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ORIGINAL EMPIRICAL RESEARCH

Felt something, hence it works: Merely adding a sensory signal to a product improves objective measures of product efficacy and product evaluations

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Abstract

Product efficacy is an important driver of product evaluation and product usage. This research examines how marketers can improve perceived and actual product efficacy. Given the managerial ease of adjusting product design, we demonstrate that adding a sensory signal (e.g., tingling, cooling, fizzing) to a product that promises positive outcomes would improve product evaluations and actual product efficacy. In five studies (and two additional studies reported in the Web Appendix), we show that sensory signaling (vs. nonsignaling) products elicit actual product choice and improve product evaluations, repurchase likelihood, recommendation likelihood, as well as objective measures of product efficacy (such as consumer performance). This occurs because the sensory signals make consumers feel a greater transfer of benefits to the body during product usage. We further demonstrate that the effect holds even when persuasion knowledge is activated. Together, this research provides important insights on product designs that benefit not only marketers but also consumers.

Keywords Product efficacy · Sensory marketing · Objective performance · Energization · Inference

Introduction

Product efficacy is an important driver of product evaluation and product usage. For example, many long-term consumer health and fitness problems could be attributed to non-adherence with pharmaceutical products due to consumers' poor product efficacy perceptions (Ilyuk et al., 2014a). The present research focuses on how marketers can improve perceived and actual product efficacy. One way that marketers can improve perceived product efficacy is by influencing consumer expectancies, which is done by manipulating the verbal or brand claims delivered via product labels or advertising messages (Cornil et al., 2017; Irmak et al., 2005; Plassmann & Weber, 2015). However, these verbal claims require cognitive resources to understand the language and to remember, and may also activate psychological defense mechanisms that attenuate the positive expectancies (Friestad & Wright, 1994). One way to improve actual product efficacy is by increasing the dosing of the active ingredient, such as testosterone, sugar, or caffeine, in their products (Benedetti, 2009). Although increasing the dosing of the active ingredient effectively improves consumer performance in the short term, this intervention can be dangerous in the long term due to side effects from overdosing (Cornil et al., 2017).

We propose a novel way to increase perceived and actual product efficacy. We suggest that adding a sensory signal (e.g., tingling, cooling, or fizzing) to a product that

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promises positive outcomes ("sensory signaling products") can actually make the product more efficacious. For example, a tingling gel that promises to boost muscle function would be more efficacious compared to a gel without the sensation, controlling for the same verbal claims and active ingredients. This is because the tingling sensation signals to the consumers that product benefits are being transmitted to the body, resulting in more positive product evaluations and better consumer performance (e.g., lift the weight longer or perform more handgrip contractions). Moreover, we suggest that sensory signaling product designs are less vulnerable to defense mechanisms activated by persuasion knowledge.

From a practical perspective, the findings of this research suggest that products become more effective when consumers receive sensory signals during product usage. Therefore, marketers can strategically add a sensation to their products to increase the actualization of product efficacy, product evaluations and the likelihood to repurchase and recommend the products. Moreover, the findings suggest that sensory signaling products bring positive outcomes to consumers, such as improvements in exercise volume and duration.

Theoretically, our findings contribute to the literature in three ways. First, we expand research in the product efficacy literature. Research in this stream focus on the stock part of the stock-and-flow mental model of inference-making (Groesser & Schaffernicht, 2012; Johnson-Laird, 2012): how consumers perceive the amount of stock inside a product, such as the perceived potency of what is residing inside a pharmacological pill (Benedetti, 2009), perceived adequacy of the product amount (Ilyuk & Block, 2016), and perceived strength of a cough syrup advertised as awful tasting (Kramer et al., 2012). We contribute a new perspective by examining the "flow" part that occurs between one stock (product) to another stock (consumer's body) in product efficacy judgments, while controlling for the amount of stock across conditions. Because flow goes in two possible directions (inflow and outflow), a conceptual approach that alters consumers' perceptual abilities in detecting (otherwise invisible) outflow of product benefits would help consumers re-purchase critically important products such as vaccine boosters.

Second, we contribute to the sensory marketing literature (Krishna & Schwarz, 2014), which mainly examines how external sensory cues influence product perception. Research in this domain shows that ambient music (Biswas et al. Szocs 2019), display space (Zhang et al., 2021), and ambient temperature (Park & Hadi, 2020) influence consumers' product choices and evaluations. We extend this work by identifying sensory cues of the product itself as a factor that can increase favorable product responses. In addition, Krishna (2011) suggested that the field of sensory marketing has had a reputation for being "touchy feely." We contribute a unique dimension by showing that sensory cues of the product lead to important outcomes beyond subjective evaluations of the product. We demonstrate how sensory cues in the products increase actual product efficacy, as measured by objective consumer performance, and this effect is underpinned by objective changes in bodily energization, evidenced by systolic blood pressure.

Third, we broadly add to the marketing placebo literature by identifying sensory (bodily) signals as a factor that can increase placebo responses. This finding extends prior research that focused on manipulating verbally and symbolically-mediated variables, such as price (Shiv et al., 2005), branding (Garvey et al., 2016), product label wording (Cornil et al., 2017; Irmak et al., 2005), and source expertise (Plassmann & Weber, 2015). Relatedly, there is also emerging research on self-efficacy showing the positive effects of verbal cues on self-efficacy (Achar et al., 2020; Banker et al., 2020; Park & John, 2014). We contribute to these findings by documenting the impact of adding a nonverbal, sensory (bodily) cue that influences self-efficacy.

In the next section, we first review the literature on the role of cognition in increasing perceived and actual product efficacy, and then develop our hypothesis regarding the role of sensory (bodily) signals in enhancing and sustaining perceived and actual product efficacy.

Conceptual development

The role of cognition in increasing product efficacy

Cognitive concepts and symbols (such as pricing or branding) can change consumers' expectancies about a product, which are then able to alter purchase intentions (Benedetti, 2014; Plassmann & Weber, 2015; Shiv et al., 2005). For example, in the context of energy drinks, Shiv et al. (2005) showed that the cognitive concept of "low price" (vs. "high price") activated by the discounted price of "$0.89" (vs. the price of "$1.89") caused participants to believe that the energy drink they consumed was less efficacious. Similarly, Garvey et al. (2016) showed that the cognitive concept of "high performance" activated by the "Swoosh" logographic symbol and the word "Nike" caused participants to putt a ball more accurately, increasing preference for the ostensibly performance-branded product. Likewise, verbal claims such as "Vodka-Red Bull cocktail" made consumers believe that the product is intoxicating, and thus increased consumer preference and risk-taking

(Cornil et al., 2017). Thus, these examples suggest that verbal claims and brand symbols are able to positively influence consumer preference. Going beyond verbal claims and brand symbols, the present research focuses on the role of product design and examines how the sensory aspects of product design can influence consumer inferences during product usage, and improve marketing and consumer outcomes.

The role of sensory (bodily) signals in increasing and sustaining product efficacy

We posit that, compared to a product without a sensory signal (e.g., a testosterone booster gel or a pain reliever cream that does not elicit sustained sensations; "nonsignaling products"), a product that emits a sensory signal (e.g., a testosterone booster gel or a pain reliever cream that tingles or fizzes; "sensory signaling products") would induce consumers to believe that product benefits are being transferred to their body (henceforth, "perceived transfer of benefits"). This idea is supported by research suggesting that the information received from the tactile sensory channel is particularly diagnostic and self-specifying (Bermúdez, 1998). Unlike sensations received via other sensory channels (e.g., hearing the sound of a bell attached to a product) that our perceptual system can clearly separate from our body (i.e., the auditory bell ring is not "self-specifying," Bermúdez, 1998), a product-induced tactile sensation (e.g., tingling, fizzing, cooling) feels diagnostic to whether the body is experiencing changes. As consumers readily look for evidence to confirm their prior beliefs—the verbally communicated effectiveness of the product ("confirmation bias," Nickerson, 1998), they would interpret the sensory signals as evidence that the product is transmitting these expected benefits to their body.

Furthermore, once consumers believe that the product is transferring benefits to the body, their perceptual system would seek out a biased subset of sensations that confirm the expected effects. The literature on self-schema processing (Stewart-Williams, 2004) has suggested that promised benefits can be actualized by a schematic processing approach through selective attunement to different bodily perceptual stimuli (perceptual attunement). For example, people who falsely believe that they had consumed caffeine would notice and interpret random information (such as heartbeat pace or feelings of alertness) as a sign of an increase in vitality and invigoration (Benedetti, 2009). In the same vein, the product-induced sensation would lead consumers to notice other small positive sensations on their body that they would otherwise have overlooked (e.g., alertness) that further reinforce their belief of a product benefit transfer.

Sensory signaling products improve product evaluations and product choice

We argue that such an increase in the perceived transfer of benefits induced by sensory signaling products should increase product evaluations. This is because consumers perceive changes in sensory signals (rather than steady states) to be more diagnostic (Berelson & Steiner, 1964). Additionally, sensory signaling products satisfy three conditions in psychophysics (Alloy & Tabachnik, 1984; Einhorn & Hogarth, 1986) that improve product cause-and-effect judgments. First, sensory signals arriving *after* a product application trigger the perception of a correct cause-and-effect sequence (the effect comes after the cause). Second, sensory signals reduce the temporal delay between the cause and effect (sensory signaling products induce a palpable effect immediately, compared to nonsignaling products that induce an effect many hours or days after product use, if at all, Benedetti, 2009; Panksepp, 1998). Third, sensory signals increase the perceptibility of the effect (compared to nonsignaling products whose effect is often imperceptible; "Is it working?" Garber & Seligman, 1980; Ilyuk et al., 2014b). Therefore, manipulations that enhance cause-and-effect judgments should make consumers believe that the product is working, thereby leading to favorable product responses. Thus, we propose that sensory signaling products should positively influence marketing-relevant variables: specifically, product choice, product attitudes, willingness to pay, purchase intention, repurchase likelihood, and recommendation likelihood. Hence, we propose the following hypothesis:

H1a Sensory signaling products will improve product evaluations and product choice compared to nonsignaling products.

H1b Perceived transfer of benefits will mediate the relationship between the type of product (signaling vs. nonsignaling) and product evaluations and product choice.

Sensory signaling products improve objective measures of product efficacy

We argue that a product design that increases perceptions of transfer of benefits should not only benefit the marketer, but also improve consumers' outcomes by improving actual product efficacy. An increase in the perceived transfer of product benefits should increase bodily energization and subsequently improve actual product efficacy (i.e., improvement in performance). The literature on bodily interior perception ("interoception"; Craig, 2002, 2003, 2014) suggests that human systems probabilistically predict a positive (or negative) bodily outcome in the immediate future as induced by bodily sensations (Pezzulo, 2014). In other words, a change in sensory (bodily) signal indicates whether one is getting better or worse, and therefore induces the activation versus inhibition of the pursuit of rewards via energy release or conservation. For example, when consumers consume food, limb temperature increases as food is digested and gradually transformed into latent energy. This rise in body temperature signals to consumers that the body has received new resources to pursue rewards (such as mating opportunities). With more latent resources to pursue rewards, the body knows it can release maximum levels of energy output (i.e., bodily energization) in order to increase the probability of obtaining the reward. Thus, we propose that using sensory signaling (vs. nonsignaling) products should increase consumers' perception that the product has transferred greater benefits to the body. As a result, this enhanced transfer of benefits should cause the consumer's body to be more energized, which then improves actual performance (e.g., enabling a longer exercise duration, or a higher number of movement repetitions and sets). Taken together, we propose the following hypotheses:

H2a Sensory signaling products will improve product efficacy (as measured by objective performance) compared to nonsignaling products.

H2b Perceived transfer of benefits and subsequent bodily energization will serially mediate the relationship between the type of product (signaling vs. nonsignaling) and product efficacy.

Sensory signaling products are more resistant to persuasion knowledge

Research shows that consumers are able to correct for the influence of verbal slogans, but are less able to correct for the influence of less verbal (or nonverbal) brand symbols (Laran et al., 2011). For example, Shiv et al. (2005) found that consumers solved more word puzzles when they consumed a full-priced product than when they consumed a discounted product. However, when consumers were induced to be skeptical about the price manipulation, they solved a similar number of word puzzles. This suggests that purely verbal symbols (such as price manipulation) are generally vulnerable to persuasion knowledge because consumers could counter-argue against verbal claims (Friestad & Wright, 1994). The present research suggests a product design intervention that is relatively resistant to persuasion knowledge.

We propose that sensory signaling product designs (sensory cues paired with a verbal claim) should be more effective in preventing counterarguments from consumers compared to nonsignaling product designs (absence of sensory cues paired with a verbal claim). When sensations arrive during a consumer experience, these sensations and their processing displace rigorous analysis because sensations become an "experiential proxy" for evaluation (Berelson & Steiner, 1964; Schwarz, 2015). The sensations that consumers experience during product usage, including both the product sensation (e.g., tingling) and the subsequent additional bodily sensations that emerge (e.g., feelings of alertness), will provide a sensory rebuttal of the skeptical beliefs (e.g., "My mind was initially skeptical, but my body tells me that the product is working after all"). In contrast, a nonsignaling product would be more likely to fail to influence product efficacy, because the non-sensation provides little evidence to counterargue against skeptical beliefs about product claims. Hence, we propose the following hypothesis:

H3 Sensory signaling products will improve product efficacy (as measured by objective performance) compared to nonsignaling products even if persuasion knowledge is activated.

Thus, the conceptual framework can be summarized in Fig. 1.

Overview of the studies

Seven studies (including two experiments reported in the Web Appendix) tested our hypotheses. The first set of studies (Studies 1–2 and Web Appendix S1) tested whether sensory signaling (vs. nonsignaling) products increase product evaluations and real choice (H1a). The studies also provided evidence that perceptions of transfer of product benefits drive the enhanced product evaluations and ruled out alternative explanations (H1b). The second set of studies (Studies 3–5 and Web Appendix S2) tested whether sensory signaling (vs. nonsignaling) products improve actual product efficacy as measured by objective consumer performance (H2a). The studies also examined physiological evidence that underpins the relationship between type of product and objective performance (Studies 4–5). Finally, Study 5 provided evidence for a serial mediation (H2b) and investigated whether sensory signaling (vs. nonsignaling) products are more resistant to persuasion knowledge (H3). All data are available in ResearchBox (https://researchbox.org/856&PEER_REVIEW_passcode=JAPLPO).

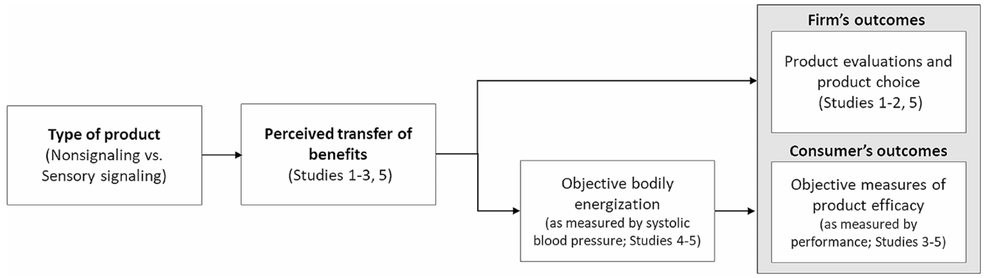

Fig. 1 Conceptual framework. *Note.* Figure 1 shows conceptual framework in which adding a sensory signal to a product improves downstream consequences on marketing-related variables such as product evaluation, product choice, and likelihood of repurchase and recommending product (Studies 1–2, Study 5; firm's outcomes) and improves objective measures of product efficacy (Studies 3–5; consumer's outcomes)

Study 1: Sensory signaling products are perceived to be more effective

Study 1 sought to demonstrate our proposed effect among consumers in the real world. We asked consumers to share an actual product usage experience regarding either a sensory signaling product or a nonsignaling product, and to provide product evaluations. To measure product evaluations, we created an overall product evaluation index by averaging attitudes toward the product, efficacy judgment, repurchase likelihood, and recommendation likelihood. We predicted that consumers would report higher product evaluations for sensory signaling (vs. nonsignaling) products (H1a), and that this would be mediated by a perceived transfer of benefits (H1b). To provide further support for our mechanism, we measured and ruled out one potential alternative explanation: that participants using sensory signaling (vs. nonsignaling) products were more curious about how the product would work, and that this might improve product evaluations.

Method

Procedure As preregistered[1], we recruited 300 participants (56% females; M_{age} = 39.59 years, $SD = 14.52$; four participants did not report gender) from Prolific for a nominal compensation. The study had a one factor (product type: nonsignaling vs. sensory signaling), between-subjects design. Following the consent form and random assignment of two product conditions, participants were asked to write down their actual product usage experience. In the nonsignaling product condition, participants were asked to recall their recent product usage experience in which they did not experience much sensory stimulation (e.g., no tingling, no burning, no fizziness, no cooling) while using the product. In the sensory signaling product condition, participants were asked to recall their recent experience in which they experienced a strong sensory stimulation (e.g., tingling, burning, fizziness, cooling) while using the product. See Web Appendix 1 for examples of products and sensory signals generated by the participants.
After the writing task, we asked participants to report their product evaluation using the following three items ("How useful is this product?" "How favorable is this product?" "How good is this product?" 1 = not very useful /very unfavorable/very bad, 7 = very useful/very favorable/very good; α = .96; Maheswaran, 1994). In addition, we asked participants to evaluate the effectiveness of the product ("How effective is this product" 1 = not at all, 7 = very much), likelihood to repurchase the product ("How likely is it that you would buy this product again?" 1 = very unlikely, 7 = very likely), and likelihood to recommend the product to others ("How likely is it that you would recommend this product to others?" 1 = very unlikely, 7 = very likely).

Following the dependent measure, participants responded to a scale measuring perceived transfer of benefits: "While you were using the product, what percentage of the benefits (e.g., pain reduction, body energization) has the product transferred to you?" (0% = I feel that no benefits were transferred from the product to me; 50% = I feel that some, but not all, of the benefits, have been transferred from the product to me; 100% = I feel that all the benefits have been transferred from the product to me). After that, participants rated their level of curiosity ("How curious were you about how the product works when using the product?" 1 = not curious at all, 7 = very curious). Finally, participants answered demographic questions, were debriefed, and were thanked for their participation.

Results

Product evaluations We created a product evaluation index (α = .97). Supporting H1a, an ANOVA on the product evaluation index was significant, with higher product evaluations for sensory signaling products ($M = 5.84$, $SD = 1.29$) compared to nonsignaling products ($M = 5.29$, $SD = 1.88$;

[1] https://aspredicted.org/J2T_M1X.

$F(1, 298) = 8.89$, $p = .003$, $\eta_p^2 = .029$). Our results were also significant on each of the individual measures of product evaluations (see Table 1 for means).

Perceived transfer of benefits As anticipated, an ANOVA revealed a significant effect, with higher levels of perceived transfer of benefits for sensory signaling products ($M = 74.86$, $SD = 25.76$) compared to nonsignaling products ($M = 61.30$, $SD = 35.03$; $F(1, 298) = 14.53$, $p < .001$, $\eta_p^2 = .046$).

Mediation analysis Supporting H1b, the indirect effect of product type (sensory signaling, coded 1; nonsignaling, coded 0) on product evaluation index via perceived transfer of benefits was significant (95% CI [.28, .91]). See Web Appendix 2 for regression coefficients.

Ruling out alternative explanation of curiosity An ANOVA revealed a significant effect, with higher levels of curiosity for sensory signaling products ($M = 4.91$, $SD = 1.68$) and nonsignaling products ($M = 4.43$, $SD = 1.92$; $F(1, 298) = 5.25$, $p = .023$, $\eta_p^2 = .017$). However, curiosity did not mediate the effect of product type on product evaluations (95% CI: [-.09, .04]).

In the next study, we continued to test the effect on marketing outcomes including actual product choice, and controlled the sensory signal.

Study 2: Sensory signaling products increase actual product choice

Study 2 had three objectives. First, it examined the effect of product type on actual product choice using an incentive-compatible design. We predicted that participants using a sensory signaling product (vs. nonsignaling product) would perceive a greater transfer of product benefits, and hence should be more likely to purchase the product. In addition to product choice as our marketing outcome, we also measured the likelihood that participants would recommend the product to other people. We predicted that participants who used a sensory signaling product would provide better product review ratings (i.e., higher star ratings) compared to those who used a nonsignaling product, and that this would be mediated by perceived transfer of benefits. Another objective of this study was to continue ruling out the alternative explanation of curiosity and to explore the effect on self-efficacy after product usage. If consumers perceive that sensory signaling (vs. nonsignaling) products work better because they can perceive the transfer of benefits from the product to their body, then they should believe that they have an increased ability to perform the task.

Method

Stimuli To increase external validity, we carefully selected two novel products (i.e., herbal balm) from the market. These products were taken from the same brand, where one elicited a tingling sensation, and the other did not. The two products had the same smell, texture, and ingredients. To control for the perceptual features of the stimuli, we put the stimuli in a clear container. Also, to control for any preexisting associations with brands, we completely concealed the brand name. A pretest confirmed that the two stimuli differed on tingling sensation, but not on other attributes (see Web Appendix 3). Also, none of the participants were able to identify the brand.

Procedure As preregistered[2], 125 participants (52% females; $M_{age} = 26.26$ years, $SD = 9.15$; nine participants did not provide age) including students and staff on a university campus were invited to participate in a "new product testing" (i.e., herbal balm) study. The study was run one person at a time. These consumers were offered an opportunity to purchase the product at a realistic and attractive price. In measuring purchase behavior, we adopted the procedure from the literature (Lee et al., 2017) by endowing a nominal amount of money to participants that they can use to either purchase or not purchase a real product. The study had a one factor (product type: nonsignaling vs. sensory signaling), between-subjects design.

Following the consent form and random assignment, participants were led to believe that the study was about new product testing and hence they could buy the product. Each participant received 55 cents to spend on a product purchase (or not spend it at all). Next, participants were presented with the ad (see Web Appendix 3) and then applied a small amount of either a sensory signaling product or a nonsignaling product on their dominant arm, and waited for three minutes. After waiting for three minutes (for the sensation to kick in), we asked participants to squeeze the handgrip device for twenty repetitions. We controlled for the number of repetitions in order to reduce the influence of confounding factors such as fatigue or negative mood, which may unintentionally influence their decision to purchase the product. Following the squeezing task, participants completed several measures.

For the dependent measure, we asked participants how interested they would be to purchase a small jar of the product for 55 cents. We also told participants that if they chose to purchase the product, they would be paying real money and would be receiving the real product upon the completion

[2] https://aspredicted.org/H5V_PQ6.

Table 1 Summary of results

Study	Stimuli	Measured MED and DV	Main finding			
Study 1	Multiple products		Nonsignaling product ($n = 152$)	Sensory signaling product ($n = 148$)		
		Perceived transfer of benefits (100-pt)	61.30 (35.03)	74.86 (25.76)		
		Product evaluation index (7-pt)	5.29 (1.88)	5.84 (1.29)		
		Attitude towards the product (7-pt)	5.41 (1.79)	5.89 (1.22)		
		Efficacy judgment (7-pt)	5.24 (1.89)	5.93 (1.24)		
		Repurchase likelihood (7-pt)	5.26 (2.20)	5.82 (1.75)		
		Recommendation likelihood (7-pt)	4.98 (2.17)	5.63 (1.62)		
Study 2	Balm		Nonsignaling product ($n = 63$)	Sensory signaling product ($n = 62$)		
		Perceived transfer of benefits (100-pt)	56.79 (24.03)	67.15 (22.71)		
		Product preference (choice)	33.30%	58.10%		
		Product rating (5-pt)	4.24 (0.86)	4.60 (0.64)		
Web Appendix S1	Headwrap		Nonsignaling product ($n = 29$)	Sensory signaling product ($n = 28$)		
		Perceived transfer of benefits (100-pt)	26.72 (24.73)	51.04 (23.87)		
		Willingness to pay ($)	$13.03 (9.41)	$20.71 (9.90)		
		Attitude towards the product (7-pt)	3.57 (1.50)	4.56 (1.11)		
Study 3	Gel		Nonsignaling product ($n = 29$)	Sensory signaling product with related signal ($n = 27$)	Sensory signaling product with unrelated signal ($n = 28$)	
		Perceived transfer of benefits (7-pt)	4.09 (1.54)	5.10 (0.98)	4.43 (1.14)	
		Objective performance (post-pre)	-3.49 (12.95)	+7.00 (11.62)	-4.04 (12.11)	
Web Appendix S2	Spray		Nonsignaling product ($n = 36$)	Sensory signaling product with sensation present ($n = 36$)	Sensory signaling product with sensation absent ($n = 33$)	
		Perceived transfer of benefits (7-pt)	3.82 (1.76)	4.97 (1.44)	4.03 (1.63)	
		Objective performance (post-pre)	+3.50 (13.15)	+10.64 (14.63)	+4.10 (9.24)	
Study 4	Balm		Nonsignaling product with claims ($n = 31$)	Sensory signaling product with claims ($n = 34$)	Sensory signaling product without claims ($n = 31$)	
		Objective bodily energization (post-pre)	+0.18 (4.84)	+3.90 (7.43)	+3.73 (6.78)	
		Objective performance (post-pre)	+10.45 (35.01)	+31.24 (24.80)	+33.32 (20.79)	
Study 5	Balm		*Absence of suspicion prime*		*Presence of suspicion prime*	
			Nonsignaling product ($n = 32$)	Sensory signaling product ($n = 31$)	Nonsignaling product ($n = 28$)	Sensory signaling product ($n = 34$)
		Perceived transfer of benefits (100-pt)	42.34 (22.29)	66.58 (19.46)	40.32 (27.19)	66.74 (22.80)
		Objective bodily energization (post-pre)	−0.63 (7.08)	+2.87 (4.54)	−0.80 (5.59)	+2.96 (8.63)
		Objective performance (post-pre)	+11.00 (17.68)	+20.81 (21.19)	+2.68 (15.78)	+24.91 (19.02)
		Purchase intention (7-pt)	4.16 (2.03)	5.45 (0.93)	4.11 (1.73)	5.47 (1.19)
		Attitude towards the product (7-pt)	4.52 (1.86)	5.75 (1.01)	4.38 (1.71)	5.71 (1.02)

Notes. Means are reported in the table and standard deviations are reported in the parentheses of the study. Participants indicated their purchase decision using a binary scale. This measure was our behavioral outcome. Participants who chose to buy the product, indeed bought the product (and those who chose not to buy the product, did not buy the product). In addition, we asked participants to provide a product rating on a 5-point scale (1 = terrible, 5 = excellent). Next, participants completed measures of perceived transfer of benefits, self-efficacy after product usage ("How good were you at squeezing the handgrip?" 1 = very bad, 7 = very good), curiosity, and demographics. Finally, before being debriefed and thanked, participants who indicated purchasing the product gave the money to a research assistant and physically received the product as promised.

Results and discussion

Product choice As preregistered, we performed a binary logistic regression with type of product (sensory signaling product coded 1; nonsignaling product coded 0) as a predictor and product choice (1 = purchased, 0 = did not purchase) as the dependent variable. Consistent with H1a, 58.1% of participants in the sensory signaling product condition (vs. 33.3% in the nonsignaling product condition) decided to purchase the product ($b = 1.02$, $SE = .37$, Wald $\chi^2 = 7.54$, $p = .006$, Exp(b) = 2.77).

Product review ratings An analysis on the product ratings showed a significant effect, with better ratings in the sensory signaling product condition ($M = 4.60$, $SD = 0.64$) compared to the nonsignaling product condition ($M = 4.24$, $SD = .86$; $F(1, 123) = 7.03$, $p = .009$, $\eta_p^2 = .054$).

Perceived transfer of benefits An analysis on the perceived transfer of benefits showed a significant effect, with higher perceived transfer of benefits in the sensory signaling product condition ($M = 67.15$, $SD = 22.71$) compared to the nonsignaling product condition ($M = 56.79$, $SD = 24.03$; $F(1, 123) = 6.12$, $p = .015$, $\eta_p^2 = .047$).

Mediation analysis Supporting H1b, the indirect effect (IE) of product type (sensory signaling product, coded 1; nonsignaling product, coded 0) on product purchase via perceived transfer of benefits was significant (95% CI: [.09, .99]). Likewise, perceived transfer of benefits mediated the effect of product type on product ratings (95% CI: [.03, .33]). See Web Appendix 4 for regression coefficients.

Ruling out alternative explanation of curiosity An ANOVA on curiosity was not significant, with similar levels of curiosity in the sensory signaling product condition ($M = 5.79$, $SD = .89$) compared to the nonsignaling condition ($M = 5.46$, $SD = 1.19$; $F(1, 123) = 3.08$, $p = .082$). Curiosity did not mediate the effect of product type on product purchases (95% CI: [-.02, .70]).

Additional exploratory analysis An ANOVA on self-efficacy was not significant, with similar levels of perceived self-efficacy resulting after product usage among participants in the sensory signaling condition ($M = 5.53$, $SD = 1.00$) compared to those in the nonsignaling product condition ($M = 5.24$, $SD = 1.16$; $F(1, 123) = 2.30$, $p = .132$). The lack of significant difference between the two means may be due to the study structure in which we asked all participants to squeeze 20 times (as opposed to squeezing as many times as possible), which may have limited variations in self-efficacy between conditions.

In a study with a real purchase behavior measure and a measure of consumer's perceived transfer of benefits, we found that a consumer using a sensory signaling product perceived a greater transfer of product benefits and were more likely to make an actual purchase of a real product, and also responded with a better product review compared to consumers using a nonsignaling product. To further test the robustness of the proposed effect, we conducted another study to examine the effect of product type (sensory signaling vs. nonsignaling) on participants' willingness to pay and attitude towards the product using a different sensory signal (i.e., cooling sensation) and a different product (i.e., a headwrap) in a product trial context (Web Appendix S1, please refer to Web Appendix 5). Again, in support of H1a and H1b, results showed that a sensory signaling product increases product evaluations (i.e., willingness to pay and attitude towards the product) via a perceived transfer of benefits. Results also showed that perceived curiosity did not explain our results. Furthermore, we identified a potential moderator of individual differences (Protestant Work Ethic; see specific hypothesis and results in Web Appendix 5); nevertheless, the sample size was small, and conclusions must be interpreted carefully. In the next three studies (Studies 3–5), we moved beyond marketing outcomes by investigating whether adding a sensory signal to a product can increase actual product efficacy, bringing positive consequences to consumers.

Study 3: Sensory signaling products increase objective consumer performance

This study tested H2a on weightlifting performance. It had two conditions in which participants experienced different products: a nonsignaling product (a regular gel) and a sensory signaling product (a tingling gel), and the verbal claims were equated across conditions. We predicted that participants using a sensory signaling (vs. nonsignaling) product would be more likely to perceive a transfer of benefits, and subsequently perform better. In addition, we added a third condition in which participants applied a sensory signaling product but were told that the tingling sensation is unrelated to bodily improvement (hereafter, "sensory signaling product with unrelated signal"). Recall that for the effect to work, participants must infer that the tingling sensation is transferring something that helps their physiological capacity. If we overturn the positive attribution that participants assign to the sensation, the product should no longer influence performance.

Method

Stimuli To avoid inducing any a priori expectations among participants, we hired a manufacturer to create two novel versions of the same product (i.e., gel) with an equally pleasant citrus scent for the stimuli used in the physical task. We also controlled for color and texture, and then placed them inside identical containers (see Web Appendix 6). The two products had the same ingredients except for a single chemical that induces a tingling sensation, and neither product contained pharmacologically active ingredients that would affect physical performance. Like in Study 2, our pretest confirmed that the two stimuli used differed on tingling sensation as intended, but not on other attributes (see Web Appendix 6).

Procedure We recruited 84 students (52% females; M_{age} = 22.36 years, $SD = 4.40$) to participate in the study in exchange for small rewards. Upon arrival at the lab, participants read the consent form where they were invited to participate in a physical dumbbell lifting study. Participants were then randomly assigned to one of the three conditions (nonsignaling product vs. sensory signaling product with related signal vs. sensory signaling product with unrelated signal), conducted one person at a time. Each participant was instructed to use their dominant arm to hold up a 5-pound weight for as long as possible on two separate measures. Following Gray's (2010) procedure, the metal weight was held directly outwards from the side of the body, with a fully extended arm. The first time that participants lifted the weight served as a pre-manipulation measure of strength ("pre-lift"), whereas the second time they lifted the weight served as a post-manipulation measure of strength ("post-lift"). To ensure that participants gave their maximum effort on the pre-lift, they were not told in advance that they would be lifting the weight again. A research assistant blind to the hypothesis used a stopwatch to measure the weight-lifting duration (in seconds; sec) from the time that each participant held the weight until the participant dropped the weight. Participants in all three conditions lifted the weight equally well ($F(2, 81) = .40$, $p = .67$).

In between the two lifts, we manipulated our conditions. Following the approach used in prior research (Irmak et al., 2005), we created the verbal claims, which were minimally modified from an actual advertisement of performance-enhancement products: "This gel is called "Axiron," which is expected to arrive in international markets by the end of this year. In dozens of medical studies at US and European universities, the active ingredients in this gel boost muscle performance by increasing testosterone and adrenaline levels and by increasing muscle output." All participants read the same verbal claims.

Then, participants in the two sensory signaling conditions read additional information where we varied the relationship between the sensory signal and bodily improvement following the misattribution approach (Schwarz & Clore, 1983). Participants in the sensory signaling product with related signal condition (vs. sensory signaling product with unrelated signal condition) read: "A few minutes after you have applied the gel, you will feel a tingling sensation, which means that your skin will feel a tingle, and this tingling sensation will have a positive effect on your muscle performance (vs. although this sensation will not have any effect on your muscle performance)."

Next, all participants applied the citrus gel on their arms (i.e., regular gel: nonsignaling product vs. tingling gel: sensory signaling product) and waited for three minutes. A separate pretest confirmed that it took three minutes for the tingling sensation to kick in. After that, all participants lifted the weight again using the same arm (post-lift measure).

Following the post-lift, participants indicated the extent to which the product benefits had been transferred to them using the following scales: "As I was lifting the dumbbell, I can continuously feel that the gel is enhancing my muscles;" "As I was lifting the dumbbell, I can feel the positive effects of the gel in real-time;" "As I was lifting the dumbbell, I can feel the positive effects of the gel on my arms;" and "As I was lifting the dumbbell, I can feel that the gel is making me more powerful over time." (1 = strongly disagree, 7 = strongly agree; $\alpha = .89$).

Furthermore, we measured motivation, attention, anxiety, trait self-efficacy, and task difficulty (Garvey et al., 2016; Ilyuk et al., 2014b; Ilyuk & Block, 2016; Shiv et al., 2005; see Web Appendix 7 for scales), as prior research has found that these variables may influence consumer performance. For example, participants using a sensory signaling (vs. nonsignaling) product may pay greater attention to the task or feel less anxious, thus performing better. Alternatively, participants might perform better because of individual differences in strength training (trait self-efficacy), and some participants might perform better because the task was less difficult to them. Finally, participants answered some demographic questions, were debriefed, and were thanked for their participation.

Results and discussion

Objective performance We calculated a participant's objective performance by subtracting the *pre-lift* measure from the *post-lift* measure (sec). An ANOVA on the index revealed a significant effect ($F(2, 81) = 7.08$, $p = .001$, $\eta_p^2 = .149$). As a robustness check, we also performed additional analysis on the *post-lift* measure, controlling for the *pre-lift* in this study as well as in other studies (Studies 4–5); results were significant (see Web Appendix 8). In support of H2a, objective performance was higher in the sensory signaling product with related signal condition ($M = +7.00$ s, $SD = 11.62$) compared to nonsignaling product condition ($M = -3.49$ s, $SD = 12.95$; $t(81) = 3.20$, $p = .002$, $d = .851$) and sensory signaling product with unrelated signal condition ($M = -4.04$ s, $SD = 12.11$; $t(81) = 3.34$, $p = .001$, $d = .93$). Importantly, also as predicted, objective performance did not differ between sensory signaling product with unrelated signal condition ($M = -4.04$ s, $SD = 12.11$) and nonsignaling product condition ($M = -3.49$ s, $SD = 12.95$; $t(81) = .17$, $p = .87$).

Perceived transfer of benefits An ANOVA was significant ($F(2, 81) = 4.75$, $p = .011$, $\eta_p^2 = .105$), with higher perceived transfer of benefits in the sensory signaling product with related signal condition ($M = 5.10$, $SD = .98$) compared to nonsignaling product condition ($M = 4.09$, $SD = 1.54$; $t(81) = 3.04$, $p = .003$, $d = .776$) and sensory signaling product with unrelated signal condition ($M = 4.43$, $SD = 1.14$; $t(81) = 2.00$, $p = .049$, $d = .629$). In contrast, perceived transfer of benefits did not differ between sensory signaling product with unrelated signal condition ($M = 4.43$, $SD = 1.14$) and nonsignaling product condition ($M = 4.09$, $SD = 1.54$; $t(81) = 1.03$, $p = .30$).

Mediation analysis To test whether the degree of perceived transfer of benefits mediates the relationship between the type of product and objective performance, we created two dummy variables (nonsignaling product as the baseline = 0, X1 = 1 for "sensory signaling product with related signal", X2 = 1 for "sensory signaling product with unrelated signal"). We ran a bootstrapping procedure with a multicategorical independent variable (model 4; 5000 samples; Hayes & Preacher, 2014). In the comparison of X1, the mediation revealed a significant indirect effect (95% CI: [.52, 6.39]) because the confidence interval (CI) did not include zero. In the comparison of X2, the mediation revealed a nonsignificant indirect effect (95% CI: [-1.13, 3.37]). See regression coefficients in Web Appendix 9.

Additional analyses Results showed that participants' motivation and other variables did not differ across the three conditions (see Web Appendix 7 for means).

These results provide support for the role of sensory signaling in enhancing product efficacy, such that once the tingling begins, it elicits a real-time, iterative inference of "I can feel this product working," increasing the actualization of the promised positive outcomes, which subsequently results in better performance. Furthermore, designing an experiment with a third condition where participants applied a sensory signaling product but in which we varied the participant's attribution of the sensation helped us rule out the alternative explanation that the use of a sensory signaling product led to high performance due to any potential active ingredients (Benedetti, 2009). In Web Appendix S2 (please refer to Web Appendix 10), we replicated our effect using a different product (i.e., spray) and a different motor task by which to measure performance (i.e., body twisting). We also added a third condition in which we removed the sensation before participants performed the task. Together, the results of these studies provided further support for the role of sensations in inducing greater perceptions of a transfer of benefits, subsequently improving objective performance.

In the next study, we aim to answer an important question: Physiologically, how does the inference regarding the innocuous sensory signal (tingling sensation) translate into higher physical performance? To provide physiological evidence for the process, we will measure the bodily impact of a participant's iterative evaluations of sensory signals during a task by tracking objective changes in bodily energization using systolic blood pressure (SBP). Researchers have used SBP, the maximum pressure exerted by the blood against the vessel walls following a heartbeat, to assess bodily energization (Kappes & Oettingen, 2011; Oettingen et al., 2009; Wright, 1996). If consumers infer that a tingling sensation signals the transfer of product benefits and perceptual attunement subsequently occurs, then the body should become more energized (i.e., SBP should become higher).

Study 4: Physiological process evidence of increased systolic blood pressure

Study 4 had two objectives. The first objective was to provide direct bottom-up evidence for how a product with a sensation (e.g., tingle) elicits increases in bodily energization, leading to an improved performance. If sensory misattribution results in superior energization, then systolic blood pressure (SBP) should be higher among those who use sensory signaling (vs. nonsignaling) products. We measured participants' SBP while participants performed the task. The second objective was to demonstrate that sensory signals can function without explicit persuasive verbal claims. Hence, we added a third condition in which participants used sensory signaling products without reading verbal claims, and tested whether they could naturally make a positive attribution regarding the tingling sensation. If participants could infer that the innocuous sensation is a signal for incipient bodily improvement, we would expect similar response patterns as those who used a sensory signaling product accompanied by claims. This would support our account that sensory signals induce greater inferences of benefit transfer, subsequently enhancing product efficacy. We predicted that participants using sensory signaling products with or without the verbal claims would generate more energization (higher SBP), and thus perform better than participants using a nonsignaling product.

Method

Procedure A research assistant invited 100 adults on a campus who met the criteria to participate in a hand exercise study in exchange for small rewards. Eligible participants had to be free from heart disease and hypertension, and abstain from cigarettes, alcohol, strenuous exercise, caffeine, and medication for at least 2 h before the session (Oettingen et al., 2009). Four adults did not follow the procedure and were removed, yielding 96 adults in the analysis (60% females; $M_{age} = 29.37$ years, $SD = 8.41$; two participants did not provide age). The study was run one person at a time. After reading the consent form, all participants in this study (and the next study) were asked to rest quietly for five minutes before starting the experiment, to control for any variations in initial SBP.

Following the resting period, each participant was randomly assigned to one of the three conditions (nonsignaling product with claims vs. sensory signaling product with claims vs. sensory signaling product without claims) and was tested individually in a cubicle. Each participant sat at a table that held a tablet and a compression cuff. A female assistant who was blind to the hypotheses and condition obtained a baseline SBP measurement from the participant's dominant arm, using an automatic blood pressure monitor (Omron HEM7120). To obtain the participant's baseline SBP, we measured SBP twice (immediately after each other and took the average; $r = .93$). Each SBP measurement period was approximately 30 s. This measure served as a "pre-SBP" and did not differ across conditions ($F(2, 93) = .44$, $p = .64$).

After the pre-SBP measurement, we took a baseline measurement of physical performance using the handgrip task (Park & John, 2014). This measure served as a "pre-manipulation squeeze" ("pre-squeeze") measure. This task involves squeezing a commercially available handgrip exerciser set at 22 pounds of resistance. Each participant was not told how many times s(he) would have to perform the squeezing task, in order to ensure that each gave her best effort on each measure. The device consisted of two handles connected by a metal spring, and automatically counted when the participant compressed the spring. To assess the pre-squeeze measure, the device counted the number of times that each participant can squeeze within two minutes. The pre-squeeze did not differ across conditions ($F(2, 93) = 2.08$, $p = .13$). Next, we manipulated the three conditions.

In the nonsignaling product with verbal claims condition, each participant read the verbal claims modeled after an actual advertisement where the product (i.e., herbal balm like in Study 2) helps to reduce aches and pains (see Web Appendix 11), applied the regular balm on the dominant arm, and waited for three minutes. In the sensory signaling product with verbal claims condition, each participant read the same product claims, applied the tingling balm on the dominant arm, and waited for three minutes. In the product with sensory signal only condition, each participant did not read verbal claims, but applied the tingling balm and waited for three minutes. In all conditions, participants applied the balm from the wrist to the upper arm (where the systolic blood pressure cuff was placed).

Later, we asked each participant to squeeze the handgrip again for two more minutes. This served as a "*post-manipulation handgrip squeeze*" performance. Importantly, we wanted to measure objective bodily energization during the task, so we conducted two final SBP measurements while the participant squeezed the handgrip. A research assistant paused a stopwatch after participants had started squeezing for one minute and measured their SBP twice ($r = .88$). This measure served as a "post-SBP" measure. Following the post-SBP, a research assistant continued the stopwatch and each participant squeezed for another minute to complete the task. Finally, each participant completed other measures as in the previous studies (see Web Appendix 7), was debriefed, and thanked for participating.

Results and discussion

Objective performance An ANOVA on the performance index (*post-handgrip squeeze* minus *pre-handgrip squeeze*) revealed a significant effect ($F(2, 93) = 6.66$, $p = .002$, $\eta_p^2 = .125$). Replicating the results observed in Study 3, objective performance was higher in the sensory signaling product with claims condition ($M = +31.24$ times, $SD = 24.80$) compared to those in the nonsignaling product with claims condition ($M = +10.45$ times, $SD = 35.01$;

$t(93) = 3.05$, $p = .003$, $d = .691$). Also, as predicted, objective performance was higher in the sensory signaling product without claims condition ($M = +33.32$ times, $SD = 20.79$) compared to those in the nonsignaling product with claims condition ($M = +10.45$ times, $SD = 35.01$; $t(93) = 3.28$, $p = .001$, $d = .794$). Importantly, objective performance did not differ between the two sensory signaling conditions ($t(93) = .31$, $p = 76$).

Objective bodily energization An ANOVA on the index (*post-SBP* minus *pre-SBP)* was significant ($F(2, 93) = 3.32$, $p = .041$, $\eta_p^2 = .067$). Objective bodily energization was higher in the sensory signaling product with claims condition ($M = +3.90$ mmHg, $SD = 7.43$) compared to those in the nonsignaling product with claims condition ($M = +0.18$ mmHg, $SD = 4.84$; $t(93) = 2.31$, $p = .023$, $d = .588$). Similarly, objective bodily energization was higher in the sensory signaling product without claims condition ($M = +3.73$ mmHg, $SD = 6.78$) compared to those in the nonsignaling product with claims condition ($M = +0.18$ mmHg, $SD = 4.84$; $t(93) = 2.16$, $p = .034$, $d = .603$). Participants in the two sensory signaling conditions were equally energized ($t(93) = .11$, $p = .92$).

Mediation analysis We performed a mediation analysis based on a multicategorical approach (Hayes & Preacher, 2014) where nonsignaling product condition was the comparison group (coded 0). The analysis confirmed a significant indirect effect for X1 (sensory signaling product with claims; coded 1) on objective performance through objective bodily energization (95% CI: [.03, 9.39]). Similarly, results indicated a significant indirect effect for X2 (sensory signaling product without claims; coded 1) on the objective performance through objective bodily energization (95% CI: [.01, 8.11]). See regression coefficients in Web Appendix 12.

Additional analyses Participants' motivation and other variables did not differ among the three conditions (see Web Appendix 7 for means).

Results of Study 4 supported our theorizing that the enhanced perceptual salience of sensory signaling products triggers consumer inferences that some product benefits have been transmitted and that their bodily capacity is improving (as evidenced by energization; higher SBP), and subsequently performed better. Moreover, results of this study conceptually replicated and extended the findings of Study 3 in an important way. That is, we conducted the final SBP measurements *during the task* rather than after participants had completed the task. This helps provide direct evidence for bodily improvement while the task is still ongoing. To fully test our account that sensory signaling products induced perceptions of transfer of product benefits and therefore improved bodily energization, which in turn, improved objective performance, we measured and tested both mediators in the next and final study. In addition, we tested whether sensory signaling (vs. nonsignaling) products would be more resistant to persuasion knowledge and would lead to positive marketing outcomes.

Study 5: Sensory signaling products are more resistant to persuasion knowledge

This final study had three objectives. First, we proposed a serial mediation model to test whether the positive effect of sensory signaling products on objective performance would be explained by an increase in levels of perceived transfer of product benefits, which in turn, increases bodily energization, thereby improving objective performance (H2b). To provide further support for our mechanism, we measured and ruled out one potential alternative explanation: that participants using sensory signaling (vs. nonsignaling) products were more curious about how the product would work, and that this might improve performance. In addition, we continued to explore the effect on participants' perceived self-efficacy *after product use*.

Second, we tested whether a sensory signaling product would still be effective even when persuasion knowledge was activated (H3). We designed a full-factorial study in which we manipulated the product type (nonsignaling vs. sensory signaling) and persuasion knowledge (absent vs. present) in the same study. We predicted that participants using a sensory signaling product should outperform participants using a nonsignaling product either when persuasion knowledge is activated or not activated. In other words, we predicted a main effect of product type on objective performance because the literature suggests that it should be easier for consumers to counter-argue against verbal messages, and more difficult to counter-argue against sensory signals.

Third, we measured marketing outcomes. If participants believe that sensory signaling products work better due to a greater transfer of benefits than nonsignaling products, then they should be more likely to purchase the product and have favorable product attitudes. We tested whether sensory signaling products lead to higher product evaluations than nonsignaling products (H1a), and whether a perceived transfer of benefits mediated such relationship (H1b).

Method

Procedure Just like in Study 4, a research assistant recruited 125 adults (58% females; $M_{age} = 23.40$ years, $SD = 5.20$; six participants did not provide age and two participants did not report gender) who met the eligibility requirements (i.e., had no coffee, alcohol, and did not perform a strenuous exercise at least 2 h before the experiment) to participate in a study in exchange for small rewards. The study had a 2 (product type: nonsignaling product vs. sensory signaling product) × 2 (suspicion prime: absent vs. present), between-subjects design. The study was conducted one person at a time. Following the consent form signing, we first measured the baseline SBP (pre-SBP; $r = .90$) and handgrip (pre-squeeze) using a similar procedure as in Study 4. The participants were not told how many squeezing tasks would need to be performed to ensure that maximum effort was expended each time. The pre-SBP ($F(1, 121) = .28$, $p = .60$) and pre-squeeze did not differ across conditions ($F(1, 121) = .001$, $p = .98$).

Following the pre-measure, each participant read the ad, which contained a headline, a product picture, and two claims (see Web Appendix 13). We manipulated suspicion prime by varying the information on the two claims presented in the ad for an herbal balm (adapted from Kirmani & Zhu, 2007). In the absence of suspicion condition, we presented claims that communicated evidence-based factual information (i.e., "a study from consumer reports") and were not exaggerated (i.e., "made from herbs" and "this balm relieves body aches and pains"). In contrast, in the presence of suspicion condition, we presented claims that sound biased (i.e., "a recent survey conducted by own company") and exaggerated (i.e., "made from a special secret ingredient invented by our company" "this balm prevents body aches and pains from returning permanently"). We conducted a separate pretest with 40 participants (53% females; $M_{age} = 22.54$ years, $SD = 3.80$) where participants rated one of the two ads on a 7-point scale (1 = unbelievable/not truthful, 7 = believable/truthful; $r = .64$; Kirmani & Zhu, 2007). We reverse-coded these items so higher numbers indicate greater deceptiveness. Confirming our manipulation, pretest results confirmed that the ad in the suspicion present condition ($M = 4.26$, $SD = 1.24$) was perceived as more deceptive compared to the ad in the suspicion absent condition ($M = 2.98$, $SD = 1.13$; $t(38) = 3.43$, $p < .001$). Thus, we used these ads in the main experiment.

After reading the ad, each participant applied either the tingling balm or a nontingling balm and waited for three minutes (for the tingling to kick in). Next, all participants performed the handgrip task for another 2 min. Just like before, a research assistant paused the stopwatch after 1 min to measure participants' SBP during the task ($r = .92$). Participants then continued the handgrip task. Unlike in the previous study, we also collected participants' performance before we stopped them and measured their blood pressure. No unintended variables influenced SBP, as participants performed equally well before the SBP measure ($F(1, 121) = .43$, $p = .52$).

Next, each participant completed a measure of perceived transfer of benefits using the 100-point scale from Studies 1–2: "While you were squeezing the handgrip, what percentage of the benefits (e.g., pain reduction and increased strength) has the product transferred to you?" After that, participants rated their level of self-efficacy as a function of product use, curiosity, and other measures that could influence performance as in Studies 3–4 (see Web Appendix 7).

Subsequently, each participant indicated intentions to purchase the product (1 = not likely at all, 7 = very likely) as well as attitudes toward the product (1 = not very useful /very unfavorable/very bad, 7 = very useful/very favorable/ very good; $\alpha = .96$; Maheswaran, 1994). Each participant completed a manipulation check of suspicion prime using the same two items as in the pretest ($r = .92$). Each participant was debriefed and thanked for participating.

Results and discussion

Suspicion prime manipulation check A 2 (product type: nonsignaling vs. sensory signaling) × 2 (suspicion prime: absent vs. present) between-subjects ANOVA showed that the suspicion prime manipulation was effective. There was a main effect of suspicion prime, with the ad in the suspicion prime present condition ($M = 3.54$, $SD = 1.51$) viewed as more deceptive than the ad in the suspicion prime absent condition ($M = 3.08$, $SD = 1.56$; $F(1, 121) = 4.52$, $p = .036$, $\eta_p^2 = .036$). There was also a main effect of product type ($M_{signaling} = 2.73$, $SD = 1.27$ vs. $M_{nonsignaling} = 3.93$, $SD = 1.59$; $F(1, 121) = 23.77$, $p < .001$, $\eta_p^2 = .164$). That the mean for ad deceptiveness in the suspicion present condition ($M = 3.54$) was lower than the midpoint (vs. $M = 4.00$; $t(61) = 2.39$, $p = .020$) could be explained by the fact that we measured perceptions of advertising deceptiveness after participants had used the product and performed the squeezing task. Hence, participants using the sensory signaling product ($M_{signaling-PKpresent} = 2.90$, $SD = 1.25$; $M_{signaling-PKabsent} = 2.55$, $SD = 1.28$) modified their initially high levels of suspicion after experiencing the tingling sensation from the product as opposed to participants who used the nonsignaling product ($M_{nonsignaling-PKpresent} = 4.32$, $SD = 1.45$; $M_{nonsignaling-PKabsent} = 3.59$, $SD = 1.64$). We did not observe an interaction ($F(1, 121) = .56$, $p = .46$).

Objective performance The same 2×2 analysis on the index (*post-squeeze* minus *pre-squeeze*) showed a main effect of product type, with higher objective performance in the sensory signaling product condition ($M = +22.95$ times, $SD = 20.03$) compared to those in the nonsignaling product condition ($M = +7.12$ times, $SD = 17.20$; $F(1,$

121) = 23.09, $p < .001$, $\eta_p^2 = .160$). There was no main effect of suspicion prime ($F(1, 121) = .40$, $p = .53$). The interaction was marginally significant ($F(1, 121) = 3.47$, $p = .065$, $\eta_p^2 = .028$). In the case of the sensory signaling product, objective performance did not differ when suspicion prime was absent ($M = +20.81$ times, $SD = 21.19$) or present ($M = +24.91$ times, $SD = 19.02$; $F(1, 121) = .79$, $p = .38$). In the case of the nonsignaling product, objective performance was lower when suspicion prime was present ($M = +2.68$ times, $SD = 15.78$) compared to absent ($M = +11.00$ times, $SD = 17.68$; $F(1, 121) = 2.99$, $p = .086$, $\eta_p^2 = .024$). These results provided support for our H3 that sensory signaling (vs. nonsignaling) products are more resistant to persuasion knowledge.

Objective bodily energization As anticipated, the same 2×2 analysis on the index (*post-SBP* minus *pre-SBP*) revealed a main effect of product type, with levels of bodily energization higher in the sensory signaling product condition ($M = +2.92$ mmHg, $SD = 6.93$) compared to those in the nonsignaling product condition ($M = -0.71$ mmHg, $SD = 6.38$; $F(1, 121) = 9.05$, $p = .003$, $\eta_p^2 = .070$). There was no main effect of suspicion prime ($F(1, 121) = .002$, $p = .97$), and no significant interaction ($F(1, 121) = .012$, $p = .91$). See Table 1 for means in all conditions.

Perceived transfer of benefits Following the patterns of objective performance and objective bodily energization, the same 2×2 analysis revealed a main effect of product type, with higher levels of perceived transfer of benefits in the sensory signaling product condition ($M = 66.66$, $SD = 21.11$) compared to those in the nonsignaling product condition ($M = 41.40$, $SD = 24.50$; $F(1, 121) = 37.79$, $p < .001$, $\eta_p^2 = .238$). There was no main effect of suspicion prime ($F(1, 121) = .05$, $p = .82$) and no significant interaction ($F(1, 121) = .07$, $p = .79$).

Serial mediation analysis Because suspicion prime did not moderate the effect, we pooled together the conditions in testing a serial mediation. To test our proposed process on the consumer's outcome path as presented in the conceptual framework (Fig. 1), we ran a serial mediation model (model 6; 5000 samples; Hayes, 2018) with product type (sensory signaling coded 1; nonsignaling coded 0) as the independent variable, perceived transfer of benefits (Med_1) and bodily energization (Med_2) as sequential mediators, and objective performance as the dependent variable. In support of H2b, the serial mediation revealed that those in the sensory signaling product (vs. nonsignaling product) condition perceived a greater transfer of product benefits, which, in turn, increased their bodily energization and subsequently enhanced their performance (95% CI: [.31, 2.89]). See regression coefficients in Fig. 2. We also tested the reverse model, with bodily energization preceding perceived transfer of benefits, and found that the indirect effect was not significant (95% CI: [-1.10, .27]).

Rule out alternative explanations We also ran the same 2×2 analysis on the other measures (i.e., curiosity, motivation, attention, anxiety, and task difficulty). Results revealed significant main effects of product type on curiosity ($M_{nonsignaling} = 5.37$, $SD = 1.13$ vs. $M_{signaling} = 5.88$, $SD = .93$; $F(1, 121) = 8.05$, $p = .005$, $\eta_p^2 = .062$), motivation ($M_{nonsignaling} = 4.83$, $SD = 1.28$ vs. $M_{signaling} = 5.25$, $SD = 1.23$; $F(1, 121) = 3.71$, $p = .057$, $\eta_p^2 = .030$), attention ($M_{nonsignaling} = 5.53$, $SD = .89$ vs. $M_{signaling} = 5.98$, $SD = .84$; $F(1, 121) = 8.59$, $p = .004$, $\eta_p^2 = .066$), but not on other measures (see Web Appendix 7). Next, we examined whether these variables mediated our proposed effect by performing two simple mediation analyses: one from product type (IV) to objective bodily energization (Med_2), and another from product type (IV) to objective performance (DV). In the first mediation analysis (IV→Med_2), we entered perceived transfer of benefits (Med_1), curiosity, motivation, and attention as competing mediators in the same model. Results revealed a significant indirect effect only via our predicted mediator of perceived transfer of benefits (95% CI: [.44, 3.57]), but not via curiosity (95% CI: [-.88, .36]), motivation (95% CI: [-.07, 1.24]), nor attention (95% CI: [-1.01, .41]). In the second mediation analysis (IV→DV), we entered objective

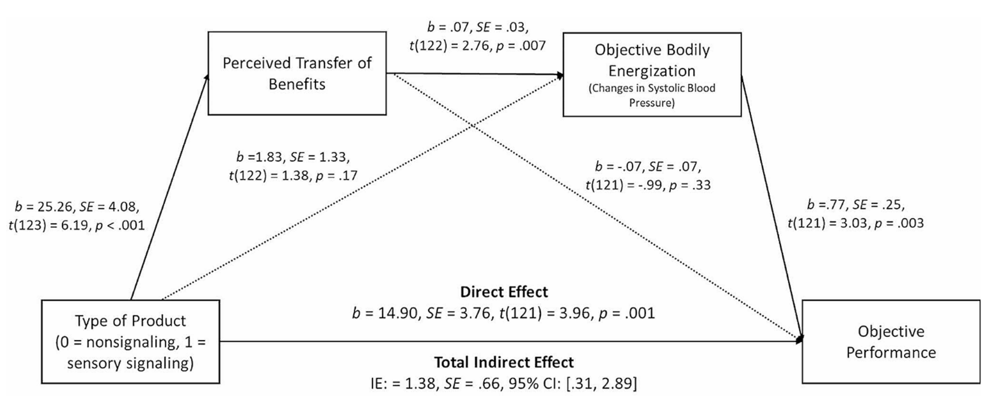

Fig. 2 Serial mediation between condition and objective performance (Study 5). *Note.* Figure 2 shows the unstandardized regression coefficients and bootstrapping based on 95% confidence intervals of the indirect effect of mediator 1 (perceived transfer of benefits) and mediator 2 (objective bodily energization, as measured by changes in systolic blood pressure) on objective performance

bodily energization (Med_2), curiosity, motivation, and attention as competing mediators in the same model. Again, results revealed a significant indirect effect only via our predicted mediator of objective bodily energization (95% CI: [.67, 5.08]), but not via curiosity (95% CI: [-1.11, 2.98]), motivation (95% CI: [-2.09, 1.56]), nor attention (95% CI: [-2.10, 2.11]).

Additional exploratory analysis A 2×2 analysis on self-efficacy after product usage revealed a main effect, with higher perceived self-efficacy in the sensory signaling condition ($M = 5.54$, $SD = 1.15$) compared to those in the nonsignaling condition ($M = 4.43$, $SD = 1.37$; $F(1, 121) = 25.37$, $p < .001$, $\eta_p^2 = .173$). There was no main effect of suspicion prime ($F(1, 121) = 2.83$, $p = .10$) and no significant interaction ($F(1, 121) = 1.10$, $p = .30$). Next, we tested how sensory signaling products increase consumers' perceived self-efficacy after product usage. Our rationale was that, if consumers perceive that sensory signaling (vs. nonsignaling) products are more able to transfer benefits to the consumer's body (e.g., increased strength), then they will perceive themselves to have a higher ability to perform the task (i.e., self-efficacy). We thus tested the following chain: a sensory signaling product design increases perceived transfer of benefits, which subsequently increases perceived self-efficacy *after* product usage. A mediation analysis revealed a significant indirect effect of product type on self-efficacy *after* product usage via perceived transfer of benefits (95% CI: [.61, 1.29]). Thus, results suggest that sensory signaling products can increase perceived self-efficacy after product usage.

Product evaluations To test H1a, we first performed the same 2×2 analyses on the two marketing outcomes. Results showed that purchase intentions were higher in the sensory signaling condition ($M = 5.46$, $SD = 1.06$) compared to those in the nonsignaling condition ($M = 4.13$, $SD = 1.88$; $F(1, 121) = 23.66$, $p < .001$, $\eta_p^2 = .164$). There was no main effect of suspicion prime ($F(1, 121) = .003$, $p = .956$) and no significant interaction ($F(1, 121) = .016$, $p = .901$). Similarly, results showed that attitudes toward the product were more positive in the sensory signaling condition ($M = 5.73$, $SD = 1.01$) than in the nonsignaling condition ($M = 4.46$, $SD = 1.77$; $F(1, 121) = 24.57$, $p < .001$, $\eta_p^2 = .169$). There was no main effect of suspicion prime ($F(1, 121) = .131$, $p = .718$) and no significant interaction ($F(1, 121) = .033$, $p = .857$). Next, we examined the mediating role of perceived transfer of benefits (H1b). Results revealed a significant indirect effect of product type (sensory signaling product, coded 1; nonsignaling product, coded 0) on purchase intentions (95% CI: [.61, 1.42]). Likewise, the indirect effect of product type on attitude towards the product was significant (95% CI: [.73, 1.56]). See Web Appendix 14 for regression coefficients.

Together, the results of Study 5 provided support for our predicted serial mediation process, in which a sensory signaling (vs. nonsignaling) product increases the levels of perceived transfer of benefits, thus increasing bodily energization, and subsequently improving performance (a serial mediation). Moreover, the results supported our hypothesis that sensory signaling (vs. nonsignaling) products are more resistant to persuasion knowledge. Furthermore, the results supported our hypothesis on marketing-related variables via perceived transfer of benefits.

General discussion

Across five studies (and two additional studies reported in the Web Appendix), we demonstrate a novel phenomenon in which adding a sensory signal to a product improves marketing outcomes (such as product evaluations, product choice, and repurchase likelihood) and improves consumer outcomes (such as consumer performance) via a perceived transfer of product benefits to the body. Our findings also suggest that adding a sensory signal makes the product more resistant to persuasion knowledge. That is, sensory signaling products can overcome a skeptical conscious mind, whereas nonsignaling products failed when a skeptical conscious mind overrode the product claims. See Table 1 for summary results. Together, our findings have theoretical and practical implications.

Theoretical contributions

First, our research contributes to the literature on product efficacy. Extant literature focused on changing *stock* perceptions of a product (e.g., a pill is perceived to have a higher stock of potent ingredients because it is given by a person wearing a white lab coat; Benedetti, 2009, perceived adequacy is higher when product packaging is single-serve; Ilyuk & Block, 2016). We expand this stream of work by investigating how sensations facilitate the perception of transfer of benefits from a product to the body, thus bringing to the literature a *flow* construct from the stock-and-flow mental model of inference-making (Groesser & Schaffernicht, 2012; Johnson-Laird, 2012). Specifically, we show that sensory signaling products improve consumers' ability to perceive an inflow of (otherwise invisible) benefits from the product to their body, giving consumers a metacognitive sense that the product is improving their body ("The tingle tells me that the product essence is now flowing to my body"). Consumers have even less ability to perceive outflows of benefits, with only 4% of consumers re-purchasing vaccines on time (Bendix, 2022). Because the "flow" construct can go in two possible directions (inflow and outflow), future research should study how marketers can use product design to induce repeat purchasing of critically important products (e.g., vaccine boosters) by facilitating the perception of outflow of benefits, signaling the need for consumers to replenish their body's "stock" of antibodies on time (e.g., every six months) to prevent severe illness and death.

We also add a unique dimension to the sensory marketing literature. Research in this domain has examined how various external sensory cues such as ambient background (Biswas et al., 2019) and ambient temperature (Park & Hadi, 2020) can influence consumer experience and product evaluations. Our work specifically adds to this research stream by showing that product-induced sensations (e.g., tingling, cooling, and fizzing) can increase product evaluations (Study 1, Study 5), product choice (Study 2), and likelihood to repurchase and recommend the product (Studies 1–2). Moreover, we add to the sensory marketing literature by showing that a product-induced sensation positively impacts actual product efficacy: simply adding a sensory signal to a product increases consumer performance in weightlifting and hand squeezing (Studies 3–5). This effect can function without explicit marketing appeals when consumers naturally generate the inference that a sensation signals the transfer of benefits (Study 4). In addition, our sensory marketing intervention appears to exert an influence on a fundamentally important human process of bodily energization and drive state (Hull, 1943; Panksepp, 1998), which implies that sensory signaling products could potentially help in dealing with important energization-related conditions, such as depression (Seligman, 1975) and immune functioning (Foster et al., 2017). This would add a unique *objective outcomes* dimension to sensory marketing, which gatekeepers felt had the reputation of focusing on "touchy-feely" subjective outcomes (Krishna, 2011). Future research should test whether sensory signaling designs integrated into depression medications can help reverse the increasing incidence of depression among consumers.

Finally, our work suggests the important role of lower-order sensory signals in contributing to top-down processes in placebo responding, an approach that had been identified as a gap in the placebo effects literature (Stewart-Williams, 2004). Our studies show that when the mind infers the tingling sensation to be evidence for the transfer of product benefits that lead to an improved bodily capacity, the tingling product outperforms a product with equally positive verbal claims that are not reinforced by a sensory signal. Moreover, our findings broadly contribute to the self-efficacy literature by demonstrating the surprisingly positive role of subtle sensory changes in product design in enhancing perceived self-efficacy, adding to cognitively-mediated processes such as branding (Banker et al., 2020; Park & John, 2014) or message framing (Achar et al., 2020). Importantly, because our intervention is sensory and does not require much verbal or symbolic processing, it should be more effective in helping vulnerable consumers, such as elderly consumers who have lost their verbal processing abilities (dementia), and less educated and subliterate consumers who cannot read (Hill & Sharma, 2020).

Practical implications

Our findings offer practical implications. Currently, many marketers do not add a sensory signal to their products. For example, Closys (a mouthwash) and Axiron (a testosterone booster) do not elicit a sensation after product application. In addition to these common consumer products, products in critical domains such as depression medications often do not have any sensation component, which can lead to "learned helplessness" as consumers feel that they are unable to help their situation (Garber & Seligman, 1980). Marketers of both common consumer products and products in critical domains can thus improve product efficacy and reduce "learned helplessness" by helping consumers perceive that consuming the product can cause perceptually identifiable positive outcomes. This would help consumers actualize the product benefits and also perceive that the product is effective, as illustrated by real-life consumers in Study 1: "Red Bull is the product that I used to revitalize myself to work longer hours… The drink has a tingling sensation when I use it. I feel energized after consuming and my reflexes seem to improve." However, marketers and policy makers should inform consumers of the risk of overdosing or over-exercising, because a sensation might motivate consumers to exert a greater effort than usual and risk injury.

What are the expected financial benefits for the firm introducing these changes? Our findings suggest that marketers who add sensory signaling to their products would benefit by increasing consumer evaluations of the product and potentially increase sales. A more nuanced suggestion is that marketers should strategically "pair usage with performance" when they provide product samples, rather than just giving out product samples without any guidance. To illustrate, an exercise cream product sample should be accompanied by instructions to use the cream three minutes (or "shortly") before weightlifting or running. The sensory signaling effect should increase bodily energization (and optimize systolic blood pressure), hence improving exercise performance. The consumer would notice an actual performance improvement and become more likely to purchase the product. Event sponsorship (e.g., Boston Marathon) would be a naturalistic way for managers to implement "pair usage with performance," where marketers could set up a booth near the starting line to ensure that consumers use the product just before the activity, hence facilitating the improved product efficacy and purchase intentions.

How might sensory signaling products alter customer satisfaction and word-of-mouth in the medium run? Sensory signals improve a consumer's perception of transfer of benefits from the product to their body, hence improving a consumer's felt ability to explain how the product is influencing the body, and tell a coherent story to themselves and to others (e.g., "I applied the product, and immediately felt something, which made me exercise longer today as I felt the energy flow from the cream to my body"). This improved ability to explain how a product works increases metacognitive confidence (Johnson-Laird, 2012; Schwarz, 2015), which may decrease anxiety and increase satisfaction. Additionally, the ability to explain how a product works to other people increases the likelihood that the consumer would tell her product story in her own words. This creates positive word-of-mouth for the marketer, via social media posts as well as in-person word-of-mouth.

Limitations and directions for future research

Our research has limitations that need to be addressed, which open avenues for future research. In order to control for external factors and have a clean experimental manipulation (Benedetti, 2009), our stimuli in Study 3 and Web Appendix S2 are deceptive only within the context of lab experiments, and are not deceptive when practiced by marketers who use active ingredients such as testosterone, glucosamine, or caffeine. In addition, had we added active ingredients to our stimuli (e.g., Testosterone in Axiron; Study 3), this would potentially harm participants who do not need the supplementation. Indeed, our manipulation followed the literature in which participants were given misleading information (Benedetti, 2009; Garvey et al., 2016; Irmak et al., 2005). In the real world, we suggest that marketers should be adding a sensory signal (e.g., tingle) to products that already have clinically proven active ingredients.

Another limitation is related to the sensory signal that is tested in our studies. Future research could study whether consumers individually differ with regards to which sensory channel they trust more as signaling an improvement in bodily resources. We chose haptic/tactile channels because these sensory channels are inherently "self-specifying" compared to, for example, auditory channels (Bermúdez, 1998). Nevertheless, it is possible that visual or auditory channels could serve as potent pathways for sensory signaling. For example, a toothbrush that makes a loud noise would lead to higher perceptions of performance and might cause the consumer to expend more effort and cognitive attention (i.e., brush the teeth longer) compared to a toothbrush that makes little or no sound. Alternatively, a sunscreen that has a darker color might be perceived as more efficacious in preventing sunburn, compared to a sunscreen that has a lighter color. Future research could test these potential ideas.

One intriguing avenue for future research would be to test the boundary conditions for product categories in which sensations would benefit marketers and consumers, versus other product categories in which sensations might backfire. For example, the Durex brand launched a vaginal lubricant product that tingled. Some consumers felt that something wrong was happening inside their bodies, even though it was just a tingling sensation. It is possible that different sensory channels or body structure elicit different perceptions of transfer of benefit versus costs. Consumers likely have different attitudes toward product-induced sensations as a function of different body parts. For example, arms and legs with thick skin might be perceived as invulnerable, and thus perceived transfers are welcome ("transfer receptive" body areas): a tingling bandage might facilitate a superior objective performance of healing wounds on the arm more quickly (2 days instead of 3 days) via a sensory-mediated immune response (Foster et al., 2017). In contrast, crevices with thin skin or soft mucous membranes might be perceived as vulnerable and thus elicit resistance or aversion to perceived transfer ("transfer averse"). Future research could test whether transfer aversion (vs. reception) might explain backfire effects.

Another future research direction would be to study boundary conditions focusing on the type of product. The extent to which the same sensory signal is interpreted as a product that is "working" versus harming might be context-dependent and altered by expectations of what the product ought to accomplish. Consumer inferences of whether a product functions as an "upper" (increase motor activity) or "downer" (decrease motor activity) may reverse how the same sensation is interpreted. Unlike "upper" products (e.g., energy boosters), downer products such as products aiming to reduce stress, which make consumers feel more relaxed and calmer (e.g., foot cream that offers tinging relief to tired legs) may not benefit from the addition of a tingling sensation, because the added sensation may be inconsistent with a consumer's desire to decrease motor activity (relax), and may trigger the interpretation that the sensation is an allergic reaction, hence decreasing product efficacy. Future research could examine whether the type of product (upper vs. downer) would moderate the effect. Managers of downer products may want to avoid adding a tingling sensation to their products because it could make consumers generate negative inferences as a result of mismatch in motor activity expectations and sensation changes, and hence decrease perceived product efficacy.

Future research could also look at the effects of longer-term use of products that have sensory signals versus those that do not. It is possible that consumers who are motivated to lose weight may over-rely on products with sensory signals, and apply more of the product than they should, in the hopes that it will work longer or do more for them, resulting in over or under-exercising. Longitudinal studies can measure the amount and frequency of product consumption as dependent measures. For example, consumers who use sensory signaling products may show a greater amount of product consumption and frequency of product consumption compared to consumers who use nonsignaling products, because they mistakenly interpret a transfer of benefit as "the product can do *all* the work for me."

Finally, future research could also examine the role of individual differences that could lead to managerially actionable boundary conditions. For example, results of our Web Appendix S1 suggest that consumers who believe that unpleasant, hard work leads to success (high PWE) are less likely to believe that sensory signaling products work as opposed to consumers who do not hold such a belief (low PWE). However, in our research, we measured this individual difference using a single behavioral item (Cheng et al., 2017). Thus, future research may replicate our effect with a multi-item scale to measure this construct (see Mirels & Garrett, 1971) and should also use a larger sample size. Future research may also examine other bodily-related variables such as participants' individual differences in somatosensory awareness (a personality trait that characterizes how attentive a person is to internal body signals; Plassmann & Weber, 2015). It is likely that the effect observed in our study would hold for participants who score low (but not high) on the somatosensory awareness scale because consumers with a high somatosensory awareness would be able to more accurately perceive changes in internally-induced bodily sensations (energization that is generated by the body's endocrine system), and would be less swayed by a product-induced bodily sensation. Future research could test this potential boundary condition.

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Declarations

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References

Achar, C., Agrawal, N., & Hsieh, M. H. (2020). Fear of detection and efficacy of prevention: Using construal level to encourage health behaviors. *Journal of Marketing Research*, *57*(3), 582–598.

Alloy, L. B., & Tabachnik, N. (1984). Assessment of covariation by humans and animals: The joint influence of prior expectations and current situational information. *Psychological Review*, *91*(1), 112–149.

Banker, S., Gosline, R. R., & Lee, J. K. (2020). Reversing the placebo: Performance-branded experiences can undermine consumer performance. *Journal of Consumer Psychology*, *30*(1), 140–148.

Bendix, A. (2022). Less than 4% of eligible people have gotten updated booster shots, one month into the rollout. Retrieved November 7, 2022 from https://www.nbcnews.com/health/health-news/updated-covid-booster-shots-doses-administered-cdc-rcna48960.

Benedetti, F. (2009). *Placebo effects: Understanding the mechanisms in health and disease*. Oxford University Press.

Benedetti, F. (2014). Placebo effects: From the neurobiological paradigm to translational implications. *Neuron*, *84*(3), 623–637.

Berelson, B., & Steiner, G. A. (1964). *Human behavior: An inventory of scientific findings*. Harcourt, Brace & World.

Bermúdez, J. L. (1998). *The paradox of self-consciousness*. MIT Press.

Biswas, D., Lund, K., & Szocs, C. (2019). Sounds like a healthy retail atmospheric strategy: Effects of ambient music and background noise on food sales. *Journal of the Academy of Marketing Science*, *47*(1), 37–55.

Cheng, Y., Mukhopadhyay, A., & Schrift, R. Y. (2017). Do costly options lead to better outcomes? How the protestant work ethic influences the cost–benefit heuristic in goal pursuit. *Journal of Marketing Research*, *54*(4), 636–649.

Cornil, Y., Chandon, P., & Krishna, A. (2017). Does Red Bull give wings to vodka? Placebo effects of marketing labels on perceived intoxication and risky attitudes and behaviors. *Journal of Consumer Psychology*, *27*(4), 456–465.

Craig, A. D. (2002). How do you feel? Interoception: The sense of the physiological condition of the body. *Nature Reviews Neuroscience*, *3*(8), 655–666.

Craig, A. D. (2003). Interoception: The sense of the physiological condition of the body. *Current Opinion in Neurobiology*, *13*(4), 500–505.

Craig, A. D. (2014). *How do you feel?* Princeton University Press.

Einhorn, H. J., & Hogarth, R. M. (1986). Judging probable cause. *Psychological Bulletin*, *99*(1), 3–19.

Foster, S. L., Seehus, C. R., Woolf, C. J., & Talbot, S. (2017). Sense and immunity: Context-dependent neuro-immune interplay. *Frontiers in Immunology*, *8*, 1463.

Friestad, M., & Wright, P. (1994). The persuasion knowledge model: How people cope with persuasion attempts. *Journal of Consumer Research*, *21*(1), 1–31.

Garber, J., & Seligman, M. E. (1980). *Human helplessness: Theory and applications*. Academic.

Garvey, A. M., Germann, F., & Bolton, L. E. (2016). Performance brand placebos: How brands improve performance and consumers take the credit. *Journal of Consumer Research*, *42*(6), 931–951.

Gray, K. (2010). Moral transformation: Good and evil turn the weak into the mighty. *Social Psychological and Personality Science*, *1*(3), 253–258.

Groesser, S. N., & Schaffernicht, M. (2012). Mental models of dynamic systems: Taking stock and looking ahead. *System Dynamics Review*, *28*(1), 46–68.

Hayes, A. F. (2018). Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Communication Monographs*, *85*(1), 4–40.

Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology*, *67*(3), 451–470.

Hill, R. P., & Sharma, E. (2020). Consumer vulnerability. *Journal of Consumer Psychology*, *30*(3), 551–570.

Hull, C. L. (1943). *Principles of behavior: An introduction to behavior theory*. Appleton-Century.

Ilyuk, V., & Block, L. (2016). The effects of single-serve packaging on consumption closure and judgments of product efficacy. *Journal of Consumer Research*, *42*(6), 858–878.

Ilyuk, V., Irmak, C., Kramer, T., & Block, L. (2014a). Efficacy expectations and adherence: Evidence of consumer biases and heuristics in pharmaceutical marketing. *Innovation and marketing in the pharmaceutical industry* (pp. 315–344). Springer.

Ilyuk, V., Block, L., & Faro, D. (2014b). Is it still working? Task difficulty promotes a rapid wear-off bias in judgments of pharmacological products. *Journal of Consumer Research*, *41*(3), 775–793.

Irmak, C., Block, L. G., & Fitzsimons, G. J. (2005). The placebo effect in marketing: Sometimes you just have to want it to work. *Journal of Marketing Research*, *42*(4), 406–409.

Johnson-Laird, P. N. (2012). Inference with mental models. *The Oxford handbook of thinking and reasoning*(pp. 134–145).

Kappes, H. B., & Oettingen, G. (2011). Positive fantasies about idealized futures sap energy. *Journal of Experimental Social Psychology*, *47*(4), 719–729.

Kirmani, A., & Zhu, R. (2007). Vigilant against manipulation: The effect of regulatory focus on the use of persuasion knowledge. *Journal of Marketing Research*, *44*(4), 688–701.

Kramer, T., Irmak, C., Block, L. G., & Ilyuk, V. (2012). The effect of a no-pain, no-gain lay theory on product efficacy perceptions. *Marketing Letters*, *23*(3), 517–529.

Krishna, A. (2011). *Sensory marketing: Research on the sensuality of products*. Routledge.

Krishna, A., & Schwarz, N. (2014). Sensory marketing, embodiment, and grounded cognition: A review and introduction. *Journal of Consumer Psychology*, *24*(2), 159–168.

Laran, J., Dalton, A. N., & Andrade, E. B. (2011). The curious case of behavioral backlash: Why brands produce priming effects and slogans produce reverse priming effects. *Journal of Consumer Research*, *37*(6), 999–1014.

Lee, S., Bolton, L. E., & Winterich, K. P. (2017). To profit or not to profit? The role of greed perceptions in consumer support for social ventures. *Journal of Consumer Research*, *44*(4), 853–876.

Maheswaran, D. (1994). Country of origin as a stereotype: Effects of consumer expertise and attribute strength on product evaluations. *Journal of Consumer Research*, *21*(2), 354–365.

Mirels, H. L., & Garrett, J. B. (1971). The Protestant Ethic as a personality variable. *Journal of Consulting and Clinical Psychology*, *36*(1), 40–44.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, *2*(2), 175–220.

Oettingen, G., Mayer, D., Timur Sevincer, A., Stephens, E. J., Pak, H. J., & Hagenah, M. (2009). Mental contrasting and goal commitment: The mediating role of energization. *Personality and Social Psychology Bulletin*, *35*(5), 608–622.

Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. Oxford University Press.

Park, J., & Hadi, R. (2020). Shivering for status: When cold temperatures increase product evaluation. *Journal of Consumer Psychology*, *30*(2), 314–328.

Park, J. K., & John, D. R. (2014). I think I can, I think I can: Brand use, self-efficacy, and performance. *Journal of Marketing Research*, *51*(2), 233–247.

Pezzulo, G. (2014). Why do you fear the bogeyman? An embodied predictive coding model of perceptual inference. *Cognitive Affective & Behavioral Neuroscience*, *14*(3), 902–911.

Plassmann, H., & Weber, B. (2015). Individual differences in marketing placebo effects: Evidence from brain imaging and behavioral experiments. *Journal of Marketing Research*, *52*(4), 493–510.

Schwarz, N. (2015). Metacognition. In M. Mikulincer, P. R. Shaver, E. Borgida, & J. A. Bargh (Eds.), *APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 203–229). American Psychological Association.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*(3), 513–523.

Seligman, M. E. (1975). Helplessness. *On depression, development and death*. Freeman.

Shiv, B., Carmon, Z., & Ariely, D. (2005). Placebo effects of marketing actions: Consumers may get what they pay for. *Journal of Marketing Research*, *42*(4), 383–393.

Stewart-Williams, S. (2004). The placebo puzzle: Putting together the pieces. *Health Psychology*, *23*(2), 198–206.

Wright, R. A. (1996). Brehm's theory of motivation as a model of effort and cardiovascular response. In P. M. Gollwitzer, & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 424–453). The Guilford.

Zhang, Y., Kwak, H., Puzakova, M., & Taylor, C. R. (2021). Space between products on display: The impact of interspace on consumer estimation of product size. *Journal of the Academy of Marketing Science*, *49*(6), 1109–1131.