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The “Visual Depiction Effect” in Advertising: Facilitating Embodied Mental Simulation through Product Orientation

RYAN S. ELDER
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This research demonstrates that visual product depictions within advertisements, such as the subtle manipulation of orienting a product toward a participant's dominant hand, facilitate mental simulation that evokes motor responses. We propose that viewing an object can lead to similar behavioral consequences as interacting with the object since our minds mentally simulate the experience. Four studies show that visually depicting a product that facilitates more (vs. less) embodied mental simulation results in heightened purchase intentions. The studies support our proposed embodied mental simulation account. For instance, occupying the perceptual resources required for embodied mental simulation attenuates the impact of visual product depiction on purchase intentions. For negatively valenced products, facilitation of embodied mental simulation decreases purchase intentions.

For years, marketers have included instructions for consumers to imagine using their product. Slogans like “Imagine the Possibilities” from Intel and Apple, or merely “Imagine” from Samsung, encourage consumers to transport themselves into a state in which they are using the product. The success of such appeals has been well documented within the consumer behavior literature (e.g., Bone and Ellen 1992; Gregory, Cialdini, and Carpenter 1982; MacInnis and Price 1987; McGill and Anand 1989; Petrova and Cialdini 2005, 2008). But what causes consumers to imagine using the product in the absence of such pleas? Can just the way in which a product is visually depicted (e.g., to the right or to the left) affect the extent to which consumers imagine using the product? Is this something the advertiser should

give attention to? Within this article, we build on recent models of cognition and perception to show that simply altering the way a product is visually depicted can elicit more (or less) mental simulation of product interaction and that this can result in higher (or lower) purchase intentions. Specifically, we focus on how orienting a product toward one's dominant hand—for instance, showing a picture of a mug with the handle on the right—facilitates simulation of using the product, which affects behavioral intentions.

The theory of grounded cognition holds that our bodily states, actions, and even mental simulations are used to generate our cognitive activity (Barsalou 2008). One of the more prominent findings within this literature is the effect of bodily states on persuasion. For instance, Wells and Petty (1980) show that participants nodding their heads up and down (vs. side to side) leads to increased persuasion of an editorial message. Additionally, participants holding a pen between their teeth (facilitating the muscles used during smiling) evaluate funny cartoons to be funnier than when holding a pen between their lips (limiting the use of muscles used during smiling; Strack, Martin, and Stepper 1988). Participants also evaluated novel Chinese ideographs more favorably when their arms were flexed versus extended, producing a pulling motion toward oneself versus pushing away, respectively (Cacioppo, Priester, Berntson 1993).

More recent research supporting the concept of embodied cognition has focused on metaphorical transfers of meanings. For example, participants rated hypothetical individ-

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uals more positively on socially warm characteristics when they had previously held a warm (vs. cold) cup of coffee (Williams and Bargh 2008). In an opposite causal direction, participants who felt socially excluded were prone to rate the temperature of the experimental room as colder than those who did not feel socially excluded (Zhong and Leonardelli 2008).

Despite the recent interest in embodied cognition, bodily states are only one of the ways in which cognition is grounded (Barsalou 2008). Mental simulation, or the reenactment of perceptual experiences, is another way in which cognition is grounded and is the focus of the current research. By mental simulation, we are referring to a more automatic form of mental imagery that is initiated by exposure to verbal or visual representations of objects. Specifically, we show that visual depictions of an object (e.g., a mug with the handle on the right or the left) can lead to more (vs. less) embodied mental simulation (picking up the mug and drinking from it) and result in higher (vs. lower) purchase intentions for the object (the mug). Across a series of four studies, we provide support for this primary hypothesis, while additionally explicating the process involved and providing boundary conditions.

In the first set of studies (studies 1a and 1b), we show that visual stimuli that orient the product toward the participant's dominant hand can facilitate simulated interaction with the product depicted, which leads to heightened purchase intentions. In our second study, occupying the perceptual resources required for simulation (by occupying participants' hands) is shown to affect the visual depiction effect. Our third study explores the visual depiction effect for negatively valenced stimuli. Finally, our fourth study examines the mediating role of mental simulation in our hypothesized process.

We begin by establishing the theoretical foundation for our hypothesized effects, with a review of relevant literature on mental simulation, our primary process of interest. Four experiments follow that test these hypotheses. We conclude by addressing specific contributions of the research, as well as by presenting future directions in this area.

LITERATURE REVIEW

The theory of grounded cognition—as related to mental simulation—posits that our initial perceptions of objects, both conscious and nonconscious, are stored in memory and are simulated or played back on subsequent encounters with not only the object itself but also representations of that object, such as verbal and visual depictions. For example, when we eat a chocolate, the brain encodes and integrates all of the different sensory perceptions related to the chocolate (e.g., how it looks, what it feels like when you bite into it, what it tastes like on your tongue). When we later produce knowledge of chocolate, we mentally simulate prior perceptions associated with the chocolate, leading to neural activation of many of the same sensory regions of the brain active during perception (Barsalou 2008). Several neuroimaging studies corroborate this proposition, as conceptual

processing of sensory perceptions leads to neural activation of corresponding regions of the brain. For example, imagining the music of Beethoven leads to activation of the auditory cortex (Zatorre and Halpern 2005), passively reading words like “cinnamon” or “garlic” leads to neural activity in the primary olfactory cortex (González et al. 2006), and viewing images of chocolate chip cookies activates the primary (frontal operculum/insula) and secondary (orbitofrontal cortex; Rolls 2005) taste cortices (Simmons, Martin, and Barsalou 2005).

Motor Simulation

One of the more intriguing consequences of the perception-cognition connection is that what we see visually is used to prepare our motor responses (Jeannerod 2001). That is, we draw on our knowledge of prior interactions to simulate interaction with surrounding stimuli. If the visual depiction affords interaction, our mind gets ready for that action through simulation of our prior experiences. This connection between vision and motor simulation has been explored in both neural and behavioral contexts.

Within the neuroscience literature, this connection between vision and motor response has been examined using several imaging technologies. Chao and Martin (2000) had participants view and name several different images while in an fMRI scanner, and they show that viewing and naming “tools” leads to activation in premotor areas of the brain (whereas it does not for “animals,” “houses,” or “faces,” which have a weaker connection between visual and motor response). Using positron emission tomography (PET), Grèzes and Decety (2002) show similar results. When participants viewed images of objects and determined whether the object was upright or inverted, or silently named the action the object is used for, the researchers found neural activity within the motor areas of the brain. Thus, simply viewing the object led to similar neural activity as using the object.

The conclusions from the neuroscience literature on the connection between vision and motor response have been additionally supported by behavioral research. Tucker and Ellis (1998) showed that participants were quicker to judge the orientation of an object (upright or inverted) if the handle of the object and the hand of response were in alignment. Specifically, if the object's handle was oriented toward the right hand, the right-hand key press was significantly faster than the left-hand key press. The researchers showed that in addition to orientation, object size plays a role in simulated motor response (Tucker and Ellis 2001). In one experiment, participants were instructed to distinguish between a natural versus a manufactured item. Participants responded by pressing one of two buttons—one button was pressed by using the index finger and thumb (precision grasp—such as that used to hold a grape); the other button was pressed by squeezing the three fingers and palm of the hand (power grasp—such as that used to hold a banana). When participants viewed smaller (larger) objects that would be easier to hold with a precision (power) grasp, participants were

quicker to categorize them with the precision (power) grasp. The researchers propose that mental simulation of the motor response leads to this quickened response time in these studies, as the mind is ready for interaction.

In Tucker and Ellis's (1998, 2001) research, participants' motor response mimics (or not) their mental motor response to the stimuli—in the "mimic" condition, response is found to be faster than in the "do-not-mimic" condition. Thus, when participants see an object held with a precision grasp like a grape versus a power-grasp object like a banana, they respond faster to the former when using a precision grasp (mimic condition) and faster to the latter when using a power grasp (mimic condition). When participants see an object oriented toward the right versus the left hand, they respond faster with the right hand (mimic condition).

But, what if the mental simulation has no motor connection with the experimental motor response? Can the mental simulation still affect the measured variable? To carry on with our example of the mug, will the mental simulation of picking up and drinking from a mug with the handle on the right (vs. the left) affect the response a participant gives on a purchase intention scale (note that the motor actions of the participant's response on the scale have no connection with the embodied mental simulation of using the mug)? Further, apart from affecting quickness of response, will mental simulation also affect an actual cognitive response like purchase intention?

In order to answer these questions, we build on the literature we just reviewed and some additional literature. The neuroscience literature we reviewed and also Tucker and Ellis's (1998, 2001) work does suggest that visual stimuli (e.g., products) can result in mental simulation of motor activity (e.g., interacting with the product). Further, the ability to imagine behavioral scenarios has been shown to have a large impact on intentions to perform such behaviors (Anderson 1983; Gregory et al. 1982; Schlosser 2003). Indeed, imagined behavior can influence intentions without directly affecting attitudes (Schlosser 2003). In the former studies, participants were explicitly asked to imagine product interaction behaviors (Anderson 1983; Gregory et al. 1982), or the experimental stimuli varied in the level of actual product interaction (e.g., a Web site that allows object interaction vs. a Web site that does not; Schlosser 2003). As opposed to the more explicit manipulations of product interaction in these former studies, we are focusing on a more subtle form—that of visual depictions of products inducing the embodied mental simulation. We propose that the simulated experience from visual depiction will also affect purchase intentions in a manner similar to actual interaction. Since we anticipate visual depictions to lead to imagined behavior, and not necessarily alter perceptions through an affective route (see also Nowlis and Shiv 2005; Shiv and Nowlis 2004), we focus on the effect of visual depiction on purchase intention.

As such, we propose that:

H1a: Visual stimuli depicting a positively valenced product that facilitate more (vs. less) embodied

mental simulation will result in higher (vs. lower) behavioral intentions.

The visual depiction effect suggests that some visual depictions are more able to allow the observer to mentally simulate picking up and interacting with the product than others, thereby increasing purchase intentions.

Valence of Stimuli

We anticipate greater mental simulation to increase behavioral intentions only when the stimulus is positively valenced. When the stimulus is negative, increasing mental simulation should lead to a decrease in behavioral intentions.

Valence also allows us to disentangle our proposed process from an alternative account of perceptual fluency. Prior research has shown perceptual fluency to have a purely positive effect on a stimulus (Reber, Winkielman, and Schwarz 1998; Winkielman and Cacioppo 2001).

Mental simulation and perceptual fluency, therefore, make similar predictions when the stimulus is positive. However, when the stimulus is negative, the two models make distinct predictions. Simulating a negative experience should be more negative. The availability-valence hypothesis claims that as participants elaborate on a message, additional cues are stored in memory on the basis of the vividness of this information or instructions to imagine (Kisielius and Sternthal 1984, 1986). Should this information be positive, the available information when making evaluations should also be positive; however, the contrast is true when the available information is negative. Hence, for a negative or aversive experience, the ability to mentally simulate the experience should make it more negative. Thus:

H1b: Visual stimuli depicting a negatively valenced product that facilitate more (vs. less) embodied mental simulation will result in lower (vs. higher) behavioral intentions.

Hypotheses 1a and 1b also implicitly assume that:

H2: The amount of embodied mental simulation will mediate the impact of visual product depiction on purchase intentions.

Demonstrating Process—Impeding Mental Simulation by Perceptual Limitations

We examine the impact of occupying perceptual resources on reducing the ability to mentally simulate. The connection between perception and cognition is so direct that they often compete for the same resources. Indeed, recent research has established similar neural activity for perception and imagination (Kosslyn, Ganis, and Thompson 2001; Simmons et al. 2005; Zatorre et al. 1996). This competition for resources has been shown on a behavioral level as well (Unnava, Agarwal, and Haugtvedt 1996).

Recent research also shows that blocking the ability to perceive has consequences on cognition. Rauscher, Krauss,

and Chen (1996) show that restricting the ability to make physical gestures when recounting a scene with spatial dimensions impairs participants' ability to describe the scene. Oberman, Winkielman, and Ramachandran (2007) showed that by activating the facial musculature used during smiling (zygomaticus major), participants were less able to mimic facial expressions and were consequently worse at recognizing happy faces.

More recently, Havas and colleagues (2010) show that similar restrictions on facial activity inhibit related cognitive activity. Participants in the study were Botox patients who received injections in their brow to remove frown lines, effectively paralyzing the musculature used in frowning one's brow. Participants were significantly slower to understand angry and sad sentences after the Botox treatment than before, as they were not able to generate the facial expressions used corresponding to those emotions.

The prior literature suggests that if one occupies physical perceptual resources, it will affect related cognitions. We propose that by occupying the perceptual resources used in motor response, the ability to mentally simulate a motor response will be reduced. Therefore, the effects of visual product depiction on simulated product interaction and hence on purchase intentions will be attenuated when perceptual resources are active. As we will be focusing on motor simulation, we anticipate that occupying the hands in a task while viewing the stimuli will reduce the impact of visual depiction on purchase intentions. We hypothesize that:

H3: Impeding mental simulation by occupying perceptual resources will attenuate the visual depiction effect on behavioral intentions.

Figure 1 shows the complete conceptual framework, as well as a brief overview of the contribution each experiment

makes to the proposed model. Studies 1a and 1b establish the basic visual depiction effect that orienting a product to facilitate embodied mental simulation will affect purchase intentions. This basic effect (hypothesis 1a) is also tested in the other three studies. Study 2 provides support for the proposed mental simulation account by imposing perceptual constraints (testing hypothesis 3). In study 3, we test whether the visual depiction effect will be reversed for negatively valenced stimuli (hypothesis 1b). Finally, in study 4, we provide evidence for our hypothesized process by examining the mediating role of mental simulation (hypothesis 2).

STUDY 1: TESTING THE BASIC VISUAL DEPICTION (GREATER MENTAL SIMULATION) EFFECT

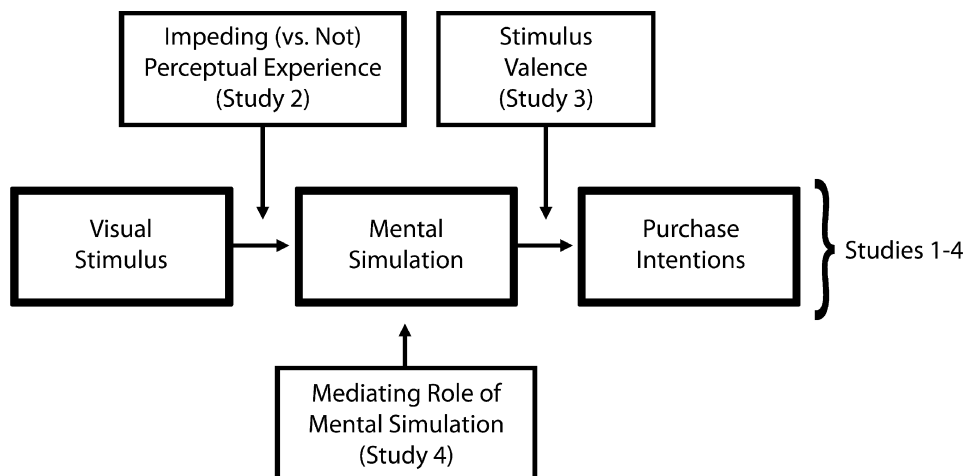
Study 1a: Yogurt

Overview and Method. Study 1a tests our basic hypothesis (hypothesis 1a) that visual stimuli depicting a positively valenced product that facilitate more (vs. less) mental simulation will result in higher (vs. lower) purchase intentions. Our stimuli were images of a bowl of yogurt with a headline reading "Smooth Vanilla Yogurt" (see fig. A1 in the appendix). Two versions of the stimulus feature a spoon on either the right or the left side of the bowl. The inclusion of the spoon was meant to facilitate mental simulation. We created the two versions of the experimental stimuli (spoon on left or right) by simply flipping the image over a vertical axis using photo-manipulation software. We additionally included a control condition wherein the spoon was removed. Thus, in total there were three versions of the stimulus to give us a simple one-factor design with object orientation as the manipulated independent variable.

One hundred and twenty-one participants were recruited

FIGURE 1

CONCEPTUAL FRAMEWORK



to complete the study from an online survey panel. Participants in the survey were told that they would be evaluating products and were then presented with the image of the yogurt bowl. Participants were told to view the image for as long as they desired before proceeding to the questions regarding the product. Our dependent variable was the participants' likelihood of purchasing the yogurt. Specifically, we asked participants, "How likely would you be to purchase this yogurt?" (1 = not at all likely; 7 = very likely). Participants also indicated their gender, as well as their handedness for eating (right or left). After answering the questions, participants were thanked for their time and proceeded to a second, unrelated questionnaire.

Results and Discussion. Handedness of the participants is a key individual difference variable that can affect our results. A match between spoon orientation and handedness (right or left) should facilitate mental simulation more than a mismatch. That is, if the orientation was directed to the right and the participant was right-handed (coded as a match—similarly done for left orientation of spoon and left-handedness), mental simulation should be facilitated. This coding procedure is followed before analysis in all subsequent studies.

Our main hypothesis (hypothesis 1a) is that the orientation of the spoon handle will influence the participants' behavioral (i.e., purchase) intentions. As such, our analysis focused on the participants' stated purchase intentions for the yogurt. We conducted a one-way ANOVA with purchase intentions as the dependent variable and match of orientation as the independent variable. We also included gender as a covariate; however, it was not significant here or in any of the subsequent studies and is not discussed further.

Thirteen percent of the participants were left-handed. We recoded the initial orientation independent variable to represent a match, mismatch, or control condition. We next conducted a one-way ANOVA with orientation as the independent variable and purchase intentions as the dependent variable. This initial omnibus test was significant ($F(2, 118) = 3.43, p < .05$), and we proceeded to explore our planned contrasts. Our initial hypothesis maintains that visual stimuli that facilitate more (vs. less) mental simulation will result in higher (vs. lower) purchase intentions. The first set of planned contrasts explored the difference between the match and the mismatch conditions. As hypothesized, when the spoon orientation matched the participant's dominant hand, purchase intentions were significantly higher than when the orientation did not match ($M_{\text{match}} = 5.76, M_{\text{mismatch}} = 4.70; F(1, 118) = 4.20, p < .05$).

The control condition allows us to gauge whether the match between orientation and handedness increases purchase intentions or whether the mismatch decreased purchase intentions. Additionally, the inclusion of an instrument to facilitate mental simulation allows us to provide support for mental simulation. Should the results follow from a mental simulation account, removing the instrument that facilitates mental simulation should attenuate the impact of initial orientation on purchase intentions. Thus, the match condi-

tion should lead to higher purchase intentions than the control condition. Additionally, there should not be a significant difference between the mismatch and the control conditions, as mental simulation is not facilitated in either. Two planned contrasts supplement the initial findings. In exploring the difference between the match and the control conditions, we find that as predicted, purchase intentions for the yogurt are significantly higher when the orientation of the spoon matches the participant's dominant hand than when the spoon is removed ($M_{\text{match}} = 5.76, M_{\text{control}} = 4.45; F(1, 118) = 6.20, p < .05$). A separate contrast was conducted to explore the difference between the mismatch and the control conditions. As hypothesized, there is no significant difference between the mismatch and the control conditions for the stated purchase intentions ($M_{\text{mismatch}} = 4.70, M_{\text{control}} = 4.45; F(1, 118) = .37, p > .2$).

Posttest. A brief posttest was conducted to identify to what extent the stimuli used in the study facilitated mental simulation. Measures for mental simulation were adapted from prior research on imagery (Bone and Ellen 1992). Eighty-eight participants from an online survey panel completed the posttest. Each participant was randomly assigned into one of the three conditions (ultimately match, mismatch, control) used in the main study. Participants were given instructions to evaluate the item depicted to them as part of a study for a restaurant. After viewing the picture, participants were asked to rate the image on several dimensions related to the mental simulation of eating the yogurt. Specifically, participants were asked to rate the extent to which images of eating the yogurt came to mind (1 = not at all; 9 = to a great extent), the number of images that came to mind (1 = few or no images; 9 = lots of images), and to what extent they could imagine eating the yogurt (1 = not at all; 9 = to a great extent). The mean of these three items was used to form an "embodied mental simulation scale" ($\alpha = .91$). An ANOVA conducted with orientation as the independent variable and the embodied mental simulation scale as the dependent variable revealed a significant difference across the cells ($F(2, 85) = 3.42, p < .05$). As predicted, the match condition led to greater embodied mental simulation than the mismatch condition ($M_{\text{match}} = 6.62, M_{\text{mismatch}} = 5.43; F(1, 85) = 4.93, p < .05$). Similarly, the match condition led to greater embodied mental simulation than the control condition ($M_{\text{match}} = 6.62, M_{\text{mismatch}} = 5.34; F(1, 85) = 5.57, p < .05$). There was no difference in embodied mental simulation between the mismatch and the control conditions ($p > .5$).

Study 1b: Hamburger

Study 1b was designed to replicate the findings from study 1a within a different product category. The stimuli featured a hamburger with a right hand, left hand, or no hand holding it (see fig. A2 in the appendix).

Method and Results. Ninety-five undergraduate students participated in the study in exchange for course credit. The

procedure and measures were identical to those employed in study 1a. As in study 1a, the initial orientation independent variable was recoded as a match, mismatch, or control condition (depending on handedness). A one-way ANOVA with orientation as the independent variable and purchase intentions as the dependent variable revealed a significant difference between the means ($F(2, 92) = 5.20, p < .01$). Planned contrasts show that the match condition led to significantly higher purchase intentions than the mismatch condition ($M_{\text{match}} = 4.63, M_{\text{mismatch}} = 3.06; F(1, 92) = 9.00, p < .01$), replicating the findings from study 1a and providing additional support for hypothesis 1a.

The match condition led to significantly higher purchase intentions than the control condition ($M_{\text{match}} = 4.63, M_{\text{control}} = 3.30; F(1, 92) = 6.55, p < .05$), and there was no significant difference between the mismatch and the control conditions ($M_{\text{mismatch}} = 3.06, M_{\text{control}} = 3.30; F(1, 92) = .22, p > .2$).

Posttest. This posttest was similar to that in study 1a. Fifty-nine participants from an online panel were randomly assigned to each condition from the primary study and evaluated the picture of the hamburger on the extent to which images of eating the hamburger came to mind (1 = not at all; 9 = to a great extent), the number of images of eating the hamburger that came to mind (1 = few or no images; 9 = lots of images), and the extent to which they could imagine eating the hamburger (1 = not at all; 9 = to a great extent; $\alpha = .94$). An ANOVA conducted on the embodied mental simulation scale revealed a significant difference across cells ($F(2, 56) = 3.41, p < .05$). Planned contrasts revealed that more participants in the match condition reported greater mental simulation than those in the mismatch condition ($M_{\text{match}} = 7.00, M_{\text{mismatch}} = 5.67; F(1, 56) = 3.88, p = .05$). Similarly, the match condition led to greater mental simulation than the control condition ($M_{\text{match}} = 7.00, M_{\text{mismatch}} = 5.32; F(1, 56) = 6.15, p < .05$). There was no difference in mental simulation between the mismatch and the control conditions ($p > .5$).

Discussion. The results from studies 1a and 1b are indicative of a mental simulation account. Visual depictions that facilitate more mental simulation lead to higher purchase intentions than those that facilitate less mental simulation. The inclusion of control conditions and posttests provided further support for this proposed process—removing the instrument to facilitate mental simulation (spoon in study 1a and hand in study 1b) had similar consequences on both purchase intentions and embodied mental simulation as orienting the product toward the participant's nondominant hand. Understanding this effect of the instrument to facilitate mental simulation is key, as it helps explain the process for the effect and moves the findings beyond the effect of orientation. It is not “orientation” per se that results in our effects but whether a particular visual depiction (which can be a particular orientation) facilitates mental simulation.

STUDY 2: VISUAL PRODUCT DEPICTION AND SIMULATION BLOCKING (CAKE)

Overview

With study 2, we test hypothesis 3 that impeding mental simulation by occupying perceptual resources will limit the impact of the visual depiction effect on purchase intentions. Support for hypothesis 3 will further back our mental simulation account for the visual depiction effect. Since prior literature has shown that cognition and perception use similar resources (Kosslyn et al. 2001; Oberman et al. 2007; Simmons et al. 2005; Unnava et al. 1996; Zatorre et al. 1996), occupying perceptual resources that correspond to those used in mental simulation should attenuate the effects of visual product depiction on purchase intentions (hypothesis 3). As our operationalization of mental simulation involves motor activity with the hands, occupying participants' hands should attenuate the effects of visual product depiction on purchase intentions.

Method

For this study, we took a food item (cake) and created an advertisement with a fork on either the left or the right side of the plate. The advertisement contained a short headline “Serving Happiness” and an accompanying logo (see fig. A3 in the appendix).

The key manipulation in this experiment was to block mental simulation by engaging participants' perceptual resources or, more specifically, engaging their hands. Importantly, we needed to engage these perceptual resources without participants guessing the hypotheses or becoming overly inquisitive while participating in the study. We selected a physical object for participants to hold in their hand while viewing the advertisement. This item was a spring-loaded clamp used to hold objects together. The clamp was small enough to fit in a participant's hand and did not require excessive strength to open. We selected this object to ensure that participants would be actively engaged in a motor response while viewing the advertisement.

We employ four conditions in which participants' physical resources are active, which we propose will differentially affect the ability to mentally simulate interaction with the depicted product. In the control condition, participants were not required to hold anything in their hands, which simply replicates the procedure from our prior studies. The three remaining conditions require participants to hold a clamp in either their nondominant hand or their dominant hand or to hold a clamp in both hands.

Predictions

Our results to this point suggest that without occupying physical resources, participants simulate with their dominant hand. Thus, a clamp in the nondominant hand should not change the results much, and we predict a replication of the basic visual depiction effects, such that the match condition

should lead to higher purchase intentions than the mismatch condition.

However, when participants hold the clamp in their dominant hand, the ability to simulate with one's dominant hand is blocked. Thus, we should expect an attenuation of the basic visual depiction effect of orientation on purchase intentions. Indeed, it is possible that holding the clamp in one's dominant hand increases simulation with the nondominant hand. Therefore, the mismatch condition in which the fork is orientated toward the participant's nondominant hand may become a temporary match condition and drive a reversal of the basic visual depiction effect.

Finally, when participants are holding a clamp in both hands, we predict that the ability to mentally simulate interaction with either hand is blocked, leading to an attenuation of the difference between match and mismatch conditions.

Three-hundred and twenty-one undergraduate students participated in the study in exchange for course credit. The design of study 3 was a 2 (orientation: match, mismatch) $\times 4$ (simulation block: none, dominant hand, nondominant hand, both hands) between-subjects design. The study was described as examining physical endurance, so as to not unduly surprise participants with our manipulation of holding the clamp. Participants were seated in front of a computer with at least one clamp placed on the left side of the computer. The initial screen presented to participants on the computer instructed them that they would be participating in an experiment exploring the impact of distraction on physical endurance. In all conditions, participants were instructed that they would be viewing a series of advertisements that would advance on their own after 5 seconds. They were to view the advertisements and then answer questions about them, as well as about the physical endurance task.

Per the condition that the participants were in, they were told to pick up the clamp with either their dominant hand or their nondominant hand, pick up one clamp in each hand, or place their hands flat on the desk (no simulation block). To coincide with the physical endurance cover story, participants were additionally instructed to squeeze the clamp such that 1 inch was visible between the tips of the clamps. This action required a modest exertion of effort. Participants viewed four advertisements, which advanced on their own. The target advertisement always came third in the sequence (the other three advertisements were immaterial). After the advertisements, participants were instructed to place the clamps back in their original location and proceed to answer the questions about the advertisements. Participants first answered questions regarding the cake advertised and next answered several questions about themselves, including demographics and individual difference scales. Upon completion of the target questionnaire, participants in the no-simulation-block condition were asked to pick up the clamp and squeeze it until 1 inch was between the tips. Next, all participants answered questions about physical endurance and the difficulty of opening the clamps.

Measures

As in the prior studies, participants first rated the likelihood of purchasing the advertised cake (1 = not at all likely; 9 = very likely). In order to ensure that our simulation block manipulations did not alter participants' affective state in any systematic manner, we also administered the 20-item Positive Affect Negative Affect Scale (PANAS; Watson, Clark, and Tellegen 1988). After completing the scale, participants also reported their handedness and gender. In order for us to maintain the cover story, all participants also answered questions regarding how difficult it was to open the clamps and how tired their hands felt.

Results

We first examined any potential effects of the tasks on affective measures. Separate 2×4 ANOVAs with the positive and negative dimensions of PANAS as dependent variables revealed neither significant main effects nor any significant interactions between orientation and simulation-blocking conditions.

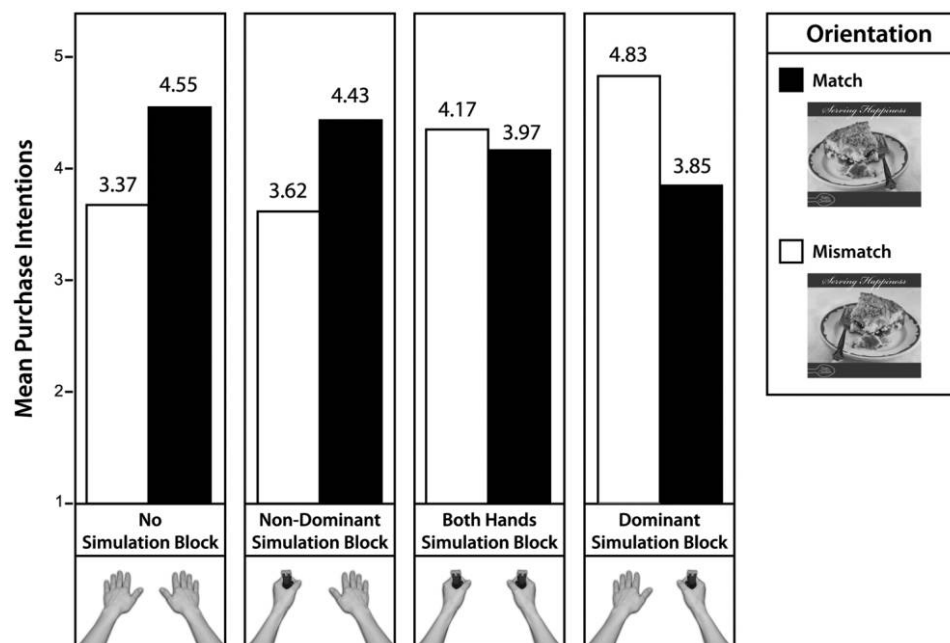
Of the 321 participants, 34 (11%) were left-handed. As in studies 1a and 1b, handedness and (fork) orientation together determined whether participants were in a match or mismatch condition. Our key hypothesis is with regard to the interaction between orientation and simulation blocking on purchase intentions. We initially conducted a 2×4 ANOVA, with orientation and simulation blocking as the independent variables and purchase intentions as the dependent variable. Neither the main effect of orientation nor the main effect of simulation blocking was significant. Importantly, the interaction between the two factors was significant ($F(3, 313) = 4.73, p < .05$). Figure 2 graphically presents the means. Planned follow-up contrasts reveal the predicted pattern of results.

An initial simple effects test within the control condition shows a replication of our prior results, such that a match between orientation and handedness led to significantly higher purchase intentions than a mismatch ($M_{\text{match}} = 4.55, M_{\text{mismatch}} = 3.37; F(1, 313) = 4.88, p < .05$). Within the nondominant simulation-blocking condition, as predicted, the match condition led to significantly higher purchase intentions than the mismatch condition, replicating our prior results ($M_{\text{match}} = 4.43, M_{\text{mismatch}} = 3.62; F(1, 313) = 4.16, p < .05$). This result suggests that simply holding the clamp in one's hand does not block overall mental simulation of motor activity. It may block simulation of the motor activity where the physical resources are occupied (e.g., the nondominant hand), which is explored further in our other blocking condition, as described below.

We find a complete reversal of the basic visual depiction effect in the dominant hand simulation block condition when compared with the no-simulation-block and the nondominant hand conditions. Specifically, we find that purchase intentions for the cake are significantly higher in the mismatch condition than in the match condition ($M_{\text{match}} = 3.85, M_{\text{mismatch}} = 4.83; F(1, 313) = 5.62, p < .05$). These results,

FIGURE 2

MEAN PURCHASE INTENTIONS BY CONDITION—STUDY 2



NOTE.— Images are for a right-handed participant. Color version available as an online enhancement.

although not entirely unexpected, are surprising given their magnitude. The results suggest that when the dominant hand is physically engaged, participants are simulating with their nondominant hand, as it is the hand that is free.

The final simulation block condition is where participants hold one clamp in both hands. The results are supportive of our prediction that there will be no significant difference in purchase intentions between the match and the mismatch orientation conditions ($M_{\text{match}} = 3.97$, $M_{\text{mismatch}} = 4.17$; $F(1, 313) = .20$, $p > .2$).

Posttest

Forty participants from an online panel completed a posttest designed to examine the differential mental simulation elicited by the two versions of the stimuli. Each viewed the advertisement and then rated the extent to which images of using the fork to eat the cake came to mind (1 = not at all; 9 = to a great extent), the number of images of using the fork to eat the cake that came to mind (1 = few or no images; 9 = lots of images), and the extent to which they could imagine using the fork to eat the cake (1 = not at all; 9 = to a great extent; $\alpha = .94$). As predicted, the match condition led to greater embodied mental simulation than the mismatch condition ($M_{\text{match}} = 5.84$, $M_{\text{mismatch}} = 4.22$; $F(1, 38) = 5.29$, $p < .05$).

Discussion

The results from study 2 are largely supportive of our hypotheses 1a and 3. We find support for our process explanation of mental simulation driving the effect of visual product depiction on purchase intention. As perceptual resources are occupied through a physical task, the resources used to mentally simulate the interaction are made less available, affecting the visual depiction effect obtained in earlier studies. Specifically, when participants have their dominant hand available, the corresponding visual product depiction leads to higher purchase intentions; however, when the dominant hand is occupied, the effects are reversed. Additionally, when perceptual resources are occupied for both hands, we see an attenuation of the effects of visual product depiction on purchase intentions. Study 2 provides unique behavioral support for the mental simulation-perception link. In sum, perceptual activity has consequences on mental simulation and ultimately on behavioral intentions.

Study 2 demonstrates the grounded nature of mental simulation, such that perception and cognition are not independent. This connection is shown to have consequences on behavioral intentions. So far, we have focused on positively valenced stimuli. In the next study, we focus on whether facilitation of mental simulation for negatively valenced

stimuli will reduce purchase intention (i.e., we test hypothesis 1b).

STUDY 3: STIMULI VALENCE (SOUP)

Overview

The results of the prior three studies are supportive of a mental simulation process. However, one potential alternative explanation to this point would be that the visual product depiction is simply easier to process or more fluent. Although the findings from study 2, in which the connection between perceptual activity and mental simulation is shown, do much to rule out this perceptual fluency account, study 3 is designed to disentangle the two models further and explicate the process underlying the results obtained thus far. We do this by introducing stimulus valence. Prior research has shown perceptual fluency to have a purely positive effect on a stimulus (Reber et al. 1998), whereas mental simulation may magnify the valence of the stimulus, making a positive stimulus more positive and a negative stimulus more negative (Kisielius and Sternthal 1984, 1986). We created two sets of visual stimuli, one positively valenced and one negatively valenced, with the description of the stimulus making it either positive or negative.

Pretest

The pretest was conducted to ensure that proper manipulations of valence were selected. Sixty-six participants from the same population as the main study were administered the pretest. Participants were told that they would be rating food items on several dimensions. These food items were four different soups (cottage cheese and tomato soup, cottage cheese and ketchup soup, asiago cheese and tomato soup, and cheddar cheese and tomato soup). Attitudes toward the soups were rated on 9-point scales (1 = strongly dislike; 9 = strongly like). Of the four soups, attitudes were lowest for cottage cheese and ketchup soup ($M = 1.89$), next lowest for cottage cheese and tomato soup ($M = 3.50$), and identical for asiago cheese and tomato soup and cheddar cheese and tomato soup ($M = 5.70$). We chose asiago cheese and tomato soup as the positively valenced stimulus. Although cottage cheese and ketchup soup had the lowest overall ratings, we chose cottage cheese and tomato soup for the negatively valenced stimulus to reduce the possibility of floor effects (i.e., the stimulus being too negative). The two sets of stimuli were significantly different on attitudes ($F(1, 65) = 51.45, p < .01$).

Method

The stimuli for study 3 were created by taking an image of a bowl of tomato soup with a spoon on one side and flipping it over a vertical axis to create a mirror image of the soup. Thus, as in study 1a, the spoon was on either the right or the left side of the bowl. To manipulate the valence of the soup, we included a verbal headline for the image,

as well as a short description of the soup. The only difference within the verbal copy was the name of the cheese, with cottage cheese for the negatively valenced stimulus and asiago cheese for the positively valenced stimulus. Versions of the stimuli are contained within the appendix (see fig. A4). The design for study 3 is thus a 2 (orientation: match, mismatch) \times 2 (valence: positive, negative) between-subjects factorial design.

One hundred and fifty-eight participants were recruited to complete the study from an online survey panel. Participants were told that they would be evaluating a proposed food item from a restaurant menu. They were instructed to view the image for as long as they wished before proceeding to answer questions about the soup. Participants next rated their likelihood of purchasing the soup in a manner identical to the prior studies. Finally, participants indicated their handedness and were asked to recall which type of soup they had viewed. Upon completion of the experiment, participants were asked to guess its purpose. No participant showed insight into the experimental hypotheses or manipulations.

Results

Of the 158 participants, 19 (12%) were left-handed. The data were recoded as in the prior studies to represent a match or mismatch between the participant's handedness and orientation of the spoon.

An ANOVA was conducted with orientation and valence as the independent variables and purchase intentions as the dependent variable. A representation of the means is shown in figure 3. The main effect of orientation is not significant ($p > .5$). However, as expected, we do get a main effect of valence ($F(1, 154) = 38.22, p < .001$). An examination of the means shows purchase intentions to be higher for the positively valenced soup than the negatively valenced soup ($M_{\text{positive}} = 5.91, M_{\text{negative}} = 3.52$).

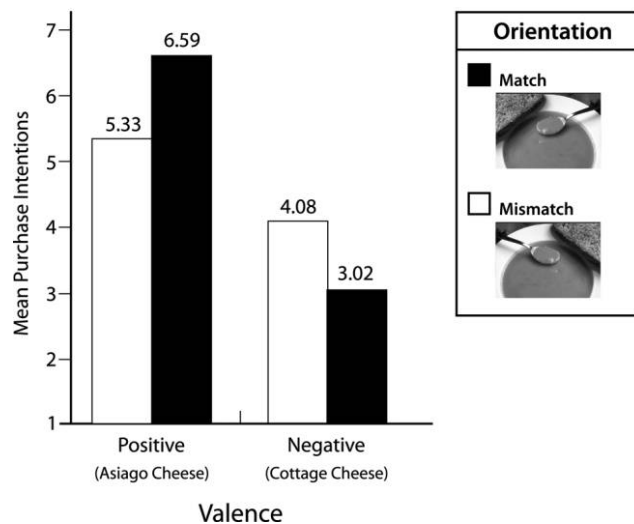
Of greater importance, we also get a significant interaction between orientation and valence on purchase intentions ($F(1, 154) = 8.84, p < .005$). Planned follow-up contrasts reveal that within the positively valenced condition, the match condition leads to significantly higher purchase intentions than the mismatch condition ($M_{\text{match}} = 6.59, M_{\text{mismatch}} = 5.33; F(1, 154) = 4.93, p < .05$). These results represent a replication from the findings of the prior studies, whereby visual stimuli facilitating more (vs. less) mental simulation lead to higher purchase intentions, supporting hypothesis 1a. Per hypothesis 1b, when the stimuli are negatively valenced, we should see a reversal of this effect. Indeed, supportive of hypothesis 1b, we find that within the negatively valenced condition, the match condition leads to significantly lower purchase intentions than the mismatch condition ($M_{\text{match}} = 3.02, M_{\text{mismatch}} = 4.08; F(1, 154) = 3.92, p = .05$).

Posttest

Although our results are supportive of a mental simulation account, we lack empirical evidence that participants indeed simulate more in a match (vs. mismatch) condition, regard-

FIGURE 3

MEAN PURCHASE INTENTIONS BY CONDITION—STUDY 3



NOTE.— Images are for a right-handed participant. Color version available as an online enhancement.

less of valence. We conducted a posttest to make sure that the valence of the stimuli did not affect mental simulation across conditions. Thus, this posttest included an identical design as the actual study using the same stimuli. Specifically, we employed a 2 (orientation: match, mismatch) \times 2 (valence: positive, negative) between-subjects design. Ninety-five participants from an online panel were randomly assigned to view one of four stimuli and then rated the extent to which they could mentally simulate the experience of eating the soup. We again used a three-item scale to measure embodied mental simulation. Participants rated the extent to which images of eating the soup came to mind (1 = not at all; 9 = to a great extent), the number of images of eating the soup that came to mind while viewing the soup (1 = few or no images; 9 = lots of images), and to what extent they could imagine eating the soup (1 = not at all; 9 = to a great extent; $\alpha = .93$).

We conducted an ANOVA with orientation and valence as the independent variables and mental simulation as the dependent variable. Resulting from the analysis is only a main effect of orientation, with the match condition leading to significantly greater mental simulation than the mismatch condition ($M_{\text{match}} = 6.83$, $M_{\text{mismatch}} = 5.28$; $F(1, 91) = 12.84$, $p < .005$). Neither the main effect of valence nor the interaction of orientation and valence is significant. Follow-up contrasts reveal that when the soup was positively valenced, the match condition led to significantly greater mental simulation than the mismatch condition ($M_{\text{match}} = 7.13$, $M_{\text{mismatch}} = 5.31$; $F(1, 91) = 9.17$, $p < .005$). Similarly, when the soup was negatively valenced, the match condition

led to significantly greater mental simulation than the mismatch condition ($M_{\text{match}} = 6.48$, $M_{\text{mismatch}} = 5.25$; $F(1, 91) = 4.16$, $p < .05$). While within the match condition the mean for mental simulation is directionally higher for positive versus negative valence, this difference is not significant ($M_{\text{positive}} = 7.13$, $M_{\text{negative}} = 6.48$; $F(1, 91) = 1.05$, $p > .2$).

Discussion

The findings of study 3 establish boundary conditions to the prior results but, more importantly, help to explicate the process underlying our results. Specifically, the results of study 3 provide further support for our mental simulation account as opposed to purely a fluency account, as fluency would predict an increase in purchase intentions for both the positive and the negative stimuli given a match between orientation and handedness. As simulation of a negative experience is facilitated by visual product depictions, the overall effect is a decrease in purchase intentions with increased mental simulation. While, taken as a whole, the prior studies exhibit strong support for visual depiction facilitating mental simulation, in study 4 we test directly for this process explanation.

STUDY 4: THE PROCESS OF MENTAL SIMULATION (MUG)

Overview and Method

We test the hypothesized process that visual product depiction affects purchase intentions by facilitating embodied mental simulation (as depicted in fig. 1). Unlike the previous studies in which mental simulation was measured in a post-test (with a different set of participants), in this study, we measure mental simulation with the same participants who provide their purchase intention. In addition, we use a multi-item purchase intentions scale.

The stimuli are images of stainless steel mugs with handles. The image of the mug was flipped over a vertical axis to create two versions of the stimulus. In addition to the mug, the stimuli included a logo for a fictitious brand (Terra), as well as a brief amount of verbal copy (“smart. design. life. 100% Quality Materials”; see fig. A5 in the appendix).

Measures

Purchase Intentions Scale. Apart from the purchase intention measure used throughout our studies (“How likely would you be to purchase this mug?”; 1 = not at all likely; 9 = very likely), we used two other measures taken from prior literature (Baker and Churchill 1977; Bone and Ellen 1992). Specifically, we asked participants to respond to the following items: “The next time I purchase a mug, I will buy the advertised mug” (1 = strongly disagree; 9 = strongly agree); “How likely would you be to actively seek out this mug in a store to purchase it?” (1 = not at all

likely; 9 = very likely). These three items were combined to form a scale measuring purchase intentions ($\alpha = .88$).

Attitude toward the Product. As an additional evaluative measure for the product, we capture overall attitudes toward the mug using three items (1 = bad/dislike/unpleasant; 9 = good/like/pleasant; $\alpha = .93$; Mitchell and Olson 1981). In our prior studies, we have focused on purchase intentions alone as extant literature has exhibited a strong connection between imagined behavior and behavioral intentions (Anderson 1983; Gregory et al. 1982; Schlosser 2003). Also, as stated earlier, imagined behavior can influence intentions without directly affecting attitudes (Schlosser 2003). As such, we do not necessarily expect differences in attitudes toward the product between conditions, but we measure it nonetheless in this study.

Embodied Mental Simulation. We used the same three measures as those we used in the preceding posttests to measure mental simulation: “As you viewed the ad, to what extent did images of using the mug come to mind (for example, picking it up, holding it in your hand, etc)?” (1 = not at all; 9 = to a great extent); “While viewing the ad, I experienced:” (1 = few or no images of using the mug; 9 = a lot of images of using the mug); “To what extent while viewing the ad could you imagine using the mug?” (1 = not at all; 9 = to a great extent). We combined these measures to form a scale for mental simulation ($\alpha = .86$).

Ease of Mental Simulation. While we have hypothesized that the “amount” of mental simulation will be affected by visual depiction, we additionally measure “ease of mental simulation” and test whether ease of mental simulation could also drive our results. We employed three additional measures to capture the ease of simulating using the mug: how difficult or easy the images of using the mug were to create (1 = extremely difficult; 9 = extremely easy), how quickly they formed these images (1 = not at all quickly; 9 = very quickly), and the extent to which they agreed with the statement “I had no difficulty imagining using the mug in my mind” (1 = strongly disagree; 9 = strongly agree). These three measures were combined to form an ease of simulation scale ($\alpha = .83$).

Design and Procedure

Study 4 uses a one-factor design. Seventy-eight participants from an online panel completed the study in exchange for monetary compensation. The procedure for study 4 closely followed that employed in the prior studies. Participants were told the purpose of the study was to evaluate a potential new product from a household item product line. Participants were randomly assigned to view the mug in one of two orientations. They were told to view the advertisement for as long as they wished before proceeding to the questionnaire, which contained our measures for purchase intentions, attitudes toward the mug, amount of mental simulation generated, and the ease of generating mental simulation. As in our prior studies, we also captured handedness.

Results

Before analysis, we recoded the initial orientation of the product to represent a match or mismatch with the participant's dominant hand (9% left-handed). An ANOVA with orientation as the independent variable and our purchase intentions scale as the dependent variable revealed significantly higher purchase intentions in the match versus mismatch conditions ($M_{\text{match}} = 4.79$, $M_{\text{mismatch}} = 3.44$; $F(1, 76) = 14.47$, $p < .001$). We next examined the impact of orientation on attitudes toward the mug and found no significant difference between the match and the mismatch conditions ($M_{\text{match}} = 6.21$, $M_{\text{mismatch}} = 5.85$; $F(1, 76) = 1.16$, $p > .2$). Finally, we examined the impact of orientation on the amount and ease of mental simulation. Although directionally the mismatch condition led to greater ease of mental simulation, these differences were only marginally significant ($M_{\text{match}} = 6.26$, $M_{\text{mismatch}} = 5.53$; $F(1, 76) = 3.20$, $p = .08$). However, as predicted, participants in the match condition did report greater mental simulation than those in the mismatch condition ($M_{\text{match}} = 4.97$, $M_{\text{mismatch}} = 4.04$; $F(1, 76) = 4.87$, $p < .05$).

We next examine whether the amount of mental simulation mediates the impact of visual depiction on purchase intentions. Analyses conducted through Preacher and Hayes's (2008) macro with bootstrapped samples (5,000) indicate complementary mediation (Zhao, Lynch, and Chen 2010), supporting hypothesis 2. Controlling for orientation, mental simulation had a significant and positive effect on purchase intentions ($\beta = .30$, $t(76) = 3.38$, $p < .005$). The total effect of orientation on purchase intentions was also significant ($\beta = 1.34$, $t(76) = 3.80$, $p < .001$), as reported earlier. The indirect path of the effects of orientation on purchase intentions through mental simulation was also significant, with the 95% confidence interval excluding zero (.0349–.7191).

GENERAL DISCUSSION

Recent models of cognition suggest a considerable amount of overlap between perceptual and imagined activity, as it relates to the senses (Barsalou 1999, 2008; Gibbs 2006; Wilson 2002). A primary objective of this article is to extend this research by examining the interplay between cognition and perception as it relates to visual product depiction. We propose and show that the way a product is visually depicted can facilitate mental simulation, with significant behavioral consequences. Specifically, we show that even the subtle manipulation of orienting an object toward a participant's dominant hand leads to heightened purchase intentions. We claim that this effect is due to the facilitation of mental simulation of interacting with the object.

Four experiments support our claim that visual product depictions can facilitate mental simulation, with consequences on consumers' purchase intention. Studies 1a and 1b demonstrate the basic visual depiction effect across two different categories—simply altering the direction of a spoon or hand affects purchase intentions. As the control condition is not significantly different from the mismatch

condition, the results from studies 1a and 1b show that a match between orientation of the product and the individual's dominant hand increases purchase intentions (as opposed to a mismatch condition decreasing purchase intentions).

The results from study 2 explicate the process by exhibiting the connection between impeding perceptual activity and mental simulation. Specifically, we had four conditions in which perceptual resources were differentially engaged, including conditions in which participants held a clamp in their dominant hand, nondominant hand, or both hands or did not hold a clamp. When the clamp was held in the participant's nondominant hand, a match between visual product depiction and handedness led to higher purchase intentions than a mismatch. Intriguingly, when the clamp was held in the participant's dominant hand, we obtain the reverse effects, such that a mismatch between visual product depiction and handedness led to significantly higher purchase intentions than a match. Finally, we anticipated and found that occupying the perceptual resources of both hands attenuated the overall impact of visual product depiction on purchase intentions. These results contribute to the behavioral literature exploring the connection between cognition and sensory perception.

Should mental simulation underlie our results, a negative experience should become more aversive. Study 3 results are consistent with this logic. Study 3 also provides additional evidence that fluency does not fully explain our results. If fluency underlies our results, a negative experience should become more positive, as perceptual fluency has a hedonically positive effect, irrespective of stimuli valence.

Finally, in study 4 we provide evidence for the underlying process involved and receive support for our mental simulation account. Visual depictions indeed facilitate mental simulation. This simulated experience with the stimulus ultimately leads to increased purchase intentions. This process is supported through mediation and creates intriguing avenues for future research on the construct of embodied mental simulation.

Managerial implications of this research follow directly from our results. In several of the studies, we have used advertisements as the primary stimuli. Our results suggest that advertisers can increase purchase intentions by facilitating mental simulation through their visual depictions of the product. One way to do this is by simply orienting the product (e.g., a cup with a handle) toward the right. While this may alienate a small percentage of left-handed individuals, the impact on right-handed individuals should overwhelm this effect.

These results are also informative for shelf display in retail environments. For example, a very slight change in display of the mugs at the front of a coffee shop may have a significant impact on purchases, as consumers simulate grasping them to a greater extent. Including an instrument that facilitates mental simulation should have similar consequences on purchase intentions as orienting the visual depiction. As shown in studies 1a and 1b, the lack of an

instrument that facilitates mental simulation (e.g., spoon) reduces the impact of the visual depiction on purchase intentions. Examples of other instruments to facilitate mental simulation include handles on products like bottles, mugs, and containers, or even hands interacting with the product. These consequences of visual depiction affect not just advertising but product packaging as well, and designers should focus on incorporating these instruments of simulation in the outer package design. Replications of our effects with actual purchase data in a retail environment would serve to increase the generalizability of our findings, although the current set of studies is directly applicable to online shopping.

Our manipulations of visual depiction to facilitate mental simulation all involved the concept of handedness and motor simulation. The fact that this operationalization is limited to instances in which the product can interact with one's hands limits the application of this research. We chose this manipulation due to prior literature showing the effects of visual depiction on motor simulation (Tucker and Ellis 1998, 2001). Intriguingly, however, this is most assuredly not the only way of facilitating mental simulation. Indeed, many other visual depictions can encourage mental simulation. For example, positioning a pair of warm, fuzzy slippers with the openings toward (vs. away from) the consumer should facilitate mental simulation of interacting with the slippers with one's feet. Similarly, having the bottle top off of a soda, opening the driver's door in a car advertisement, or folding down the sheets on the side of a bed positioned toward the consumer are all very subtle ways of facilitating consumer mental simulation. Importantly, these other manipulations would move beyond handedness of the individual and be more broadly applicable in practice.

There are several specific extensions of the current research that would provide valuable insight. Our findings on valence and mental simulation show the negative consequences of imagining certain actions. However, prior literature has also shown an increase in actual behavior of a seemingly negative experience (donating blood) when imagined (Anderson 1983). Further delineation of the boundaries of when valence reduces intentions is needed. Additionally, future research should examine the connection between perception and cognition as it relates to mental simulation. We chose to impede mental simulation of motor activity by having participants hold a clamp in their hand; however, the ability to mentally simulate consumption of food may have also been inhibited by having participants eat something while viewing the advertisement (e.g., chewing gum). Actual sensory experiences in general may alter both the ability to mentally simulate as well as the type of mental simulation generated. While in this article we focus on the amount of mental simulation that the visual depiction affords, a remaining question is the type of mental simulation that consumers engage in. Our manipulations were designed to elicit motor simulation, but additional sensory experiences could also be simulated through visual depiction, such as imagining olfaction, audition, taste, and even haptic experiences.

Furthermore, while in our studies, we measure mental simulation as a function of visual depiction, we have not measured mental simulation in the blocking conditions of study 2 (but have inferred it from purchase intention)—future research should also test directly the extent of mental simulation that prevails in these conditions.

While significant strides have been made in explicating the consequences of deliberate imagery on consumer behavior (for a review, see Petrova and Cialdini 2008), the more automatic form of mental simulation warrants further attention. We propose that the operative process in our studies is automatic mental simulation. Contrasting this form of mental simulation with more deliberate forms of imagery would provide a greater understanding of when and how consumers imagine product interaction and what the ultimate consequences from these images are.

Another theoretical avenue to pursue is the interplay between simulated experience and direct product experience. Prior literature within sensory experience and consumer psy-

chology has shown that sensory experiences can be altered through cognitions generated both before (Allison and Uhl 1964; Elder and Krishna 2010; Hoegg and Alba 2007; Lee, Frederick, and Ariely 2006; Levin and Gaeth 1988) and after (Braun 1999) exposure to the stimuli. However, the prior literature has explored this connection at a deliberate level, with the information coming from external sources. Within the current context, mental simulations occur due to more automatic processes stemming from an individual's own prior experience. Future research could determine to what extent mental simulations are connected to individual direct product experiences or to an aggregation of prior experiences. When are specific experiences more likely to be simulated? Do these simulations then alter the actual perceptual experience in ways similar to externally generated cognitions? The close connection between actual and simulated product experience provides rich avenues for future research. Much research remains to be done on mental simulation within the realm of consumer behavior.

APPENDIX

FIGURE A1

STIMULI USED IN STUDY 1A



NOTE.—Color version available as an online enhancement.

FIGURE A2

STIMULI USED IN STUDY 1B



NOTE.—Color version available as an online enhancement.

FIGURE A3

STIMULI USED IN STUDY 2



NOTE.—Color version available as an online enhancement.

FIGURE A4

STIMULI USED IN STUDY 3



NOTE.—Color version available as an online enhancement.

FIGURE A5

STIMULI USED IN STUDY 4



NOTE.—Color version available as an online enhancement.

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