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Research Report

Multisensory interaction in product choice: Grasping a product affects choice of other seen products

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Abstract

Consumers often touch products before reaching purchase decisions, and indeed touch improves evaluations of the given product. The present research investigates how touching a given product influences perception and choice of other seen products. We show that grasping a source product increases the visual fluency of a haptically similar product, thereby increasing the likelihood of choosing that product, but not the willingness to pay for it (Study 1). We also show that visually crowded rather than sparse product displays increase the effect of touch on choosing other haptically similar products, and that individuals' instrumental need for touch further modulates this effect (Study 2). Our results suggest that by manipulating or mimicking the haptic features (e.g., shape and size) of objects that consumers grasp while shopping, marketers can develop packaging that facilitates consumers' visual processing of their products, thereby increasing choice of those products.

Keywords: Multisensory interaction; Visuo-haptic priming; Sensory marketing; Tactile perception; Product choice

Vision and touch are both important experiential sources in product-based consumption, as shown by prior research examining the visual (e.g.Elder & Krishna, 2012, Lee & Labroo, 2004) and haptic (e.g.Grohmann, Spangenberg, & Sprott, 2007, Peck & Childers, 2003a) modalities independently of one another. Touching a product during evaluation decreases frustration (Peck & Childers, 2003a), improves evaluation (Grohmann et al., 2007), and increases actual choice of the touched product (Streicher & Estes, 2015). However, product evaluation and consumption are multisensory experiences (Elder & Krishna, 2010; Krishna, Elder, & Caldara, 2010; Krishna & Morrin, 2008), so the cross-modal interaction between vision and touch may be important for understanding consumer behavior. Thus far, consumer researchers have investigated the relative impacts of haptic and visual cues on judgments of products (Krishna, 2006), and have shown that congruence of visual and haptic properties of a package can improve evaluations (Eelen, Dewitte, & Warlop, 2013; Elder & Krishna, 2012; Littel & Orth, 2013). For instance, haptic exposure to Coca Cola's distinctively shaped bottle facilitates visual perception and choice of Coca Cola (Streicher & Estes, 2015). Here we hypothesize more generally that haptic exposure to an object can facilitate visual processing and choice of *other* seen products of the same shape and size. This hypothesis is important because many products are packaged similarly in terms of shape and size, and because consumers often grasp a product while visually evaluating other products. Take for instance the common shopping situation where a consumer views a product display while grasping some other object (e.g., another product, a cell phone, etc.). We demonstrate that touching a source product increases the visual fluency of a haptically similar product, thereby increasing actual choice of that product (Study 1). We further show that crowded visual displays accentuate this effect, especially among individuals for whom touch is particularly informative (Study 2).

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Touch, visual fluency, and product choice

Neuroscientific and behavioral studies indicate that haptic processing is fundamentally integrated with visual processing (Amedi, Jacobson, Hendler, Malach, & Zohary, 2002). The visual and haptic modalities share overlapping neural pathways for processing object shape (Snow, Strother, & Humphreys, 2014), and in fact perceiving an object through both modalities typically improves the accuracy of shape perception relative to either modality alone (Ernst & Banks, 2002; Helbig & Ernst, 2007). Vision provides a fast "visual preview" of an object's haptic properties, which can then be confirmed or disambiguated by haptic exploration (Lederman & Klatzky, 2009). Moreover, shape perceptions from touch may activate a corresponding neural shape representation in the visual cortex (Masson, Bulthé, de Beeck, & Wallraven, 2015; Snow et al., 2014). Consequently, purely haptic exposure to a familiar object (i.e., manually exploring without viewing) facilitates visual recognition of the given object (Reales & Ballesteros, 1999). For example, after manually exploring a spoon, people are faster to recognize an image of a spoon (Pesquita, Brennan, Enns, & Soto-Faraco, 2013). However, it remains unclear whether such visuo-haptic priming also occurs when the haptic and visual signals arise from clearly distinct sources (Gephstein, Burge, Ernst, & Banks, 2005). The present research provides the first direct test of this hypothesis.

Processing fluency is a metacognitive judgment of the ease with which a given target is perceptually processed or conceptually understood. High processing fluency is experienced positively (Reber, Schwarz, & Winkielman, 2004), and numerous studies document how fluent processing increases product evaluations and choice (e.g.Janiszewski & Meyvis, 2001, Labroo, Dhar, & Schwarz, 2008, Lee & Labroo, 2004). In the present studies, we investigated more specifically *visual fluency*, which is the ease with which a given target is visually perceived. For instance, the visual priming of contours increases liking of objects with a matching shape because the object is perceived more fluently (Winkielman & Cacioppo, 2001). And as reviewed above, haptic shape perception can also facilitate visual processing of that shape (e.g., Pesquita et al., 2013). Critically however, we predicted that haptic exposure to a source product may increase the visual fluency of a target product that is haptically similar but spatially distant (cf. Gephstein et al., 2005). Grasping a Red Bull slim can should facilitate visual processing of other slim cans, because the haptic exposure activates a visual shape representation, which then visually primes recognition of objects with that shape. And given that fluency improves product evaluations, haptic exposure to a source product should also increase choice of a haptically similar target product. Thus,

H_1. Grasping a product increases choice of another product of the same size and shape.

H_2. This effect of haptic exposure on choice of other products is mediated by visual fluency.

We conducted a preliminary study (N = 98; see Supplemental Online Materials) investigating effects of haptic exposure on processing fluency and product evaluation, and the results supported H_1 and H_2, but were not as specific as those reported in Studies 1 and 2 below. Importantly, the studies reported below were designed to control for conceptual and motor fluency. We had participants grasp a product with their right arm extended either straight out to the right (Study 1) or straight behind their back (Study 2) while viewing and then choosing among products directly in front of them. Because all participants held their arms and hands in the same position, there were no motor differences such as reaching for a product (as in Eelen et al., 2013; Elder & Krishna, 2012). And because the choice was always between two versions of the same product in different packages (e.g., a can or a bottle of Fanta), conceptual fluency of the brand itself was also controlled. Thus, the present studies specifically isolated visual fluency as a mediator of the hypothesized effect of touch on choice of other seen products.

Study 1

Study 1 tested H_1 and H_2. All participants extended their right arm directly out to the right, while viewing a Fanta bottle and can (see Fig. 1A) on a computer display straight ahead. Some participants had a bottle or can of Fanta placed into their hand during viewing, whereas others viewed the products without grasping anything. Participants' task was to name the two products onscreen as quickly as possible (e.g., "Fanta bottle and can"). This object naming task provided an objective measure of visual fluency, as fluent stimuli tend to be named faster than disfluent stimuli (Pesquita et al., 2013; Reales & Ballesteros, 1999). Participants then rated the visual fluency of both products, and chose one of them to have as reward for participating (see Table 1). We also included willingness to pay (*WTP*) as a control measure (see Florack, Kleber, Busch, & Stöhr, 2014; Peck, Barger, & Webb, 2013; Peck & Shu, 2009; Shu & Peck, 2011), and indeed it was unaffected by the haptic manipulation (see Supplemental Online Materials).

Methods

Design

The study had a 2 (exposure: visual-only, visuo-haptic; between-participants) × 2 (product: left, right; within-participants) mixed design, with object naming, visual fluency ratings, and WTP estimates as dependent variables. Participants additionally chose between the two products as reward for participating.

Participants

One hundred forty two right-handed students at a European university (M = 24.6 years; 54.3% female) were randomly assigned to conditions. Left-handers were ineligible to participate because the experimental apparatus was designed for right-handers. After the experiment participants were debriefed for hypothesis guessing and thanked with a gift (i.e., bottle or can of Fanta). Two participants who guessed the purpose of the study were excluded from analysis (final N = 140).

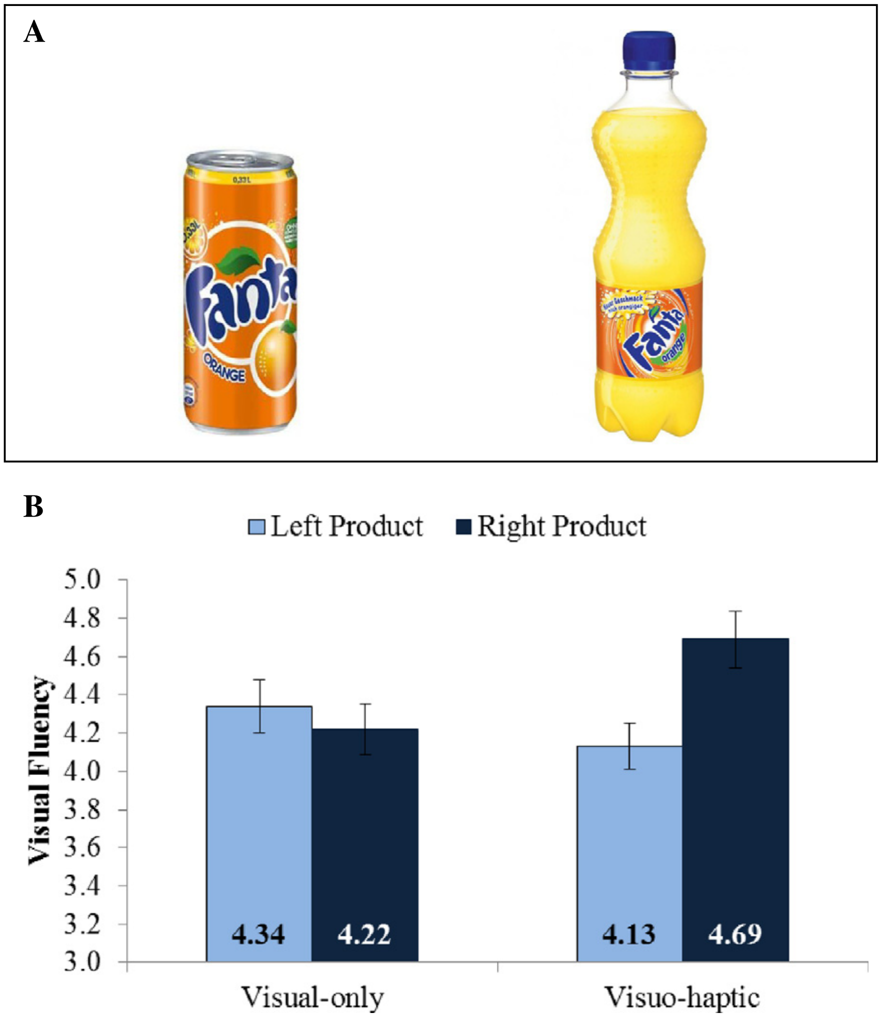

Fig. 1. Panel A: Products used in Study 1. Panel B: Visual fluency ratings ($M \pm SE$) of products shown on the left or right of the display after visual-only or visuo-haptic exposure. Note that left/right position of the products was counterbalanced, only the product on the right was grasped, and only by participants in the visuo-haptic condition.

Stimuli

Haptic stimuli were a 0.33-l aluminum can and a 0.5-l plastic bottle, both of the same brand and containing the same beverage (Fanta) but with different shapes. Visual stimuli were original-size images of those two products (see Fig. 1A).

Table 1
Measures and items used in Study 1 (visual fluency and WTP) and Study 2 (instrumental NFT). See the Supplemental Online Materials for full reporting of the WTP measure in Study 1.

Visual fluency (bottle: α = .74; can: α = .78)
1 = not at all visually attractive, not at all visually eye-catching, difficult to process visually; 7 = very visually attractive, very visually eye-catching, easy to process visually
Willingness to pay (WTP)
If we would take this product from you, how much would you be willing to pay in order to keep it? _______ €
Need for touch (NFT; α = .94)
I place more trust in products that can be touched before purchase; I feel more comfortable purchasing a product after physically examining it; If I can't touch a product in the store, I am reluctant to purchase the product; I feel more confident making a purchase after touching a product; The only way to make sure a product is worth buying is to actually touch it; There are many products that I would only buy if I could handle them before purchase.
1 = strongly disagree; 7 = strongly agree

Procedure

Participants were seated at an L-shaped table, with a computer screen directly in front of them and an empty desktop to their right. All participants extended their right arm directly out to the right, resting it on the desktop with the right hand facing upward and open. Participants were informed that they would see two objects onscreen simultaneously, and they were instructed to name both objects as quickly as possible (cf. Helbig & Ernst, 2007) without constructing a sentence (e.g., "bottle and can"). Participants in the *visual-only* group simply named the two objects as quickly as they could. Participants in the *visuo-haptic* group were additionally informed that an object would be placed into their extended hand when the objects appeared onscreen, and they were instructed to enclose it with a grip. They were instructed to maintain their gaze straight ahead at the display in order to name the two viewed objects as quickly as possible. Because the right arm was extended laterally while the gaze was directed ahead, participants were unable to see the haptic stimulus without turning their head (which would have disqualified them). The bottle and can were simultaneously presented onscreen for 8 s, because people typically spend less than 10 s manually exploring products (cf. Wolf, Arkes, & Muhanna, 2008), and pilot trials confirmed that exposures longer than 8 s caused boredom. We counterbalanced the left/right position of the two containers so that each was seen on the right by 50% of participants. Critically, the haptic stimulus was always the container appearing on the right position of the display. After the 8 s exposure, the images disappeared and the experimenter removed the haptic stimulus out of sight. After this speeded naming task, participants reported their perceived fluency for both visual stimuli (order randomized). We adapted Labroo et al.'s (2008) 3-item measure of processing fluency by adding the word "visual" to each item (see Table 1). As reward for participating, participants then chose which of the two seen products they would like to have.

Results

Visual fluency

As an objective measure of visual fluency, we recorded which of the two containers was named first (cf. Pesquita et al., 2013; Reales & Ballesteros, 1999). Because each container appeared equally often in both positions onscreen, we tested whether the container presented on the right, where touch was manipulated, was named first. The right container was named significantly more often as first object by participants in the visuo-haptic group (54.3%) than by those in the visual-only group (22.9%), Pearson $\chi^2(1) = 4.34$, $p < .05$. This result conceptually replicates prior demonstrations of visuo-haptic priming (Pesquita et al., 2013; Reales & Ballesteros, 1999). Grasping an object facilitates visual perception of other products of the same shape and size.

Participants also rated their perceived fluency of visual processing of the viewed products (see Fig. 1B). A mixed ANOVA on visual fluency ratings with product (left, right) and group (visual-only, visuo-haptic) as factors revealed a significant interaction, $F(1, 138) = 4.57$, $p < .05$. Whereas the left product was equally fluent in the visual-only and visuo-haptic groups, $p > .3$, the right product was significantly more visually fluent in the visuo-haptic group than in the visual-only group, $t(138) = 2.33$, $p < .05$. Thus, like the objective measure reported above, subjective fluency ratings also indicated that grasping one product facilitates the visual processing of a haptically similar product. In fact, the objective fluency measure significantly predicted the subjective fluency ratings, thus providing convergent validity (see Supplemental Online Materials).

Product choice

As predicted, the right product was chosen significantly more often among the visuo-haptic group (60.0%) than among the visual-only group (42.9%), $\chi^2(1) = 4.12$, $p < .05$. Thus, grasping a product increased participants' likelihood of choosing another product of the same size and shape, supporting H_1.

Mediation

Bootstrap mediation analysis (Hayes, 2013; model 4; 10,000 samples) with group (visual-only = 0, visuo-haptic = 1) as the independent variable, visual fluency ratings as mediator, and product choice (0 = left, 1 = right) as the dependent variable indicated full mediation. The indirect effect of haptic exposure on product choice via visual fluency was highly significant (bias-corrected 95% $CI = .0848–2.622$), whereas the direct effect was nonsignificant ($p > .2$). We also replicated this analysis, but using only the single item that most clearly measures visual fluency (e.g., "How easy to process visually was the Fanta bottle?"), and the results were virtually identical. Hence, visual fluency strongly mediated the effect of haptic exposure on product choice, supporting H_2.

Study 2

Psychophysical research suggests that the effects of touch on visual fluency and choice of haptically similar products (as shown in Study 1) should vary across visual conditions. Specifically, optimal integration theory (Ernst & Banks, 2002; Helbig & Ernst, 2007) posits that haptic and visual information contributes to object recognition in a compensatory manner: As visual perception becomes less reliable, haptic perception assumes a greater role in the recognition of object shape. For instance, haptic shape priming is stronger when the target object is visually degraded (e.g., blurred; Ernst & Banks, 2002; Helbig & Ernst, 2007; Pesquita et al., 2013). Thus, haptic-to-visual shape priming might be even greater with crowded product displays, which reduce the visual focus on any given product, and thus may increase the relative weighting of haptic information in product evaluation. To test this prediction, participants in Study 2 viewed either two chocolates (*sparse display*) or 36 chocolates (*crowded display*) while they grasped a chocolate that either haptically matched (*haptic match*) or mismatched the viewed chocolates (*haptic mismatch*).

Another potential moderator of this haptic effect on product choice is the individual's need for touch (*NFT*; Peck & Childers, 2003b), which consists of two main components: *Autotelic NFT* measures hedonic stimulation from touch (i.e., touching for pleasure), whereas *instrumental NFT* measures utilitarian aspects of touch (i.e., touching for information). NFT moderates the effect of product touch on consumers' evaluations of and confidence in the touched product (Grohmann et al., 2007; Peck & Childers, 2003a). In particular, people high in instrumental NFT typically rely on their haptic system to improve product judgments (Peck & Childers, 2003b). Thus, we predicted a 3-way interaction of haptic exposure, visual density, and instrumental NFT.

H_3. The effect of haptic exposure on choice of other products is larger among crowded product arrays than among sparse arrays, and these effects of haptic exposure and visual density

Fig. 2. Panel A: Haptic stimuli used in Study 2. Panel B: Visual product arrangements in the crowded (left) and sparse (right) visual display conditions.

are larger among high NFT individuals than among low NFT individuals.

Methods

Design

The study was a 2 (visual density: crowded, sparse) × 2 (haptic exposure: match, mismatch) × 2 (instrumental NFT: high, low) between-participants experiment, with product choice as dependent variable.

Participants

Two hundred six students (M = 23.8 years; 61% female) were randomly assigned to conditions. After the experiment participants were debriefed for hypothesis guessing and thanked with a gift (chocolate). One participant who guessed the purpose of the study was excluded from analyses (final N = 205).

Stimuli

Haptic stimuli included a rectangular 50-g chocolate bar and a square 60-g version, both of the same brand and containing the same chocolate (Milka hazelnut). We also included as a mismatching haptic stimulus an egg-shaped Kinder Surprise chocolate, which is popular in the country of our study but which differs in shape from both of the chocolate bars (see Fig. 2A). Visual stimuli were product arrangements of the chocolate bar and square, with either one (sparse display) or 18 (crowded display) replicates of each product (see Fig. 2B).

Procedure

Participants stood in front of a table with their eyes closed and with the right arm extended behind them. They were instructed to keep their eyes closed until an object was placed in their hand, at which time they were to open their eyes immediately. They were informed that they would see an arrangement of objects that they should look at and keep an impression of in their mind. An experimenter then placed one of three chocolates (i.e., bar, square, or egg) in the participant's hand and reminded him or her to now view the object arrangement. A second experimenter ensured that all participants kept their eyes shut until they received the signal to open them. Participants never saw the haptic stimulus. Participants in the *sparse display* group saw one chocolate bar and one chocolate square placed next to each other on the table, whereas participants in the *crowded display* condition saw 18 replicates of the chocolate bar and 18 of the chocolate square. The

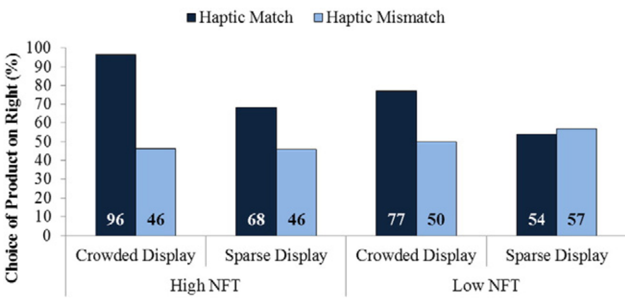

Fig. 3. Product choice from a crowded or sparse display after grasping a haptic match or mismatch, among participants high or low in NFT, in Study 2. Note that only the product on the right was grasped, and only by participants in the haptic match condition. Participants in the haptic mismatch condition instead grasped a different product from either of the seen products.

left/right position of the products was counterbalanced. In the *haptic match* condition, participants grasped either the chocolate bar (25% of participants) or the chocolate square (25% of participants), whichever was presented on the right of the product arrangement. In the *haptic mismatch* condition (remaining 50%), participants instead grasped the chocolate egg, which did not match either of the shown chocolates. After 8 s of viewing the product arrangement, an experimenter removed the haptic stimulus and product arrangement. As reward for participating, participants then chose one of the previously seen products. Then they answered the German version of the instrumental NFT scale (Nuszbaum, Voss, Klauer, & Betsch, 2010; see Table 1).

Results

We conducted a logistic regression with haptic exposure (mismatch = 0, match = 1), visual density (sparse = 0, crowded = 1), instrumental NFT (median-split; low = 0, high = 1) and their three-way interaction as predictors, and with product choice (left = 0, right = 1) as the dependent variable. The main effect of haptic match was significant, $B = .66$, $se = .33$, $Wald = 4.15$, $p < .05$. As illustrated in Fig. 3, participants were more likely to choose the product on the right of the display while grasping (with their right hand) something of the same shape than while grasping something of a different shape. The other main effects were nonsignificant (both $p > .66$). Most critically, the 3-way interaction was significant, $B = 2.63$, $se = 1.09$, $Wald = 5.73$, $p < .05$. To investigate the interaction further, we conducted separate regressions at the two levels of instrumental NFT (i.e., low vs. high).

Among high NFT participants, as predicted, the interaction between visual density and haptic exposure was significant, $B = 2.53$, $se = 1.24$, $Wald = 4.14$, $p < .05$. More specifically, the effect of haptic exposure was stronger with crowded displays [$B = 3.45$, $se = 1.01$, $Wald = 9.99$, $p < .01$] than with sparse displays [$B = 1.22$, $se = .65$, $Wald = 3.52$, $p = .06$]. Among low NFT participants, the same pattern of results was observed, but it was significantly attenuated (as indicated by the 3-way interaction). Indeed, neither main effect (both $p > .63$) nor the interaction was significant ($p = .11$). In sum, grasping one product increased choice of another haptically similar product, and this haptic effect was accentuated with crowded visual displays. However, this moderation of the haptic effect by visual density was significantly attenuated among participants low in instrumental NFT. These results support H_3.

Discussion

Theoretical contributions and managerial implications

The present research provides several theoretical contributions. To begin with, this research demonstrates that grasping one product can affect the visual processing of another product. Neuroscientists speculated that visuo-haptic priming may occur even when the haptic and visual information arises from different sources (Gephstein et al., 2005; Helbig & Ernst, 2007), but the present research provides the first evidence of this, using both objective and subjective measures of visual fluency. Because haptic shape perceptions can prime a visual shape representation (Masson et al., 2015; Snow et al., 2014), grasping the source product facilitated visual processing of the target product. Similarly, this research is also the first to demonstrate that grasping one product affects choice of another product. Prior studies had shown that grasping a product can affect consumer behaviors toward that grasped product (e.g.Grohmann et al., 2007, Peck & Childers, 2003a, Streicher & Estes, 2015), but none had tested the more generalized visuo-haptic effect that we demonstrate here. Moreover, our experiments controlled both conceptual fluency (because the product choices were always of the same brand) and motor fluency (because the haptic matches and mismatches entailed the same body posture and motor action) while targeting a specific perceptual modality (i.e., vision), thus isolating the processing mechanism to visual fluency.

Another novel contribution is to demonstrate the compensatory relationship between vision and touch in product evaluation. When visual information is somehow degraded (e.g., by decreasing clarity), then haptic information assumes a greater role in object recognition (Ernst & Banks, 2002; Helbig & Ernst, 2007; Pesquita et al., 2013). Consequently, we showed for the first time that the effect of touch on product choice is accentuated by crowded product displays, which may overload the visual system and hence increase reliance on haptic information. Finally, the present studies also extended the moderation of consumer touch effects by NFT (Grohmann et al., 2007; Peck & Childers, 2003a). People high in instrumental NFT typically use touch to inform their product evaluations (Peck & Childers, 2003b), and thus they are more prone to use their haptic system to compensate the lack of reliable visual information in crowded product displays.

The present results also have clear managerial implications. Most basically, these results suggest that retailers can influence consumer choices by manipulating the haptic features of product packages. For instance, our results suggest that late entrants into a consumer market could benefit from adopting product packages that are haptically similar to the market leaders' packages. Theoretically, grasping a slim can of Red Bull while continuing to peruse the shelf would facilitate perception of other brands that also use the slim can. And conversely, our results emphasize why market leaders should therefore trademark unique product packages to avoid perceptual spill-over effects for late entrants and copycats. The moderating effect of visual density of product displays may also be relevant, as managers who seek to utilize the effect of haptic exposure on product choice could increase the visual density of product displays.

Limitations and future directions

A limitation of Study 1 is that the visual-only group did not grasp any object. Although the visuo-haptic and the visual-only groups were otherwise identical (i.e., reached out to the right), haptic stimulation of the right hand alone might have increased visual attention for the right product, thereby increasing visual fluency and choice of the right product. However, Study 2 eliminated this potential confound by having all participants grasp a product that haptically either matched or mismatched the viewed products, and again the haptic match condition increased choice of the product on the right. If the effect were simply due to haptic stimulation of the right hand, then the match and mismatch conditions should not differ, because both entailed haptic stimulation.

A remaining theoretical question is whether this effect of visuo-haptic interaction on product choice occurs unconsciously. Because the haptic and visual stimuli in our studies were from clearly different sources, our participants knew that the felt and seen objects were not the same. Yet, the felt object still influenced perception and choice of the seen object. This suggests that the effect may occur more-or-less automatically (see also Streicher & Estes, 2015), but future research may examine the extent to which this effect can be controlled. Additionally, it is currently unknown whether the source and target objects must be identically shaped (as in our studies), or whether merely similar shapes can also elicit the sort of haptic-visual priming that we showed.

Many practical implications also remain to be tested. Market researchers could attempt to influence consumer choices either by manipulating the haptic features of product packages, or by manipulating consumers' grasp. For instance, marketers could attempt to haptically mimic the objects that consumers often grasp or carry while shopping (e.g., cell phone, handbag, wallet, keys, cigarette pack), to examine whether those common haptic stimuli increase choice of the mimicking products. Alternatively, retailers could attempt to induce consumers to grasp shopping apparatuses with particular haptic features (see Streicher & Estes, 2016). For instance, consumers regularly carry a shopping apparatus (e.g., a basket or cart) or grasp a display apparatus (e.g., a refrigerator door handle). Do the haptic features of the shopping or display apparatus influence consumers' choice of products? We hope that our studies will motivate further research into haptic aspects of consumer behavior, and the multisensory nature of consumption more generally.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jcps.2016.01.001.

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