell, Deborah J., Barbara E. Kahn, and Susan C. Knasko (1995), "There's something in the air: effects of congruent or incongruent ambient odor on consumer decision making," *Journal of Consumer Research*, 229–38.

Morrin, Maureen (2010), "Scent Marketing," in *Sensory Marketing: Research on the sensuality of products*, A. Krishna, ed., New York, London: Routledge, 75–86.

———, and S Ratneshwar (2000), "The impact of ambient scent on evaluation, attention, and memory for familiar and unfamiliar brands," *Journal of Business Research*, 49(2), 157–65.

———, and S. Ratneshwar (2003), "Does it make sense to use scents to enhance brand memory?," *Journal of Marketing Research*, 40(1), 10–25.

Morrin, M., and S. Ratneshwar (2000), "The impact of ambient scent on evaluation, attention, and memory for familiar and unfamiliar brands," *Journal of Business Research*, 49(2), 157–65.

Morrison, Michael, Sarah Gan, Chris Dubelaar, and Harmen Oppewal (2011), "In-store music and aroma influences on shopper behavior and satisfaction," *Journal of Business Research*, 64(6), 558–64.

Morrot, Gil, Frédéric Brochet, and Denis Dubourdieu (2001), "The Color of Odors," *Brain and Language*, 79(2), 309–20.

Moskowitz, Howard R., Andrew Dravnieks, and Leon A. Klarman (1976), "Odor intensity and pleasantness for a diverse set of odorants," *Perception & Psychophysics*, 19(2), 122–28.

Muehling, Darrel D., and Vincent J. Pascal (2011), "An empirical investigation of the differential effects of personal, historical, and non-nostalgic advertising on consumer responses," *Journal of Advertising*, 40(2), 107–22.

Nölke, Stephan Vincent, and Christiane Gierke (2011), *Das 1x1 des multisensorischen Marketings*, Cologne: comevis.

Nosek, Brian A., Anthony G. Greenwald, and Mahzahrin R. Banaji (2007), "The Implicit Association Test at age 7: A methodological and conceptual review," in *Social psychology and the unconscious: The automaticity of higher mental processes*, J. A. Bargh, ed., Psychology Press, 265–92.

Ohloff, Günther (1996), *Irdische Düfte - himmlische Lust: Kulturgeschichte der Duftstoffe*, Insel-Verlag.

Orth, Ulrich R., and Aurelie Bourrain (2005), "Ambient scent and consumer exploratory behaviour: a causal analysis," *Journal of Wine Research*, 16(2), 137–50.

———, Daniela Campana, and Keven Malkewitz (2010), "Formation of consumer price expectation based on package design: attractive and quality routes," *The Journal of Marketing Theory and Practice*, 18(1), 23–40.

———, Frauke Heinrich, and Keven Malkewitz (2012), "Servicescape interior design and consumers' personality impressions," *Journal of Services Marketing*, 26(3), 194–203.

———, and Keven Malkewitz (2008), "Holistic package design and consumer brand impressions," *Journal of Marketing*, 72(3), 64–81.

Österbauer, Robert A., Paul M. Matthews, Mark Jenkinson, Christian F. Beckmann, Peter C. Hansen, and Gemma A. Calvert (2005), "Color of Scents: Chromatic Stimuli Modulate Odor Responses in the Human Brain," *Journal of Neurophysiology*, 93(6), 3434–41.

Overby, Jeffrey W., Robert B. Woodruff, and Sarah Fisher Gardial (2005), "The influence of culture upon consumers' desired value perceptions: A research agenda," *Marketing Theory*, 5(2), 139–63.

Peck, J., and T. L. Childers (2008), "Sensory factors and consumer behavior," *Handbook of consumer psychology*, 193–219.

Peck, Joann, and Terry L. Childers (2006), "If I touch it I have to have it: Individual and environmental influences on impulse purchasing," *Journal of business research*, 59(6), 765–

69.

———, and ——— (2008), “Effects of Sensory factors on Consumer Behavior - If It Tastes, Smells, Sounds, and Feels Like a Duck, Then It Must Be a…: Effects of Sensory Factors on Consumer Behaviors,” in *Handbook of consumer psychology*, C. P. Haugtvedt, P. Herr, and F. R. Kardes, eds., New York, Howe: Taylor Francis Group, 193–219.

Perl, Eliezer, Uzi Shay, Raphael Hamburger, and Jacob E. Steiner (1992), “Taste-and odor-reactivity in elderly demented patients,” *Chemical senses*, 17(6), 779–94.

Persson, Viktor (2011), “Crossmodal correspondences between visual, olfactory and auditory information,” Stockholm.

Peterson, Robert A., and Matthew Sauber (1983), “A mood scale for survey research,” in *Proceedings of the American Marketing Association’s Educators Conference*, American Marketing Association, 409–14.

Peters-Texeira, Angela, and Neela Badrie (2005), “Consumers’ perception of food packaging in Trinidad, West Indies and its related impact on food choices,” *International journal of consumer studies*, 29(6), 508–14.

Petty, Richard E., and John T. Cacioppo (1986), *The elaboration likelihood model of persuasion: Central and peripheral routes to attitude change*, New York: Springer.

———, and Duane T. Wegener (1999), “The elaboration likelihood model: Current status and controversies.,” in *Dual-process theories in social psychology*, S. Chaiken and Y. Trope, eds., New , NY: Guilford, 41–72.

Piqueras-Fiszman, Betina, and Charles Spence (2011), “Crossmodal correspondences in product packaging. Assessing color–flavor correspondences for potato chips (crisps),” *Appetite*, Feeding infants and young children: guidelines, research and practice, 57(3), 753–57.

Preacher, Kristopher J., and Andrew F. Hayes (2004), “SPSS and SAS procedures for estimating indirect effects in simple mediation models,” *Behavior Research Methods, Instruments, & Computers*, 36(4), 717–31.

———, and ——— (2008), “Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models,” *Behavior research methods*, 40(3), 879–91.

Proust, Marcel (2013), *Swann’s Way: In Search of Lost Time*, Yale University Press.

Quay, Anthea (2012), “Frozen Food Maker Installs The Smell of Baked Potatoes At Bus Stops,” (accessed March 27, 2014), [available at http://designtaxi.com/news/351562/Frozen-Food-Maker-Installs-The-Smell-of-Baked-Potatoes-At-Bus-Stops/].

Raghubir, P. (2010), "Visual perception: an overview," in *Sensory Marketing: Research on the Sensuality of Products*, A. Krishna, ed., New York, London: Routledge, 201–18.

Raghubir, Priya, and Eric A. Greenleaf (2006), "Ratios in Proportion: what should the shape of the package be?," *Journal of Marketing*, 70(2), 95–107.

———, and Aradhna Krishna (1999), "Vital dimensions in volume perception: can the eye fool the stomach?," *Journal of Marketing Research (JMR)*, 36(3).

Rolls, Edmund T, Hugo D Critchley, Roger Mason, and Edward A Wakeman (1996), "Orbitofrontal cortex neurons: role in olfactory and visual association learning," *Journal of Neurophysiology*, 75(5), 1970–82.

Rouby, C., S. Pouliot, and M. Bensafi (2009), "Odor hedonics and their modulators," *Food Quality and Preference*, 20(8), 545–49.

Schaal, Benoist (2012), "Emerging chemosensory preferences Another playground for the innate-acquired," in *Olfactory cognition*, G. M. Zucco, R. S. Herz, and B. Schaal, eds., Amsterdam, Philadelphia: John Benjamins Publishing, 237–68.

———, R. Soussignan, L. Marlier, F. Kontar, I. S. Karima, and R. Tremblay (1997), "Variability and invariants in early odour preferences: Comparative data from children belonging to three cultures," *Chemical Senses*, 22, 191–236.

Scharf, Andreas, and Hans-Peter Volkmer (2000), "The impact of olfactory product expectations on the olfactory product experience," *Food quality and preference*, 11(6), 497–503.

Scheinman, Pamela L (1996), "Allergic contact dermatitis to fragrance: a review," *American journal of contact dermatitis: official journal of the American Contact Dermatitis Society*, 7(2), 65–76.

Schifferstein, Hendrik, and Marc Cleiren (2005), "Capturing product experiences: a split-modality approach," *Acta psychologica*, 118(3), 293–318.

Schifferstein, Hendrik N. J., and Sylvia T. Blok (2002), "The signal function of thematically (in) congruent ambient scents in a retail environment," *Chemical senses*, 27(6), 539–49.

Schifferstein, Hendrik N.J., and Pieter M.A Desmet (2007), "The effects of sensory impairments on product experience and personal well-being," *Ergonomics*, 50(12), 2026–48.

Schifferstein, Hendrik N. J., and Anne M. K. Michaut (2002), "Effects of appropriate and inappropriate odors on product evaluations," *Perceptual and Motor Skills*, 95(3f), 1199–1214.

Schifferstein, Hendrik N. J, and Charles Spence (2008), "Multisensory Product Experience," in *Product Experience*, H. N. J. Schifferstein and P. Hekkert, eds., Oxford, UK: Elsevier,

133–61.

Schifferstein, Hendrik N.J, and Inge Tanudjaja (2004), "Visualising fragrances through colours: the mediating role of emotions," *Perception-London*, 33(10), 1249–66.

Schifferstein, Hendrk N.J (2006), "The perceived importance of sensory modalities in product usage: A study of self-reports," *Acta psychologica*, 121(1), 41–64.

Schoormans, Jan PL, and Henry SJ Robben (1997), "The effect of new package design on product attention, categorization and evaluation," *Journal of Economic Psychology*, 18(2), 271–87.

Schwarz, Norbert, and Gerald L. Clore (2003), "Mood as information: 20 years later," *Psychological Inquiry*, 14(3-4), 296–303.

Seigneuric, Alix, Karine Durand, Tao Jiang, Jean Yves Baudouin, and Benoist Schaal (2010), "The nose tells it to the eyes: Crossmodal associations between olfaction and vision," *Perception*, 39(11), 1541–54.

Senger, Emily (2011), "Scent-free policies generally unjustified," *CMAJ : Canadian Medical Association Journal*, 183(6), E315–16.

Seo, Han-Seok, Ernst Roidl, Friedrich Müller, and Simona Negoias (2010), "Odors enhance visual attention to congruent objects," *Appetite*, 54(3), 544–49.

Seo, H. S, A. Arshamian, K. Schemmer, I. Scheer, T. Sander, G. Ritter, and T. Hummel (2010), "Cross-modal integration between odors and abstract symbols," *Neuroscience letters*, 478(3), 175–78.

Shiu, Eric, David Walker, and Chi Jyun Cheng (2006), "A Theoretical Investigation into the Potential Applications of Olfactory Cues to the Marketing of New Products," *Innovative Marketing*, 2(4), 44–53.

Siemer, Matthias (2005), "Moods as multiple-object directed and as objectless affective states: An examination of the dispositional theory of moods," *Cognition & Emotion*, 19(6), 815–45.

Smith, N. Craig, and John A. Quelch (1993), *Ethics in marketing*, Irwin Homewood, IL.

Spangenberg, Eric R., Ayn E. Crowley, and Pamela W. Henderson (1996), "Improving the store environment: do olfactory cues affect evaluations and behaviors?," *The Journal of Marketing*, 67–80.

———, Bianca Grohmann, and David E. Sprott (2005), "It's beginning to smell (and sound) a lot like Christmas: the interactive effects of ambient scent and music in a retail setting," *Journal of Business Research*, 58(11), 1583–89.

Spangenberg, E. R., D. E. Sprott, B. Grohmann, and D. L. Tracy (2006), "Gender-congruent

ambient scent influences on approach and avoidance behaviors in a retail store," *Journal of Business Research*, 59(12), 1281–87.

Spence, Charles (2002), "The ICI report on the secret of the senses," *The Communication Group, London*.

——— (2011), "Crossmodal correspondences: a tutorial review," *Attention, Perception, & Psychophysics*, 73(4), 971–95.

Stangor, Charles, and David McMillan (1992), "Memory for expectancy-congruent and expectancy-incongruent information: A review of the social and social developmental literatures.," *Psychological Bulletin*, 111(1), 42–61.

Steiner, Jacob E. (1979), "Human facial expressions in response to taste and smell stimulation," in *Advances in child development and behavior*, H. W. Reese and L. P. Lipsitt, eds., London: Academic Press, 257–95.

Stephens, Jeff (2007), "Stop and Smell the Brand," *ABA Bank Marketing*, 39(8), 30–34.

Stevens, Joseph C., Linda M. Bartoshuk, and William S. Cain (1984), "Chemical senses and aging: taste versus smell," *Chemical Senses*, 9(2), 167–79.

Stevenson, Richard J., and Robert A. Boakes (2003), "A mnemonic theory of odor perception.," *Psychological review*, 110(2), 340–64.

Stoll, Marco, Sebastian Baecke, and Peter Kenning (2008), "What they see is what they get? An fMRI-study on neural correlates of attractive packaging," *Journal of Consumer Behaviour*, 7(4-5), 342–59.

Sulmont, Claire, Sylvie Issanchou, and E.P. Köster (2002), "Selection of Odorants for Memory Tests on the Basis of Familiarity, Perceived Complexity, Pleasantness, Similarity and Identification," *Chemical Senses*, 27(4), 307–17.

Summers, Teresa A., and Paulette R. Hebert (2001), "Shedding some light on store atmospherics: influence of illumination on consumer behavior," *Journal of business research*, 54(2), 145–50.

Sung, Yongjun, and Spencer F. Tinkham (2005), "Brand personality structures in the United States and Korea: Common and culture-specific factors," *Journal of Consumer Psychology*, 15(4), 334–50.

Teas, R. Kenneth, and Sanjeev Agarwal (2000), "The effects of extrinsic product cues on consumers' perceptions of quality, sacrifice, and value," *Journal of the Academy of Marketing Science*, 28(2), 278–90.

Trommsdorff, Volker, and Thorsten Teichert (2011), *Konsumentenverhalten*, Stuttgart: W. Kohlhammer Verlag.

Tsalikis, John, and David J. Fritzsche (1989), "Business ethics: A literature review with a focus on marketing ethics," *Journal of Business Ethics*, 8(9), 695–743.

Tubaldi, Federico, Caterina Ansuini, Roberto Tirindelli, and Umberto Castiello (2009), "The Effects of Task-Irrelevant Olfactory Information on the Planning and the Execution of Reach-to-Grasp Movements," *Chemosensory Perception*, 2(1), 25–31.

Underwood, Robert L., and Noreen M. Klein (2002), "Packaging as brand communication: effects of product pictures on consumer responses to the package and brand," *Journal of Marketing Theory and Practice*, 58–68.

Vande Kamp, Mark E. (2002), "Auditory implicit association tests," Washington: University of Washington.

VDI 3882 Blatt 1:1992-10 (1992), "Olfaktometrie; Bestimmung der Geruchsintensität," (accessed September 27, 2014), [available at http://www.beuth.de/de/technische-regel/vdi-3882-blatt-1/936711].

Veryzer, Robert W. (1999), "A nonconscious processing explanation of consumer response to product design," *Psychology & Marketing*, 16(6), 497–522.

Vlahos, James (2007), "Scent and Sensibility," *New York Times*.

Wansink, Brian (1996), "Can package size accelerate usage volume?," *The Journal of Marketing*, 60, 1–14.

———, and Koert Van Ittersum (2003), "Bottoms up! The influence of elongation on pouring and consumption volume," *Journal of Consumer Research*, 30(3), 455–63.

Ward, Philipp A., Barry J. Davies, and Dion Kooijman (2003), "Ambient smell and the retail environment: relating olfaction research to consumer behavior," *Journal of business and management*, 9(3), 289–302.

Warrenburg, Stephen (2005), "Effects of fragrance on emotions: moods and physiology," *Chemical Senses*, 30(suppl 1), i248–49.

Wasserman, Edward A., and Ralph R. Miller (1997), "What's elementary about associative learning?," *Annual review of psychology*, 48(1), 573–607.

Weinberg, Peter, and Wolfgang Gottwald (1982), "Impulsive consumer buying as a result of emotions," *Journal of Business research*, 10(1), 43–57.

Westerink, Joyce, and Slava Kozlov (2004), "Freshness in Oral Care: Attributes and Time-Dependency of a Multidimensional, Dynamic Concept," *Journal of Sensory Studies*, 19(3), 171–92.

De Wijk, Rene A., Frank R. Schab, and William S. Cain (1995), "Odor identification," *Memory for odors*, 21–37.

Willander, Johan, and Maria Larsson (2007), "Olfaction and emotion: The case of autobiographical memory," *Memory & Cognition*, 35(7), 1659–63.

Wright, Alice A., and John G. Lynch (1995), "Communication effects of advertising versus direct experience when both search and experience attributes are present," *Journal of consumer research*, 708–18.

Yang, Sha, and Priya Raghubir (2005), "Can bottles speak volumes? The effect of package shape on how much to buy," *Journal of Retailing*, 81(4), 269–81.

Yeshurun, Yaara, and Noam Sobel (2010), "An odor is not worth a thousand words: from multidimensional odors to unidimensional odor objects," *Annual review of psychology*, 61, 219–41.

Young, Maia J., Larissa Z. Tiedens, Heajung Jung, and Ming-Hong Tsai (2011), "Mad enough to see the other side: Anger and the search for disconfirming information," *Cognition and Emotion*, 25(1), 10–21.

Zelano, Christina, Jessica Montag, Rehan Khan, and Noam Sobel (2009), "A Specialized Odor Memory Buffer in Primary Olfactory Cortex," *PLoS ONE*, 4(3), e4965.

Zellner, Debra A., Angela M. Bartoli, and Robert Eckard (1991), "Influence of Color on Odor Identification and Liking Ratings," *The American Journal of Psychology*, 104(4), 547–61.

Appendix

Fig. A-1: Study 2; Questionnaire for t0

C A U	Christian-Albrechts-Universität Kiel	A&F Marketing

Produktbewertung

In diesem Experiment geht es darum zu erfahren, wie Sie folgendes Produkt bewerten.

Bitte beantworten Sie alle Fragen so ehrlich wie möglich. Es gibt keine „richtigen“ oder „falschen“ Antworten. Wir sind an Ihrer ehrlichen Meinung interessiert.

Ihre Informationen bleiben komplett anonym.

Ihre Antworten werden vertraulich behandelt und nicht für kommerzielle Zwecke verwendet.

Um weitere Informationen zu erhalten kontaktieren Sie bitte Frau Nathalie Nibbe (nnibbe@ae.uni-kiel.de) oder Herrn Prof. Dr. U. Orth (uorth@ae.uni-kiel.de).

Vielen Dank für Ihre Mithilfe!

Name:_____

Teil I: Fragen bezüglich der Zahnpastaverpackung auf dem Bildschirm

Bitte schauen sie es sich genau an und beantworten Sie folgende Aussagen:

1.		**7**	**6**	**5**	**4**	**3**	**2**	**1**	
Die Marke ist mir…	Sehr bekannt	○	○	○	○	○	○	○	Überhaupt nicht bekannt
Die Verpackung finde ich…	Sehr attraktiv	○	○	○	○	○	○	○	Sehr unattraktiv
Wie schwer fällt es Ihnen, sich bei verschlossenen Augen, die Verpackung vorzustellen?	Sehr leicht	○	○	○	○	○	○	○	Sehr schwer
Wie schwer würde es Ihnen fallen, dieses Produkt zu einem späteren Zeitpunkt zu beschreiben?	Sehr leicht	○	○	○	○	○	○	○	Sehr schwer

2. Die Zahnpasta ist…	Stimme voll und ganz zu	**7**	**6**	**5**	**4**	**3**	**2**	**1**	Stimme überhaupt nicht zu
…erfrischend.		○	○	○	○	○	○	○	
…modern.		○	○	○	○	○	○	○	
…reinigend.		○	○	○	○	○	○	○	

3.	Stimme voll und ganz zu	**7**	**6**	**5**	**4**	**3**	**2**	**1**	Stimme überhaupt nicht zu
Ich würde das Produkt gerne einmal ausprobieren.		○	○	○	○	○	○	○	
Ich würde dieses Produkt gerne kaufen.		○	○	○	○	○	○	○	
Im Vergleich zu anderen Produkten dieser Art ist es sehr wahrscheinlich, dass ich dieses Produkt kaufen würde.		○	○	○	○	○	○	○	

Fig. A-2: Study 2; Questionnaire for t1

Teil II: Fragen zu Ihrer Person

4.	Stimme voll und ganz zu	7	6	5	4	3	2	1	Stimme überhaupt nicht zu
Dinge zu besitzen, die ein herausragendes Design haben, führen dazu, dass ich mich gut fühle.		○	○	○	○	○	○	○	
Ich schaue mir gerne Werbung für Produkte mit herausragendem Design an.		○	○	○	○	○	○	○	
Das Design eines Produktes ist für mich eine Quelle des Wohlbefindens.		○	○	○	○	○	○	○	
Schöne Dinge machen unsere Welt lebenswert.		○	○	○	○	○	○	○	
Manchmal habe ich das Gefühl, dass auf Grund des Designs eines Produkts der Eindruck entsteht, es würde sich nach mir ausstrecken und mich berühren.		○	○	○	○	○	○	○	
Sofern das Design eines Produktes mich wirklich anspricht, verspüre ich das Gefühl dieses kaufen zu müssen.		○	○	○	○	○	○	○	
Ich halte mich für eine Person, die stark auf Gerüche reagiert.		○	○	○	○	○	○	○	
Beim Kauf eines Produkts, achte ich sehr auf den Geruch.		○	○	○	○	○	○	○	
Wenn ich ein Produkt gerne riechen mag, kaufe ich es.		○	○	○	○	○	○	○	

5. Die folgenden Aussagen beschreiben, wie sich Menschen in Einkaufssituationen fühlen können. Bitte kreuzen Sie an inwiefern Sie mit den Aussagen übereinstimmen.

	Stimme voll und ganz zu	7	6	5	4	3	2	1	Stimme überhaupt nicht zu
Einkaufen ist ein wahrer Genuss.		○	○	○	○	○	○	○	
Während eines Einkaufs erledige ich immer nur das, was zu erledigen ist.		○	○	○	○	○	○	○	
Ich versuche nur die Sachen zu kaufen, die ich benötige		○	○	○	○	○	○	○	
Die Shopping-Jagd sorgt bei mir für Spannung/ Nervenkitzel.		○	○	○	○	○	○	○	

6. Ich bin ____ Jahre alt, und ○ weiblich ○ männlich

C | A | U Christian-Albrechts-Universität Kiel | A&F Marketing

Produktbewertung

Im zweiten Teil des Experiments geht es erneut darum Ihre Meinung zu erfahren.

Bitte beantworten Sie alle Fragen so ehrlich wie möglich. Es gibt keine „richtigen“ oder „falschen“ Antworten. Wir sind an Ihrer ehrlichen Meinung interessiert.

Ihre Informationen bleiben komplett anonym.

Ihre Antworten werden vertraulich behandelt und nicht für kommerzielle Zwecke verwendet.

Um weitere Informationen zu erhalten kontaktieren Sie bitte Frau Nathalie Nibbe (nnibbe@ae.uni-kiel.de) oder Herrn Prof. Dr. U. Orth (uorth@ae.uni-kiel.de).

Vielen Dank für Ihre Mithilfe!

Name:_____

Teil I: Erinnerung

1. Bitte beschreiben Sie stichwortartig das Produkt, das Sie hier beim letzten Mal gesehen haben – Was fällt Ihnen dazu ein?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Teil II: Bewertung des Produkts

2.		7	6	5	4	3	2	1	
Die Verpackung fand ich…	Sehr attraktiv	○	○	○	○	○	○	○	Sehr unattraktiv

3. Das Produkt fand ich …	Stimme voll und ganz zu	7	6	5	4	3	2	1	Stimme überhaupt nicht zu
…erfrischend		○	○	○	○	○	○	○	
…modern		○	○	○	○	○	○	○	
…reinigend		○	○	○	○	○	○	○	

4.	Stimme voll und ganz zu	7	6	5	4	3	2	1	Stimme überhaupt nicht zu
Ich würde das Produkt gerne einmal ausprobieren.		○	○	○	○	○	○	○	
Ich würde dieses Produkt gerne kaufen.		○	○	○	○	○	○	○	
Im Vergleich zu anderen Produkten dieser Art ist es sehr wahrscheinlich, dass ich dieses Produkt kaufen würde		○	○	○	○	○	○	○	

Fig. A-3: Study 3; Questionnaire for t0

Fragebogen

1 Für den Verantwortlichen

Welche Kombination (Zahnpasta/ Duft) bekommt der Proband vorgelegt?

- grüne Box/keinDuft
- rote Box/kein Duft
- grüne Box/Menthol
- rote Box/Menthol
- grüne Box/Marzipan
- rote Box/Marzipan

2 Start

Herzlich Willkommen!

Im Rahmen eines Projektes der CAU Kiel untersuchen wir, wie Konsumenten Zahnpastaverpackungen wahrnehmen. Ihre Beteiligung ist eine wesentliche Voraussetzung für das Gelingen dieser Arbeit.

Sie bleiben anonym!

Ihre Antworten werden selbstverständlich vertraulich behandelt. Sie bleiben anonym und Ihre Antworten werden nicht zu kommerziellen Zwecken verwendet.

Bitte beantworten Sie alle Fragen so gut Sie können. Es gibt keine richtigen oder falschen Antworten. Wir sind lediglich an Ihrer Meinung interessiert.

3 Fragen zur Verpackung

Bitte öffnen Sie nun die Schachtel, die vor Ihnen steht und schauen sich die Zahnpastaverpackung genau an.

Gerne dürfen Sie die Zahnpastaverpackung auch aus der braunen Box herausnehmen, aber lassen Sie bitte die Zahnpastaverpackung geschlossen und nehmen Sie die Tube nicht heraus.

Danach legen Sie bitte die Verpackung zurück und beantworten bitte die folgenden Fragen. Bitte lassen Sie die Schachtel geöffnet vor Ihnen stehen (im markierten Rahmen), um auch während der Beatwortung der Fragen die Verpackung immer wieder anschauen zu können.

Bitte bewerten Sie auf einer Skala von 1 bis 7, inwieweit Sie mit folgenden Aussagen übereinstimmen. Es gibt kein 'richtig' oder 'falsch'.

Die Marke der Zahnpasta ist mir ...

	1	2	3	4	5	6	7	
überhaupt nicht bekannt	○	○	○	○	○	○	○	sehr bekannt

Das Design der Zahnpastaverpackung finde ich...

	1	2	3	4	5	6	7	
sehr unattraktiv	○	○	○	○	○	○	○	sehr attraktiv

Das Design der Verpackung...

	1	2	3	4	5	6	7	
mag ich überhaupt nicht	○	○	○	○	○	○	○	mag ich sehr

Wie schwer fällt es Ihnen, sich dieses Produkt bei geschlossenen Augen vorzustellen?

	1	2	3	4	5	6	7	
sehr schwer	○	○	○	○	○	○	○	sehr leicht

Wie schwer würde es Ihnen fallen, dieses Produkt zu einem späteren Zeitpunkt zu beschreiben?

	1	2	3	4	5	6	7	
sehr schwer	○	○	○	○	○	○	○	sehr leicht

Die Zahnpastaverpackung ist....

	1	2	3	4	5	6	7	
altmodisch	○	○	○	○	○	○	○	modern
unpassend	○	○	○	○	○	○	○	passend
von niederer Qualität	○	○	○	○	○	○	○	von hoher Qualität

4 Zahnpastaeigenschaften

Bitte überlegen Sie sich jetzt, wie Sie die Eigenschaften dieser Zahnpasta auf Grund der Verpackung einschätzen würden und geben an, inwieweit Sie mit folgenden Aussagen übereinstimmen. Es gibt kein 'richtig' oder 'falsch'.

Die Zahnpasta ist....

	Stimme überhaupt nicht zu 1	2	3	weder noch 4	5	6	Stimme voll und ganz zu 7
erfrischend	○	○	○	○	○	○	○
modern	○	○	○	○	○	○	○
reinigend	○	○	○	○	○	○	○

5 Kaufabsicht

Nun interessiert uns, inwieweit Sie bereit wären, die Zahnpasta zu kaufen. Bitte beantworten Sie folgende Aussagen:

	Stimme überhaupt nicht zu 1	2	3	4	5	6	Stimme voll und ganz zu 7
Ich würde das Produckt gerne einmal ausprobieren.	○	○	○	○	○	○	○
Ich würde dieses Produkt gerne kaufen.	○	○	○	○	○	○	○
Im Vergleich zu anderen Produkten dieser Art ist es sehr wahrscheinlich, dass ich dieses Produkt kaufen würde.	○	○	○	○	○	○	○

Der Durchschnittspreis für eine Tube Zahnpasta beträgt 2,00€. Was schätzen Sie, wie teuer diese Zahnpasta ist?

Schätzpreis in €

Und wieviel würden Sie max. dafür ausgeben?

€

6 Mood

Nun interessiert uns noch, wie es Ihnen in diesem Moment geht. Bitte beantworten Sie folgende Aussagen.

Zur Zeit habe ich/ bin ich....

	1	2	3	4	5	6	7	
traurig	○	○	○	○	○	○	○	glücklich
schlechte Laune	○	○	○	○	○	○	○	gute Laune
gereizt	○	○	○	○	○	○	○	zufrieden
bedrückt	○	○	○	○	○	○	○	fröhlich

7 Aussagen zur Person

Die folgenden Aussagen beschreiben, wie sich Menschen in Einkaufssituationen fühlen können. Bitte kreuzen Sie an, inwiefern Sie mit den Aussagen übereinstimmen.

	Stimme überhaupt nicht zu 1	2	3	4	5	6	Stimme voll und ganz zu 7
Einkaufen ist ein wahrer Genuss.	○	○	○	○	○	○	○
Während eines Einkaufs erledige ich immer nur das, was zu erledigen ist.	○	○	○	○	○	○	○
Ich versuche nur die Sachen zu kaufen, die ich benötige.	○	○	○	○	○	○	○
Die Shopping-Jagd sorgt bei mir für Spannung/ Nervenkitzel.	○	○	○	○	○	○	○

8 Grund?

Können Sie sich vorstellen, welchen Hintergrund dieses Experiment hat?
Bitte schreiben Sie kurz Ihre Überlegungen dazu auf.

9 Infos

Bitte geben Sie nun noch ihr Alter und Geschlecht an:

Alter:

Ich bin

weiblich männlich

Bitte geben Sie als Letztes den Ihnen zugewiesenen ID-Code ein:

Code:

10 Endseite

Vielen Dank für Ihre Unterstützung!

Fig. A-4: Study 3; Questionnaire for t1

Fragebogen

1 Für den Verantwortlichen

Welche Kombination (Zahnpasta/ Duft) bekommt der Proband vorgelegt?

- grüne Box/keinDuft
- rote Box/kein Duft
- grüne Box/Menthol
- rote Box/Menthol
- grüne Box/Marzipan
- rote Box/Marzipan

2 Begrüßung

Herzlich Willkommen

Vielen Dank, dass Sie sich erneut Zeit genommen haben, um an unserer Studie teilzunehmen.

Wie beim ersten Mal geht es darum, Fragen zu beantworten. Ihre Meinung ist uns wichtig. Es gibt kein 'richtig' oder 'falsch'.

3 Erinnerung_Frage

Bitte nehmen Sie sich einen Augenblick Zeit und erinnern sich an das Produkt, was wir Ihnen das letzte Mal vorgeführt haben. Bitte beschreiben Sie es stichwortartig. Schreiben Sie alles auf, was Ihnen diesbezüglich einfällt.

4 Erinnerung_Frage_2

Bitte schätzen Sie ein, wie gut Sie sich an das Produkt vom letzten Besuch bei uns erinnern.

	1	2	3	4	5	6	7	
ich erinnere mich überhaupt nicht	○	○	○	○	○	○	○	ich erinnere mich sehr gut

5 Evaluierung des Produkts

Im folgenden geht es erneut um die Verpackung/ das Produkt, welches Sie beim letzten Mal gesehen haben. Bitte beantworten Sie die Fragen:

Die Verpackung fand ich...

	1	2	3	4	5	6	7	
sehr unattraktiv	○	○	○	○	○	○	○	sehr attraktiv

Nun geht es darum, von der Verpackung auf die Eigenschaften der Zahnpasta zu schließen. Bitte bewerten Sie folgende Attribute:

Die Zahnpasta fand ich...

	Stimme überhaupt nicht zu 1	2	3	4	5	6	Stimme voll und ganz zu 7
erfrischend	○	○	○	○	○	○	○
modern	○	○	○	○	○	○	○
reinigend	○	○	○	○	○	○	○

Nun interessiert uns, inwieweit Sie bereit wären, die Zahnpasta zu kaufen. Bitte beantworten Sie folgende Aussagen:

	Stimme überhaupt nicht zu 1	2	3	4	5	6	Stimme voll und ganz zu 7
Ich würde das Produkt gerne einmal ausprobieren.	○	○	○	○	○	○	○
Ich würde dieses Produkt gerne kaufen.	○	○	○	○	○	○	○
Im Vergleich zu anderen Produkten dieser Art ist es sehr wahrscheinlich, dass ich dises Produkt kaufen würde.	○	○	○	○	○	○	○

6 Design/ Geruch

Nun interessiert uns noch, wie Sie generell dem Design von Produkten gegenüber stehen. Bitte kreuzen Sie entsprechende Antworten an.

	Stimme überhaupt nicht zu 1	2	3	4	5	6	Stimme voll und ganz zu 7
Produkte zu besitzen, die ein herausragendes Design haben, führt dazu, dass ich mich gut fühle.	○	○	○	○	○	○	○
Ich schaue mir gerne Werbung für Produkte mit herausragendem Design an.	○	○	○	○	○	○	○
Das Design eines Produktes ist für mich eine Quelle des Wohlbefindens.	○	○	○	○	○	○	○
Schöne Produkte machen unsere Welt lebenswert.	○	○	○	○	○	○	○
Manchmal habe ich das Gefühl, dass auf Grund des Designs eines Produktes der Eindruck entsteht, es würde sich nach mir ausstrecken und mich berühren.	○	○	○	○	○	○	○
Sofern das Design eines Produktes mich wirklich anspricht, verspüre ich das Gefühl, dieses kaufen zu müssen.	○	○	○	○	○	○	○
Ich halte mich für eine Person, die stark auf Gerüche reagiert.	○	○	○	○	○	○	○
Wenn ich ein Produkt gerne riechen mag, kaufe ich es.	○	○	○	○	○	○	○

7 Duft

Die Zahnpastaverpackung war beduftet. Bitte bewerten Sie folgende Aussagen.

Verpackung und Duft passten...

	1	2	3	4	5	6	7	
...überhaupt nicht zusammen.	○	○	○	○	○	○	○	...sehr gut zusammen

Bitte bewerten Sie nun nur den Duft.

Der Duft war...

	1	2	3	4	5	6	7	
nicht wahrnehmbar	○	○	○	○	○	○	○	extrem intensiv
sehr unangenehm	○	○	○	○	○	○	○	sehr angenehm

8 code

Bitte geben Sie als Letztes den Ihnen zugeordneten Code ein.

Mein Code ist:

Nun haben Sie noch die Möglichkeit aufzuschreiben, was Ihnen bezüglich der Zahnpastaverpackung positiv/ negativ aufgefallen ist.

9 Ende

Vielen Dank für Ihre Unterstützung!

10 Endseite

Table A-1: Pretested Stimuli for study 1

Category	Stimuli	Mean value on key benefit
Toothpaste_visual stimuli Key benefit: freshness		5.2
		4.2
		3.67
		3.55
		3.0
		2.6
Toothpaste_olfactory stimuli Key benefit: freshness	Menthol	4.2
	Lemon	3.5
	Ice candy	3.1
	Vanilla	1.9
	Peanut	1.5
	Marzipan	1.1

Pillows_visual stimuli Key benefit: comfort		4.7
		4.2
		3.5
		3.5
		2.5
		2.1
Pillows_olfactory stimuli Key benefit: comfort	Vanilla	4,3
	Lavender	3,5
	Tangerine	3,4
	Menthol	2,9

Chocolate_visual stimuli Key benefit: indulgence		5.22
		3.6
		4.7
		3.58
		2.33
		2.5
		3.7

Chocolate_olfactory stimuli Key benefit: indulgence	Chocolate 1	3.4
	Chocolate 2	4.1
	Chocolate 3	4.5
	Peanut	2.5
	Cinnamon	4.08
	Cocos	3.6

Table A-2: Pretested stimuli for study 3

Visual stimulus	N	Mean value
	10	4.18
	10	3.0
	10	4.1
	10	4.38