THE ROLE OF SENSORIMOTOR PERCEPTIONS IN SHAPE PRODUCT EVALUATIONS AND BRAND CHOICE

Dissertation

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Dissertation Outline

Linking consumers’ perceptions to their cognitions is increasingly in the focus of contemporary marketing literature not least owing to its economic importance to managers. Haptic and motor perceptions, however, are the least studied modalities in marketing although they are part of many consumption experiences. This dissertation investigates how these two modalities shape important consumer behavior variables such as product and brand choice to extend current knowledge in marketing, consumer psychology and grounded cognition. The dissertation is based on four papers, which are either accepted (Paper (1) and (2)), invited for revision (Paper (3)) or currently under review (Paper (4)). Each of the papers investigates how shoppers’ haptic and motor perceptions shape consumption behavior. The following synopsis first addresses the reciprocal link between perception and cognition and documents key findings in haptic and motor research to identify relevant research questions. The rest of the work clarifies the paradigmatic stance of the author, summarizes the contributions and limitations of each study, and provides theoretical and managerial implications along with an agenda for future research.

Paper (1–4) are documented in Appendices (A–D) along with an evaluation of how the papers are attributable to a cumulative dissertation in Management at the University of Innsbruck (Appendix E). The four papers are:


(2) Streicher, Mathias C. and Zachary Estes (2015), „Touch and Go: Merely grasping a product facilitates brand perception and choice“, *Applied Cognitive Psychology*.

(3) Streicher, Mathias C. and Zachary Estes (accepted revision plan), „Mere Touch Improves Product Evaluation and Increases Brand Choice via Processing Fluency“, *Journal of Consumer Psychology*.

In memory of my father Prof. Dr. Erich Streicher
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I. RESEARCH SYNOPSIS
1. Introduction

Sensory marketing is on the rise! In 2013 Heineken introduced beer cans into the European market, which are imprinted with tactile ink and Coca-Cola just recently launched a gesture-based campaign with vendor machines at universities giving away free coke for the exchange of hugging the machine. Although flamboyant communication activities are nothing novel per se the intended and systematic use of sensorimotor perceptions in marketing is a relatively recent phenomenon. It has also stimulated new research on the role of the senses in shaping consumption not least owing to the dramatic shift, which took place at the bottom of cognitive psychology. The shift was a growing consensus that mental phenomena partially emerge from modality-specific pathways, which have been previously thought to operate only on perceptual input (Barsalou 1999; Glenberg 1997; Lakoff and Johnson 1999; Mandler 1992; Wilson 2002). These modalities are commonly known as vision, audition, olfaction, the gustatory sense, haptics, proprioception (motor activities) and introspections (feelings or thoughts) (Barsalou 1999). Much research in various mind and brain disciplines nowadays converge on the observation that mental processes use the same modus operandi as perception, which has coined the term embodied or grounded cognition, respectively (Barsalou 2008).

Malter (1996) and Zaltman (1997) were the first marketing scholars, who introduced the concept of grounded cognition into the domain of consumer research. As consumption lies at the heart of marketing and the senses are the primary vehicles linking consumption to consumers’ cognitions it does not surprise that the marketing of the senses is one of the most influential shifts in the phenomenology of today’s marketing (Achrol and Kotler 2012). Thus far, this paradigm has led to experiential or sensory branding concepts (Hultén 2011; Hultén, Broweus, and Dijk 2009; Lindstrom 2005; Schmitt 1999), metaphor-based brand research tools (Coulter, Zaltman, and Coulter 2001; von Wallpach and Kreuzer 2013;), and more generally, to a plethora of consumer behavior studies that investigate the link between perception and cognition (for a review, see Krishna and Schwarz 2014).

Although the term sensory marketing is often used to refer to this novel trend in marketing it is hard to find a satisfying definition, in particular because the term has become a buzzword for scattered research on the role of the senses in marketing (Krishna and Schwarz 2014). Topics evolve around why and how vision, hearing, smelling, tasting, and touching are important to marketing and how cognitions are grounded in sensory experiences. Sensory per-
ceptions, for instance, can be used to create subconscious triggers that connote abstract product attributes, which are presumably more effective than verbally communicated ones because they are self-generated (Krishna 2012). But many questions still remain unanswered because historically there is much more consumer research on the visual sense compared to any other modality (Krishna 2012; Krishna and Schwarz 2014). The haptic modality, for instance, is the least studied sense in marketing although it is the only proximal sense to connect the recipient directly to the source of experience (Peck 2010; Peck and Childers 2008). For the motor modality, some of the marketing literature does not even recognize it as source of experience (Lindstrom 2005; Hultén et al. 2009) despite its relevance for branding practice (e.g., Apple’s patented slide-to-unlock gesture or Coca-Cola’s recent claim “Movement is Happiness”). The present synopsis fills this gap and investigates how the haptic and motor modality shape important consumer behavior variables.

To begin with haptics, it was previously known that people touch products for diagnostic and hedonic reasons (Peck and Childers 2003b) and that an individual’s inclination to do so can modulate touch-related product evaluations (Krishna and Morrin 2008). Product touch increases product evaluations (Grohmann, Spangenberg, and Sprott 2007) and consumers’ confidence in those evaluations (Peck and Childers 2003a). It was also known that touching products elicits higher monetary valuations through increases in ownership feelings (Peck and Shu 2009; Shu and Peck 2011). However, there is virtually no empirical data, which link product touch to important consumption variables like brand choice. Additionally, all prior studies on product touch did not sufficiently control the exposure time, with some of them lasting over several minutes (Peck and Shu 2009; Shu and Peck 2011). Product touch may happen spontaneously for the sake of fun or other reasons (Peck and Childers 2003b) but nothing is known whether such brief and incidental product touches promote brand choice at all. Managers, however, ultimately need to learn whether brief product touch influences the choice of their brands. The first question thus evolves around whether briefly touching products increases product and brand choice.

For the motor modality, some work has shown that actively inducing unobtrusive motor activities can affect consumption behaviors (Förster 2003, 2004; Hung and Labroo 2011). For example, merely inducing arm flexion increases food consumption relative to arm extension (Förster 2003). More recent work has also demonstrated that carrying a shopping basket, which induces arm flexion, increases preference for vice products relative to pushing a shop-
ping cart (Van den Bergh, Schmitt, and Warlop 2011). Such effects are commonly explained based on a conditioning logic. Because arm flexion usually co-occurs with acquiring desired outcomes and arm extension with avoiding undesired outcomes lateral arm movements become associated with positive and negative evaluations (Cacioppo, Priester, and Bernston 1993). By this evaluative conditioning perspective, the respective arm postures are hardwired with positivity and negativity. Van den Bergh et al. (2011) go even further and argue that arm postures come to signify specific motivational foci. They argue that arm flexion rather than extension induces search for immediate motivational foci. However, the present research argues that the current theoretical explanation of such effects is critically incomplete because research on affective evaluation has shown the relationship between arm movements and emotions is strongly moderated by task demands (Eder and Rothermund 2008; Lavender and Hommel 2007; Markman and Brendl 2005). Given relatively limited prior testing of exactly how arm posture affects consumer behavior (Förster, 2003; 2004; Van den Bergh et al. 2011), a general theoretical explanation of such effects remains open to investigation.

In sum, more than nine laboratory experiments were conducted to investigate the research questions, which were preceded in some cases by pilot studies. As a general logic of discovery the author used both deductive and abductive approaches (Aliseda 2004).

For the haptic modality, this study extends prior research (Grohmann et al. 2007; Peck and Shu 2009; Shu and Peck 2011) by introducing haptic priming (Paper (1) & (2)) and processing fluency from visuo-haptic integration (Paper (3)) as novel processing mechanisms to the consumer literature. The studies also use more behavioral measures since no study has ever conclusively shown whether product touch increases actual choice. The findings offer also novel managerial implications since all existing studies on product touch were not sufficiently time-controlled. This research provides the first demonstration that brief product touch increases actual brand choice. As shown in Paper (1) and (2), touch alone (without viewing) can increase brand choice through priming of haptic properties, which are associated with particular brands (e.g., the shape and texture of a Coca-Cola glass bottle). Haptic priming differs from previous touch studies in that the author investigated effects from conceptual priming of a brand from purely haptic stimulation on subsequent brand choice rather than confounding vision and touch (Grohmann et al. 2007; Krishna and Morrin 2008; Peck and Childers 2003a; Peck and Shu 2009; Shu and Peck 2011). Once a specific haptic feel is part of the brand knowledge it can be used on other objects (e.g., a handle bar of a shop’s door) or visu-
ally novel products (e.g., brand extensions), thus automatically facilitating cognitive accessibility and choice of the primed brand at the point of purchase. Paper (3) shows that briefly touching and viewing products (e.g., 4 seconds) is sufficient to increase brand choice relative to viewing-only. This is because vision and touch are functionally integrated (Amedi et al. 2002; Helbig and Ernst 2007), thus increasing brand choice through increases in processing fluency (Reber, Schwarz, and Winkielman 2004). This effect is independent of whether a haptic feeling is associated with a specific brand albeit conceptual activation from haptic priming might enhance this effect (see Limitations and Future Research). It might therefore pay off to introduce novel products in stores by using established haptic brand signatures on products and have additional sales force stimulating consumers to quickly touch target products.

For the motor modality, the findings extend current knowledge on grounded cognition with important managerial implications of how to induce cognition–compatible shopping activities. The research finds that pushing a shopping cart with flexed rather than extended arms increases purchase quantities and that the effects are not fixed but mediated by task demands. A critical test shows that neither the evaluative conditioning nor the motivational account explain the obtained results. Rather the author establishes direct support for an ideomotor compatibility explanation. If a shopping situation, for example, conceptualizes product acquisition as movement away from the body priming arm extension rather than flexion increases product purchases. This result is virtually inconsistent with the evaluative and the motivational account since they both do not predict this effect. For managers the results provide guidance of how to design motor activities, which are compatible with consumers’ mental simulations that ground their decision-making.

The findings also contribute to consumer protection because they allow public policy makers to make informed judgments about the persuasive potential of such unobtrusive manipulations as described here. Maybe most important is to provide such findings to society at large because some marketing scholars argue that the marketing of the future should have the normative commitment to stimulate self-education of consumers in becoming responsible decision-makers (Webster and Lusch 2013). In this sense, parts of this work have been brought to the public in magazines (e.g., Haptica) and national TV-documentaries (e.g., ORF2).

The following synopsis first discusses the concept of grounded cognition to better understand the reciprocal link between perception and cognition. This is followed by a more focused re-
view on how the two modalities shape consumer behavior to identify relevant research questions. Third, the synopsis describes the research approach and the paradigmatic stance of the author. Finally, theoretical and managerial implications of the projects are discussed and limitations as well as an agenda for future research are provided.
2. Grounding Cognition in Modality Systems

As for many psychological theories, the concept of grounded cognition did not develop overnight but had forerunners in other disciplines. The German philosopher Kant, for example, noted as early as 1787 in his seminal essay “The Critique of Pure Reason” that understanding cannot intuite, and the sensuous faculty cannot think. No faculty can replace the other and knowledge can only arise from the united operation of both (Kant 1787/1965). What Kant meant is that mind and body is an indivisible unit, which was a keen thought given the state of knowledge about mind and brain at the time. The Gestalt theorists were the first scholars to introduce principles of perception more systematically into the domain of cognition. Köhler (1921), for instance, applied Gestalt principles to the domain of problem solving, which he tested on chimpanzees. The rise of the computer age in the second half of the last century, however, was so influential on the Zeitgeist that theories about the mind became virtually computer-like (Fodor 1975; Pylyshyn 1984). This view was so prevalent in behavioral sciences that it was not before the end of the last century until scholars challenged the computer metaphor of cognition by bringing together logic (e.g., the Symbol-Grounding Problem) and data from other fields (e.g., brain research) to put people and their bodies back in psychology (for reviews, see Barsalou 2008; Meier et al. 2012). Chapter 2 outlines some of the most important aspects about grounded cognition by evaluating supportive data and opposing positions. The content is structured in such ways that it clarifies the term grounded from a cognitive perspective without pre-empting a more detailed consumer literature review on the haptic and motor modality.

2.1. Evaluating the Core Assumptions

To date, grounded cognition has developed to one of the most exciting theories in behavioral sciences because it provides a common basis for various disciplines such as attitude and emotion research (Niedenthal et al. 2005), implicit memory (Schacter, Dobbins, and Schnyer 2004), explicit memory (Wheeler, Petersen, and Buckner 2000), linguistics (Glenberg and Kaschak 2002), brain research (Damasio and Damasio 1994), and neuroimaging (Chao and Martin 2002), all of which shape important consumer behavior topics (Krishna and Schwarz 2014). Common to the various disciplines is that they converge on the observation that perceptions, bodily states and modality brain areas shape cognition. The strength of grounded cognition

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1 They did not even have psychological laboratories at the time of Kant. In fact, Wilhelm Wundt founded the first laboratory in 1879.
cognition lies in the ability to generalize beyond isolated research contexts, which has virtually
removed the disciplinary divide between mind and brain. Additionally, it is a parsimonious
concept since existing resources (e.g., modality areas of the brain) are implemented for multiple
functions (e.g., perception and cognition) – a peculiarity which could be referred to as
perceptual–cognitive isomorphism. The most prominent theoretical framework within
grounded cognition is arguably the *Perceptual Symbol System* theory (Barsalou 1999).

The theory postulates that mental processes are grounded in the modality-specific areas of the
brain. During perception subsets of modality-specific activation patterns become extracted
and stored. Consider that the term “modality” goes beyond exteroceptive perceptions and also
includes introspections (e.g., the feel of hunger) as well as proprioceptions (e.g., limb position).
Convergence zones in the prefrontal cortex integrate modality-specific activation patterns that essentially constitute the multimodal architecture of memory (Damasio 1989; Simmons and Barsalou 2003). Extracted activation patterns become reinstated on later occasions in multimodal simulations to perform an array of cognitions such as memory retrieval, problem solving, and conceptual understanding, to name but a few (Barsalou 1999). This is also corroborated by neuroimaging studies that visualize brain activity during cognitions. Research in this field has demonstrated that mere imaginations of music played leads to activation of the auditory cortex (Zatorre and Halpern 2005), reading smell-related words activates the primary olfactory cortex (González et al. 2006), and viewing pictures of tools activates motor circuits commonly associated with grasping (Chao and Martin 2000). These are just excerpts from a bulk of evidence that has accumulated over the past years. Critically, these systems have been previously assumed to operate only on input and motor control, which poses the question why such modality activations occur in the absence of perceptions and actions. Grounded cognition argues that perceptual simulations constitute cognitions.

Proponents of amodal theories sometimes argue that modality activations during cognitions
are epiphenomenal. This argument criticizes that brain activity of modal areas during conceptual processing could be an accompanying effect rather than causal for cognition. This criticism is hard to square with many empirical observations. Patients with brain lesions in spatial processing areas, for example, have been reported to lose knowledge about locations (Levine, Farach, and Warah 1985), which suggests that damages to modality areas cause conceptual deficits because they constitute cognition. Emotion research has shown that conceptual processing of emotional content recruits facial motor resources, which are commonly used for
emotional expressions (Strack, Martin, and Stepper 1988). If relevant motor systems become blocked (e.g., by holding a pen laterally between the lips), cartoons are rated as less funny. Such effects occur only if the task requires to process the emotional stimulus on conceptual rather than on perceptual levels (Niedenthal et al. 2009). This suggests that modality activations become recruited to support conceptual understanding, and it makes the epiphenomenal argument weak.

Amodal theories in contrast treat perception and cognition as two fundamentally different concepts (Pylyshyn 1984). One issue is whether cognition needs to be explained by using principles of perception if mental phenomena can be sufficiently conceptualized without perceptual components. Most amodal concepts such as the Spreading Activation Theory (Collins and Loftus 1975) make empirically consonant predictions. Given that word-like feature lists represent the structure of memory one should expect that reading words related to warm temperature should activate neighboring words related to interpersonal warmth. In contrast, one should not expect that merely holding a warm rather than a cold beverage activates concepts of interpersonal warmth because feature-lists contain arbitrary symbols with no natural relation to temperature sensations (Williams and Bargh 2008). Thus, the main problem with amodal theories is not what they predict (e.g., spreading activation) but what they do not predict because their conceptual elements do not generalize beyond a specific research context (e.g., linguistics). The reason why amodal theories are low in generality is because their conceptual elements (e.g., feature list and nodes linked by propositions) typically apply only to the phenomena from which they emerged (e.g., semantic activation of words by other related words). Grounded cognition retains all core functions of amodal concepts (e.g., spreading activation) but implements them by using perceptual principles (Barsalou 2008). Grounded cognition should therefore be seen as extension of amodal concepts rather than being disparate with them. In the end, the controversy can only be solved by plausibility argumentations.

As such, the Symbol-Grounding-Problem is an excellent example of how arguments can be brought to the discourse, which are solely based on logic. In his article, Harnad (1990) elaborated on the basic problem, which any cognitive model would have to solve to represent cognition: „How can the semantic interpretation of a formal symbol system be made intrinsic to the system, rather than just parasitic on the meanings in our heads? How is symbol meaning to be grounded in something other than just more meaningless symbols?“ (p 335). Symbols such as feature-lists, scratches on a paper and events in a digital computer are altogether arbi-
trary physical tokens, which are only used according to some explicit rules based on their shape but not their meaning. Any cognitive system based on such arbitrary symbol operation would be virtually incapable to generate any meaningful thoughts. Consider being in a foreign country with a foreign language, which you are not familiar with. All you have is a dictionary, which is written in that foreign language. The dictionary depicts all the tokens, words, and even rules that are necessary to understand the language. From an amodal perspective you should have everything necessary to decipher the foreign language. In such a situation of meaningless symbols, however, you would have to experience the symbols together with the perceptions that refer to their meaning (e.g., somebody acts like crying while she is pointing on the foreign word for crying).

The prior example demonstrates that cognitive representations must map in some way onto the perceptions that constitute their meaning. Using the same principles for cognition, which bear meanings to a perceiver, is the most parsimonious way to solve the Symbol Grounding Problem.

This thesis evolves around the basic assumption that the principles of perception shape cognition. The following two chapters illustrate this issue by presenting intriguing findings for both, the haptic and motor modality.

2.2. Grounding Cognition in Haptic Sensations

The term “haptics” refers to cutaneous and kinesthetic perceptions typically perceived via the hands although associated receptor cells can be found in varying density from head to toe (Lederman and Klatzky 2009; Peck 2010). Touch is a fundamental sense in human perception because it is the first sense to develop in the womb and it also serves as an early matrix for the development of self-awareness (Gallace and Spence 2010). After birth, interpersonal touch plays an important role for the emotional and physiological health of babies (Montagu 1986) and it shapes infant–parent attachment to a considerable degree (Harlow 1958). Some researchers even speculate that the touch modality „[…] may be the most relevant for scaffolding later conceptual knowledge.“ (Ackerman, Nocera, and Bargh 2010, 1714).

Several studies show that general haptic stimulation can support conceptual processing of haptic properties (van Dantzig et al. 2008; Connell, Lynott, and Dreyer 2012). Connell and colleagues had participants place their hands on vibrating cushions before they were visually
presented different objects. They found that size estimations of the objects (e.g., as a conceptual measure) were more accurate when a vibration to the hands preceded the judgments. This effect occurs because content-free activation of haptic brain areas increases the modality’s readiness for use in a later task, thus increasing conceptual performance (e.g., facilitating the simulation of appropriate grips to estimate object size). Because the effect exists only for objects, which are manipulable by hands (e.g., a coin but not a house), the haptic modality supports conceptual understanding only if it is a relevant source of experience for the judgment. Haptic perceptions can also activate more abstract concepts in a metaphorical sense, which allows conclusions about the grounding of meanings.

Williams and Bargh (2008) provide a vivid example of how physical warmth activates thoughts of interpersonal warmth. As the experimenter walked the participants to the lab he casually asked them to quickly hold a beverage so he could ostensibly take some notes on a clipboard. Half of the participants were handed a cold beverage container while the other half were handed a warm beverage container. Upon arrival at the lab, all participants received the same description of an ambiguous person, which served as target in a subsequent personality-rating task. Participants, who held the warm beverage in the prior situation rated the target person more favorable compared to the participants, who touched the cold beverage. Touching warm rather than cold objects also led to greater prosocial behavior of the participants towards others. Examples like these demonstrate that haptic sensations lie at the heart of fundamental concepts such as interpersonal warmth. Williams, Huang, and Bargh (2009) argue that early childhood experiences serve as an ontogenetic scaffold for higher-order concepts. Throughout infancy, physical closeness is experienced together with the bodily warmth of a caretaker, thus providing an experiential matrix for the development of abstracts thoughts such as interpersonal warmth. Seen this way, perceptions serve as sensory metaphors, which ground the conceptual understanding of higher-order concepts. Because knowledge is organized in multimodal simulations, priming of specific sensory perceptions activates associated higher-order concepts (Barsalou 2008).

Another study by Ackerman et al. (2010) showed that weight, texture, and hardness similarly ground fundamental concepts in dimension-specific ways. For example, participants exposed more rigid behaviors in a negotiation task when sitting on hard vs. soft chairs, and rated job candidates as more qualified when reading applications on heavy rather than on light clipboards. The weight of the clipboards, however, did not influence evaluations of unrelated
traits (e.g., the likeability of the applicant among colleagues), suggesting that haptic sensations of weight are specific for the concept of importance and seriousness.

The consumer behavior literature provides similar examples that were published years before metaphor priming boomed in social psychology. One of these examples can be found in Hornik’s study on the effect of interpersonal touch in consumption settings (1992). Casual touch by shop employees, for instance, can increase the patronage’s willingness to try out products or the willingness to tip for a service. Krishna and Morrin (2008) provide another touch example and report that drinking water from a stable plastic cup increases quality judgments of the consumed water relative to a flimsy cup. Although the articles explain their findings via other routes than grounded cognition the conceptual similarity with the social psychology findings is remarkable. In Hornik’s study on interpersonal touch it seems plausible that interpersonal touch activated concepts of prosocial behavior similarly like it has been shown for warm temperature sensations (Williams and Bargh 2008). In Krishna and Morrin’s study on haptic-to-taste transfer effects, the feel of haptic stability presumably activated the concept of quality because fundamental haptic properties such as solidness lie at the heart of this concept (Ackerman et al. 2010). Both studies are excellent examples how relevant haptic metaphor priming is to marketing practice (for examples in other modalities, see Lee and Schwarz 2012).

Because product choice is often preceded by touch (McCabe and Nowlis 2003; Peck and Childers 2003a; 2003b) touch might be a yet underestimated modality in influencing brand choice through conceptual activation. Haptic sensations could serve as powerful brand identifiers, if they become associated with specific brands (e.g., the feel of a Coca-Cola bottle). This would suggest even more specific concept activation from haptic sensations than previously demonstrated by metaphor priming.

The reviewed data thus far indicate two things: First, cognitions emerge from modality-specific pathways such as haptics, which pertains to the neural grounding of cognition in modality systems. Second, abstract concepts are scaffolded by more concrete sensory analogies, which pertains to the semantic grounding of meanings in perceptions. Knowledge about the world, however, must also represent dynamic properties such as actions. To accomplish this, the motor modality is particularly important as outlined in the next chapter.
2.3. Grounding Cognition in Motor Activity

The motor modality processes all perceptions, which are perceived through receptor cells in muscles and joints (McCloskey 1978). It comprises perceptions about the relative position of body parts, their movement direction, and the involved muscle activity.

The motor system has been reported to ground a plethora of conceptual processes such as understanding of language (Glenberg and Kaschak 2002; Zwaan and Taylor 2006), objects (Chao and Martin 2000; Conell, Lynott, and Dryer 2012; Tucker and Ellis 1998), emotions (Niedenthal 2007; Niedenthal et al. 2001; Stepper and Strack 1993), social life (Gallese, et al. 2009), arithmetic operations (Lugli et al. 2013), and even entirely abstract entities such as magnitude concepts (Badets and Pesenti 2010; Guan, Meng, and Glenberg 2013).

In linguistics, for example, it has been demonstrated that action-related sentences are processed faster if the experimental task requires actions, which are compatible with the implied direction of the sentence (Glenberg and Kaschak 2002). In the study, the participants were instructed to indicate the sensitivity of sentences by button presses that afforded either a hand movement away or towards the body. For instance, the participants read “Andy closed the drawer”, which implies a direction away from the body. Conversely, reading “Andy handed the Pizza to you” implies a direction towards the body. Whenever the implied direction matched with the direction of the button presses, the participants were faster to make sensitivity judgments. This compatibility effect occurs because processing of the action-related sentences recruits a perceptual simulation to represent the implied action. Because motor simulations and motor output (e.g., the button presses) are processed in the same neural systems (Barsalou 1999) it is easier to maintain a cognition-compatible movement. Much data from various psychological subdomains demonstrate how compatibility of bodily states and cognitions influence behavior (for a review, see Barsalou et al. 2003).

Solarz (1960), for example, presented positive and negative words on cards to participants (see for a replication, Chen and Bargh 1999). Upon exposure of a card, the participants were asked to indicate the valence of the stimuli as quickly as possible by either pulling them towards themselves or pushing them away. Solarz also manipulated the movement direction for both positive and negative words, so that each direction was indicative for either positive or negative words. Analyzing the latency, he found that the respondents were faster to indicate negative words in the away rather than toward direction and for positive words the other way.
around. Common with Glenberg and Kaschak’s (2002) study is that conceptual processing of the stimuli seems to potentiate motor contingencies of arm flexion or extension. This is because processing of affective words primes approach or avoidance tendencies, which are part of the words’ conceptual representation (Niedenthal et al. 2005). Thus, the common denominator for both studies is that the motor system becomes recruited as cognitive resource to serve situated tasks and that maintaining cognition–compatible movements increases task performance (e.g., reaction speed).

Rather than measuring arm flexion and extension, Cacioppo et al. (1993) investigated whether merely inducing arm flexion and extension has an effect on stimulus evaluation. They presented neutral Chinese ideographs to their participants while they pressed their hand either on top of a table to induce arm extension or against the bottom of a table to induce arm flexion. As part of the task, the respondents were asked to make like–dislike judgments of the ideographs while they performed one of the arm postures.

Because inducing arm flexion increased liking of the neutral Chinese ideographs compared to arm extension the authors conclude similar to a Pavlovian conditioning logic that muscle activity is directly linked to affective states. They argue that through a lifetime of repetitions arm flexion becomes associated with positive affects because it co-occurs with acquiring of desired objects. And because undesired stimuli are usually pushed away arm extension becomes associated with negative affects. This evaluative conditioning model suggests that arm flexion should always lead to more positive evaluations and arm extension should always lead to more negative evaluations, regardless of contextual factors.

One trajectory for the following consumer literature review is to elaborate how inducing arm flexion and extension influences consumption and how the effects can be explained.

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2 Arm extension occurs when the hand is extended away from the body (elbow ≈ 180°), whereas arm flexion occurs when the hand is retracted toward the body (elbow ≈ 90°).
3. The Role of Haptic and Motor Perceptions in Shaping Product Evaluations and Brand Choice

The data reviewed thus far indicate that haptic and motor perceptions ground an array of cognitions. The following consumer literature review evolves around the more specific question how haptic and motor perceptions link to important consumption variables. The review will also put consumer literature findings in relation to the previous topics to substantiate the basis for developing research questions.

3.1. Haptics and Consumer Behavior

Consider that the touch modality is the only sense, which connects the consumer directly with the source of experience. This makes the touch modality per se important to marketing. One stream of research, for example, has investigated effects from interpersonal touch such as it happens when store personal casually touches a consumer on the upper arm (Hornik 1992). In the prior chapter it was suggested that interpersonal touch is directly linked to prosocial concepts, which can influence behavior towards others. Hornik found that unobtrusive touches increase dwell time in stores, monetary spending, tip behavior and compliance to engage in point-of-sale promotions. This effect, however, can backlash if the touching person is not an employee but a stranger. Martin (2012), for example, reported that dwell time, spending and brand attitudes were negatively influenced if a male or female stranger touched customers. The results suggest that effects from metaphor priming are strongly moderated by contextual factors.

Another stream of research has investigated perceived product contamination from observing other people touching products, or from products touching each other (Argo, Dahl, and Morales 2006; Morales and Fitzsimmons 2007). Argo and colleagues, for example, had consumers observe products being touched by other consumers, which led to decreased favorability of the touched product through feelings of disgust. Such contamination effects can also occur if a disgusting source product (e.g., sanitary pads) touches another product (e.g., cookies). This effect exists only for direct physical contact and is absent if the products are just close to each other.
A third stream of research is concerned with behavioral effects from actively touching marketing-related materials. Touching a marketing communication, for example, that incorporates a neutral or positive touch element (e.g., a flyer with a bird feather attached) triggers affective responses, which in turn increases the persuasiveness of the contained message relative to having no touch element (Peck and Wiggins 2006). Most research in this domain has been devoted to product touch not least owing to its importance to consumers.

Product touch provides important information prior to purchasing, thus increasing the confidence in the own purchase decision (Peck and Childers 2003a). Product packages, closed showcases, or online stores are altogether barriers, which can lead to frustration because it prevents touching and handling products prior to purchase. Such effects are often modulated by individual traits and habits. Peck and Childers (2003b) showed that people differ in their Need for Touch (NFT) and that two independent dimensions drive this difference. On the one hand, people touch products because it is fun or otherwise stimulating. In this case, touch is an autotelic end in itself (Peck 2010). One the other hand, people touch products because it is diagnostic for the product, therefore being an instrumental means to an end. Because people high in NFT rely more on haptic information when making purchases, the absence of product touch prior to a purchase frustrates them more compared to low NFT consumers (Peck and Childers 2003a). This effect can be partially lessened if verbal descriptions instill haptic imagery (e.g., the weight of a product). Product-type is another import boundary condition, which modulates touch-related effects. Products for which touch provides important information (e.g., a sweater) are generally evaluated more positive in offline rather than online shopping settings (McCabe and Nowlis 2003) and verbal descriptions of haptic product properties cannot compensate the absence of touch here (Peck and Childers 2003a).

One particular interesting finding is that product touch can lead to behavioral outcomes, which go beyond affective reactions from tactile stimulation (Shu and Peck 2011). Physical control over objects is fundamental to feelings of ownership and loosing objects is usually experienced negative such as it can be observed in toddlers. Peck and Shu (2009) showed that merely touching products elicits feelings of ownership independent of whether one legally owns the product or not. This subjective ownership, in turn, also leads to higher monetary valuations of the touched object, much like loss aversion drives the endowment effect (Kahneman, Knetch, and Thaler 1990). One question therefore is whether briefly touching a product, say as promotion activity, increases actual brand choice.
This question still waits answering, since there are several important limitations to the existing studies (e.g., Peck and Shu 2009; Shu and Peck 2011; Reb and Connolly 2007; Wolf, Arkes, and Muhanna 2008). The first limitation pertains to the ecological validity of the experimental paradigm, which was used to investigate touch related endowment effects. All studies applied a buyer–seller paradigm similar to bidding auctions in order to determine willingness to pay for buyers and willingness to accept for sellers. Such procedures usually last from several minutes (Peck and Shu 2009; Shu and Peck 2011) up to half an hour (Reb and Connolly 2007), which could artificially increase product involvement even for low-involvement products (e.g., a ball pen as often used in endowment studies), and nothing is known how this interacts with sensory stimulation (e.g., enhancing effects from touch). Data suggests that perceptual attention and product involvement are highly correlated (Behe et al. 2015). However, as pre-tests suggest (e.g., Wolf et al. 2008) people usually spend less than 10 seconds to haptically explore casual products like ball pens prior to their decision-making. One question therefore is whether prior studies overstate the magnitude of their effects due to rather long, uncontrolled exposure times and measures, which artificially enhance conceptual thinking (e.g., determining willingness to pay).

The only study to investigate the role of haptic exposure time was provided by Wolf et al. (2008), but unfortunately they only compared two groups that touched a product for a different amount of time. The absence of a no-touch condition makes it virtually impossible to conclude whether brief product touch has any effects behavioral effects at all relative to no touch. Another shortcoming is that in the existing studies visual exposure always preceded and outlasted haptic exposure to an unknown degree, which is another source for confounds. This raises the question whether the existing results generalize to a shopping scenario where consumers do not dwell for minutes holding one and the same target product. There is also nothing know whether product touch links to actual product and brand choice because it has never been measured. The overarching research question for the haptic part of this thesis therefore reads:

*Does incidental product touch increases brand choice and what are potential mechanisms to explain touch-related effects on brand choice?*

First, haptic properties of objects can semantically prime more abstract concepts such as demonstrated in social psychology (e.g., Ackerman et al. 2010; Chandler, Reinhard, and
Schwarz 2012; Williams et al. 2009). More recently, Pesquita et al. (2013) had participants manually explore common objects (e.g., an elongated light bulb) that were hidden from view, while viewing an object that slowly appeared onscreen. They found priming not only for identical but also for categorically related targets (e.g., a round light bulb). The priming of categorically related objects suggests that haptic exposure activates a general semantic representation of the given object (see also Johnson, Paivio, and Clark 1989).

Consider a product with a unique shape such as the nostalgic Coca-Cola bottle. It seems likely that after sufficient exposures specific haptic properties of a product become learned and associated with a particular brand. Because the typical feel of the nostalgic Coca-Cola bottle has been unchanged for many generations of consumers it has become part of the brand knowledge (Lindstrom 2005). Thus, if haptic properties are associated with a particular brand, touching them should conceptually activate the associated brand in consumption situations just like general haptic properties can activate higher-order concepts (Ackerman et al. 2010). From a managerial perspective, this seems favorable since strong and unique associations in consumers’ mind are said to be the basis of strong brands (Keller 2008). The visual modality is still the prime vehicle for marketing communication, so that the use of other modalities for branding purposes seems reasonable. Given that a particular haptic feel is part of brand knowledge it could serve, for example, as brand identifier at the point of purchase. Incidental haptic exposure to familiar branded package designs could eventually increase choice of a brand through haptic priming. Because such effects have never been demonstrated research question (1a) reads:

1a: Does haptic priming of a familiar branded product increases the choice of that brand?

Another underresearched topic in marketing is how multiple sensory perceptions influence evaluations and choice of products and brands. Recent neuroscience studies suggest that touch contributes to visual processing because both senses use highly overlapping neural resources (Amedi et al. 2002; Stilla and Sathian 2008). Other studies report that touch and vision are also functionally integrated since both modalities jointly facilitate shape and size detection, all of which facilitates object recognition (Ernst and Banks 2002; Gaissert and Wallraven 2012; Helbig and Ernst 2007; Lederman and Klatzky 2009). Touching and viewing a product relative to viewing only could thus facilitate perceptual processing of products even under conditions of brief exposure. Processing fluency, in turn, is experienced affectively positive (Reber
et al. 2004), which can ultimately drive product liking and brand choice (Janiszewski and Mayvis 2001; Lee 2002; Lee and Labroo 2004; Labroo, Dhar, and Schwarz 2008). Therefore, research question (1b) reads:

1b: Does briefly viewing and touching products increase brand choice through processing fluency relative to viewing only?

Thus far, the literature review has identified two potential mechanisms, which could both drive product and brand choice. The latter concept, namely visuo-haptic shape integration, differs from haptic priming in that it addresses perceptual fluency effects from bi-modal product sensations on brand choice (e.g., visuo-haptic vs. visual-only exposure) rather than conceptual priming effects from purely haptic stimulation on subsequent brand choice. The visuo-haptic integration effect is independent of whether a haptic sensation is associated with a particular brand whereas the haptic priming effect depends on this association.

3.2. Motor Activity and Consumer Behavior

The motor modality is increasingly receiving attention from marketing scholars and managers because recent research suggests that mental motor affordance shapes product liking to a considerable degree (Eelen, Dewitte, and Warlop 2013; Elder and Krishna 2012; Ping, Dhillon, and Beilock 2009). When looking at advertised products, for example, consumers prefer products, which look easy to grasp. Products with handles typically infer a grasping orientation and if the handle is pointed towards the dominant hand they are preferred over products, which are differently orientated. This is because the brain automatically runs mental motor simulations to support conceptual understanding of objects (Chao and Martin 2000), which is easier to perform for the dominant hand (Elder and Krishna 2012; Ping et al. 2009). This phenomenon has been described elsewhere as off-line cognitions because cognitions are decoupled from acting but nevertheless involve motor circuits of the brain (Wilson 2002).

Other research is concerned how actual motor activities influence consumer behavior. Research on self-control, for example, has shown that muscle strengthening can increase will-power, which in turn supports self-regulation and long-term goal attainment (Hung and Labroo 2011). This was manipulated by asking the participants to clench a fist, which helped them, to consume unpleasant medicine or withstand food temptations relative to no muscle strengthening. One may conclude that because firmed muscles usually co-occur with will-
power strengthening, merely firming muscles is hardwired with willpower. However, imagine the target task would have been reading annoying statements while clenching a fist. It seems possible that clenching a fist leads in this context to increases of anger relative to not clenching a fist because clenching a fist arguably co-occurs often with angry states. Although hypothetical, the example implicates that a conditioning logic is not without problems in explaining effects from motor primes. How can a conditioning logic generalize for one and the same motor paradigm beyond a particular context if not the context itself is seen as active participant in cognition (Wilson and Golonka 2013)? We will come back to this issue.

Isometric arm flexion and extension is another well-studied motor paradigm in consumer research, presumably because of its popularity in emotion and attitude research (Cacioppo et al. 1993; Chen and Bargh 1999; Solarz 1960; Markman and Brendl 2005). Förster (2003) was the first one to apply this paradigm to a consumption context and demonstrated that merely inducing arm flexion rather than extension increases food intake. Under the guise of an EMG study, participants were instructed to either press their hand against the top or bottom of a table which induced arm flexion or extension, respectively. A bowl of cookies was placed unobtrusively right next to the participants, which served as dependent measure. The participants in the arm flexion group consumed significantly more cookies compared to the extension group although the ergonomics of the arm postures and mood did not explain the results. Initial theorizing, based on evaluative conditioning, explained that repeatedly pushing aversive stimuli away and pulling appetitive stimuli toward the body establishes automatic associations between those arm movements and affective states (Cacioppo, Priester, and Berntson 1993) so that merely performing such arm postures influences consumption via affective routes.

Van den Bergh et al. (2011) compared basket and cart shopping, which induces either arm flexion or extension, and had the participants chose products in a self-control dilemma (i.e., a forced choice between a vice and a virtue product). The results indicate that participants in the arm flexion group favored vice over virtue products stronger compared to the arm extension group. This result is at odds with the evaluative conditioning account because the theory would not predict selective preferences for either vices or virtues. Instead the authors support a motivational explanation, which is a modification of the evaluative conditioning theory. The motivational theory suggests that specific muscle activities always accompany the same be-
havioral tendencies and therefore inducing arm flexion rather than extension is hardwired with a search for immediate gratification (i.e., vices).

A third explanation for arm posture priming of consumption is that ideomotor compatibility of thoughts and actions enhances consumption. Ideomotor compatibility means that embodied and cognitive states are compatible, which can increase task performance (Barsalou et al. 2003). Such compatibility effects can be observed, for instance, if information has the same valence as an expression pattern. People are generally faster to indicate negative stimuli by lever movements that engage arm extension rather than flexion and vice versa (Solarz 1960; Chen and Bargh 1999). This is because processing of affective words triggers representations of emotional outcomes, which prime actions operating on those outcomes (Eder and Hommel 2013). Therefore, motor output (e.g., reaction speed) is facilitated for lever movements, which are potentiated by cognitions (Niedenthal et al. 2005).

According to the ideomotor compatibility account the motor priming of consumption depends on how an individual mentally simulates product acquisition. Glenberg and Kaschak (2002) showed that conceptual processing of sentences, which imply acquisition of objects, potentiate faster arm flexion responses. Product choice and consumption are typically enacted by motion toward the body: Shopping typically entails moving products from shelves into one’s basket, and ingestion entails bringing food or liquid toward the mouth. Thus, movement toward the body is typically used to mentally simulate consumption and product choice. So by default, arm flexion is compatible with mental simulations of consumption, and hence arm flexion should increase consumption and choice, especially of desirable products (Förster 2003, 2004; Van den Bergh et al. 2011). Conversely, if the shopping conceptualizes product acquisition as movement away from the body the formerly compatible arm flexion prime should be incompatible and decrease consumption.

Indirect support for this ideomotor compatibility account of shopping behavior comes from research on affective evaluation. It was reported above that people are generally faster to classify negative stimuli by pushing a lever (or joystick) away from the body, but are faster to classify positive stimuli by pulling the lever toward the body (Chen and Bargh 1999; Solarz 1960). Across a series of experiments, however, Eder and Rothermund (2008) showed that this emotion-direction effect was strongly moderated by task constraints. For instance, when moving the lever toward the body was labeled as “pull down” (which has a negative connotation), then participants were faster to classify negative words with that movement toward the
body. And when Eder and Rothermund labeled moving the lever away from the body as “push up” (which has a positive connotation), then participants classified positive words more quickly with that movement away from the body. Thus, simple manipulations of the task conceptualization completely reversed the standard effect of stimulus valence on response direction (see also Lavender and Hommel 2007; Markman and Brendl 2005; Rotteveel and Phaf 2004). Because the ideomotor compatibility account makes no assumptions about emotional valence and instead attributes arm posture effects to the compatibility between the simulated product acquisition (i.e., the “idea”) and the actual arm movement (i.e., the “motor”) different conceptualizations of product acquisition should interact with arm posture effects. This, however, would be at odds with the motivational or evaluative conditioning model because both do not predict an interaction between motor prime and situated task demands.

The literature review has identified three potential theories with mutually exclusive predictions for posture priming of consumption: the evaluative conditioning model (Cacioppo et al. 1993) predicts an increase of consumption for arm flexion rather than extension independent of task demands. It does also predict no differential effects of arm flexion and extension on vice and virtue products. The motivational theory (Van den Bergh et al. 2011) predicts that arm flexion selectively increases choice of vice but not virtue products whereas arm extension selectively increases choice of virtue but not vice products. The ideomotor compatibility model predicts that depending on task demands either arm flexion or extension increases product choice independent of product-type. Without knowing which explanation applies to a shopping scenario, shop owners that carry virtue products (e.g., drug stores) could indeed think of replacing all shopping baskets by carts because prior result implicate that performing arm extension increases preference for virtues. But what if Van den Bergh and colleagues’ effects do not generalize to a shopping scenario because a forced choice task differs tremendously from a shopping scenario where consumers are free to choose from each option? What cannot be determined from Van den Bergh et al.’s forced choice paradigm is whether shoppers might also have wanted more of virtue products as a function of arm flexion; that is, because participants had to choose, we learn nothing about the unchosen product. Scrutinizing this issue is not only of theoretical importance but it could also prevent managers from making false investments based on such data. Research question (2) therefore reads:

2: How does pushing a shopping cart with flexed vs. extended arms influence purchases of different product-types (vice and virtue products)
4. Research Approach

The identified research questions indicate gaps in consumer literature, which justify further investigations. This research takes a particular stance in generating knowledge among a kaleidoscope of other possible approaches, which will be clarified in the following.

4.1. Paradigmatic Stance

To investigate the research questions, a quantitative approach was selected. The choice was less motivated by a purely positivistic worldview but more by a pragmatic evaluation of benefits and sacrifices that come along with different approaches in different research situations (Ariseda 2004; Rossman and Wilson 1985). Quantitative research assumes that there are regularities in the world, which exist independent of opinions and which can be observed objectively (Neuman 2003). In quantitative designs observations can be made in two ways: First, one can observe phenomena in the real world without interfering with them (Field and Graham 2003). This is commonly referred to as correlational design. Second, one can manipulate an aspect of the environment and observe how it affects specific outcome variables. This is commonly referred to as experimental design. Although both forms of inquiry share many similarities they fundamentally differ in discovering causal relations. In correlational designs, causal relations are discovered through unobtrusive observations without any intervention (Field and Graham 2003). In experimental designs, causal relations are identified through intended manipulation of an independent variable to ascertain that changes of a dependent variable (i.e., the measurement) is a cause from the initial manipulation. Because experiments typically control the cause–effect path (i.e., a manipulation preceding an effect) while all other factors remain constant, controlled, randomized or counterbalanced experiments provide rigorous conditions to test causal explanations (Viswanathan 2008).

Applying experimental research requires a priori knowledge (assumptions) about possible causes (i.e., independent variables) and effects (i.e., dependent variables), and how a cause might link to an effect (i.e., process variables). This a priori knowledge allows hypothesizing about possible cause-effect relationships prior to testing and it is usually deducted from general rules. In deductive approaches the conventional logic is that “[…] science starts from problems, and not from observations.” (Popper 1963, 222). Paper (1), (2) and (4) are examples for a deductive approach because the hypotheses were derived from a priori knowledge.
about general rules, which was achieved by extensive literature reviews and conceptual development.

A pluralistic view of science, however, extends this logic by accepting deductive, inductive or abductive reasoning as equal ways to make scientific discoveries (Ariseda 2004). In abduction, for example, an observation stands at the beginning of a scientific discovery rather than a problem. Paper (3) was initially developed based on a surprising observation that needed explanation. In investigating research question (1a) it was shown that conceptual activation from product touch can facilitate subsequent visual perception of the brand. A related question was whether product touch also facilitates visual perception of products in the moment of touch rather than measuring delayed priming effects on brand name reading (as reported in Paper (1) and (2)).

In a pretest the author found that touching products indeed facilitates visual perception of products. Because this effect was also found for beverage containers, that were not associated with a specific brand, there was an observation, which needed an explanation other than conceptual activation. Thus, paper (3) was developed moving back and forth between empirical observations and deductive reasoning because the observation could be explained by theories of visuo-haptic shape integration. This process is commonly referred to as abduction, which takes a pluralistic stance within the logic of scientific discoveries (Ariseda 2004).

To answer the research questions an experimental approach was selected. The main reason for the choice of this method was that the author had a priori knowledge about potential causes, processes and effects from either deductive or abductive reasoning. That does not mean that experimental designs are always the best way to conduct research. The rise of mixed methods research shows that researchers increasingly acknowledge that there is no superior way of doing research, and that selection of one method is always a trade-off with loss and gains (Morgan 2007; Schulze 2003). Thus, different types of inquiry can have equal informative value and certain methods can be more appropriate for specific research endeavors than others (Rossman and Wilson 1985). The grounding of brand meanings in sensory metaphors, for instance, has been demonstrated by both qualitative (von Wallpach and Kreuzer 2013) and quantitative inquiries (Möller and Herm 2013), with the former approach informing about how to reveal sensory metaphors of brand knowledge and the latter informing about how to influence brand knowledge through sensory metaphors.
4.2. Overview of the Research Projects

Nine experiments and several pretests were applied to investigate the research questions. All experiments were conducted in the lobby of the University of Innsbruck (SOWI Campus) and all participants hired at that location. Figure 1 provides a procedural overview of the various research projects.
## Haptic Project

### 2010
- **Literature Review**
- **Formulation of RQ (1a) & Hypotheses**

### 2011
- **Pre-Tests**
  - Selection of product packages, which are haptically associated with their brand
- **Design of four Experiments & Data Collection**
  - Haptic Priming of familiar branded products on visual fluency task, category generation, and brand choice
- **Data Analysis (SPSS)**
- **Accepted for Publication**

### 2012
- **Paper 1 ACR**
  - **Observations:** Abductive Reasoning
  - **Pre-Tests**
  - Design and selection of visual targets and haptic stimuli
  - **Formulation of RQ (1b) & Hypotheses**
  - **Design of two Experiments & Data Collection**
  - Visuo-haptic vs. visual-only exposure to target products on visual fluency, product attitudes, and brand choice
  - **Data Analysis (SPSS)**
  - **Submission: Invited for Revision**

### 2014
- **Paper 2 ACP**
  - **Design of two Experiments & Data Collection**
  - Visuo-haptic vs. visual-only exposure to target products on visual fluency, product attitudes, and brand choice
- **Paper 3 JCP**
  - **Formulation of RQ (2a; b) & Hypotheses**

### 2015
- **Paper 4 JCP**
  - **Submission: Under Review**

## Motor Project

### Literature Review

### Formulation of RQ (2a; b) & Hypotheses

### Pre-Tests
- Selection of products for a shopping task; pretest of vice-virtue valence

### Design of three Experiments & Data Collection
- Priming of arm pull-push behaviors
  - within a realistic shopping scenario (pushing a shopping cart)
  - within a controlled lab procedure on pretested vice-virtue products
  - within a controlled lab procedure and additional manipulation of the situated meaning of pull-push behaviors

### Data Analysis (SPSS)

### Submission: Under Review

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**Figure 1:** Flowchart of the research inquiries
5. Contributions of Individual Paper Projects

The following chapter provides an extended abstract for each paper. The extended abstracts provide only that information, which is directly necessary to understand the main findings of each paper. Details about the method, design and statistical data can be found in the full paper versions in the Appendices.

Because Paper (1) and (2) are based on the same data they overlap in important points. The main difference is that Paper (2) takes additional variables and analyses into account, which had to be omitted from Paper (1) due to the brevity of the publication format. Both papers are published (Proceedings of Consumer Research and Applied Cognitive Psychology).

Paper (3) was submitted to the Journal of Consumer Psychology and is invited for revision and resubmission. Due to changes in the review procedures the journal nowadays requires writing a detailed revision plan, which has been already submitted and accepted for Paper (3). The revised paper will be submitted by end of June 2015.

Paper (4) was submitted to the Journal of Consumer Psychology and is currently under review.
5.1. Paper (1): From the Hands to the Mind – Haptic Brand Signatures

Mathias C. Streicher (2012),
Advances in Consumer Research Vol. 40.
See Appendix (A) for a full version of that paper

Paper (1) investigates the question whether haptic cues such as product packages are effective brand identifiers. The paper shows that brief exposure to brand-specific haptic primes (e.g., two seconds) semantically activate the brand, thereby promoting the brand’s visual perception, cognitive accessibility, and choice in subsequent situations. The data of paper (1) helps answering research question (1a).

To prevent visual confounding, the participants were blindfolded throughout the priming procedure. Under the guise of a weight judgment task, the participants were handed two identical beverage containers in both hands, which were removed after a brief duration (approximately 2 seconds). This priming procedure was identical for all experiments reported in the paper. The participants were handed Coca-Cola bottles, Red Bull cans or Römerquelle water bottles, which served as priming stimuli (between-subject design). According to pretests the Red Bull can and the Coca-Cola bottle are haptically associated with the respective brand whereas the Römerquelle is not associated with any particular brand. After removing the objects from the participants, the experimenter asked whether one of the objects was heavier (the experimenter attached for one of the two containers additional 20 grams). Afterwards, the respondents participated in another study, which was the actual dependent measure (visual brand identification task in Experiment 1-2; brand listing task in Experiment 3; brand choice task in Experiment 4). We also checked for hypothesis guessing and whether the participants were aware of the brand stimulus during the weight judgment task.

Experiment 1 and 2 indicate that purely tactile exposure to a familiar branded product facilitated perceptual identification of that brand, relative to priming of a competitor brand and relative to an unprimed control group. For instance, participants identified “Red Bull” more quickly after holding Red Bull cans than after holding Coca-Cola bottles. It was also shown that haptic priming of Coca-Cola bottles significantly increased visual perception of the brand Coca-Cola compared to priming of similarly shaped Römerquelle bottles. Thus, experiment 1 and 2 revealed that haptic priming of visual brand recognition was brand specific.
Experiment 3 tested whether haptic priming of familiar branded product packages increases a brand’s salience in later situations. Nedungadi (1990) showed that visual priming of brand names increases a brand’s likelihood of being included in the consideration set in later consumption situations. Experiment 3 replicates this effect with a haptic prime and shows that haptic priming increased a brand’s salience in the consideration set. For instance, the brand Red Bull was listed more often on the first rank after touching Red Bull cans rather than touching Coca-Cola or Römerquelle water bottles. Touching Red Bull cans thus reliably increased the brand’s salience in later situations.

Experiment 4 investigated whether haptic priming links to important consumption variables such as brand choice. The previous findings on visual brand recognition and brand salience suggest this effect. Coca-Cola and Red Bull products served as haptic stimuli in the weight judgment task. After the task, participants were asked to choose either a Coca-Cola or a Red Bull beverage as reward for participating. As expected, participants significantly preferred whichever brand was touched in the weight judgment task.

The findings are consistent with our predictions based on grounded cognition (Barsalou 1999, 2009). The paper shows conceptual priming of visual brand perception from touch as well as important downstream effects on brand consideration and choice. All participants were debriefed after the experiment for awareness of the prime brand during the weight judgment task so that the analysis included only participants who were unaware of the haptic prime.

One limitation of Paper (1) is the relative brief analysis and discussion of the data not least owing to the publication format. Paper (2) thus expands on the conceptual framework, data analysis and discussion. The most important extension is the additional analysis of boundary conditions such as the role of Need for Touch (Peck and Childers 2003a, 2003b) in modulating haptic priming and whether consciousness of the prime brand enhances or inhibits priming effects.
5.2. Paper (2): Touch and Go – Merely grasping a product facilitates brand perception and choice

Mathias C. Streicher and Zachary Estes (2015), Applied Cognitive Psychology

See Appendix (B) for a full version of that paper

Similar to Paper (1) Paper (2) investigates the question whether product packages are effective brand identifiers. Paper (2), however, extends the conceptual framework and data analysis in important ways. Since we had included an awareness check after the experiment (e.g., aided recall) we had recorded whether a participant was aware of the prime stimuli or not. Additionally, we asked the participants to provide their Need for Touch scores on a German version of the NFT scale (Nuszbaum et al. 2010). Paper (2) thus substantiates the findings of Paper (1) by additionally analyzing how the participants’ Need for Touch scores and prime awareness modulate haptic priming.

Whereas Paper (1) included only subjects who were unaware of the prime brand Paper (2) explicitly distinguishes between participants who consciously identified the prime brand during the weight judgment task and those who did not. This is important as it provides additional information about the strength and generality of the haptic priming effects. In experiment 1 and 2 (visual identification task), we found no significant difference between participants who were aware of the prime brand during the weight judgment task and those ones who were not. Thus, the cross-modal priming of visual brand identification did not vary as a function of conscious awareness of the prime brand.

In experiment 3 (e.g., brand listing task), we additionally analyzed the general likelihood of listing a brand in the consideration after the priming, which is a more sensitive measure rather than analyzing whether a brand was listed on the first rank (see Paper (1)). We found that both brands Red Bull and Coca-Cola were listed more frequently after grasping the respective brand stimulus compared to the groups that touched different brands. We also analyzed the mean rank of listing Coca-Cola and Red Bull in the brand listing task. The results revealed that both brands had significantly higher mean ranks after touching the respective brand stimulus than after touching different brands. Again, we analyzed whether the effects varied as a function of conscious awareness of the prime brand during the weight judgment task. Indeed,
conscious awareness moderated the haptic priming with higher consideration set salience for participants who had explicit memory of the priming stimulus. The effect of haptic priming on brand salience, however, remained still significant for prime unaware participants.

In experiment 4 (brand choice task), we additionally analyzed whether the haptic priming of brand choice varied as a function of the participants’ NFT scores. Neither the autotelic nor the instrumental dimension of the NFT scale interacted with the haptic priming effect. We therefore conclude that participants’ NFT scores did not modulate haptic priming on brand choice. This also indicates that the effect of haptic priming has greater generality than other touch-related consumption effects (e.g., Krishna and Morrin 2008, Peck and Wiggins 2006).

Paper (1) and (2) jointly support answering research question (1a): Haptic priming of familiar branded products increase the consideration and choice of that brand in later situations, and, as shown in Paper (2), the effects are independent from conscious awareness or NFT traits. Thus, the effect of product touch on brand choice has greater generality than previously assumed. Moreover, the failure of the perceptually similar Römerquelle bottle to facilitate perception of “Coca Cola” in Experiment 2 indicates that the haptic activation of the brand concept was highly specific.

Another important question is whether briefly viewing and touching products increases brand choice relative to viewing only. The following Paper (3) evolves around this topic.
5.3. Paper (3): Mere touch improves product evaluation and increases brand choice via processing fluency

Mathias C. Streicher and Zachary Estes (submitted 2014, under revision), Journal of Consumer Psychology
See Appendix (C) for a full version of that paper

Paper (3) investigates the question whether briefly touching products increases brand choice through increases of processing fluency. The paper differs from the previously presented concept in that we investigate touch-related consumption effects from bi-modal integration rather than conceptual priming effects from touch. Paper (3) shows that briefly touching and viewing products increases product attitudes and brand choice relative to viewing only. The paper further scrutinizes the underlying processing mechanisms and finds that brand choice is mediated by increases in processing fluency. Hence, Paper (3) gives important answers to research question (1b).

In experiment 1, the participants were seated in front of a 21-inch monitor and were visually presented two water bottle brands onscreen that slightly differed in their shape. Because we counterbalanced the left-right position for each bottle brand, we always provided the right water bottle in the touch condition behind the screen. Each of the two water bottle brands appeared equally often on the right side in both the no touch and touch condition (e.g., one-factorial between design). Upon appearance of the bottle pictures the participants were asked to either look only at the product (e.g., visual-only condition) or to reach behind the screen and grasp the product while viewing the product picture onscreen (visuo-haptic condition). After 4 seconds of exposure, the visual depiction of the water bottles disappeared and participants in the visuo-haptic group were asked to remove their hand. This procedure allowed us to control the visual and haptic exposure time. Before the actual test trial, there was one practice trial with an unrelated product (e.g., canned soup) to familiarize the participants with the procedure. The overall procedure was identical for both groups except the absence of touch in the visual-only group. After the product exposure, all respondents were asked to provide their answers on multi-item scales (e.g., processing fluency) and were offered to choose from one of the two water bottles as reward for participation (e.g., the dependent variable). Finally, they were asked to provide additional control questions and debriefed for hypothesis guessing.
The analysis revealed that choice of the right position of the two groups differed significantly. As predicted, the group that saw both bottles while touching the right bottle behind the screen significantly preferred the right (touched) brand over the left brand. In contrast, the group that looked only at the visual targets chose equally from the left and right bottles. We further found that the visuo-haptic group experienced significantly higher fluency in visually processing the right (touched) water bottle compared to the visual–only group. A mediation analysis was conducted to see whether processing fluency mediated the touch-related choice of the right bottle. The indirect effect through processing fluency was significant and in the presence of the indirect effect the direct effect of touch on brand choice became non-significant. The findings thus suggest that processing fluency from visuo-haptic shape integration mediated the results from touch on brand choice (indirect-only mediation).

Experiment 2 was conceptually identical to experiment 1 but differed in stimuli presentation (e.g., novel Coca-Cola bottle designs) and dependent measures. Like in the prior experiment, participants either viewed a product onscreen or viewed the product while additionally touching it behind the monitor. A professional graphic designer developed eight novel Coca-Cola bottle designs, which were pretested. Four bottle designs were selected from the pretest, which were rated approximately equally in terms of their liking. We randomly assigned two of the pretested bottles to each participant, which were presented in two consecutive trials onscreen. Each participant completed the two test trials, which were each followed by the same multi-item questions (e.g., processing fluency, product attitudes, perceived ownership). Instead of asking the participants to choose between two products like in experiment 1, we asked them after each stimulus presentation to provide their purchase intentions. Responses on the multi-item scales were therefore averaged across the two test trials and combined into one index for processing fluency, perceived ownership, and product attitudes. Subjective ownership feelings were recorded because product touch has been reported to increase product valuations (Peck and Shu 2009; Shu and Peck 2011) and we were interested whether this variable contributes to our effects. Aside these modifications experiment 2 was identical with experiment 1.

The analysis of experiment 2 revealed that product attitudes, processing fluency, and subjective ownership feelings were significantly increased as a function of touch relative to no touch. We therefore conducted a multiple mediation analysis to see whether ownership feelings and processing fluency jointly mediate the touch-related increases of product attitudes.
The indirect effect through processing fluency was significant but not the indirect effect through ownership feelings. The data of experiment 1 and 2 thus corroborates the predictions from visuo-haptic shape integration (Ernst and Banks 2002; Helbig and Ernst 2007), which helps answering research question (1b).

Paper (1), (2), and (3) show that brief touch can increase brand choice. The papers also show that there are multiple routes in obtaining such effects. One route is to prime haptic properties, which are part of consumer brand knowledge. Another route is to engage consumers’ in touching products, because bi-modal product sensations from highly integrated senses support consumers’ brand choice through facilitated perceptual processing. Both routes can ultimately influence product and brand choice in dramatic ways.

Mathias C. Streicher and Zachary Estes (submitted 2015, under review), Journal of Consumer Psychology
See Appendix (D) for a full version of that paper

Paper (4) investigates three potential explanations for motor priming of consumption. Paper (4) finds that pushing a shopping cart with flexed rather than extended arms generally increases product purchases for both vice and virtue product categories. Scrutinizing the effects, Paper (4) finds support that if product choice is associated with movements towards the body, priming of arm flexion rather than extension increases purchases. This effect is not fixed, however, because if product choice becomes framed as movement away from the body (e.g., due to situated task demands) priming of arm extension rather than flexion increases purchases. The data favor an ideomotor compatibility explanation, which helps answering research question 2.

In experiment 1, participants pushed a shopping cart in a shopping task with either flexed or extended arms (e.g., one-factorial between design with two levels). To distract the participants from the arm posture, we attached impulse pads either on the top or on the bottom of a cart’s handle bar (e.g., on both endpoints of the bar). We additionally wired the impulse pads to an ostensible recording device, which was placed inside the shopping cart. Under the guise of an EMG study, the participants were then told to keep their hands on the impulse pads while pushing the cart so that physiological reactions could be recorded during their shopping. This naturally induced either arm flexion or extension without making the arm posture salient. The participants then moved the shopping cart in one of the two arm postures to two tables, which were equidistant from each other and from the starting point (10 meters). The two tables displayed either vices (e.g., candies) or virtue products (e.g., dish soap), labeled at regional discounter prices. The participants were asked to shop at the first table (e.g., write down their product choices on a questionnaire), and then continued to push the cart to the second table to proceed with their shopping. The spatial position of the vice-virtue tables was counterbalanced in both conditions and we also counterbalanced whether the vice or virtue table was to approach at first. At the end of the experiment the participants were asked additional control questions (e.g., mood) and debriefed for hypothesis guessing. Experiment 1 found that partic-
Participants in the arm flexion condition generally purchased more products rather than the arm extension group. We also found no difference between vice and virtue products so that arm flexion rather than extension increased purchases equally for vice and virtue products. Note that Van den Bergh and colleagues’ motivational theory would predict that priming arm flexion increases preference only for vice but not virtue products. Moreover, following the motivational logic arm extension should increase preference of virtues, which we did not observe at all. Experiment 1 thus supports either the evaluative or the ideomotor compatibility account.

In experiment 2 we applied a standard lab procedure for arm flexion and extension (e.g., Förster 2003; Van den Bergh et al. 2003). To induce arm flexion or extension, participants were asked to press their dominant hand either against the top or bottom of a table while they chose from several pretested vice and virtue products in a web-based shopping scenario. We additionally included a control group, which was asked to simply rest their dominant hand on their laps (e.g., one-factorial between design with three levels). Consistent with experiment 1, we found that the arm flexion group purchased more products independent of vice–virtue valence relative to the extension and control group. Moreover, there was no difference between the control and arm extension group, so that posture primes only facilitate but not inhibit consumption relative to a control group. This is in line with prior research, which has shown that only cognition-compatible arm movements influence product evaluations (Förster 2004). This supports the ideomotor compatibility account because arm flexion is by default compatible with acquisition of objects and arm extension is not (Glenberg and Kaschak 2002). The evaluative conditioning model in contrast would predict approximately equal increases and decreases relative to a neutral group, which received no affective treatment.

In experiment 3 we used the same arm paradigm as in experiment 2 except the absence of an unprimed control group. As the focus of this study was on whether changes in the environmental context mediate effects from arm posture primes we had participant indicate their product choice by actually moving their product purchases either towards or away from the body while either performing arm flexion or extension with the dominant arm (e.g., two-factorial between design with two levels for each factor). This reversed the situated meaning of the motor movements in regards to represent product choice, which allowed us to test the compatibility explanation more directly against the evaluative and the motivational account. The stimuli were 12 Red Bull cans at discounter price, which were placed in front of the seat-
ed participants on a table. After the experiment, several control questions were administered to the respondents. If effects from arm posture primes are compatibility effects between motor input and mental motor representations, the reversal of choice direction should interact with the motor primes. Indeed, we found exactly this interaction between motor primes and choice direction (e.g., towards vs. away). Participants, who had to indicate their purchases by moving the desired amount of a product towards the body, purchased more when performing arm flexion rather than extension. This result basically replicates the result of the prior experiments. Participants who indicated their purchases by moving the desired amount of a product away from the body, purchased more when performing arm extension rather than flexion. Experiment 3 thus suggests that the compatibility of motor input (e.g., arm flexion or extension) and choice direction (e.g., towards or away) mediated the results.

In sum, all three experiments support the basic notion that by default arm flexion rather than extension increase consumer behavior (Förster 2003, 2004; Van den Bergh et al. 2011). The results, however, deviate from prior studies. We demonstrate that arm flexion and extension influence behavior not through hardwired evaluative or motivational links but based on their compatibility with mental motor simulations. This suggests that priming effects from lateral arm movements are not stable but they depend on task demands. This extends existing theory in important ways and provides novel managerial implications. Paper (3) therefore helps answering research questions 2.
6. Discussion

In 1997, Zaltman published an emotional proclamation in the Journal of Marketing Research where he criticized the amodal perspective in studying consumer phenomena, which was the prevalent cognitive perspective at that time. Almost two decades later, the marketing of the senses has lead to fundamental shifts in the phenomenology of today's marketing (Achrol and Kotler 2012). However, there still remains much to learn within this relative young subdomain of marketing. Touch is often said to be the least studied sense in marketing (Peck and Childers 2008) and the motor modality is sometimes not even appreciated as source of consumption experience (Lindstrom 2005; Hultén et al. 2009). This thesis contributes to current literature in the field of sensory marketing by demonstrating how the haptic and motor modality shape important consumption variables. First, the research demonstrates that brief product touch is sufficient to increase product and brand choice. This can be achieved by either priming haptic properties of a brand (Paper 1–2) or by simply allowing consumers to touch products (Paper 3). Second, the research shows that product purchases can be influenced by incidental motor activities such as the pushing of a shopping cart (Paper 4). The research also shows that the motor priming of consumption depends on situated task demands so that the ecological validity of motor studies is critically constrained by the context in which the results were obtained. This chapter provides a detailed discussion of the results along with limitations and an agenda for future research.

6.1. Theoretical Implications

Although product touch was previously known to increase product evaluations (Grohmann et al. 2007) and consumers’ confidence in those evaluations (Peck and Childers 2003a), Paper (1), (2), and (3) provide the first demonstration that brief product touch increases actual consumer choice. Moreover, Paper (1) and (2) are also the first to demonstrate “pure” effects of touch: Whereas prior marketing studies allowed consumers to see and touch products (Grohmann et al. 2007; Krishna and Morrin 2008; Peck and Childers 2003a, 2003b), our participants grasped the products without seeing them. Our results thus provide the first evidence, under the most controlled conditions, that haptic exposure facilitates preference for the given brand. But how does brief product touches increase brand choice?

Following the conceptual framework on situated simulation in general and cross-modal prim-
ing in particular, Paper (1) and (2) show that haptic exposure to the given product activated a conceptual representation (e.g., Barsalou 2009; Martin 2007; Pesquita et al. 2013; Reales and Ballesteros 1999), which then facilitated subsequent processing of the given brand. Through repeated experiences with Coca Cola, for example, our brains encode and associate the various sensory properties of this brand, including not only its taste, but also the look and feel of its bottle, the sound of the brand name, etc. The mental representation of Coca Cola thus includes its sensory properties, which are strongly associated with one another and with the brand name. Grasping a Coca Cola bottle thus activated the conceptual representation of Coca Cola (Experiment 3), which facilitated perception of “Coca Cola” (Experiments 1 and 2), and in turn, this increased processing fluency led participants to choose Coca Cola (Experiment 4). Also recall that awareness of the haptic prime brand increases the magnitude of the effect (Paper 2, Experiment 3). Our experimental paradigm might therefore underestimate the true magnitude of the effect in many real-world contexts, because our participants were blindfolded. In more realistic shopping settings people are fully aware of the brands they grasp. Thus, researchers should be aware that the impact of haptic brand priming is highly sensitive to other contextual factors.

Moreover, the haptic activation was highly specific because the perceptually similar Römerquelle bottle did not facilitate visual perception of “Coca Cola”. Prior research has demonstrated how rather unspecific haptic perceptions such as weight or temperature can activate general concepts (Ackerman et al. 2010; Chandler et al. 2012; Williams et al. 2009) or how touching a product activates a semantic representation of a product category (Pesquita et al. 2013). The present research, in contrast, shows that haptic priming is not limited to a few fundamental haptic properties and that activation can be very specific for a particular product in a category. Touching artificial shape and texture combinations of objects (e.g., products) can therefore prime specific knowledge structures (e.g., brands) if they are part of them.

Paper (3) provides another demonstration of how merely touching products may increase actual brand choice but differs from Paper (1) and (2) in important ways. Paper (3) shows that bi-modal sensations from vision and touch increase product and brand choice relative to only viewing products. Prior studies have shown that physically controlling a product can increase a product’s perceived value through ownership feelings (Peck and Shu 2009, Shu and Peck 2011). Paper (3) extends this literature by demonstrating that brief touch (i.e., 4 seconds) is sufficient to increase brand choice and that processing fluency mediates the effect. Much re-
search in the field of multisensory integration suggested this mediation by processing fluency: Vision and touch are fundamentally integrated sensory systems, in that they serve similar functions of object identification and they activate largely overlapping neural pathways in the visual cortex (Amedi et al. 2002; Lacey and Sathian 2012). Indeed, visuo-haptic perception facilitates identification of object properties (Ernst and Banks 2002; Helbig and Ernst 2007), and thus seeing and feeling the shape of a product facilitates consumers’ ability to think about the product, relative to only viewing the product. This increase in processing fluency, in turn, ultimately improves those evaluations and increases the likelihood that consumers will choose that product (Janiszewski and Mayvis 2001; Lee 2002; Lee and Labroo 2004; Labroo et al. 2008). We also investigated whether subjective ownership feelings might have contributed to the effect (Peck and Shu 2009, Shu and Peck 2011). The analysis indicated that only processing fluency but not perceived ownership mediated the effect of touch on choice. That does not mean that touch-related ownership does not increase brand choice. It could well be that perceived ownership increases brand choice at longer visuo-haptic exposure rates. Previous research suggests this moderation from haptic exposure time (Wolf et al. 2008). As far as it concerns brief product touch, Paper (3) shows that processing fluency should be given more weight as explanation. Thus, Paper (3) extrapolates from recent neuroscientific studies of multisensory integration to propose, test, and support a new and important processing mechanism underlying the mere touch effect.

Paper (1), (2), and (3) also investigate important boundary conditions of touch-related effects. Unlike several prior studies (Grohmann et al. 2007; Peck and Childers 2003a, 2003b), all three papers found that NFT scores did not moderate the effect of product touch on choice. Krishna and Morrin (2008), for instance, report that high but not low NFT consumers are able to discount influences from haptic stimulation on product evaluations but their participants were fully aware of what they had grasped (e.g., a stable vs. flimsy plastic cup). Our participants were blindfolded and typically unaware of the haptic stimulus or they grasped the product for a limited amount of time (i.e., 4 seconds). This suggests that effects from NFT traits require a minimum of conscious elaboration on haptic information. Thus, brief haptic exposure to a product has even more general and direct effect on consumer behavior than previously known.

Paper (4) shows that pushing a shopping cart with flexed rather than extended arms increases purchases for different product-types such as vices and virtues. Because of the absence of a
product-type interaction a motivational account (Van den Bergh et al. 2011) cannot explain our results. The research also show that arm flexion increased purchases, whereas arm extension had no effect on purchases, relative to a neutral arm posture. This is at odds with the evaluative conditioning account because several studies have shown that positive conditioning of a neutral target increases product evaluations, whereas negative conditioning of a neutral target decreases evaluations (Schemer et al. 2008; Walther and Grigoriadis 2004). Moreover, Paper (4) shows that arm flexion and extension can both be functional to increase consumption of desirable products. This is virtually incompatible with the motivational and the evaluative conditioning account because they are both based on a conditioning logic that does not predict situated effects. Rather the effects point towards a compatibility effect from mental simulations and actual motor input.

Much data suggest that thinking is grounded in perceptual simulations that recruit motor representations (Chao and Martin 2000; Tucker and Ellis 2001). Thus, in simulating product acquisition specific movements are functional means to this end. Prior research has demonstrated that conceptual processing of object acquisitions potentiates arm flexion responses (Glenberg and Kaschak 2002). By default, consumption and product acquisition is typically enacted by arm flexion to bring desirable food towards the mouth or to take possession of objects. Priming of arm flexion therefore increases consumption because it is compatible with mentally simulating product acquisition. Thus, if a shopping situation conceptualizes product acquisition as movement away from the self (experiment 3) arm extension rather than flexion is compatible with mental simulations of product acquisition, which increases consumption.

Moreover, paper (4) provides important information about the direction of the effects. Based on prior research it was impossible to conclude whether arm extension inhibits consumption or not (Förster 2003; Van den Bergh et al. 2011). Our research shows that incompatible arm movements do not influence consumption in relation to a neutral group with no arm posture treatment (experiment 2). Thus, lateral arm movements only facilitate but not inhibit consumption. But how can this effect be explained? Research suggests that people experience resource depletion when motor activities are incompatible with their cognitions (Förster and Strack 2000; Förster and Strack 1996). Thus, one explanation for the absence of an inhibitory effect of arm posture priming on consumption is that people experience signals from this resource depletion, which in turn leads to automatic correction of their behavior (Förster 2004; Strack 1992).
The compatibility model can also explain results from prior research, so it incorporates other findings as particular instance of a more general explanation. Imagine you are presented an apple and a chocolate bar and you are forced to choose one of the two products (like Van den Bergh and colleagues did). The forced choice between the vice and virtue product evokes a self-control dilemma with temptation on the one side and the higher-order goal of healthy eating on the other. Fulfilling the long-term goal of healthy eating requires distancing from the temptation (Trope and Fishbach 2000). In this particular situation arm extension is best suited to construct a perceptual simulation, which represents this goal. In fact, people with dieting goals are significantly faster in detecting temptations (e.g., calorie-rich food) by pushing a joystick away and faster to detect virtue activities (e.g., work-out) by pulling a joystick towards themselves compared to non-dieters (Fishbach and Shah 2006). Hence, merely extending arms in a forced-choice dilemma should facilitate mentally distancing from the temptation, because motor input and simulations are compatible. Indeed, Van den Bergh and colleagues found that inducing arm flexion relative to extension sabotages self-control in a temptation dilemma. Ideomotor compatibility therefore is contingent upon the mental simulation of problem solving in a particular situation, rather than a hardwired and unmalleable association between bodily activity and mental states.

6.2. Managerial Implications

Paper (1), (2), and (3) show that brief product touch is a powerful means to induce preference for products. The effects are also high in their generality since individual NFT scores neither modulate haptic priming nor processing fluency. Our finding on haptic priming suggests that implicit or incidental haptic activation from haptic signatures can influence brand choice. Many Dutch beer brands, for example, emboss their brand names onto glass containers, and Heineken just recently launched a new can design using tactile ink, which vividly elicits the illusion of condensed water on the can’s surface. In consuming beer from a tactile can haptic memory becomes stored for this brand, thus rendering the brand more accessible in mind when feeling the same texture in a subsequent consumption situation. Moreover, data from mere exposure research suggests that automatic recognition processes instill a feeling of familiarity, which can increase brand attitudes (Janiszewski 1993).

Situations in which consumers can learn a specific feel of a brand are abundant. Products and their packaging are altogether potential brand identifiers, which are often touched prior, during, or after consumption. This learning process happens mostly incidentally because repeated
exposure naturally co-occurs with every consumption situation. Given the abundance of logos and visual clutter in shopping situations, haptic brand signatures might therefore be an effective alternative to establish brand identifiers. This seems favorable since strong and unique associations in consumers’ mind are said to be the basis of strong brands (Keller 2008). The reality, however, is that many fast-moving consumer goods are increasingly sold in identical product packages (e.g., the 0.33 liter slim can) to reduce spending on product packaging because increasing standardization is commonly associated with cost reduction (Samiee and Roth 1992). A brief look at the product landscape reveals that many managers are not fully aware that competitive advantages through haptic signatures could compensate extra spending on product design and packaging in the long run.

Red Bull, for example, was the first company to market slim cans to the mass and the failure to establish exclusive property rights for the container has weakened their sensory asset. Thus, me-too brands (e.g., Flying Horse) have used their unprotected haptic signature in the meantime, which presumably facilitated their market entry rather than preventing it. Based on semantic touch-taste transfer effects (Krishna and Morrin 2008) it seems likely that touching slim cans also improves taste perceptions of me-too energy drinks because the touch is associated with the market leader. Because the studies, in which we used the slim can as priming stimulus, were conducted already a couple years ago multiple brands could be associated with the feel a slim container nowadays. Back then, the haptic feel of the slim container was indeed primarily associated with Red Bull, which was also corroborated by pretests at the time. But given the mass of products, which use this container format today, it seems likely that touching a slim container would nowadays prime a lot of different competitor brands such as Monster, Rockstar, Flying Horse, or even Coca-Cola. Coca-Cola’s strategy to market their beverages in identical slim containers thus seems like an unreasonable strategy, which, if anything, reduces differentiation based on such brand manifestations.

How could haptic signatures be used other than on products? Many retail shops, for example, have refrigerators that consumers can open to select a beverage. Our results suggest that consumers’ choices are routinely affected by the shape of the refrigerator handle. If the handle were shaped like a Coca-Cola bottle, people would presumably be more likely to choose Coca-Cola. And conversely, rounded handles should promote the choice of Red Bull. One might similarly expect haptic priming of consumer choices based on the haptic properties of a shop-
ping basket, for instance, or indeed of any object that the consumer grasped before the given choice.

But even products without a unique haptic signature can benefit from product touch. The results of Paper 3 suggest that simply allowing consumers to quickly touch products increases liking and ultimately choice of the brands. This is, because bi-modal sensations from touch and vision facilitate consumers’ understanding of products, which is experienced affectively positive (Reber et al. 2004). Bulky packages or closed showcases therefore sabotage product liking for both low and high NFT consumers because NFT did not moderate our touch effects. Conversely, product displays that invite for product touch capitalize on this mere touch effect. The Austrian drug store DM, for example, has recently begun to attach unpacked samples of shavers to their shelves to stimulate consumers to touch the products and our results suggest that such incidental product touches increase product sales. Brief product touch might even increase liking of visually unfamiliar product designs such as the present research demonstrated in experiment 2 of Paper (3). Given that marketing budgets for new products are often limited, managers could allocate their resources to in-store promotions that stimulate product touch rather than to visual advertisements. One may even think of time-limited campaigns with promoters encouraging consumers to touch a promoted product.

The results of Paper (4) have also important practical implications for managers, in particular because experimental task demands are explicitly treated as mediators. Thus, the ideomotor compatibility model prevents overstating the ecological validity of experimentally obtained results, which can eventually prevent managers from drawing wrong conclusions from such data. The account also provides a practicable rationale to analyze and predict how motor activities might influence consumption. The most important step is to clarify how the motor system might be used as representational resource in a particular consumption situation (Wilson and Golonka 2013). For instance, opening refrigerator doors towards oneself is intrinsically more compatible with subsequent product choice than sliding doors sideward. But ideomotor compatibility also predicts that arm flexion may not always increase purchases, depending how a situation conceptualizes consumption. Many impulse purchases made at the check-out area are enacted by moving the chosen products away from oneself, by either handing the product directly to a cashier or placing it onto a belt that moves away from oneself and toward the cashier. Our results suggest that such product choices made directly at the check-out area should be facilitated by arm extension, rather than arm flexion.
Ideomotor compatibility also applies to other motor paradigms and situations. Given that counting is easier when experiencing a congruent motion (Lugli et al., 2013) it might pay off to walk business partners prior to price negotiations downstairs to facilitate discounts.

6.3. Public Policy Implications

Our results provide also import implications for public policy makers. As a side effect, the results in this research represent mostly automatic cognitions because the true goal of the experiments, and thus the manipulations, were always disguised to reduce response bias (Viswanathan 2008). Such manipulations and effects typically operate outside of consumers’ awareness. This is per se not so dramatic since large parts of consumers’ cognitions are said to operate on subconscious levels (Bargh 2002). The ethical problems seem to start at where manipulative techniques are applied with the explicit intention to bypass defensive screen mechanisms of consumers. Since human nature is opportunistic it is a major responsibility of consumer research to contribute to critical discourses, at least by providing information to the public. Some scholars even suggest that consumer research should balance studies of how to influence consumer behavior with studies on how to defend against such unwanted influences (Bargh 2002).

Paper (1) and (2), for instance, show that cylindrical handles on refrigerator doors could lead to increased sales of Red Bull, and the consumer might not be aware of this influence. Nostalgia fans might still remember the rubber grips for bicycle handlebars that were shaped like Coca-Cola bottles. Our results implicate that these are ways to berth brands unobtrusively in consumers’ life similar like product placements are weaving brands into TV shows. Fitzimmons, Chartrand, and Fitzsimons (2007) provide a stark example how subliminal priming of brands can influence behavior in subsequent situations.

Paper (4) provides another demonstration that even unobtrusive activities such as the pushing of a shopping cart can influence spending behavior. It would take only relative simple adjustments to induce arm flexion by means of a modified shopping cart (e.g., handles similar to a borrow). Our data also suggests that posture primes only facilitate but not inhibit consumption. But how can one defend against such influences?

Although we did not investigate potential defense strategies some recommendation should be given at this point. Prior research has show that psychological distance generally facilitates
embodiment effects (Jia and Smith 2013). Psychological distance is often referred to as high levels of construal and it means that people have rather broad cognitive processing styles (Trope and Liberman 2010). Conversely, thinking analytically induces low levels of construal, which hamper unwanted embodiment effects. This basically means that the more a consumer thinks about her decision the less likely such influences should occur.

In this sense, our findings can contribute to consumer protection because they allow public policy makers to make informed judgments about the persuasive potential of such unobtrusive manipulations as described here. Some marketing scholars even argue that the marketing of the future should have the normative commitment to stimulate self-education of consumers in becoming responsible decision-makers (Webster and Lusch 2013). Because the author feels committed to such ideals, parts of this work have been featured in public magazines (e.g., Haptica) and national TV-documentaries (e.g., ORF2).

6.4. Limitations and Future Research

Although the present research was designed and conducted with the intention to provide novel consumer insights under the most controlled conditions the research has several important limitations.

Because Paper (1), (2), and (3) used a controlled procedure for the haptic exposure we learn nothing about how variations in haptic exposure time might contribute to the effects. This is important for two reasons: first, haptic dwell time might differ with product category as well as with product involvement and it would be informative to investigate this issue more closely. Second, because the haptic exposure rates in Paper (3) were rather brief, it does not provide strong tests of competing explanations such as perceived ownership (Peck and Shu 2009). With increasing exposure rates, perceived ownership could indeed mediate purchases such as suggested by prior research (Peck and Shu 2011; Wolfes et al. 2008). Our results are not meant to challenge prior findings on mere touch, rather we show more conclusively that processing fluency explains choice effects if product touch is rather brief. Another limitation of Paper (3) is that the experimental paradigm was rather low in ecological validity. In both studies, participants grasped a product behind the computer screen while viewing the product onscreen. Although this allowed us to control the exposure rates for the visual and haptic modality, the procedure itself creates a rather artificial consumption setting. Other factors, which we did not address, might modulate the effects in Paper (3) and should be included in future
research. According to Helbig and Ernst (2007), the haptic modality contributes more to the overall perception if the visual source is unreliable. Bright light conditions in supermarkets, for example, increase the reliability of the visual modality, which could reduce processing fluency effects from touch to ineffectiveness. Conversely, overcrowded store shelves tax the visual system, which could increase the weight of the haptic system in shaping an overall perception, thereby increasing processing fluency from touch. It also has to be clarified whether the psychological processes from mere touch occur only for objects that are manipulable by hands. In fact, based on recent cognitive research it seems likely that perceived ownership and processing fluency occur only for products that can be grasped with the hand (Connell et al. 2012).

Moreover, it is not fully clear from Paper (1–3) how the two mechanisms haptic priming and visuo-haptic integration relate to each other. Pesquita et al. (2013) provide an example that conceptual priming from touch and visuo-haptic shape integration might jointly contribute to object recognition. In experiment 2 of Paper (3) we used classic Coca-Cola bottles as touch stimulus and found that touching them increased liking of novel Coca-Cola designs through processing fluency. One might therefore speculate that parts of the increased fluency and liking could have been due to conceptual priming of the brand from touch like we showed in Paper (1–2). Although it would not change our basic finding (e.g., that increases in processing fluency mediate increases in product liking) it would be informative to further scrutinize the source of the effects (e.g., a combination of visuo-haptic shape integration and conceptual priming). Future research could investigate the relationship of different sources of the mere touch effect and if they are additive.

In Paper (4) we tried to apply a realistic shopping scenario. Despite our efforts one might speculate whether our design overstates the magnitude of the effects. Across all three studies our participants maintained the induced arm posture very consistently while making hypothetical purchases. Our results could thus overstate the magnitude of such effects in real shopping situations, where arm postures presumably are less consistently maintained across the course of shopping. Future studies should investigate the magnitude of such effects in real shopping settings, which would give the additional opportunity to investigate how differing shopping apparatuses contribute to this effect (e.g., basket vs. cart).
7. References


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II. APPENDICES
Appendix A: Paper (1)

From the Hands to the Mind:  
Haptic Brand Signatures

Mathias C. Streicher (2012),  
Advances in Consumer Research Vol. 40.
From the Hands to the Mind: Haptic Brand Signatures

Mathias Streicher

ABSTRACT

How closely are brands linked to their haptic signatures? One pretest and four experiments show that brand-specific haptic primes automatically activate a brand’s knowledge structures, thereby promoting perceptual processing in other modalities, cognitive accessibility, and prime-congruent brand choices. Implications for sensory marketing and product management arise.
Many consumption situations connect consumers to brands in a physical sense by touch. A famous example is Coca-Cola’s contour bottle, which has become the brand’s haptic signature and part of consumers’ brand knowledge. Here, I address the question of how closely brands are linked to their haptic signatures. In four experiments I show brand-specific knowledge activation from haptic primes with implications for sensory marketing.

Touch is the first sense to develop in the womb presumably providing an early matrix for self-awareness in the absence of the external world (Gallace and Spence 2010) and it is the only proximal sense that connects the percipient directly to the source of experience (Peck 2010). Touch-orientated consumers feel more frustrated and less confident when making product evaluations if touch is unavailable (Peck and Childers 2003a) and simply holding products in the hands can promote a sense of psychological ownership (Peck and Shu 2009). While some companies already brand haptic sensations very successfully (Lindstrom 2005), research on brand-related touch thus far has received no attention at all, perhaps because the touch sense is still the most underappreciated sense in marketing (Peck and Childers 2008). Previous studies have addressed effects from interpersonal touch (Hornik 1992), touch as chronic need (Peck and Childers 2003b), effects from haptic imagery on psychological ownership (Peck and Berger 2009), or cross-modal carry-over effects from nondiagnostic tactile sensations to gustatory judgments of products (Krishna and Morrin 2009).

In the domain of social psychology there is increasing evidence that haptic experience is directly linked to mental concepts in a metaphorical way such as touching a warm cup activates concepts of social warmth (Williams and Bargh 2008), tactile roughness carries over to the evaluation of a social interaction (Ackerman, Nocera, and Bargh 2010), or lying in an email
increases preference for hand sanitizers to purify the dirty body part (Lee and Schwarz 2010). These modality-specific pathways between haptic sensations and mental concepts suggest a physical-to-mental scaffolding which grist the mills of embodied theorists suggesting higher-order concepts to be ontogenetically scaffolded by concrete bodily experience (Williams, Huang, and Bargh 2009).

Here, I hypothesize that exposing participants to haptic primes from beverage containers automatically activates the corresponding brand knowledge, thus promoting perceptual processing in other modalities, cognitive accessibility, and prime-congruent brand choices. To carve out the effects from brand-related haptic input without interference from other modalities I conducted four experiments where I exposed participants for 2 seconds blindfolded within an ostensible weight-judging task to beverage containers from different brands. Afterwards, they were asked to participate in another unrelated study that was the actual dependent variable. Finally, participants were debriefed whether they had recognized the prime in the weight-judging task to exclude their data if necessary.

In experiment 1 I randomly assigned participants to Coca-Cola glass bottles, Red Bull cans, or a group without treatment followed by an unrelated task that visually presented the target name Red Bull with increasing clarity on a computer screen. Participants were significantly faster to identify the brand name Red Bull if they had been previously exposed to a Red Bull can compared to the other groups ($M_{\text{Red Bull}} = 2.85$ sec vs. $M_{\text{unprimed}} = 3.04$ vs. $M_{\text{Coca-Cola}} = 3.05$; $F(2, 111) = 5.244, p = .007$; Tukey post hoc $p < .05$). Experiment 2 replicated the results but this time using the brand name Coca-Cola as visual target and compared Coca-Cola versus Römerquelle bottles that share basic characteristics such as surface material (glass), container type (bottle), girth, and weight. As expected, the Coca-Cola group was significantly
faster to identify the visual target Coca-Cola compared to the other groups \((M_{\text{Coca-Cola}} = 3.09 \text{ sec vs. } M_{\text{Römerquelle}} = 3.27 \text{ vs. } M_{\text{unprimed}} = 3.34; F(2, 177) = 6.294, p = .002; \text{ Tukey post-hoc test } p < .05)\). The results show that brand-related haptic sensations automatically increase perceptual fluency cross-modally for the corresponding brand. It seems noteworthy that these effects occurred outside of people’s awareness. Although the experience of perceptual fluency can influence affective judgments in a positive direction (Reber, Winkielman, and Schwarz 1998) it remains unclear whether this makes a brand more salient in consumers’ consideration set when thinking about brands of a certain product category.

In experiment 3 I therefore primed participants with Coca-Cola bottles, Römerquelle bottles, or Red Bull cans. In a subsequent task, I asked them to list brands for the category of beverages. The ANOVA for Red Bull shows that the ratio the brand was listed first (top-of-mind) was significantly higher in the Red Bull condition compared to all other groups \((M_{\text{Red Bull}} = 26\% \text{ vs. } M_{\text{Coca-Cola}} = 6\% \text{ vs. } M_{\text{Römer}} = 6\% \text{ vs. } M_{\text{control}} = 12\% ; F(3, 227) = 5.134, p = .02; \text{ Tukey post-hoc } p < .05)\).

Experiment 4 analyzed whether brand-related haptic sensations can actually influence brand choices. Containers from Coca-Cola, Red Bull, and Römerquelle served as stimuli. After the priming task participants were offered either a Coca-Cola or a Red Bull beverage as reward. The ANOVA of a dummy variable \((1 = \text{Coca-Cola vs. } 0 = \text{Red Bull})\) shows that participants primed with Coca-Cola bottles chose most often Coca-Cola \((M_{\text{Coca-Cola}} = 64\%)\) while those primed with Römerquelle bottles chose almost equally from the two brands \((M_{\text{Römer}} = 52\%)\) and those primed with Red-Bull cans chose Coca-Cola least frequently \((M_{\text{Red Bull}} = 39\%)\) but the most Red Bull \((F(2, 167) = 4.160 p = .017; \text{ Dunnett-C post-hoc } p < .05)\).
This is the first study to show how brand-related haptic sensations automatically activate brand knowledge, which influences a brand’s cognitive accessibility or brand choices. In times of diminishing product life cycles with frequent visual face-liftings, the retention of haptic signatures could perpetuate the bond between consumers and brands and help to reduce communication costs to familiarize consumers with new products or product changes. New products that use established haptic signatures have a greater chance to do better simply because they are recognized faster and promote consideration and choice of that brand.
Appendix B: Paper (2)

Touch and Go:

Merely grasping a product facilitates brand perception and choice

Mathias C. Streicher and Zachary Estes (2015),
Applied Cognitive Psychology
Touch and Go:

Merely grasping a product facilitates brand perception and choice

Mathias Streicher

ABSTRACT

Consumers often touch products, and such haptic exploration can improve consumers’ evaluations of the product. We tested whether cross-modal priming might contribute to this effect. Under the guise of a weight judgment task, which served as a haptic prime, we had blindfolded participants grasp familiar products (e.g., a Coca Cola bottle). We then had participants visually identify the brand name as quickly as possible (Experiments 1 and 2), list the first beverage brands that come to mind (Experiment 3), or choose between beverage brands as reward for participation (Experiment 4). Haptic exposure facilitated visual recognition of the given brand, and increased participants’ consideration and choice of that brand. Moreover, this haptic priming was brand-specific and occurred even among participants who did not consciously identify the prime brand. These results demonstrate that haptic brand identities can facilitate recognition, consideration, and brand choice, regardless of consumers’ conscious awareness of this haptic priming.

Keywords: brand perception; cross-modal priming; product perception and choice; sensory marketing; tactile perception
Haptics are cutaneous and kinesthetic perceptions, such as the shape, texture, and weight of an object, typically perceived via the hands (Lederman & Klatzky, 2009; Peck, 2010). Haptic exploration facilitates object recognition (Gallace & Spence, 2009; Lederman & Klatzky, 2009), and the haptic properties of a product, such as the shape, texture, or weight of a package, broadly affect consumer perceptions, attitudes, and behaviors (Krishna, 2012; Spence & Gallace, 2011). We investigated whether grasping a product (e.g., a Coca Cola bottle) facilitates visual recognition of the brand concept (i.e., “Coca Cola”) and a semantically related competitor (e.g., “Red Bull”), and whether it increases consideration and choice of the brand among competitors. We first briefly consider the importance of haptics in product evaluation, we then review the extant evidence of haptic priming, and finally we present four experiments testing the influence and specificity of haptic priming on the perception, consideration and choice of brands.

**Touching Products**

The “feel” of a product or package is an often-overlooked but nonetheless influential marketing tool (Spence & Gallace, 2011). Unique haptic properties, such as Coca Cola’s famous contour bottle, can represent and literally shape the brand in consumers’ minds (Lindstrom, 2005). Haptic sensations from product touch can differentiate a brand from its competitors, and indeed, consumers often touch products before they reach a purchase decision (Peck & Childers, 2003a). Products for which touch provides important information (e.g., a blanket) are preferred in offline rather than online shopping settings (McCabe & Nowlis, 2003), and moreover, consumers prefer products that are easy to grasp. For instance, people prefer a detergent bottle with the handle oriented toward the dominant hand (Elder & Krishna, 2012; Ping, Dhillon, & Beilock, 2009). However, if the dominant hand is otherwise occupied, then people prefer a bottle with the handle oriented toward the nondominant hand (Eelen, Dewitte, & Warlop, 2013; Shen & Sengupta, 2012).
haptic properties of a product can also influence consumer perceptions. For instance, water tastes better out of a firm cup than a flimsy cup (Krishna & Morrin, 2008).

In general, allowing consumers to touch a product facilitates their evaluations of that product. However, there are important limitations of the current knowledge about product touch. To begin with, rather surprisingly, no published study has tested whether product touch increases actual product choice. Peck and Childers (2003a) had participants evaluate a product that they could either touch or not, and they found that product touch increased participants’ confidence in their evaluations and decreased their frustration with the evaluation task. In a subsequent study, Peck and Childers (2006) found that a point of purchase sign that encouraged touch (i.e., “Feel the freshness”) increased the impulsivity of fruit purchases, relative to shoppers who were not exposed to the sign. Unfortunately however, they did not report any measure of whether shoppers actually touched the products, nor did they report any measure of actual purchase quantities. Thus, Peck and Childers (2006) did not provide evidence that the sign increased either touch or purchase quantities.³ Perhaps the closest effect to actual consumer choice was reported by Grohmann, Spangenberg, and Sprott (2007), who found that product touch increased consumers’ evaluations of the product. Collectively then, the prior studies have shown that product touch improves product evaluations, but ultimately marketers need to know whether touch increases consumers’ actual consideration and choice of a product.

A second limitation is that the psychological mechanisms supporting such haptic effects on product perceptions and evaluations are not yet well understood. One contributing factor is perceived ownership: Touching a product increases one’s sense of

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³ Moreover, this experimental design cannot rule out the plausible alternative hypothesis that any positively worded sign (e.g., “Fresh”) might increase the impulsivity of purchases, regardless of whether the sign encourages touch.
ownership (Peck & Shu, 2009), and given that people tend to value things that they own (Kahneman, Knetch, & Thaler, 1990), touching a product thus increases its perceived value (Shu & Peck, 2011). In fact, simply imagining that one has touched a product can induce the same sense of perceived control and ownership of the product (Peck, Barger, & Webb, 2013). Of course, few complex behaviors (e.g., product evaluation) are fully explained by a single psychological mechanism (e.g., perceived ownership). The present experiments therefore test whether another processing mechanism – haptic priming – might also contribute to the effect of product touch on brand perception and choice. Stated simply, we hypothesized that haptic activation of a specific brand would facilitate perception of and preference for that brand.

**Haptic Priming**

The present study is theoretically motivated by psychological research on cross-modal priming, whereby stimulation of one perceptual modality facilitates perception of a related stimulus in another modality. Early research on cross-modal priming focused on audio-visual language processing, showing for instance that hearing a word facilitates the subsequent reading of that word, and vice versa (e.g., Kirsner & Smith, 1974). Hearing a word or sentence also speeds the visual recognition of a related object, or vice versa (e.g., Hirschfeld, Zwitserlood, & Dobel, 2011; Holcomb & Anderson, 1993), and cross-modal priming has also been observed among more abstract stimuli, such as auditory pitch and visuo-spatial height (e.g., Connell, Cai, & Holler, 2013; Evans & Treisman, 2010). Thus, the majority of research on cross-modal priming has examined the relation between the auditory and visual modalities.

However, a rapidly growing literature has begun to examine interactions between vision and touch. The visual and haptic modalities converge functionally, in that both modalities contribute similarly to critical aspects of object recognition, categorization,
and memory, such as the perception of object size, shape, and location (Ernst & Banks, 2002; Gaissert & Wallraven, 2012; Gallace & Spence, 2009; Helbig & Ernst, 2007; Lacey, Campbell, & Sathian, 2007; Lederman & Klatzky, 2009). In fact, vision and haptics may act as complementary perceptual systems for object recognition, allowing the simultaneous processing of more perceptual information across the two modalities than within either modality alone (Ernst & Bulthoff, 2004; Hillis, Ernst, Banks, & Landy, 2002). Indeed, this view supports the more general theory of situated simulation, which asserts that the brain encodes the perceptions, actions, and introspections evoked by a stimulus (i.e., the situation), and that subsequent cognitions about that stimulus reactivate (i.e., simulate) those sensorimotor and introspective experiences (for review see Barsalou, 2009; Martin, 2007). For example, exposure to a lemon may involve experience of its various sensory properties (e.g., appearance, feel, taste, and smell), and thus later thoughts about a lemon reactivate this multisensory experience. After repeated experiences with lemons, their specific sensory properties become strongly associated with one another. By this theory, the various sensory modalities that are repeatedly experienced with a concept are integrated into a holistic, “situated” representation of that concept. The visual and haptic modalities are particularly highly associated, in that strongly visual objects also tend to be strongly haptic (Lynott & Connell, 2013; see also Louwerse & Connell, 2013). And thus, it follows that perception of an object in one of these modalities should facilitate perception of that object in the other modality (i.e., cross-modal priming).

In a particularly influential study, Reales and Ballesteros (1999) presented 60 common objects (e.g., glove, lock, sponge, spoon) that participants examined either visually or haptically, and then they tested participants’ speed at identifying those objects later when re-presented either visually or haptically. Reales and Ballesteros found equivalent priming effects within-modalities (i.e., visual-visual or haptic-haptic) and
across-modalities (i.e., visual-haptic or haptic-visual), thus demonstrating visuo-haptic cross-modal priming of object recognition (see also Ballesteros et al., 2009; Bushnell & Baxt, 1999; Easton, Greene, & Srinivas, 1997; Norman et al., 2004). More recently, Pesquita et al. (2013) had participants manually explore common objects (e.g., a cup) that were hidden from view, while viewing an object that slowly appeared onscreen. Critically, the image visually depicted either the identical object (i.e., the cup that had been haptically explored), a categorically related object (i.e., a differently-shaped cup), or an unrelated object (e.g., a brush). Pesquita et al. found that visual recognition of the target object was facilitated for both identical and categorically related objects, with greater priming of identical targets than of related targets. The priming of categorically related objects suggests that haptic exposure activates a general semantic representation of the given object (see also Johnson, Paivio, & Clark, 1989).

**Hypotheses**

So in summary, the visual and haptic properties of an object are strongly associated with one another through their repeated co-occurrence during experiences with that object (Barsalou, 2009), and consequently haptic exposure to a given object facilitates visual recognition of that object. This haptic priming of object recognition underlies our first hypothesis.

**H1:** Incidental haptic exposure to a familiar branded product will facilitate the visual perception of that brand.

For instance, merely grasping a Coca Cola bottle (without seeing it) should facilitate the visual perception of “Coca Cola” later in an ostensibly unrelated task. We also predicted that haptically priming a brand would increase the consideration and choice of that brand. Nedungadi (1990) examined the effects of visual priming on the consideration and choice of brands. In one experiment, participants read a series of 12 general
statements about various brands (e.g., “McDonald’s has adequate seating capacity”), but three of those statements were about the same target brand. In another experiment, participants evaluated a series of five print ads, the last of which was the target brand. In both experiments, participants then generated consideration sets (i.e., the set of brands that a consumer considers when making a product choice) and made choices in the given product category (e.g., fast food restaurants). Participants were more likely to include the target brand in their consideration set and were generally more likely to choose the target brand if that brand had been primed than if it had not. Thus, prior visual exposure to a brand facilitates consideration and choice of that brand. We expected a similar priming effect from haptic exposure.

**H2:** Incidental haptic exposure to a familiar branded product will increase the consideration and choice of that brand.

**Experiment 1**

Experiment 1 tested whether haptic priming of a specific brand facilitates perceptual identification of that brand (**H1**), as suggested by prior studies of cross-modal priming. Under the guise of a weight judgment task, which served as our haptic prime, we first had blindfolded participants grasp a pair of Coca Cola bottles or Red Bull cans. We then presented the phrase “Red Bull” gradually on a computer display and instructed participants to identify the phrase as quickly as possible. A third group of participants completed the brand identification task without first performing the haptic priming task. If haptic priming of visual perception is stimulus-specific, then grasping a competitor brand (Coca Cola) should not facilitate perception of the target brand (Red Bull). On the other hand, to the extent that Coca Cola is semantically related to Red Bull, activating the former brand should spread activation to the latter brand in participants’ neurocognitive networks (Collins & Loftus, 1975; Nedungadi, 1990), and hence grasping Coca Cola could facilitate percep-
tion of “Red Bull”. For instance, Pesquita et al. (2013) found that haptic exploration of a cup facilitated perception of another, differently-shaped cup. Comparison of the different-brand and no-brand conditions thus tests the specificity of haptic brand priming.

**Methods**

**Participants.** Participants in all experiments and pretests reported herein were undergraduates at a typical European university. All were recruited on campus and were rewarded with a gift (a beverage in Experiment 4; candy in all other experiments), and none participated in more than one experiment or pretest reported herein. 160 undergraduates participated in Experiment 1, and an additional 75 participated in a stimulus pretest.

**Stimuli.** Stimuli were selected from a pretest in which 75 students participated blindfolded in an object naming task. We handed each participant several different beverage containers, one at a time and in counterbalanced order. Participants explored each container manually, and then attempted to name the corresponding brand. We chose Coca Cola and Red Bull because the classic 0.25l Coca Cola bottle (87% correct) and the 0.25l Red Bull slim can (61% correct) were identified most frequently. See Figure 1 for illustration of the selected prime stimuli.

**Haptic Priming Procedure.** In the haptic priming task, participants were blindfolded and two objects (i.e., two Coca Cola bottles or two Red Bull cans) that were identically-shaped but differing slightly in weight were placed in the participant’s hands simultaneously (one object per hand). Participants were instructed to focus their attention on an ostensible weight difference, and to indicate which of the objects was heavier. Immediately after the participant responded, the experimenter removed the objects from the participant’s hands and placed the objects out of view, and then removed the blindfold. This task was comparable to Reales and Ballesteros’ (1999) “physical encoding” condition, in which their participants rated the object’s volume. Our weight judgment task was intended to activate the prime brand
while also minimizing the likelihood of a demand effect, whereby participants consciously identify the prime brand and then alter their behavior intentionally (see General Discussion). Because merely grasping and lifting an object (without manual exploration) is sufficient for recognizing familiar objects (Klatzky & Lederman, 1992), we assumed that this weight judgment task would activate the brand concept. However, by maintaining participants’ attention on a physical feature of the object (i.e., its weight), we hoped to minimize their conscious recognition of the brand. We also questioned participants at the conclusion of the experiment to probe their recognition of the prime (see “Awareness Check Procedure” below).

**Perceptual Identification Procedure.** After the haptic priming task, participants were asked to participate in another unrelated study on visual accuracy, in which they attempted to identify as quickly as possible the brand “Red Bull” on a computer display after judging the weight of two Red Bull cans (“same brand” condition) or two Coca Cola bottles (“different brand” condition), or without judging any weights (“no brand” control condition). The identification task was a clarification procedure (e.g., Perruchet & Baveux, 1989; Pesquita et al., 2013; Reales & Ballesteros, 1999), whereby a stimulus appears gradually onscreen, and participants were instructed to identify the target at the earliest possible point in the clarification process. Participants were seated in front of a 15-inch laptop. After reading the instructions and completing a practice trial with the visual target “test”, a single target trial was presented. When the participant pressed the enter key, the target brand name (i.e., “Red Bull”) appeared gradually, starting with only a few pixels and increasing incrementally until the target was fully visible. Targets were embedded within a gray 12.5 × 4.5 cm frame. As soon as the target was identified, the participant pressed the enter key again, which triggered a visual mask to cover the brand name. Participants then verbally reported the target.

**Awareness Check Procedure.** During debriefing we sought to identify whether partic-
Participants were consciously aware of the identity of the brand used in the haptic priming task. At the conclusion of the experiment, the experimenter asked each participant whether he or she had recognized the object in the weight judgment task, and if so, to describe it as precisely as possible. Any imprecise response that suggested possible awareness of the brand (e.g., “it was a glass bottle”) was followed by a second prompt for a more specific answer (e.g., “Was it any particular kind of bottle?”). Participants’ post-experiment responses were subsequently used to examine whether conscious awareness of the prime brand moderated the presumed effect of haptic exposure on perception of that brand.

Results

Eight outlying participants whose response time (RT) was more than one-and-a-half interquartile ranges beyond the quartiles were excluded from analyses, which thus included 152 participants. Mean identification RTs are illustrated in Figure 2 (left). A one-way between-participants ANOVA indicated a significant effect of prime condition on target identification RT, \( F(2, 149) = 7.37, p < .001 \). As predicted in \( H_1 \), the target brand “Red Bull” was identified significantly faster after haptic exposure to the same brand (Red Bull; \( M = 2.83 \) s) than after haptic exposure to a different brand (Coca Cola; \( M = 3.03; t(118) = 3.30, p < .001, \) Cohen’s \( d = .61 \) ) or no brand (\( M = 3.04; t(90) = 3.05, p = .003, d = .67 \) ). The different brand and no brand conditions did not differ significantly, \( p = .88 \), thus revealing that haptic priming was brand-specific. That is, priming a competitor brand (Coca Cola) did not facilitate perception of the target brand (Red Bull).

During debriefing, 13 participants explicitly identified Red Bull as the stimuli used in the weight judgment task. We therefore reanalyzed the data without those 13 “brand-aware” participants, and the pattern of statistically significant results remained unchanged: Prime condition still significantly affected RT, \( F(2, 136) = 5.77, p = .004 \), and “Red Bull” was still

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4 Participants in the “no brand” control conditions were excluded from this questioning.
identified significantly faster after haptic exposure to the same brand than to a different brand ($t(105) = 2.96, p = .004, d = .58$) or no brand ($t(77) = 2.90, p = .005, d = .67$). Notably, these effect sizes were nearly identical to the original ones observed when the 13 brand-aware participants were included ($d = .61$ and $.67$, as reported above). Moreover, within the group who were primed by grasping Red Bull cans, the RTs of participants who explicitly identified Red Bull as the prime stimuli ($n = 13, M = 2.77, SE = .12$) did not differ from those who failed to identify the prime stimuli ($n = 47, M = 2.85, SE = .04$), $p = .47$. Thus, the cross-modal priming of “Red Bull” did not appear attributable to participants’ conscious awareness of the brand during the haptic priming task.

### Experiment 2

Experiment 1 demonstrated haptic priming of brand recognition ($H_1$) that appeared to be brand-specific. Notably however, the same- and different-brand primes in Experiment 1 differed markedly in their haptic properties: Whereas a Red Bull can is metal, vertically linear, and texturally flat, a Coca Cola bottle is glass, curved, and textured. So if haptic priming were contingent on the haptic similarity between the prime and target brands, then haptic exposure to a Coca Cola bottle may have failed to prime visual recognition of “Red Bull” simply because the prime and target brands were too dissimilar haptically. Experiment 2 therefore provided a more stringent test of the specificity of haptic priming by using a different comparison brand that was more haptically similar to the target brand. In this experiment Coca Cola was the target brand in the identification task, so participants in one group first judged the weight of two Coca Cola bottles, and participants in the control group again did not perform a weight judgment task. For the different-brand condition we chose Römerquelle$^5$, because its glass bottle is haptically similar to the Coca Cola bottle (unlike a Red Bull can). Thus, Experiment 2 was a conceptual replication of Experiment 1, but with a

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$^5$ Römerquelle (see Figure 1) is a brand of mineral water that is popular at the location of the study.
more similar comparison stimulus for greater specificity and a different target brand for
greater generality.

**Methods**

223 undergraduates identified the brand “Coca Cola” after judging the weight of two
Coca Cola bottles (“same brand”) or two Römerquelle bottles (“different brand”), or without
judging any weights (“no brand”). These stimuli were selected from the pretest reported in
Experiment 1, where 87% of the blindfolded participants correctly identified the 0.25l Coca
Cola bottle by haptic exploration. In contrast, the 0.25l Römerquelle bottle was rarely identi-
fied (7% correct). Thus it provided perceptually similar haptic exposure (see Figure 1) with
minimal brand interference. The haptic priming, perceptual identification, and awareness
check procedures were otherwise identical to those of Experiment 1.

**Results**

Ten outlying participants (see criterion in Experiment 1) were excluded from analyses,
which thus included 213 participants. Results are illustrated in Figure 2 (right). Prime condi-
tion again significantly affected RTs, \( F(2, 210) = 5.77, p = .004 \). As predicted in \( H_1 \), the tar-
get brand “Coca Cola” was identified significantly faster after haptic exposure to the same
brand (Coca Cola; \( M = 3.13 \) s) than after haptic exposure to a different brand (Römerquelle;
\( M = 3.27 \); \( t(148) = 2.20, p = .030, d = .37 \)) or no brand (\( M = 3.33 \); \( t(149) = 3.14, p = .002, d = .52 \)).
The different brand and no brand conditions again did not differ significantly, \( p = .32 \).
Thus, despite the increased haptic similarity between the prime and target brands in this ex-
periment, the different-brand condition once again failed to facilitate recognition of the hapti-
cally similar target brand.

After removing 36 “brand-aware” participants who explicitly identified Coca Cola as

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6 The faster recognition of “Red Bull” in Experiment 1 than of “Coca Cola” in Experiment 2 is most likely due
to word frequency. In Brysbaert and New’s (2009) corpus, which contains about 51 million words and is the
_corpus that best predicts word recognition times, “red” and “bull” both occur substantially more fre-
quently (7551 and 1403 occurrences, respectively) than both “coca” and “cola” (214 and 282 occurrences,
respectively).
the stimuli in the weight judgment task, the pattern of statistically significant results remained unchanged: Prime condition still significantly affected RTs, $F(2, 174) = 6.29, p = .002$, and “Coca Cola” was still identified significantly faster after haptic exposure to the same brand than to a different brand ($t(112) = 2.54, p = .013, d = .48$) or no brand ($t(113) = 3.36, p < .001, d = .64$). If anything, these effect sizes were slightly larger than in the preceding analysis in which the 36 brand-aware participants were included ($d = .37$ and $.52$). However, within the group who were primed by grasping Coca Cola bottles, the RTs of participants who explicitly identified Coca Cola as the prime stimuli ($n = 36, M = 3.17, SE = .08$) did not differ from those who failed to identify the prime stimuli ($n = 52, M = 3.09, SE = .05$), $p = .38$. Thus, the cross-modal priming of “Coca Cola” did not appear attributable to participants’ conscious awareness of the brand during the haptic priming task.

**Experiment 3**

Experiments 1 and 2 both revealed haptic priming of visual brand recognition ($H_1$) that was brand-specific. Next we sought to demonstrate that merely grasping a product increases the salience of that product ($H_2$). After completion of the haptic priming task (i.e., blindfolded weight judgment of Coca Cola bottles or Red Bull cans), we had participants list the first beverage brands that come to mind. Explicitly visually priming a brand increases its likelihood of being included in the consideration set (Nedungadi, 1990). We predicted that a more subtle haptic exposure to a given brand would also increase the salience of that brand in the consumers’ mindset.

**Methods**

171 undergraduates grasped either two Coca Cola bottles or two Red Bull cans during the haptic priming task, which was identical to that of Experiment 1. Participants were then asked to participate in an unrelated study on brands, in which they were given a sheet with seven blank lines and were asked to list the first brands that come to mind for the category of
beverages. The post-experiment awareness check was identical to that of Experiment 1.

Results

Figure 3 illustrates the percentages of participants in the Coca Cola and Red Bull prime groups who listed Coca Cola and/or Red Bull among their beverage brands. Participants in both groups were more likely to list Coca Cola than Red Bull, which simply confirms that Coca Cola is a more salient beverage than Red Bull. However, Coca Cola was significantly more likely to be listed by participants who previously grasped Coca Cola bottles (90%) than by participants who grasped Red Bull cans (79%), $\chi^2 (1) = 3.99$, $p = .046$. And conversely, Red Bull was significantly more likely to be listed by participants who previously grasped Red Bull cans (56%) than by participants who grasped Coca Cola bottles (27%), $\chi^2 (1) = 15.37$, $p < .001$.

We also analyzed the mean rank position in which Coca Cola and/or Red Bull were listed among each participant’s consideration set. For this analysis lower scores indicate higher salience (e.g., rank 1 indicates top-of-mind), and we assigned a rank of 8 in all cases where the given brand was not listed among the participant’s 7-item consideration set. A $2 \times 2$ mixed ANOVA revealed a significant main effect of target brand, $F(1, 169) = 107.59$, $p < .001$, with Coca Cola ($M = 2.76$) being listed earlier than Red Bull ($M = 5.73$). This effect replicates the basic finding that Coca Cola is a more salient beverage than Red Bull. More critically, this effect was qualified by a significant prime $\times$ target interaction, $F(1, 169) = 20.77$, $p < .001$: Coca Cola was listed marginally earlier after grasping Coca Cola bottles ($M = 2.42$) than after grasping Red Bull cans ($M = 3.09$), $t(169) = 1.78$, $p = .077$, $d = .27$, whereas Red Bull was listed significantly earlier after grasping Red Bull cans ($M = 4.76$) than Coca Cola bottles ($M = 6.70$), $t(169) = 4.59$, $p < .001$, $d = .70$. Thus, results supported $H_2$.

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7 For simplicity the figure shows percentages of participants, but the analyses were based on frequencies, so Chi-square is the appropriate statistic.
Fifty-two “brand-aware” participants explicitly identified the brand that they grasped during the haptic priming task. We thus compared the ranks of brand-aware and brand-unaware participants by adding prime awareness (dummy coded; no = 0, yes = 1) as a third factor in a 2 (prime brand) × 2 (target brand) × 2 (prime awareness) ANOVA. Results are illustrated in Figure 4. The 3-way interaction was significant, \(F(1, 167) = 5.47, p = .021\). This interaction indicates that the effect of haptic prime brand on the mean rank position of the target brand in participants’ consideration sets was significantly moderated by participants’ awareness of the prime brand. To investigate this moderation further, we conducted separate 2 (prime brand) × 2 (target brand) ANOVAs on the ranks by brand-aware and brand-unaware participants. Among brand-aware participants, the interaction was significant, \(F(1, 50) = 20.72, p < .001, \eta^2_p = .29\). Coca Cola was listed significantly earlier after haptic exposure to Coca Cola than to Red Bull, \(t(50) = 2.30, p = .026, d = .74\), whereas Red Bull was listed significantly earlier after haptic exposure to Red Bull than to Coca Cola, \(t(50) = 4.03, p < .001, d = 1.29\). Among brand-unaware participants, the interaction was smaller but also significant, \(F(1, 117) = 8.21, p = .005, \eta^2_p = .07\). Red Bull was again listed significantly earlier after haptic exposure to Red Bull than to Coca Cola, \(t(117) = 3.40, p < .001, d = .63\), but Coca Cola was listed equally early after haptic exposure to Coca Cola or to Red Bull, \(p = .61, d = .09\). To summarize, the effect size of haptic priming on the salience of Coca Cola decreased from \(d = .74\) among brand-aware participants to a nonsignificant .09 among unaware participants, and for Red Bull the effect size decreased from an extremely large 1.29 among brand-aware participants to a medium effect of .63 among brand-unaware participants. Thus, the effect of haptic priming on brand rank was significantly moderated by conscious awareness of the prime brand, such that the cross-modal priming effect was accentuated by prime awareness. With or without prime awareness, however, significant cross-modal priming was observed (H2).
Experiment 4

Experiment 3 demonstrated that merely grasping a product increases participants’ consideration of that brand. In Experiment 4 we further tested whether grasping a product also increases participants’ choice of that product. After completion of the haptic priming task (i.e., blindfolded weight judgment of Coca Cola bottles or Red Bull cans), as reward for their participation we offered participants a choice between a bottle of Coca Cola or a can of Red Bull. Whereas product touch is known to increase product evaluations and confidence in those evaluations (Grohmann et al., 2007; Peck & Childers, 2003a), this is a more direct test of whether product touch also affects actual consumption (i.e., brand choice). We also tested for two potential moderators of the presumed influence of product touch on product choice. One plausible moderator of the choice between Coca Cola and Red Bull was participants’ prior preference for these beverages. We thus assessed participants’ prior consumption of those brands. Another plausible moderator was participants’ need for touch (NFT). Individuals who are high in NFT are strongly affected by the ability to touch a product, whereas those who are low in NFT are largely unaffected (Grohmann et al., 2007; Krishna & Morrin, 2008; Peck & Childers, 2003a, 2003b). Thus, grasping a product might be more likely to influence product choice among high NFT participants.

Methods

126 undergraduates grasped either two Coca Cola bottles or two Red Bull cans during the haptic priming task, which was identical to that of Experiment 1. Participants were then thanked and were asked to choose between a bottle of Coca Cola or a can of Red Bull as reward for participating. They indicated their choice by ticking a box on a sheet of paper, so that the prime objects (Coca Cola or Red Bull) were never in view of participants in either the weight judgment task or the choice task. After asking participants “What do you think the purpose of this study was?”, we had participants rate on a scale from 1 (“never”) to 9 (“very
often”) how often they drink Coca Cola and Red Bull (i.e., each participant rated both brands). Finally, participants also completed the 12-item NFT scale (Nuszbaum, Voss, Klauer, & Betsch, 2010), which distinguishes between autotelic NFT (i.e., hedonic aspects of touch, such as enjoyment) and instrumental NFT (i.e., functional aspects of touch, such as texture; Peck & Childers, 2003b).

Results

Two participants who correctly guessed the purpose of the experiment were removed from analyses, which thus included 124 participants. As illustrated in Figure 5, participants who previously grasped Coca Cola bottles were more likely to choose Coca Cola (65%), whereas those who previously grasped Red Bull cans were more likely to choose Red Bull (59%), $\chi^2 (1) = 6.91, p = .009$. Results thus supported $H_2$. We then tested, via separate logistic regressions, whether autotelic ($\alpha = .94$) or instrumental NFT scores ($\alpha = .91$) moderated the effect of the haptic prime on brand choice. We dummy coded the prime brand and the chosen brand (in both cases, 0 = Red Bull, 1 = Coca Cola), and entered the prime in the first step as the predictor of the chosen brand. This initial step statistically replicated the Chi-square reported above, $\chi^2 (1) = 6.96, p = .008$, with the prime brand significantly predicting brand choice. In separate analyses, we then added in a second step either autotelic or instrumental NFT scores (both continuous predictors) and their interactions with the prime brand. Neither interaction significantly predicted brand choice, both $p > .38$, thus indicating that NFT did not moderate the effect of the haptic prime on brand choice. Finally, we also tested whether participants’ brand choices were moderated by their prior consumption frequencies of the given brands. We repeated the stepwise logistic regressions, but including either Coca Cola or Red Bull consumption frequencies (and the critical interaction with prime brand) instead of NFT scores. Again, neither interaction approached significance, both $p > .32$. So in sum, haptic priming significantly influenced brand choice, and this effect was not moderated
by either NFT or prior consumption of the brands.

**Discussion**

Experiments 1 and 2 demonstrated that merely grasping a product (i.e., in the absence of visual stimulation) facilitated perceptual identification of that brand, thus supporting $H_1$. For instance, participants identified “Red Bull” more quickly after holding Red Bull cans than after holding Coca Cola bottles. Experiments 3 and 4 further demonstrated that haptic exposure to a familiar brand significantly increased participants’ consideration and choice of that brand, thus supporting $H_2$. Participants who previously grasped Coca Cola bottles or Red Bull cans were more likely to list Coca Cola or Red Bull respectively among their most salient beverage brands, and were more likely to choose Coca Cola or Red Bull respectively as their reward for participating. This latter effect was observed regardless of participants’ need for touch, and regardless of their prior consumption frequency of the two brands. Overall then, these studies have shown that a unique haptic brand identity facilitates processing of brand-specific stimuli cross-modally and thus reliably increases consideration and choice of that brand.

How, exactly, does haptic stimulation facilitate visual and conceptual processing of the target stimulus? Following the prior theoretical development on situated simulation in general and cross-modal priming in particular, we suggest a simple explanation: Haptic exposure to the given object activated the conceptual representation of that object (e.g., Barsalou, 2009; Martin, 2007; Pesquita et al., 2013; Reales & Ballesteros, 1999), which then facilitated subsequent processing of the given concept. Through repeated experiences with Coca Cola, our brains encode and associate the various sensory properties of this brand, including not only its taste, but also the look and feel of its bottle, the sound of the brand name, etc. The mental representation of Coca Cola thus includes its sensory properties, which are strongly
associated with one another and with the brand name. Consequently, grasping a Coca Cola bottle activated the conceptual representation of Coca Cola (Experiment 3), which facilitated perception of “Coca Cola” (Experiments 1 and 2), and in turn, this increased processing fluency led participants to choose Coca Cola (Experiment 4).

Although product touch was previously known to increase product evaluations (Grohmann et al., 2007) and consumers’ confidence in those evaluations (Peck & Childers, 2003a), ours is the first demonstration that product touch increases actual consumer choice. Moreover, ours is also the first to demonstrate “pure” effects of touch: Whereas the prior marketing studies allowed consumers to see and touch products (Grohmann et al., 2007; Krishna & Morrin, 2008; Peck & Childers, 2003a, 2003b), our participants grasped the products without seeing them. Our results thus provide the first evidence, under the most controlled conditions, that haptic exposure facilitates preference for the given brand. Moreover, the failure of the perceptually similar Römerquelle bottle to facilitate perception of “Coca Cola” in Experiment 2 indicates that the haptic activation of the brand concept was highly specific. Furthermore, unlike several prior studies (Grohmann et al., 2007; Peck & Childers, 2003a, 2003b), we found that individuals’ need for touch did not moderate the effect of product touch on choice. Thus, haptic exposure to a product has even more general and direct effect on consumer behavior than previously known.

We also examined whether these effects of haptic priming depended critically on participants’ conscious awareness of the brand used in the priming task, or whether the haptic priming was “presemantic” (to use the terminology of Reales & Ballesteros, 1999). For instance, one might reasonably suppose that conscious awareness of the prime led people to expect the prime on a subsequent perceptual task, or perhaps to feel compelled to choose the primed brand during a subsequent choice task (i.e., a “task demand” effect). Indeed, when explicitly asked to identify the brands by touch, most of the blindfolded participants in our
pretest were able to identify a Coca Cola bottle and a Red Bull can. But this does not necessarily indicate that participants in the haptic priming task spontaneously did so, especially given that the haptic exposure occurred under the guise of a weight judgment task. Haptic properties are detected significantly less accurately than visual, auditory, gustatory, and olfactory properties (Connell & Lynott, 2010; see also Gallace & Spence, 2008). Moreover, during visuo-haptic object recognition the haptic modality is dominated by the visual modality (Kassuba et al., 2013; Klatzky, Lederman, & Matula, 1993), and object shape is identified more accurately by vision than by touch (Norman et al., 2012). So merely grasping these products may have implicitly activated the brand concept rather than eliciting conscious awareness of the brands. In fact, relatively few of our participants identified the brands later in post-experiment questioning.

In Experiments 1 and 2, the facilitated identification of the previously grasped brand remained significant and equally large after removing the subset of participants who explicitly identified the prime brand, and a direct comparison of those brand-aware participants to the brand-unaware participants revealed no significant difference in identification times in either experiment. In Experiment 3, awareness of the prime did indeed significantly moderate the effect of haptic priming on brand consideration. However, significant cross-modal priming was observed among both brand-aware and brand-unaware participants. That is, awareness of the prime accentuated its effect on brand consideration, but the effect also occurred among unaware participants. Finally, in Experiment 4 we used a more general question to identify participants who correctly guessed the purpose of the experiment, and only two participants did so. We were less concerned about prime awareness in this experiment for practical reasons: We assume that marketers would be happy to capitalize on touch-induced choice regardless of consumers’ awareness of this effect. In sum, we did find some evidence that conscious awareness of the prime brand accentuates the effect of haptic priming, but haptic
The haptic priming of brand identification, consideration, and choice that we observed was highly reliable across experiments, though the effect sizes varied substantially depending on the measures employed. For instance, relative to the unprimed control condition, the “same brand” condition in the perceptual identification measure of Experiments 1 and 2 elicited medium effect sizes (Cohen’s $d = .67$ and $=.52$ respectively), whereas the brand rank measure used in Experiment 3 produced effects that ranged from nonsignificant ($d = .09$) to extremely large (1.29), depending on the given brand and participants’ awareness of the prime brand. And in raw terms, grasping a Red Bull increased the likelihood of listing Red Bull among one’s most salient beverage brands by 29% (Experiment 3), and it increased the likelihood of actually choosing Red Bull by 24% (Experiment 4). In general then, the haptic priming of brands appears to have medium-to-large effects. One may reasonably question, however, whether these tasks and measures overestimate the true effect of haptic brand priming in more realistic consumer contexts. For instance, whereas our experiments focused on two target beverages (Coca Cola and Red Bull), most actual purchasing contexts (e.g., supermarket shelves, refrigerated cases) entail more than two beverage choices. The magnitude of the haptic priming effect would likely be attenuated in such conditions. On the other hand, recall that our participants were blindfolded while they grasped the target brand, and the majority of them were unable to explicitly identify the brand. In more realistic shopping conditions, however, consumers are fully aware of the brands that they grasp. So given that awareness of the haptic prime brand increases the magnitude of the effect (Experiment 3), our experimental conditions might actually underestimate the true magnitude of the effect in many real-world contexts. Thus, both researchers and marketers alike should be aware that the impact of haptic brand priming is highly sensitive to other contextual factors.
Shopping environments differ in whether products can be grasped, with some products being displayed in cases (e.g., watches) and others being available for touching (e.g., mobile phones). Moreover, some products are sold unpackaged or in minimal packages that promote touch (e.g., vegetables), whereas others are fully enclosed in their packages (e.g., cereals). Interestingly, our finding of touch-induced preference – even in the absence of conscious awareness of the haptic prime brand – suggests that implicit or incidental haptic activation can influence consumer choice. To give some real-world examples, many Dutch beer brands emboss their brand names onto glass containers, and Heineken just recently launched a new can design using tactile ink, which vividly elicits the illusion of condensed water on the can’s surface. Hence, incidentally consuming beer from a tactile can could establish haptic memory for this brand, thus rendering the brand more accessible in mind when haptically exploring products in a subsequent shopping situation (Peck & Childers, 2003a).

Similarly, many retail shops have refrigerators that consumers can open to select a beverage. Our results suggest that consumers’ choices are routinely affected by the shape of the refrigerator handle. If the handle were shaped like a Coca Cola bottle, people would presumably be more likely to choose Coca Cola. And conversely, rounded handles should promote the choice of Red Bull. Indeed, a few examples of such brand-shaped handles do exist in the marketplace, but they are by far the exception rather than the rule. One might similarly expect haptic priming of consumer choices based on the haptic properties of a shopping basket, for instance, or indeed of any object that the consumer grasped before the given choice. Preliminary work in our lab supports these speculations, and more generally, we hope that our research will motivate further integration of cognitive psychology and consumer behavior.
References


Figure 1. Illustrations of the haptic stimuli grasped by blindfolded participants in the prime tasks of Experiments 1, 3, and 4 (Red Bull and Coca Cola) and in Experiment 2 (Coca Cola and Römerquelle).
Figure 2. Identification times ($M \pm 95\% CI$) of visually presented target brands after blindfolded haptic exposure to the same brand, a different brand, or no brand in Experiments 1 (“Red Bull”) and 2 (“Coca Cola”).
**Figure 3.** Percentages of participants who included Coca Cola and/or Red Bull among their list of beverage brands after blindfolded haptic exposure to Coca Cola or Red Bull in Experiment 3.
Figure 4. Ranks ($M \pm 95\% CI$) of Coca Cola and Red Bull among participants’ list of beverage brands after blindfolded haptic exposure to Coca Cola or Red Bull, as a function of whether participants were unaware or aware of the prime brand, in Experiment 3. Lower scores indicate higher salience (e.g., rank 1 is the first brand listed).
**Figure 5.** Percentages of participants who chose to receive Coca Cola or Red Bull after blindfolded haptic exposure to Coca Cola or Red Bull in Experiment 4.
Appendix C: Paper (3)

Mere touch improves product evaluation and increases brand choice via processing fluency

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Journal of Consumer Psychology
Mere touch improves product evaluation and increases brand choice via processing fluency

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ABSTRACT
Consumers often touch products before reaching purchase decisions, and indeed touch improves product evaluations (i.e., the mere touch effect). On the basis of recent neuroscience studies of multisensory integration, we posit that briefly viewing and touching a product drives product evaluations through increases in processing fluency from visuo-haptic integration. We test our assertion in two experiments and compare processing fluency and perceived ownership as complementary processing mechanisms in a multiple mediation model. Our results demonstrate that brief product touch (4 seconds of haptic exposure) increases liking, purchase intentions, and actual choice of real products and new product designs. Moreover, this mere touch effect was fully mediated via processing fluency, and was not mediated by perceived ownership or moderated by individuals’ need for touch. Our results suggest that by encouraging consumers to touch their products, marketers can facilitate consumers’ understanding of their products, thereby increasing evaluations and choice of those products.

Keywords: multisensory integration; visuo-haptic integration; sensory marketing; haptic sensation; product touch; product evaluation and choice.
Products are often placed in merchandising racks that invite haptic exploration,\(^8\) and indeed consumers often touch products before they reach a purchase decision (Peck & Childers, 2003a). In fact, consumers prefer products that are easy to grasp (Eelen, Dewitte, & Warlop, 2013; Elder & Krishna, 2012), and products for which touch provides important information (e.g., a sweater) are preferred in offline rather than online shopping settings (McCabe & Nowlis, 2003). Consumers may also touch products simply because it is pleasant, fun, or otherwise stimulating (Peck, 2010; Peck & Childers, 2003a; 2003b). Product touch improves product evaluations (Grohmann, Spangenberg, & Sprott, 2007) and increases confidence in the product evaluation (Peck & Childers, 2003a), and it also may increase impulsive purchase behavior (Peck & Childers, 2006). In their seminal study Peck and Shu (2009) found that manually controlling a product heightened the perceived value of that product – a paradigm called *mere touch*.

Yet, touch is the most under-researched modality in marketing (Peck & Childers, 2008) and in behavioral sciences at large (Gallace & Spence, 2010a). For instance, no study has conclusively clarified whether mere touch increases sales. In addition, prior studies on product touch have not controlled for haptic exposure time (e.g. Peck & Shu, 2009; McCabe & Nowlis, 2003). Many consumers rather quickly touch products in shopping situations (e.g., quickly grasp a product with a new design to have a closer look), and it is unclear whether such brief haptic exposure is sufficient to influence product evaluations and purchasing behavior. Because recent neuroscience studies suggest that visuo-haptic perception facilitates encoding of object properties (Helbig & Ernst, 2007) we contend that a brief product touch can indeed promote product choice through increases in processing fluency from multisensory integration. Thus, we examined whether merely touching products for a brief dura-

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\(^8\) The term “haptics” refers to cutaneous and kinesthetic perceptions, such as the shape, texture, and weight of an object, typically perceived via the hands (Lederman & Klatzky, 2009; Peck, 2010).
tion increases product choice and attitudes, and whether processing fluency mediates these presumed effects.

**Mere Touch**

Touch is the first sense to develop in the womb, it is the only proximal sense to connect the recipient directly with external objects, and it scaffolds fundamental concepts such as self-awareness (Gallace & Spence, 2010b) and personality (Williams, Huang, & Bargh, 2009). Thus far, consumer researchers have investigated an individual’s need for touch (Peck & Childers, 2003a, 2003b), affective responses from actual or imagined touch (Grohmann et al., 2007; Peck, Barger, & Webb, 2013; Peck & Shu, 2009; Peck & Wiggins, 2006; Shu & Peck, 2011), semantic carry-over effects from haptic properties on product attributes (Krishna & Morrin, 2008), interpersonal touch between people (Hornik, 1992; Martin, 2012), and perceived contamination either from people touching products (Argo, Dahl, & Morales, 2006) or from products touching each other (Morales & Fitzsimmons, 2007).

In this article, however, we focus on the power of mere product touch: For example, Peck and Shu (2009) reported that manually controlling a product increases one's sense of ownership, which increases the product's perceived value by inducing an endowment effect (Shu & Peck, 2011). However, this endowment effect from product touch was smaller for participants in a buyer role compared to participants in a seller role (studies 3 and 4). Hence, it remains unknown whether perceived ownership from mere touch could explain buying behaviors, particularly if the touch is only brief.

Here we propose and test a novel explanation of the effect of mere touch on product evaluation and choice: Recent findings on multisensory integration indicate that haptic processing is fundamentally integrated with visual processing (Amedi et al., 2002). Both senses serve similar functions, such as shape detection and object identifi-
cation (Helbig & Ernst, 2007), and many cerebral cortical regions previously thought to be specialized for visual processing are also activated during haptic tasks (Lacey & Sa-thian, 2012). In fact, Littel and Orth (2013) found that congruence of visual and haptic bottle design properties can improve brand perception, which corroborates the idea that visuo-haptic integration facilitates object encoding and interpretation.

**Processing fluency from visuo-haptic integration**

Processing fluency is the ease with which a given target is processed perceptually or conceptually. It is a form of metacognitive information, and high processing fluency is experienced positively (Reber, Schwarz, & Winkielman, 2004). Numerous studies document how fluent processing affects consumer behavior in important ways (e.g., Janiszewski & Mayvis, 2001; Lee, 2002; Lee & Labroo, 2004). Based on the large body of empirical data the consensus is that “[...] any variable that increases fluency of processing will result in more positive evaluations of the stimulus” (Winkielman, Schwarz, Fazendeiro, & Reber, 2003, p. 203). For instance, Labroo, Dhar, and Schwarz (2008) found that verbally priming brand identifiers (e.g., “frog”) increases processing fluency, and hence product choice, of a subsequently presented product that visually depicts that brand identifier (e.g., an image of a frog on a wine label).

In contrast, virtually nothing is known of whether or how touch can influence consumer choice through increases in processing fluency. General haptic stimulation can support conceptual processing of haptic properties (van Dantzig, Pecher, Zeelenberg, & Barsalou, 2008). For instance, placing the hands on a vibrating cushion facilitates judgments of manipulable objects (Connell, Lynott, & Dreyer, 2012). But no prior study has examined the presumed influence of specific haptic stimulation from product touch on the processing fluency of consumer behaviors such as product evaluation, purchase intention, or actual product choice. Here we further test whether that increased pro-
cessing fluency can explain, either fully or partially, the effect of product touch on product attitude and actual product choice.

Notably, our proposed route for processing fluency differs from the aforementioned studies. Whereas prior studies investigated facilitative effects from haptic activation on unrelated, subsequent tasks (Connell et al., 2012; van Dantzig et al., 2008) we investigate whether simultaneously seeing and touching products increases product attitudes and choice through increases in processing fluency. Thus our study investigates multisensory integration of simultaneous sensations rather than cross-modal priming of sequential sensations. We believe this is important because it may provide a parsimonious explanation why touching and seeing products may increase product choice even under conditions of brief exposure. As already mentioned, vision and touch use highly overlapping neural resources (Amedi et al. 2001, 2002), and they support processing of the same object properties such as shape (Ernst & Banks, 2002; Helbig & Ernst, 2007). Hence, the combination of seeing and touching a product should facilitate processing because one modality supports the other. This increased processing fluency should, in turn, increase product evaluation and choice.

Thus, we predicted that viewing and grasping products would increase product evaluation (e.g., attitude and choice), compared to viewing alone ($H_1$). Moreover, we predicted that processing fluency mediates this hypothesized effect of touch on product evaluation ($H_2$). Additionally, we also test whether the effect of touch on product choice is moderated by the individual’s autotelic need for touch ($NFT$; Peck & Childers, 2003b), which has been shown to moderate similar behaviors such as consumers’ confidence in a product evaluation (Peck & Childers, 2003a). Individuals high in autotelic NFT enjoy haptic stimulation more and are better able to discount non-diagnostic haptic product information in their evaluations (Krishna & Morrin, 2008). We therefore tested whether par-
participants’ high in NFT were more likely to experience a boost in processing fluency and an increase in product evaluation from touching a product. Finally, given the importance of perceived ownership in other mere touch effects (Peck & Shu, 2009; Shu & Peck, 2011), we also measured participants’ ownership feelings, and we test whether processing fluency and perceived ownership act as complementary mediators of the mere touch effect. Figure 1 shows our conceptual framework.

In study 1, we demonstrate that briefly touching and viewing products increases actual product choice through increases in processing fluency, compared to viewing products alone. In study 2, we extend our findings to the context of novel product designs and include perceived ownership in a multiple mediation model to examine the relative contributions of these two process variables.

**Study 1**

**Methods**

**Participants.** Sixty right-handed students⁹ at a typical European university (mean age: 23.3; 63.3% female) were randomly assigned to conditions. After the experiment participants were debriefed for hypothesis guessing and thanked with a gift (candies).

**Stimuli.** Haptic stimuli were half-litre bottles of sparkling water by two local brands that are equally ubiquitous in the country of our study but that have different bottle shapes (Römerquelle and Vöslauer, see Figure 2). The bottles were mounted upright on a fixture to facilitate naturalistic grasping and to prevent moving or lifting. Visual stimuli were original-size images of those two products.

**Procedure.** Participants were seated in front of a 21-inch computer screen and informed that they would see on the screen different products that would also be avail-

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⁹ Because our experimental apparatus was designed for right-handers, seven left-handed volunteers were prevented from participating but nonetheless were rewarded the same as other participants.
able for touching behind the screen. Participants in the visuo-haptic condition (vi-ha) were instructed to grasp the product behind the right side of the screen when it appeared on the screen, like they would grasp the product on a store shelf. In a practice trial they were presented a tomato soup can on the far right side of the screen, with the actual can available for touch directly behind the image on the screen. They were instructed to grasp the product as if holding it (not gradually exploring it) and only for the time that it was visually present on the screen (i.e., 4 seconds).

In the following test trial the Römerquelle and Vöslauer bottles were simultaneously presented onscreen, with one brand appearing on the far right and the other directly left from it. We counterbalanced the left/right position of the two brands so that each brand was seen on the right by 50% of participants. Whichever brand appeared on the right of the screen, the actual bottle of that brand was presented for touch behind the screen. The right image and its haptic counterpart behind the screen were presented in identical positions on the horizontal and vertical planes (i.e., the bottle was placed directly behind the image). This position made grabbing quite easy while also creating a fairly realistic visuo-haptic experience. After grasping the bottle behind the screen and viewing the visual stimuli on the screen for 4 seconds, participants were asked to choose between the two visually presented brands as reward for participating. Participants then reported their perceived fluency for both bottles on multi-item scales and answered several control questions, most of which were adapted from Labroo et al. (2008) (see Table 1). They also completed the German version (Nuzbaum, Voss, Klauer, & Betsch, 2010) of the six-item measure of autotelic need-for-touch (Peck & Childers, 2003b).

Participants in the visual-only control condition (vi) also saw the two bottles simultaneously in the same positions (counterbalanced), but without touching any ob-
ject in the test trial. Aside from the absence of the haptic exposure, this condition was otherwise identical to the visuo-haptic condition.

Results

Control factors. Debriefing revealed that none of the participants guessed the purpose of the study. Somewhat surprisingly, participants reported greater task involvement in the visual-only group ($M = 5.93$) than in the visuo-haptic group ($M = 5.03$), $t(58) = 2.91, p < .01$. However, the type of exposure (visuo-haptic vs. visual-only) had no significant effect on task liking, task complexity or mood (all $p > .1$), nor did the general preference ratings for the two brands differ significantly, $p = .37$. Thus, the groups were matched for several individual and task factors.

Product choice and processing fluency. Because each brand appeared equally often in both positions on the screen, we coded as our measure of product choice whether the brand presented on the right, where touch was manipulated behind the screen, was chosen as reward for participating. Participants’ product choices are illustrated in Figure 3. As predicted in $H_1$, the right brand was chosen significantly more often by participants who touched and saw it (70%) than by those who only saw it (43%), Pearson $\chi^2 (1) = 4.34, p < .05$. Moreover, the left and right brands were chosen about equally often by the visual-only group (i.e., they did not differ from 50% chance, $p = .47$), whereas the right (grasped) brand was significantly preferred over the left (non-grasped) brand by the visuo-haptic group, $\chi^2 (1) = 4.80, p < .05$.

The type of exposure also affected perceived fluency: Whereas the visuo-haptic and visual-only groups perceived the left brand with equivalent fluency ($M = 4.67, p = .13$), the right brand was perceived significantly more fluently by participants who grasped it than by those who only viewed it [$M_{\text{vis-ha}} = 5.23$ vs. $M_{\text{vi}} = 4.64$, $t(56) = -2.13, p < .05, d = .57$].
**Need for touch.** We tested for moderation via spotlight analyses (Hayes, 2012; criterion = 1 SD) on product choice and processing fluency with haptic condition as focal predictor and autotelic NFT scores as the moderator. NFT scores did not interact with type of exposure, both $p > .8$, therefore indicating no moderation.

**Mediation.** Bootstrapping mediation analysis (Hayes, 2012; 10,000 samples) with type of exposure as the independent variable (X), processing fluency (ME) as mediator and product choice as the dependent variable (Y) indicated indirect-only mediation (Zhao, Lynch, & Chen, 2010). Controlling for product touch (X), perceived fluency (ME) had a significant positive effect on product choice (path $b$), $B = .71$, $se = 0.31$, $z = 2.26$, $p < .05$. Moreover, the indirect effect through the mediator was significant (bias-corrected 95% CI = .0097–1.3117), whereas the direct effect of type of exposure on product choice was nonsignificant, $p > .1$. Hence, processing fluency fully mediated the effect of haptic exposure on product choice, supporting $H_2$.

**Study 2**

As predicted in $H_1$, participants in study 1 were significantly more likely to choose a given brand if they had previously grasped it than if they had not grasped it, and they also reported greater fluency of processing the bottle if they grasped it than if they only viewed it. Moreover, as predicted in $H_2$, processing fluency mediated this mere touch effect. Thus, study 1 demonstrated that touching a product increases processing fluency, thereby increasing actual product choice. The clear practical implication is that marketers should encourage consumers to touch their product. Of course, there are many methods for encouraging product touch. Here we focus on one common strategy, namely, creating novel or attractive package designs. Study 2 thus conceptually replicates study 1, with participants evaluating novel package designs of a familiar product. We tested whether haptic exposure to a Coca-Cola bottle would increase pro-
cessing fluency, liking, and purchase intentions for a bottle of Coca-Cola with a novel visual design. In addition, given the importance of perceived ownership in other mere touch effects (Peck & Shu, 2009; Shu & Peck, 2011), we also included both processing fluency and perceived ownership in a multiple mediation model.

**Methods**

**Participants.** 98 students at the same university participated in a product design study (mean age: 23.3; 51.6% female) and an additional 42 participated in a stimulus pretest (mean age: 25.3; 54.8% female). Participants were randomly assigned to conditions, and after completing the experiment participants were debriefed for hypothesis guessing and thanked with a gift (candies).

**Stimuli.** Stimuli were developed by a professional graphic designer, who created seven novel visual designs of a traditionally-shaped 0.25l Coca-Cola bottle decorated with unobtrusive artwork and including the brand name Coca-Cola. In a pretest 42 students evaluated how much they like each design, and how likely they are to buy each design (1 = dislike very much, very unlikely to buy; 7 = like very much, very likely to buy). The two measures were correlated for each of the seven designs, with $r = 0.65$ on average (all $r > 0.5$, $p < .01$), so we combined them into an attitude index for each visual design. To avoid potential ceiling or floor effects in the main experiment we selected the four designs with mean attitude scores nearest the scale midpoint ($M_{green} = 4.11$, $SD = 1.48$; $M_{orange} = 4.14$, $SD = 1.56$; $M_{pink} = 4.03$, $SD = 1.77$; $M_{white} = 4.23$, $SD = 1.81$), and there was no significant difference among them, $p > .8$. The selected stimuli are shown in Figure 4.

**Procedure.** The procedure of study 2 was almost identical to study 1 but differed in the following points: Each participant was presented two novel bottle designs randomly sampled from the four pretested designs, but each of the two designs was pre-
sent presented individually onscreen (rather than in pairs), and participants evaluated each of the two sampled designs (rather than choosing between them). Thus there were two experimental trials (rather than one). Participants were randomly assigned to either grasp a classic 0.25l Coca-Cola glass bottle behind the screen for 4 seconds on both trials (visuo-haptic) or not (visual-only). After each trial, participants reported their perceived fluency and ownership of the object and evaluated the product design on multi-item scales (see Table 2). After the second experimental trial we asked the same control questions as in study 1 (see Table 2). Aside from the absence of haptic exposure, the visual-only condition was otherwise identical to the visuo-haptic condition.

**Results**

**Control factors.** Debriefing revealed that none of the participants guessed the purpose of the study, and independent t-tests confirmed that the type of exposure had no significant effect on task involvement, task liking, task complexity, mood, or liking of Coca-Cola (all \( p > .5 \)).

**Product attitude, processing fluency, and perceived ownership.** Data were averaged across the two product designs evaluated by each participant. Because participants’ preference for Coca-Cola correlated significantly with product attitude (\( r = .41, p < .01 \)), perceived fluency (\( r = .23, p < .05 \)), and perceived ownership (\( r = .3, p < .01 \)), we included this preference factor as a covariate in all subsequent analyses. Indeed, this covariate remained significant in each of the three analyses (all \( F > 6, p < .05 \)). Nonetheless, after statistically controlling participants’ preference for Coca-Cola, the type of exposure significantly affected product attitude [\( M_{vi-ha} = 5.28 \) vs. \( M_{vi} = 4.64 \), \( F(1, 93) = 10.66, p < .01, d = .59 \)], processing fluency [\( M_{vi-ha} = 5.45 \) vs. \( M_{vi} = 4.98 \), \( F(1, 93) = 6.5, p < .05, d = .5 \)], and perceived ownership [\( M_{vi-ha} = 3.48 \) vs. \( M_{vi} = 2.59 \), \( F(1, 92) = 9.9, p < .01, d = .6 \)]. These evaluations are shown in Figure 5.
As predicted, participants who grasped the Coca-Cola bottle reported significantly more positive attitudes toward the design, greater fluency of processing the design and greater perceived ownership of the product than participants who only viewed the designs.

**Need for touch.** To analyze for moderation we conducted spotlight analyses (Hayes, 2012; criterion = 1 SD) on product attitude, processing fluency, and perceived ownership, with haptic condition as focal predictor and autotelic NFT scores as the moderator. NFT scores did not interact with type of exposure, all \( p > .3 \), thus indicating no moderation.

**Multiple mediation.** We conducted a multiple mediation analysis with haptic exposure as the independent variable (X), processing fluency (ME_1) and perceived ownership (ME_2) as mediators and product attitude as the dependent variable (Y). Preference for Coca-Cola was included as a covariate. Bootstrapping (Hayes, 2012; 10,000 samples) revealed that perceived fluency and perceived ownership jointly mediated the effect of grasping on product attitudes, as the total indirect effect through the two mediators was significant (bias-corrected 95% CI = .0705–.3987). The covariate, preference for Coca-Cola, also had a significant positive effect on product attitude, \( B = .07, \ t(90) = 3.79, \ p < .001 \). The direct effect of haptic exposure on product attitudes was nonsignificant, \( B = .09, \ t(90) = 1.45, \ p > .1 \), thus indicating full mediation.

Looking at the specific indirect effects, we found indirect-only mediation for perceived fluency (ME_1) (Zhao et al., 2010). Controlling for haptic exposure (X), perceived fluency (ME_1) had a significant positive effect on product attitude (path \( b_1 \), \( B = .83, \ t(90) = 11.53, \ p < .001 \)). The indirect path \( a_1b_1 \) of grasping on product attitudes through perceived fluency (ME_1) was also significant (bias-corrected 95% CI = .0488–.3669), indicating mediation. In contrast, controlling for haptic exposure (X), perceived owner-
ship (ME₂) had no significant effect on product attitude (path b₂), p > .1, and the indirect path a₂b₂ of grasping on product attitudes through perceived ownership (ME₂) was also nonsignificant (95% CI = -.0055–.0948), indicating no mediation. Moreover, the indirect effect of processing fluency (point estimate = .2027) was significantly larger than the indirect effect of perceived ownership (point estimate = .0302), with the bias-corrected 95% CI excluding zero (0.162–.3562). Hence, full mediation occurred through processing fluency, no mediation occurred through perceived ownership, and the indirect effect of processing fluency was significantly larger than the indirect effect of perceived ownership.

**Discussion**

Our results fully supported H₁ and H₂. Across both studies, touching a product increased liking, purchase intentions, and actual product choice. Although touch was previously known to improve product evaluations (Grohmann et al., 2007; Peck & Childers, 2003a; Peck & Shu, 2009), the present studies provide the first demonstration that this mere touch effect may occur rapidly, with haptic exposure as brief as a few seconds. Moreover, these studies are also the first to demonstrate that processing fluency mediates the mere touch effect. Much research in the field of multisensory integration suggested this mediation by processing fluency: Vision and touch are fundamentally integrated sensory systems, in that they serve similar functions of object identification and they activate largely overlapping neural pathways in the visual cortex (Amedi et al., 2001, 2002; Lacey & Sathian, 2012). Indeed, visuo-haptic perception facilitates identification of object properties (Ernst & Banks, 2002; Helbig & Ernst, 2007), and thus touching a product facilitates consumers’ ability to think about and evaluate the product, relative to only viewing the product. In turn, this increase in processing fluency ultimately improves those evaluations and increases the likelihood that consumers will choose
that product. Thus, this research extrapolates from recent neuroscientific studies of multisensory integration to propose, test, and support a new and important processing mechanism underlying the mere touch effect.

We found no evidence that the mere touch effect was mediated by perceived ownership or moderated by need for touch. However, both of these results must be interpreted with caution, as our studies were not designed to provide a strong test of either of these factors. We did find that product touch increased perceived ownership (see also Peck & Shu, 2009), but the brief haptic exposure may not have been sufficient for perceived ownership to develop fully as a processing mechanism in our studies. Likewise, our samples may have been too small or too homogenous to observe moderation by need for touch (see Grohmann et al., 2007; Krishna & Morrin, 2008; Peck & Childers, 2003b for moderation in similar tasks). Rather, what we have shown more conclusively is that processing fluency does indeed mediate the effect of mere touch on product evaluation and choice.

This research raises important issues for further research. Recent studies found that merely viewing a product reinstates motor simulations of interacting with that product (Eelen et al., 2013; Elder & Krishna, 2012). Future research could investigate whether and under which circumstances merely viewing products leads to processing fluency from simulating haptic properties of an object, and whether this increases product attitudes. It could well be that processing fluency and attitudes for advertised products are relatively higher if multimodal cerebral areas are involved in mental simulations. It also has to be clarified whether the psychological processes from mere touch occur only for objects that are manipulable by hands. In fact, based on recent cognitive research it seems likely that perceived ownership and processing fluency occur only for products that can be grasped with the hand (Connell et al., 2012).
Roberta Klatzky, a pioneer and leading expert on haptics research, recently speculated thus: “…Seduce people into touching the object, and this alone might increase the potential to buy it” (2010, p. 42). Our results support this conjecture. We demonstrated that mere touch improves product evaluation and increases product choice, and moreover, this mere touch effect is fully mediated by an increase in processing fluency from multisensory integration.
References


### Table 1. Measures and items used in study 1.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing fluency</td>
<td>Vöslauer: $\alpha = .79$ \hspace{1cm} $1 = $ not at all attractive, not at all eye-catching, difficult to process; $7 = $ very attractive, very eye-catching, easy to process</td>
</tr>
<tr>
<td></td>
<td>Römerquelle: $\alpha = .86$ \hspace{1cm} $1 = $ not at all attractive, not at all eye-catching, difficult to process; $7 = $ very attractive, very eye-catching, easy to process</td>
</tr>
<tr>
<td>Involvement in the task ($r = .76$)</td>
<td>$1 = $ not at all involved, not at all engaged; $7 = $ very involved, very engaged</td>
</tr>
<tr>
<td>Task liking ($r = .76$)</td>
<td>$1 = $ dislike very much, not at all interesting; $7 = $ like very much, very interesting</td>
</tr>
<tr>
<td>Task complexity</td>
<td>$1 = $ very difficult; $7 = $ very easy</td>
</tr>
<tr>
<td>Mood</td>
<td>$1 = $ feel very bad; $7 = $ feel very good</td>
</tr>
<tr>
<td>Vöslauer preference ($r = .56$)</td>
<td>$1 = $ dislike drinking very much, buy never; $7 = $ like drinking very much, buy very often</td>
</tr>
<tr>
<td>Römerquelle preference ($r = .53$)</td>
<td>$1 = $ dislike drinking very much, buy never; $7 = $ like drinking very much, buy very often</td>
</tr>
<tr>
<td>Need for touch (autotelic; $\alpha = .96$)</td>
<td>\hspace{1cm} When walking through stores, I can’t help touching all kinds of products; Touching products can be fun; When browsing in stores, it is important for me to handle all kinds of products; I like to touch products even if I have no intention of buying them; When browsing in stores, I like to touch lots of products; I find myself touching all kinds of products in stores. (1 = strongly disagree; 7 = strongly agree) (see Nuzbaum et al. (2010) for the German version).</td>
</tr>
</tbody>
</table>
Table 2. Measures and items used in study 2.

<table>
<thead>
<tr>
<th>Measures administered after each trial (all $r = p &lt; 0.01$)</th>
</tr>
</thead>
</table>
| **Attitude toward the product** ($r = .78$) | 1 = dislike very much, very unlikely to buy; 7 = like very much, very likely to buy  
| **Processing fluency** ($\alpha = .87$) | 1 = not at all attractive, not at all eye-catching, difficult to process; 7 = very attractive, very eye-catching, easy to process  
| **Perceived ownership** ($r = .89$) | I feel like I own the product, I feel a very high degree of personal ownership of the product (1 = strongly disagree; 7 = strongly agree)  

<table>
<thead>
<tr>
<th>Measures administered after the final trial (all $r = p &lt; 0.01$)</th>
</tr>
</thead>
</table>
| **Involvement in the task** ($r = .66$) | 1 = not at all involved, not at all engaged; 7 = very involved, very engaged  
| **Task liking** ($r = .69$) | 1 = dislike very much, not at all interesting; 7 = like very much, very interesting  
| **Task complexity** | 1 = very difficult; 7 = very easy  
| **Mood** | 1 = feel very bad; 7 = feel very good  
| **Coca-Cola preference** ($r = .79$) | 1 = dislike very much, buy never; 7 = like very much, buy very often  
| **Need for touch** (autotelic; $\alpha = .92$) | When walking through stores, I can't help touching all kinds of products; Touching products can be fun; When browsing in stores, it is important for me to handle all kinds of products; I like to touch products even if I have no intention of buying them; When browsing in stores, I like to touch lots of products; I find myself touching all kinds of products in stores. (1 = strongly disagree; 7 = strongly agree) (see Nuzbaum et al. (2010) for the German version).  


Figure 1. Conceptual framework: Multiple mediation model for product touch, ease of processing, ownership, and product evaluations.
Figure 2: Mineral water brands used in study 1.
**Figure 3.** Percentage of participants choosing the product on the left or right of the display after visuo-haptic exposure or after visual exposure only. Note that only the bottle on the right was grasped, and only by participants in the visuo-haptic condition.
**Figure 4:** Coca-Cola bottle designs used in study 2.
**Figure 5.** Evaluations ($M + SE$) of product attitude, processing fluency, and perceived ownership of novel Coca-Cola bottle designs after visuo-haptic exposure to the bottle or after visual exposure only.
Appendix D: Paper (4)

Ideomotor Compatibility in Shopping Behavior: Revisiting Effects of Arm Flexion and Extension on Product Choice

Mathias C. Streicher and Zachary Estes (under review),
Journal of Consumer Psychology
Ideomotor Compatibility in Shopping Behavior: Revisiting Effects of Arm Flexion and Extension on Product Choice

Mathias Streicher and Zachary Estes

ABSTRACT

Consumption often requires flexing arms towards the body and merely inducing such activities by shopping apparatuses has been shown to influence consumption. In three studies we show that the consumption effects from lateral arm movements arise from the fit between cognitions and motor activity. When a shopping situation conceptualizes product acquisition as movement away from the body the effects of arm flexion and extension are reversed. The findings prefer an ideomotor compatibility account rather than suggesting hardwired and unmalleable association between arm posture and consumption. The implications of these results for ideomotor research and management practice are discussed.

Keywords: consumer behavior; purchase quantities; approach and avoidance motivation; embodiment; persuasion; shopping.
Body posture influences many behaviors, including consumption. Perhaps the most widely studied and easily manipulated body posture is arm extension or flexion. *Arm extension* occurs when the hand is extended away from the body (elbow \( \approx 180^\circ \)), whereas *arm flexion* occurs when the hand is retracted toward the body (elbow \( \approx 90^\circ \)).

To illustrate, arm extension tends to facilitate responding to negative stimuli, whereas arm flexion facilitates responding to positive stimuli (for review see Eder & Hommel, 2013). Analogously, based on the association between arm flexion and positive evaluation, participants consume more when an arm is flexed than when it is extended (Förster, 2003). However, we will argue that the current theoretical explanation of such effects is critically incomplete. Initial theorizing, based on evaluative conditioning, explained that repeatedly pushing aversive stimuli away and pulling appetitive stimuli toward the body establishes automatic associations between those arm movements and affective evaluations (Cacioppo, Priester, & Berntson, 1993). Similarly, more recent theorizing explains arm posture effects in terms of motivation for immediate gratification (Van den Bergh, Schmitt, & Warlop, 2011). Alternatively, we argue that posture effects on consumption are modulated by their compatibility with cognitions (Barsalou, Niedenthal, Barbey, & Ruppert, 2003). We further argue, based on recent ideomotor studies (Eder & Rothermund, 2008; Lavender & Hommel, 2007; Markman & Brendl, 2005; Rotteveel & Phaf, 2004), that simple task constraints determine whether arm extension or flexion is compatible with consumption-related cognitions. Using a hypothetical shopping scenario, Study 1 shows that consumers’ purchase quantities are higher when pushing a shopping cart with flexed arms than when pushing the cart with extended arms. Study 2 conceptually replicates these results in an online shopping scenario. Finally, Study 3 demonstrates that effects of arm extension and flexion are reversed when shopping is conceptualized toward or away from the body. In addition to providing a
critical theoretical test, this research also contributes practically by clarifying how shopping environments can be managed to optimize consumers’ experiences.

THEORETICAL FRAMEWORK

Arm postures both reveal and influence attitudes. Arm extension is typically faster when judging negative stimuli, whereas arm flexion is faster with positive stimuli (Chen & Bargh, 1999; Solarz, 1960). Rather than measuring arm flexion and extension, Cacioppo et al. (1993) manipulated it. They had participants press their palms either downward on the topside of a table (arm extension) or upward against the bottom side of the table (arm flexion) while viewing a series of neutral Chinese ideographs. The ideographs were evaluated more positively when paired with arm flexion than with extension. Förster (2003) first applied this phenomenon to consumer behavior by manipulating arm flexion or extension (as in Cacioppo et al., 1993) while participants watched a TV program. Critically, while they watched the program, a bowl of cookies was placed nearby. Participants with flexed arms ate more cookies than those with extended arms. Researchers initially explained these posture-attitude associations via evaluative conditioning. That is, because negative stimuli are often pushed away from the body, and positive stimuli are typically pulled toward the body, arm extension and flexion respectively became associated with negative and positive evaluations of stimuli. And eventually, due to a lifetime’s experience, those arm movements themselves come to signify negativity and positivity.

Although there is much evidence for evaluative conditioning as a general behavioral mechanism (Hofmann et al., 2010), more recent evidence suggests that evaluative conditioning may not explain the effect of arm posture on attitudes. In particular, the effect appears to be moderated by the desirability of the product. For example, Förster (2003) had participants watch a documentary film with their arm in a flexion, extension, or neutral position, and with a glass of either orange juice or mineral water to drink. Importantly, the orange juice was
shown in pre-testing to be extremely tasty, whereas the mineral water was judged to be of neutral taste. Participants drank more orange juice with flexed arms and less orange juice with extended arms, relative to the neutral posture. However, arm posture did not affect consumption of the neutral product, mineral water. Similarly, Förster (2004) showed a series of desirable foods and drinks (e.g., Snickers) and undesirable foods and drinks (e.g., beef lung) to participants whose arms were either flexed, extended, or relaxed in a neutral position. Participants judged the desirable products more favorably with flexed arms, and judged the undesirable products less favorably with extended arms. Van den Bergh et al. (2011) also showed that product-type (i.e., vice or virtue) moderates the influence of arm posture on product choice. In a field study, they examined purchases by shoppers who carried a basket (which may involve arm flexion; \( n = 10 \)) or pushed a cart (which typically entails arm extension; \( n = 126 \)).

They found that basket shoppers purchased more chocolate bars, candy, and chewing gum than cart shoppers. In a follow-up lab study, they had participants either extend or flex their arms while choosing between a vice or virtue product (i.e., forced choice between a fruit and a chocolate bar). Participants in the flexion group chose more vice products than participants in the extension group. Thus, arm flexion selectively increased the choice of vice products.

Evaluative conditioning does not explain this selective effect of arm posture on product choice, because if arm flexion simply induced positive attitudes, then it should increase choices of vice and virtue products equally, as well as desirable, neutral, and undesirable products. Instead, Van den Bergh et al. (2011) supported a motivation theory, whereby arm flexion induces a drive for immediate gratification (i.e., reward-seeking behavior) due to the association between arm flexion and approach motivation (Van den Bergh, Dewitte, & Warrlop, 2008). So in the choice between an apple (which has the delayed gratification of long-
term health) and a chocolate (which has the immediate gratification of short-term satisfaction), arm flexion motivates choice of the immediately gratifying chocolate. And similarly in Förster’s (2003) study, arm flexion increased consumption of immediately rewarding products (e.g., orange juice, cookies) but not of neutral products (e.g., mineral water). Thus, at present, this motivation account provides the most complete and viable explanation of the effect of arm posture on consumer choice.

Both of these accounts of arm posture effects assume that consumer behavior is embodied, in the broad sense that cognition and behavior are constrained by one’s body (Barsalou, 2008; Casasanto, 2011). In this case, consumers’ preferences, choices, and actual consumption are influenced by the posture of the arm. Other instances of embodied cognition in consumer behavior are common and widespread (Krishna, 2012; Krishna & Schwarz, 2014). In a classic demonstration, Strack, Martin, and Stepper (1988) had participants hold a pen in their mouth such that it either induced or inhibited a smile, and participants judged cartoons to be more humorous if they were smiling than if prevented from smiling. More recently, on the basis that the oral motor system is involved in learning verbal information, Topolinski, Lindner, and Freudenberg (2014) showed that pre-occupying participants’ oral muscles (i.e., by having them eat popcorn or chew gum) while they viewed ads decreased the effectiveness of those ads.

An equally important – but less studied – assumption of embodiment is that cognition is also situated, in the broad sense that cognitions occur in various situations that may impose different constraints and hence elicit different behaviors (Barsalou, 2009; Robbins & Aydede, 2009). For instance, people prefer products when the handle is oriented toward their dominant hand, so that they could easily imagine grasping it (Elder & Krishna, 2012). But if the dominant hand is occupied (e.g., by holding something else), then people prefer the product when the handle is oriented toward the nondominant hand, again presumably because it
facilitates the mental simulation of grasping the product (Eelen, Dewitte, & Warlop, 2013). Thus, when the situation constrained the available bodily response, the embodied effect was reversed. Situation effects such as these demonstrate that the ideomotor compatibility between a mental simulation of an action (e.g., imagining grasping a cup with handle pointed leftwards) and the enactment of a compatible motion (i.e., indicating preference by pressing a button with the left hand) affects preferences and behaviors (Barsalou et al., 2003; Eelen et al., 2013; Ping, Dhillon, & Beilock, 2009).

We propose that arm posture affects shopping behavior via the ideomotor compatibility between the arm posture and the simulated movement required by the shopping situation. Given that arm flexion enacts movement toward the body, whereas arm extension enacts movement away from the body, arm flexion and extension are naturally compatible with mental simulations of moving objects toward and away from the body, respectively. Indeed, sentences that imply transfer of objects toward the body (e.g., “Andy delivered the pizza to you”) elicit faster arm flexion responses, whereas sentences that imply object transfer away from the body (e.g., “You delivered the pizza to Andy”) elicit faster arm extension responses (Glenberg & Kaschak, 2002). And critically, product choice and consumption are typically enacted by motion toward the body: Shopping typically entails moving products from shelves into one’s basket, and ingestion entails bringing food or liquid toward the mouth. Consequently, product choice and consumption typically are mentally simulated by movement toward the body. So by default, arm flexion is compatible with mental simulations of consumption, and hence arm flexion should increase consumption and choice, especially of desirable products ( Förster, 2003, 2004; Van den Bergh et al., 2011).

This account attributes the standard arm posture effect to a different mechanism than either evaluative conditioning or motivation. By both of those accounts, it is the long-term behavioral association between arm flexion and positive affect or reward that causes arm
flexion to increase product evaluations. In other words, the two previous accounts treat arm posture effects as an ideomotor reflex: From a lifetime of experience, arm flexion becomes strongly associated with acquisition and consumption of desirable objects, and hence merely flexing an arm reflexively increases consumption of desirable objects. By the ideomotor compatibility account, in contrast, this effect is due to the compatibility of the arm posture with a simulated product acquisition: Arm flexion and object acquisition are both typically enacted with the same direction of motion toward the body. Thus, product choice typically is mentally simulated via motion toward the body, and it is this ideomotor compatibility that causes arm flexion to increase consumption. That is, the effect is contingent upon the mental simulation of product acquisition, rather than a hardwired and unmalleable association between arm posture and consumption.

Critically then, according to this ideomotor compatibility account, a different shopping situation could attenuate or even reverse this effect. For example, if the mental simulation of product acquisition entailed moving chosen products away from the self, that would be compatible with arm extension (i.e., movement away) rather than arm flexion (i.e., movement toward). Thus, contrary to the typical situation in which object acquisition is mentally simulated by motion toward the body, this situation in which product acquisition is simulated away from the body should increase product choice with arm extension rather than arm flexion. This ideomotor compatibility account therefore makes a different prediction from the evaluative conditioning and motivation accounts, both of which generally claim that arm flexion increases choice of desired products.

Indirect support for this ideomotor compatibility account of shopping behavior comes from research on affective evaluation. People are generally faster to classify negative stimuli by pushing a lever (or joystick) away from the body, but are faster to classify positive stimuli by pulling the lever toward the body (Chen & Bargh, 1999; Solarz, 1960). Across a series of
experiments, however, Eder and Rothermund (2008) showed that this emotion-direction effect was strongly moderated by task constraints. For instance, when moving the lever toward the body was labeled as “pull down” (which has a negative connotation), then participants were faster to classify negative words with that movement toward the body. And when Eder and Rothermund labeled moving the lever away from the body as “push up” (which has a positive connotation), then participants classified positive words more quickly with that movement away from the body. Thus, simple manipulations of the task conceptualization completely reversed the standard effect of stimulus valence on response direction (see also Lavender & Hommel, 2007; Markman & Brendl, 2005; Rotteveel & Phaf, 2004). Although such situation effects provide general support for our ideomotor compatibility account, it must also be noted that those prior studies assume that responding toward and away from the self are associated with positive and negative valence (see also Barsalou et al., 2003; Förster, 2004). Our account, in contrast, makes no assumptions about emotional valence and instead attributes arm posture effects to the compatibility between the simulated product acquisition (i.e., the “idea”) and the actual arm posture (i.e., the “motor”).

In sum, we have identified three potential explanations of arm posture effects on consumer behavior, with mutually exclusive predictions. The evaluative conditioning model (Cacioppo et al., 1993) predicts increased consumption from arm flexion (relative to arm extension), regardless of product-type (e.g., vices and virtues). The motivation model (Van den Bergh et al., 2011) would predict that arm flexion selectively increases choice of vice but not virtue products, whereas arm extension selectively increases choice of virtue but not vice products. The ideomotor compatibility model predicts that, depending on the particular shopping situation, either arm flexion or extension can increase product choice independent of product-type. The following studies systematically test all three models. Importantly, because
the ideomotor compatibility explanation of arm posture effects is novel, these studies provide the first direct tests of all three models.

**Study 1**

Study 1 examined hypothetical purchases of vice and virtue products under conditions of arm flexion or extension in a simulated shopping scenario. All participants moved a shopping cart to tables with products arranged on them, but some participants moved the cart with arms extended, whereas others moved the cart with arms flexed. By holding constant the shopping support (i.e., all participants used a cart), this method controls for potential personal and situational differences between basket and cart shoppers while nevertheless manipulating arm posture. If arm posture effects are due to motivation, with flexion motivating immediate satisfaction and extension motivating delayed gratification, then arm flexion should induce more vice purchases, whereas arm extension should elicit more virtue purchases (Van den Bergh et al., 2011; see also Förster, 2003, 2004). That is, the motivation account predicts an arm posture × product-type interaction. In contrast, both the ideomotor compatibility and the evaluative conditioning models (Cacioppo et al., 1993) instead predict a main effect of arm posture, with flexion increasing hypothetical purchases of both vice and virtue products.

**Method**

**Participants.** 101 students (mean age: 23 years; 49% female) were recruited in the lobby of the main building at a typical Austrian university. Although they participated voluntarily, at the completion of the study they were thanked with a gift (candy). An additional 23 students participated in a stimulus pre-test.

**Products.** Products were selected from an in-class pre-test in which students (N = 23) listed vice and virtue products that they frequently buy at the supermarket. The products were grouped into categories from which we chose four vice products (can-
dies; snacks; beer; wine) and four virtue products (dish soap, toothpaste, trash bags, paper towels). For each product, the participants then determined via discussion the brand that is most frequently purchased among this student population. If there was no consensus for a given product, we chose the two most popular brands to represent this category (e.g., Snickers and M&Ms). We selected Snickers, M&Ms, Kelly potato chips, NicNac’s peanuts, Stiegl beer, Ottakringer beer and Servus white wine as vice products ($M = €1.10$) and Pril dish soap, Palmolive dish soap, Colgate toothpaste, OdolMed 3 toothpaste, Alufix trash bags and Zewa paper towels ($M = €1.67$).

**Shopping Cart.** To disguise the purpose of the study, participants were recruited to participate in a physiological study on shopping behavior. We modified a shopping cart by attaching two small electrical impulse pads either on top of the handlebar’s end points (extension group) or underneath it (flexion group). The pads were conspicuously wired to an ostensible recording device that was located in the cart (cf. Förster, 2003). Throughout the study the experimenter visually monitored participants’ hands to ensure that they contacted both impulse pads, and verbal reminders were given when necessary.

**Procedure.** Participants were instructed to move a shopping cart to two display tables, where they would see several products, and their task was to indicate how many of each product they would like to buy at the given price. Participants were randomly assigned to either the extension or the flexion group. Participants in the extension group moved the shopping cart by placing their hands on the topside of the handlebar with arms extended, whereas those in the flexion group moved the cart by bending their arms and placing their hands on the underside of the handlebar. The extension and flexion groups were otherwise identical.

The shopping scenario was arranged as an equilateral triangle, with a starting point and two shopping display tables all 10 meters apart (see Figure 1). The vice and
virtue products were presented on different display tables, with the left/right position of
the vice and virtue displays counterbalanced (relative to the starting point). Participants were
instructed to move the shopping cart from the starting point to the first display, with the
left/right position of the first display counterbalanced. Upon arrival at the first display, partic-
ipants viewed the given products and read an order form that included prices for the products.
To promote hypothetical purchasing, we assigned prices that were comparable to regional
discounters. Next to each price on the order form was an empty box, and participants indicat-
ed their purchase intentions by entering in each box the number of that given item that they
would like to buy (e.g., Ottakringer beer, €0.69 each, quantity: 2 ). The arrangement of
products on the display table was held constant, whereas the order of the products on the or-
der form was counterbalanced (i.e., two order forms listed the items in opposite orders). After
indicating their purchase intentions at the first display, participants placed their order form in
the shopping cart, re-engaged the handlebar in the assigned posture (extension or flexion),
and then moved the cart to the second display table, where the same procedure was followed.

Participants then re-engaged the handlebar in the assigned posture and moved the
shopping cart back to the starting point, where they indicated their mood (How do you feel at
the moment? 1 = very bad, 9 = very good; Förster, 2003) and rated the ergonomics of the
shopping cart (How strenuous was it to push the cart? 1= very strenuous, 9 = not strenuous at
all; How comfortable was holding the handle bar? 1 = very uncomfortable; 9 = very comfort-
able; Förster, 2003). The latter two questions were combined to form an ergonomics index (r
= .68; p < .001). Finally, participants were debriefed for hypothesis guessing and were
thanked with a candy bar.

Results

Controls. At debriefing, no participant guessed the true purpose of the experiment.
However, exploratory analyses revealed two participants whose purchase quantities were
outliers. All data from these two participants were excluded from further analysis. An independent $t$-test showed no difference in mood between the two groups ($p > .7$). However, the flexion group rated the shopping cart ergonomics worse ($M = 3.94$) than the extension group ($M = 5.67$), $t(97) = 4.38, p < .01$. This may be unsurprising, given that arm extension allows resting one’s arms on the handlebar, whereas arm flexion does not. Nonetheless, because these ergonomics scores were unrelated to purchase quantities ($r = -.03; p > .7$), this difference in ergonomics could not explain any observed difference in purchase intentions.

**Purchase quantities.** Indicated purchases were summed to create a *quantity index* for each participant. We first tested whether mood, gender, and/or age covaried with purchase quantities. Only gender (1 = male; 2 = female) correlated significantly with purchase quantities ($r = .38; p < .01$). Gender thus was included as covariate in a mixed ANCOVA on purchase quantities with posture (extension, flexion) and product (vice, virtue) respectively as independent and repeated measures. The gender covariate was again significant, $F(1, 96) = 17.83, p < .01$. Additionally, a significant main effect of product indicated more intended purchases of vice items ($M = 11.69$) than virtue items ($M = 6.33$), $F(1, 96) = 30.92, p < .01$. Moreover, a significant main effect of posture indicated more intended purchases when participants’ arms were flexed ($M_{vice} = 12.94; M_{virtue} = 7.20$) than when extended ($M_{vice} = 10.35; M_{virtue} = 5.42$), $F(1, 96) = 5.42, p < .05$. Critically, the posture and product factors did not interact ($p > .5$).

**Spending.** To facilitate interpretation, we additionally created a *spending index* in EUR currency, and we replicated the preceding analyses. Indeed, the results of this spending analysis replicated the results of the purchase quantity analysis, except that the less informative main effect of product-type was no longer significant ($p > .2$). As illustrated in Figure 2, the flexion group hypothetically spent more money ($M_{vice} = €12.08; M_{virtue} = €11.74$) than the

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11 Extreme outliers are data points which are more extreme than $Q1-3*IQR$ or $Q3+3*IQR$ with the Inter-quartile Range defined as $IQR=Q3-Q1$ (Tukey, 1977).
extension group ($M_{vice} = €9.88; M_{virtue} = €8.69$), $F(1, 96) = 4.67, p < .05$. Importantly, the interaction failed to approach significance ($p > .6$).

**Discussion.** Participants who moved the cart with arms flexed hypothetically purchased more and spent more than participants who moved the cart with arms extended. Critically, arm flexion significantly increased purchases of both vice and virtue products. This result is consistent with both the evaluative conditioning and the ideomotor compatibility models because both accounts predict a main effect of arm manipulation in this shopping scenario, independent of product-types. The difference is that the evaluative conditioning account always predicts the same main effect independent of task constraints. The ideomotor compatibility model, in contrast, predicts this main effect only if the task of choosing a product is cognitively represented in a way that is compatible with the arm posture. That is, in this typical shopping scenario, product choice is conceptualized via movement toward the body. And because arm flexion is also enacted via movement toward the body, the arm posture and product choice have compatible movements that increase consumption. Although Study 1 does not discriminate between these two accounts, Study 3 did so.

More critically, Study 1 provided no support for the motivation account, which predicts that flexion would increase purchases of vices (which are immediately satisfying) but not virtues (which require delayed gratification). Although this result may initially appear inconsistent with that of Van den Bergh et al. (2011), we do not believe it is. In their first study, Van den Bergh et al. compared vice purchases by basket shoppers and cart shoppers. Our study differed importantly in that we had no basket shoppers. Given this fundamental difference in study designs, the results are not directly comparable. In fact, we believe this design is a strength of our study: By controlling the shopping apparatus (i.e., all participants moved a shopping cart), we were able to manipulate arm posture while eliminating other potential physical and cognitive confounds (e.g., the physical weight and cognitive mindset of
carrying a basket). In their second study, Van den Bergh et al. introduced self-control dilemmas in which basket and cart shoppers had to choose between a chocolate (vice) and a fruit (virtue). They showed that basket shoppers (with flexed arms) chose more vices than cart shoppers (with extended arms). In fact, this result is directly consistent with our finding that arm flexion increased vice purchases. But what cannot be determined from Van den Bergh et al.’s forced choice paradigm is whether basket shoppers might also have wanted more of the virtue products; that is, because participants had to choose, we learn nothing about the unchosen product. Our study instead provided shopping measures of both vice and virtue products separately, and indeed we showed that arm flexion increased hypothetical purchases of both product-types. Thus, we believe that Van den Bergh et al. discovered an interesting and important difference between basket shopping and cart shopping. Our study instead shows that, independent of the shopping apparatus, arm flexion generally increases purchasing behaviors relative to arm extension.

**Study 2**

In Study 1, we manipulated arm posture by having participants move a shopping cart with arms either flexed or extended. Although relatively high in ecological validity, this manipulation differed from most other studies of arm posture, which typically have participants press their palm either upward on the underside of a table (flexion) or downward on the topside of a table (extension; Cacioppo et al., 1993; Förster, 2003, 2004). For more direct comparison with prior studies, in Study 2 we therefore used this traditional manipulation of arm posture. We also implemented two other changes aimed at increasing generalizability: Study 2 used a broader set of vice and virtue products than any prior study on arm posture, and it used an online shopping scenario in which participants browsed a set of products on a computer and indicated their purchase intentions by entering purchase quantities into an order box.
Another important theoretical question, unaddressed by Study 1, is whether arm flexion increases purchasing and/or arm extension decreases purchasing. That is, because Study 1 lacked a neutral control condition, it does not discriminate between theoretical explanations based on facilitation and inhibition of consumption. Study 2 therefore included not only flexion and extension groups, but also a control group who neither flexed nor extended their arms (as in Förster, 2004). The evaluative conditioning model predicts that arm flexion and extension respectively increase and decrease consumption, relative to a neutral arm posture. Several studies have shown that positive conditioning (i.e., pairing a target with a positive stimulus) increases product evaluations, whereas negative conditioning decreases evaluations (e.g., Schemer, Matthes, Wirth, & Textor, 2008; Walther & Grigoriadis, 2004). Moreover, neutral stimuli that are conditioned with movement toward or away from the body are later perceived to be more positive or negative, respectively (Woud, Becker, & Rinck, 2008). So if arm flexion induces positive affect and arm extension induces negative affect (Cacioppo et al., 1993), then flexion and extension should respectively increase and decrease consumption.

The ideomotor compatibility model predicts only increases, not decreases, of consumption. This is because an incompatibility between thoughts and actions takes more processing resources (Barsalou et al., 2003), and this increased resource demand can cause performance decline in other tasks (Förster & Stepper, 2000; Förster & Strack, 1996). Prior research has therefore suggested that ideomotor incompatibility can lead to correction strategies in behavior (Förster, 2004; Strack, 1992). To illustrate, Förster (2004) found that only cognition–compatible arm postures influenced evaluations of affective stimuli. That is, arm flexion increased evaluations of positive but not negative stimuli and arm extension decreased evaluations of negative but not positive stimuli. Critically, the evaluations of a control group with no posture manipulation did not differ from the evaluations of the incompatible motor–stimuli pairings. Hence, the ideomotor compatibility account predicts that arm flexion would
increase purchases relative to both control and extension groups, but that the extension and control groups would not differ from one another.

**Method**

**Participants.** 150 students ($M = 24$ years; 53% female) were recruited and rewarded in the same way as Study 1. An additional 56 students ($M = 26$ years; 55% female) participated in a stimulus pre-test.

**Products.** Products were selected from an online pre-test in which students ($N = 56$) evaluated 31 products (an extended set of those generated in the pre-test of Study 1) in terms of their vice–virtue status. An introductory slide informed participants about the concept of vice and virtue products, based on Wertenbroch’s (1998) definition of immediate or delayed consumption consequences. Participants then viewed the 31 products, with both a verbal label and a picture of the product, in random order. For each product they rated how much it represents a vice (=1) or virtue (=9) to them. We selected the 12 items with lowest ratings as vice products ($M = 2.68$, $SD = .37$) and the 12 items with highest ratings as virtue products ($M = 7.05$, $SD = .38$). On average the vice and virtue products were priced at €0.92 and €1.52 respectively. The selected items are shown in Table 1.

**Procedure.** Participants were recruited for a study investigating whether physical coordination influences the perceived ease of decision-making. The procedure simulated an online shopping experience. Participants were seated in front of a computer screen on a desk, where the experiment was presented via online survey software. Participants were asked to view some products from a hypothetical campus shop, and to indicate how many of each product they would like to buy at the given prices. The 24 products were grouped into product categories (e.g., beverages), with each category being presented on a separate webpage. Each product was presented on a separate row
of the webpage with a picture, a verbal label, and a price, and with an empty box on the right for entering the desired quantity of the product. As in Study 1, the prices were slightly discounted to promote purchase decisions. The order of the webpages (i.e., product categories) and the order of the products on each page were randomized separately for each participant. Participants indicated their purchase intentions by entering a number (i.e., purchase quantity) into the box next to any item they wanted to buy. They were permitted to leave empty any box corresponding to an item that they were not interested in purchasing.

To emphasize our cover story about physical coordination, we had participants operate the mouse and keyboard with their non-dominant hand throughout the shopping task. This allowed us to manipulate arm posture in the dominant hand, which exhibits stronger effects than the non-dominant hand (Van den Bergh et al., 2011). While hypothetically shopping online, participants’ dominant hand was placed either palm-down against the top of the desk (extension group), palm-up against the bottom of the desk (flexion group), or in a resting position in the lap (as in Förster, 2004). Participants were randomly assigned to groups.

After shopping, participants completed four control measures. Decision ease was measured with two items (How fast were you able to form your decisions? 1 = very slow, 9 = very fast; How easy was it to make your decisions? 1 = very hard, 9 = very easy) that correlated significantly ($r = .46; p < .01$). Stock buying was measured with a single item (I always buy just as much as I immediately need. 1 = disagree very much, 9 = agree very much) that was reverse-scored so that higher scores indicate more stock buying. Posture ergonomics was measured with two items (How strenuous was the posture of your dominant arm? 1 = very strenuous, 9 = not strenuous at all; How comfortable was the posture of your dominant arm? 1 = very uncomfortable, 9 = very comforta-
ble) that correlated significantly \( r = .46 \ p < .01 \). As in Förster (2003), this measure was administered to the two treatment groups only (i.e., the control group was excluded). Finally, mood was measured with three items (How do you currently feel? 1 = very bad, 9 = very good; What is your current mood? 1 = bad mood, 9 = good mood; How stressed do you feel? 1 = very stressed, 9 = not stressed at all) that inter-correlated reliably (\( \alpha = .86 \)).

Results

Controls. At debriefing, some participants felt that using their non-dominant hand might have influenced their behavior, but none of them guessed the purpose of manipulating the posture of the dominant hand. One participant whose purchase quantity was an extreme outlier (Tukey, 1977) was removed from all further analyses. No group differences were observed in decision ease (\( p = .62 \)), posture ergonomics (\( p > .24 \)), or mood (\( p = .41 \)). Surprisingly however, stock buying behavior differed across groups, \( F(2, 143) = 3.99, p < .05 \). More specifically, Tukey post hoc tests indicated that the extension group reported significantly more stock buying (\( M = 4.55 \)) than the flexion (\( M = 3.43 \)) and control groups (\( M = 3.46 \)).

Purchase quantities. Preliminary analyses revealed significant correlations between purchase quantities and mood (\( r = .17; p < .05 \)), age (\( r = -.20; p < .05 \)) and stock buying (\( r = .31; p < .01 \)). Neither gender (1 = male; 2 = female) nor ergonomics correlated with purchase quantity (both \( r < .1; p > .3 \)). Mood, age, and stock buying thus were included as covariates in a mixed ANCOVA on purchase quantities with posture (extension, flexion, control) and product (vice, virtue) respectively as independent and repeated measures. The covariates mood (\( F(1, 140) = 8.44, p < .01 \)), age (\( F(1, 140) = 8.49, p < .01 \)) and stock buying (\( F(1, 140) = 21.60, p < .01 \)) remained significant. More importantly, the main effect of posture was significant, \( F(2, 140) = 5.12, p < .01 \). Planned contrasts revealed that the flexion group purchased significantly more items (\( M_{vice} = 12.31; M_{virtue} = 14.80 \)) than both the extension group
and the control group ($M_{vice} = 7.90; M_{virtue} = 13.2; p = .03$), which did not differ from one another ($p = .39$). The less informative main effect of product was marginally significant ($p = .06$), with slightly more purchases of virtues ($M = 13.20$) than of vices ($M = 9.53$), but there was no interaction with arm posture ($p = .29$).

**Spending.** Results of hypothetical spending, illustrated in Figure 3, were the same as for purchase quantities. The main effect of posture was significant, $F(2, 140) = 5.64, p < .01$. The flexion group hypothetically spent significantly more money ($M_{vice} = €11.87; M_{virtue} = €19.25$) than both the extension group ($M_{vice} = €7.97; M_{virtue} = €14.77; p < .01$) and the control group ($M_{vice} = €7.43; M_{virtue} = €16.13, p = .01$), which did not differ from one another ($p = .53$). The main effect of product was significant ($p = .04$), with more spent on virtues ($M = €16.72$) than on vices ($M = €9.10$), but its interaction with posture again failed to approach significance ($p = .78$).

**Discussion.** As in Study 1, shoppers with a flexed arm hypothetically purchased more and spent more than shoppers with an extended arm, and again this increased purchasing with arm flexion occurred for both vice and virtue products. Moreover, the results generalize the finding of Study 1 to an online shopping environment here in Study 2. We also extended the generalizability by using a broader set of vice and virtue products than any prior study on arm posture. The results therefore provide the most extensive evidence to date of how arm postures influence consumption in a shopping scenario. Study 2 additionally showed that arm flexion increased purchases, whereas arm extension had no effect on purchases, relative to a neutral arm posture. Thus, our results indicate that arm postures have a facilitative but not inhibitory effect on consumption. This result is in line with Förster (2004), who found that only cognition–compatible but not -incompatible postures influence product evaluations. This, however, is at odds with the evaluative conditioning model because prior research has demonstrated that negative conditioning decreases consumers’ evaluations of otherwise neu-
tral products (Walther & Grigoriadis, 2004). If arm extension is hardwired with negativity, then arm extension should have decreased consumption relative to a neutral group that received no arm manipulation.

Studies 1 and 2 also failed to support the motivation account of arm posture effects, which predicts that arm flexion should only increase purchasing of vice products and not virtue products (Van den Bergh et al. 2011). That is, flexion induces an approach motivation, which is associated with the immediate reward of a vice product. And because virtue products are not immediately rewarding, flexion should not increase virtue consumption. The absence of a posture × product-type interaction in both experiments increases confidence that the motivation model does not explain our results.

Thus, the obtained results failed to support either the motivation or evaluative conditioning models, and instead supported the ideomotor compatibility model. By default, shopping is conceptualized via movement toward the body, so given that arm flexion enacts movement toward the body, those compatible movements generally increase product choices. On the other hand, neither of these first two studies directly tested the novel prediction of the ideomotor compatibility model: If product choice is conceptualized via movement away from the body, that would be compatible with arm extension rather than flexion, and hence arm extension should increase product choice.

**Study 3**

The purpose of Study 3 was to provide a strong test of our ideomotor compatibility model. We asked participants to indicate their purchase intentions by moving products (i.e., cans of Red Bull energy drink) into a hypothetical purchasing area, while maintaining a flexion or extension arm posture with the other arm (cf. Förster, 2003). Critically however, we manipulated the location of the purchasing area, so that participants indicated their purchase intentions by moving the products either toward or away from themselves. The motor com-
patibility model predictions an interaction of arm posture and purchase direction: Arm flexion should increase purchasing toward the body, whereas arm extension should increase purchasing away from the body. That is, because arm extension enacts movements away from the body, it is compatible with simulating product choices away from the body, and hence arm extension should increase purchases that are enacted by moving the products away. In contrast, the evaluative conditioning model predicts a main effect, such that only arm flexion can increase purchases. Because arm extension is associated with rejecting or repelling objects, arm extension should never increase purchasing. Thus, the ideomotor compatibility model predicts an interaction whereas the evaluative conditioning model predicts only a main effect of arm posture.

**Method**

**Participants.** 178 students ($M = 22$ years; 43% female) were recruited and rewarded in the same way as Study 1.

**Stimuli.** Stimuli were 12 Red Bull cans (.25-liter) presented at a discount price (€0.99/can). This brand is well known and regularly consumed by Austrian students.

**Procedure.** As in Study 2, participants were recruited for a study investigating whether physical coordination influences the perceived ease of decision-making. Participants were seated at a table that held (a) the 12 Red Bull cans and (b) a shopping cart symbol printed on a standard A4 sheet. In the *toward* condition, the cans were placed 40 cm away and the shopping cart symbol was placed directly in front of participants. In the *away* condition, the location of the cans and shopping cart was reversed. Participants were instructed to move into the shopping cart area, using their non-dominant hand, as many of the Red Bull cans as they would like to purchase at the given price (€0.99). Thus, to indicate their purchase intentions, participants had to move the desired number of cans either away from themselves (*away* group) or toward themselves.
(toward group). Throughout this purchasing task, participants placed their dominant hand (see Van den Bergh et al., 2011) either palm-down on the table (extension group) or palm-up against the bottom of the table (flexion group). Participants were randomly assigned to one condition of this 2 (direction: toward, away) × 2 (posture: extension, flexion) between-participants design.

After the decision, we measured ergonomics with two items (How difficult or easy was the physical activity? 1 = very difficult, 9 = very easy; The activity of the left and right arm matched. 1 = disagree very much, 9 = agree very much) that correlated significantly ($r = .50; p < .01$). We also measured mood via the same items as in Study 2 ($\alpha = .76$).

**Results**

**Controls.** At debriefing, no participant guessed the true purpose of the experiment. However, three participants whose purchase quantities were extreme outliers (Tukey, 1977) were removed from all further analyses. A 2 (direction) × 2 (posture) between-participants ANOVA on task ergonomics revealed only a significant main effect of direction, $F(1,170) = 10.93, p < .01$. Participants rated the task more ergonomic when they moved the cans towards themselves ($M = 6.79$) than away ($M = 5.85$). An analogous ANOVA on mood revealed no significant effects (all $p > .8$).

**Purchase quantities.** Purchase quantities did not correlate significantly with mood ($r = .01; p > .94$) or task ergonomics ($r = .08; p > .2$). However, gender (1 = male; 2 = female) correlated significantly with purchase quantities ($r = -.17; p < .05$), such that males intended to purchase more Red Bull than females. Purchase quantities also correlated marginally with age ($r = -.13; p > .08$). We therefore included both gender and age as covariates in a 2 (direction) × 2 (posture) ANCOVA on Red Bull purchase quantities. Both covariates were significant ($p < .05$). Most importantly, neither main effect approached significance (all $p > .7$), but
the interaction was significant, $F(1, 169) = 9.09, p < .01$. Simple effects analyses confirmed that, when indicating their desired purchases by moving them toward themselves, participants hypothetically purchased more Red Bull if they flexed the dominant arm ($M = 2.34$) than if they extended it ($M = 1.57$), $F(1, 169) = 4.95, p < .05$. This essentially replicates the result of Study 2, thereby supporting H1 yet again. In contrast, if participants indicated their desired purchases by moving them away from themselves, they chose more Red Bull ($M = 2.48$) when extending their dominant arm than when flexing it ($M = 1.59$), $F(1, 169) = 4.17, p < .05$.

**Spending.** In terms of amount hypothetically spent, participants with their dominant arm extended spent € 1.55 or € 2.45 when moving the Red Bull cans toward or away from themselves, respectively. Participants with arms flexed respectively spent € 2.32 or € 1.57 when moving the Red Bull cans toward or away from themselves. Because only a single product was available at a constant price, statistical results of the spending amount were identical to the purchase quantities reported above.

**Discussion.** In contrast to Studies 1 and 2, Study 3 showed that shoppers with a flexed arm hypothetically purchased more and spent more only when product choice was framed as movement toward the body. When product choices were conceptualized via movement away from the body, arm extension increased purchases. To our knowledge, this is first demonstration that arm extension can increase consumption, in this case hypothetical purchasing. Moreover, the effect was unrelated to mood and task ergonomics, so the effect cannot be attributed to motor priming whereby exerting a specific arm posture facilitated the physical movement of products in one or the other direction. Rather, the absence of an ergonomics effect instead supports our claim that it is the *ideomotor* compatibility between motor enactment and the direction in which product choice is mentally represented.
By default, product choice and consumption appear to be compatible with arm flexion (e.g., Cacioppo et al., 1993): Given that arm flexion enacts movement toward the body, it is compatible with simulating product choice, and hence in our Studies 1 and 2 arm flexion increased hypothetical purchasing and spending. But rather than being hardwired from a lifetime of consumption experiences, Study 3 reveals that the conceptualization of product acquisition and consumption is situated: Given that arm extension enacts movement away from the body, it is compatible with moving chosen products away from the body, and hence in the ‘away’ condition participants hypothetically purchased and spent more with an extended arm. So arm flexion and extension are differentially compatible with situated conceptualizations of product choice thereby producing an arm posture × purchase direction interaction.

This observed interaction is at odds with the evaluative conditioning model and the motivation model, both of which predict the same main effect of arm posture regardless of whether choice is framed as movement in one or the other direction. Thus, this novel effect critically discriminates between models. When the specific task situation reversed the motor action required to indicate product choices, then effects of arm flexion and extension were reversed. Arm flexion does indeed appear to be associated with consumption, but that association is overturned by a simple and transient reconceptualization of the shopping situation.

**General Discussion**

Given relatively limited prior testing of exactly how arm posture affects consumer behavior ( Förster, 2003; 2004; Van den Bergh et al., 2011), a general theoretical explanation of such effects remained open to investigation. Our approach was to provide a broad test of multiple theoretical explanations by substantially increasing the diversity of evidence concerning arm posture effects on consumer behavior. We therefore conducted three studies with three different hypothetical shopping scenarios, while also using both traditional and novel manipulations of arm posture. Study 1 used a grocery shopping scenario in which participants
moved a shopping cart with either flexed or extended arms, and results indicated that arm flexion increased purchases and spending for both vice and virtue products. Study 2 used an online shopping scenario in which participants browsed lists of products and indicated their desired quantities of each, while either flexing, extending, or relaxing the other arm. In fact, this study included a broader set of vice and virtue products than any prior study on arm posture, and it also included a neutral condition in which participants held their arms in a natural position. Arm flexion again increased purchases and spending on both vice and virtue products, relative to the neutral posture, whereas arm extension had no effect on purchases. Finally, Study 3 used a shopping scenario in which participants indicated their purchase quantities by moving the selected products (i.e., cans of Red Bull) into a purchasing area that was located either toward the body or away from the body, while also holding the other hand in either a flexed or extended posture. Whereas arm flexion increased purchases toward the body (as in Studies 1 and 2), arm extension increased purchases away from the body. Thus we demonstrated for the first time that when consumption is conceptualized as movement away from the body, arm extension induces more purchases than arm flexion. Collectively, these results are inconsistent with either an evaluative conditioning model or a motivation model of arm posture effects, and instead support an ideomotor compatibility model.

**THEORETICAL IMPLICATIONS**

An *evaluative conditioning model* (Cacioppo et al., 1993) claims that, given a lifetime of experience moving appetitive stimuli toward the body via flexed arms, the mere act of flexing one’s arms increases appetitive evaluations of target stimuli. For instance, ingestion typically entails moving food or drink toward the mouth, and taking possession of an object similarly entails moving that object toward one’s body. Both of these basic acts of consumption require arm flexion. In contrast, arm extension is typically used to expel or reject aversive stimuli. With repeated experience of such actions, arm flexion and extension respective-
ly become associated with increased and decreased consumption. Eventually this consumption-by-flexion association becomes so deeply ingrained in behavior that arm flexion automatically activates consumption behaviors. So by this account, arm flexion should generally increase consumption, choice, or evaluation of products. At first sight, some prior evidence appears inconsistent with this prediction. Förster found no effect of arm flexion on consumption of an affectively neutral product (i.e., water; Förster, 2003) or on evaluation of undesired products (e.g., beef lung; Förster, 2004). Similarly, Van den Bergh et al. (2011) found that basket shoppers with flexed arms chose more vice products – and fewer virtue products – than cart shoppers with extended arms. A generalized association between flexion and consumption (i.e., the evaluative conditioning account) cannot explain such a selective effect of arm flexion on desired products but not on undesired products. Upon closer scrutiny, however, these results may not constitute strong rejections of evaluative conditioning after all.

Förster’s (2003) null effect was with a single product (mineral water) consumed by a relatively small sample of participants ($n \approx 16$ per group), and Förster’s (2004) null effect of arm flexion was with products that participants specifically did not want to consume. Finally, Van den Bergh et al. used a forced choice methodology, so the increase in vice choices with arm flexion necessarily entailed an equal decrease in virtue choices. As explained after Study 1, this need not imply that arm flexion decreases virtue choices, only that it increased vice choices more than virtue choices. Thus, these prior results may not indicate definitive rejections of the evaluative conditioning account.

In fact, evaluative conditioning could explain the result of our Study 1, which demonstrated that arm flexion increased hypothetical purchases of both vice and virtue products. Critically however, evaluative conditioning cannot explain the results of our Study 2, where arm extension failed to decrease hypothetical purchases relative to a neutral control condition, nor can it explain the results of our Study 3, where arm extension increased hypothetical purchases.
purchases directed away from the body. If flexion and extension respectively increase and decrease evaluations (Cacioppo et al., 1993), then arm extension should decrease consumption (in Study 2) and should never increase consumption (in Study 3). Thus, the novel results of our Studies 2 and 3 provide the strongest rejection to date of the evaluative conditioning model.

The motivation model also posits that through a lifetime of consuming and acquiring things via arm flexion, that posture becomes associated with an approach motivation (Van den Bergh et al., 2011). Because an approach motivation induces reward-seeking behavior (Van den Bergh et al., 2008), arm flexion rather than extension increases preference for immediately gratifying options. So, in the choice between an apple (which has the delayed gratification of long-term health) and a chocolate (which has the immediate gratification of short-term satisfaction), arm flexion motivates choice of the immediately gratifying chocolate. However, our Studies 1 and 2 provided critical evidence against this motivation account. Both studies used a pretested set of vice and virtue products, which should have yielded a product-type × arm posture interaction. Instead, in both studies arm flexion increased consumption of both vice and virtue products approximately equally. Moreover, by the motivation account, the link between arm flexion and approach motivation is an ideomotor reflex that should always lead to the same outcome: Namely, arm flexion should increase choice and consumption. The results of our Study 3 contradicted this prediction by demonstrating that when product acquisition was conceptualized as movement away from the body, then arm flexion actually decreased hypothetical purchasing. As discussed after Study 1, we believe that Van den Bergh et al. (2011) have discovered an interesting aspect of how the shopping apparatus (i.e., basket or cart) affects temptation dilemmas (e.g., the choice between vices and virtues). But evidently, the motivation account does not generalize to a shopping setting where consumers are given the opportunity to choose equally from all options.
The ideomotor compatibility model, by contrast, successfully accounts for the results of all three studies. This model focuses on the motor compatibility between a simulated product acquisition (the “idea”) and the actual body posture (the “motor”). Because consumption behaviors (e.g., ingestion and object acquisition) typically entail motion toward the body, and because arm flexion enacts motion toward the body, consumption is – by default – compatible with arm flexion. This can explain why arm flexion has increased product evaluations, choices, and consumption of desirable and immediately gratifying products (Förster, 2003, 2004; Van den Bergh et al. 2011). In Studies 1 and 2, arm flexion increased hypothetical purchasing of both vice and virtue products, presumably because product acquisition by default was conceptualized toward the body. Moreover, in Study 2, arm flexion increased purchasing whereas arm extension did not differ from a neutral control posture. Arm extension had no effect on purchasing (relative to the neutral control posture) because the mental simulation of product acquisition toward the body was incompatible with the arm posture that typically enacts movement away from the body, and when such ideomotor incompatibility is experienced, people tend to correct their behavior to reduce this processing disfluency (Barsalou et al., 2003; Förster, 2004; Strack, 1992). Consequently, ideomotor compatibility facilitates consumption, but ideomotor incompatibility has no effect on consumption (Förster, 2004).

Study 3 provided the strictest test of the ideomotor compatibility model. A novel prediction of this model is that different conceptualizations of consumption can attenuate or even reverse the effects of arm flexion and extension: If product acquisition is conceptualized away from the body – rather than the default conceptualization of product acquisition toward the body – then consumption behaviors should be increased by arm extension rather than arm flexion. That is, if consumption is conceptualized away from the body, this is compatible with arm extension (which enacts movement away from the body), and hence arm extension should increase consumption. In support of this hypothesis, when we asked participants to
indicate their hypothetical purchases by moving products away from themselves (i.e., “away” condition of Study 3), arm extension elicited more hypothetical purchases than did arm flexion. Importantly, this result was not attributable to task ergonomics, as participants generally found it easier to move the products toward themselves but nonetheless hypothetically purchased more products when moving them away from themselves. This result demonstrates that arm posture effects can be overturned by a simple and transient reconceptualization of the situation, and to the best of our knowledge, this increased consumption from arm extension had never previously been shown. It is however consistent with a larger literature on situated cognition in consumer behavior (Barsalou, 2009; Barsalou et al., 2003; Eelen et al., 2013; Krishna & Schwarz, 2014; Ping et al., 2009). For instance, although arm flexion generally increases choice of vice products (Van den Bergh et al., 2011), for people with dieting goals this effect reverses. Relative to non-dieters, dieters judge vices (e.g., calorie-rich food) significantly faster with motion away from the body, and judge virtues (e.g., working out) faster with motion toward themselves (Fishbach & Shah, 2006). Ideomotor compatibility therefore is contingent upon the mental simulation of problem solving in a particular situation, rather than a hardwired and unmalleable association between bodily activity and mental states.

MANAGERIAL IMPLICATIONS

Our results also have important practical implications for managers. Most fundamentally, consumers may conceptualize consumption behaviors either toward or away from themselves in different situations, and our results suggest that these different conceptualizations may differentially affect consumption. For instance, although shopping carts are nearly always pushed with extended arms, shopping baskets may be carried with either a flexed or an extended arm. In fact, a primary physical constraint on arm posture among basket shoppers is the weight of the basket and its contents. When handling a light basket with few or no
products, one may easily hold the basket with a flexed arm, thereby creating ideomotor compatibility with moving products toward oneself and into the basket. However, as the basket becomes heavier, arm flexion becomes more difficult and arm extension becomes more likely. This gradual reversion to arm extension presumably creates an ideomotor incompatibility with moving products toward the self and into the basket. In other words, ideomotor compatibility predicts that people will tend to choose more products when the basket is light (and held with a flexed arm), and will begin to decrease product choices as the basket becomes heavier (and held with an extended arm). Thus, lighter baskets may encourage greater product choice, and retailers may do well to keep shoppers’ baskets as light as possible for as long as possible into the shopping event. For instance, they may stock lightweight items (e.g., tissues) at the beginning of the shopping layout, and stock heavier items (e.g., bottled water) closer to the check-out area.

A second practical implication concerns the impact of different shopping apparatuses on purchasing of vice and virtue products. Based on Van den Bergh and colleagues’ (2011) results, for instance, the owner of a drug store might conclude that carrying a basket (with flexed arm) inhibits purchasing of virtue products (e.g., soap). In order to increase such virtue purchases, then, the drug store retailer may replace all the baskets with shopping carts, which are far more expensive. However, our results demonstrate that arm posture operates similarly on different product-types (e.g., vices and virtues). What we cannot say by our results is how size, shape and ergonomics of different shopping apparatuses influence shopping behavior.

A related implication concerns impulse purchases. Product choices made at the aisles of a supermarket presumably are conceptualized toward oneself and are typically enacted by moving the chosen products into one’s cart or basket. However, many impulse purchases made at the check-out area instead are enacted by moving the chosen products away from oneself, by either handing the product directly to a cashier or placing it onto a belt that moves
away from oneself and toward the cashier. Our results suggest that such product choices made directly at the check-out area should be facilitated by arm extension, rather than arm flexion. Yet another direct implication concerns retail display designs. For example, refrigerator doors that slide open sideways are intrinsically less congruent with product acquisition and consumption than refrigerator doors that are opened by pulling them toward the body. However, if consumption is conceptualized as motion away from the body, then doors that open outward (i.e., toward the body) would be conceived as incompatible with product acquisition.

**LIMITATIONS AND FUTURE DIRECTIONS**

Our study has several important limitations, which also provide avenues for future research. Regarding our experimental manipulations, it must be noted that moving a shopping cart with flexed arms (as participants in the “flexion” condition of our Study 1 did) is unusual and potentially uncomfortable. Indeed, participants in that Study 1 rated the cart to be less ergonomic when they moved it with flexed arms than with extended arms. However, ergonomics fails to explain the observed results, because (a) the less ergonomic position of flexion actually elicited more hypothetical purchasing in Study 1, and (b) a similar result occurred in Study 3. But perhaps more generally, we hope that future research will document more directly the extent to which basket and cart shoppers actually use arm flexion and extension while shopping. Our approach was to eliminate this uncertainty in Study 1 by having all participants move a shopping cart, while varying only whether they moved it with flexed or extended arms. Similarly, using the computer mouse with the non-dominant hand in Study 2 was also somewhat unusual, and more generally, manipulating arm posture by pressing upward or downward on a desk may also lack ecological validity. Nonetheless, we used these methods because the effects of arm posture tend to be stronger when manipulated via the dominant hand
(Van den Bergh et al., 2011), and because pressing upward or downward on a table is the most widely used method for manipulating arm posture. These methods thus allowed us to examine arm posture effects most clearly and compare them to prior studies most directly. Moreover, across all three studies our participants maintained the induced arm posture very consistently while making hypothetical purchases. Our results could thus overstate the magnitude of such effects in real shopping situations, where arm postures presumably are less consistently maintained across the course of shopping. Future studies should investigate the magnitude of such effects in real shopping settings, which would give the additional opportunity to investigate how differing shopping apparatuses contribute to this effect (e.g., basket vs. cart).
References


### Table 1. Products used in study 2.

<table>
<thead>
<tr>
<th>Vice products</th>
<th>Virtue products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candy</td>
<td>Toothpaste</td>
</tr>
<tr>
<td>M&amp;M</td>
<td>Elmex</td>
</tr>
<tr>
<td>Mars</td>
<td>Odol Med 3</td>
</tr>
<tr>
<td>Snickers</td>
<td>Household</td>
</tr>
<tr>
<td>Bounty</td>
<td>Pril dish soap</td>
</tr>
<tr>
<td>KitKat</td>
<td>Palmolive dish soap</td>
</tr>
<tr>
<td>Corny</td>
<td>Zewa paper towels</td>
</tr>
<tr>
<td>Sugary drinks</td>
<td>Lovely toilet paper</td>
</tr>
<tr>
<td>Cola-Cola</td>
<td>Alu Fix baking paper</td>
</tr>
<tr>
<td>Fanta</td>
<td>Office products</td>
</tr>
<tr>
<td>Sprite</td>
<td>Stabilo text marker</td>
</tr>
<tr>
<td>Red Bull</td>
<td>PC printer paper</td>
</tr>
<tr>
<td>Ice T</td>
<td>Student notepads</td>
</tr>
<tr>
<td>Frozen food</td>
<td></td>
</tr>
<tr>
<td>Dr. Oetker pizza</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>Vöslauer mineral water</td>
</tr>
</tbody>
</table>
Figure 1. Schematic illustration of the shopping environment in Study 1. Vice and virtue products were placed on separate tables, with their location counterbalanced across tables A and B. Participants moved the shopping cart to either table A or table B (order counterbalanced) with arms either extended or flexed (between-participants) and indicated their purchase intentions by filling out an order form that listed prices for each item. Using the same arm posture, they then moved the cart to the other table and completed the order form. Finally they moved the cart back to the initial position, where they completed a follow-up questionnaire.
Figure 2. Spending ($M \pm SE$) on vice and virtue products by participants who moved a shopping cart with arms flexed or extended, Study 1.
**Figure 3.** Spending ($M \pm SE$) on vice and virtue products with the dominant arm in a flexion, extension, or neutral control posture, Study 2.
Figure 4. Spending ($M \pm SE$) by participants who moved selected products toward or away from the body with the non-dominant arm while maintaining the dominant arm in a flexed or extended posture, Study 3.
Appendix E: Evaluation of Papers Contributing to this Dissertation

This dissertation consists of four individual paper projects and follows the standards for cumulative dissertations for the Doctoral Program in Management at the University of Innsbruck, School of Management.

According to these standards, a minimum of three papers corresponding to the quality standards of international journals is required. At least one of these papers needs to be single-authored. A minimum of 3 points is required for submitting the dissertation.

The amount of points attributed to published papers depends on the rank of the publication outlet in the VHB ranking at the time of publication: A and A+ journals are attributed 3 points; B journals are attributed 2 points; and C journals as well as double blind reviewed full conference papers are attributed 1 point. In the case of co-authored papers, the amount of points attributed to the publication is multiplied by

\[ \frac{3}{n+2}, \text{ } n \text{ being the number of authors of the paper.} \]

Table 1 lists the four publications and the points attributable to the author of this dissertation. In addition to the four published papers, five conference presentations have been conducted.
<table>
<thead>
<tr>
<th>Individual Paper Project</th>
<th>VHB-Rank (points)</th>
<th>Evaluation</th>
<th>Points per author</th>
</tr>
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<tr>
<td>Streicher, Mathias C. (2012), &quot;From the Hands to the Mind: Haptic Brand Signatures&quot;, Advances in Consumer Research, Vol. 40.</td>
<td>C (1)</td>
<td>$1*3/(1+2)$</td>
<td>1</td>
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<tr>
<td>Streicher, Mathias C. and Zachary Estes (2015), &quot;Touch and Go: Merely grasping a product facilitates brand perception and choice&quot;, Applied Cognitive Psychology.</td>
<td>B* (2)</td>
<td>$2*3/(2+2)$</td>
<td>1,5</td>
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<tr>
<td>Streicher, Mathias C. and Zachary Estes (accepted revision plan), &quot;Mere Touch Improves Product Evaluation and Increases Brand Choice via Processing Fluency&quot;, Journal of Consumer Psychology.</td>
<td>A (3)</td>
<td>$3*3/(2+2)$</td>
<td>2,25</td>
</tr>
</tbody>
</table>

**SUM OF POINTS** 7

**Additional Conference Presentations:**

Streicher, Mathias and Estes, Zachary (2014), Visuo-haptic Integration Increases Purchase Intentions Via Processing Fluency, EMAC, Valencia, Spain.

Mathias Streicher (2013), Die Relevanz haptischer Kontaktpunkte von Marken, invited presentation at the BVM conference (Kongress des Bundesverbandes Deutscher Marktforscher), Berlin, April 22nd.


* not listed in the VHB ranking. 2015 Impact factor: 1.67 (5-year: 1.98)

Table 1: Individual paper projects contributing to this dissertation
Eidesstattliche Erklärung

Ich erkläre hiermit an Eides statt durch meine eigenhändige Unterschrift, dass ich die vorliegende Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel verwendet habe. Alle Stellen, die wörtlich oder inhaltlich den angegebenen Quellen entnommen wurden, sind als solche kenntlich gemacht.

Die vorliegende Arbeit wurde bisher in gleicher oder ähnlicher Form noch nicht als Magister-/Master-/Diplomarbeit/Dissertation eingereicht.

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