COGNITION AND SENSORY PERCEPTION: THE EFFECTS OF ADVERTISING AND MENTAL SIMULATION ON THE PERCEPTUAL CONSUMPTION EXPERIENCE

by

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DEDICATION

This dissertation is dedicated to Elizabeth, Collin, Ashlyn, and Shaylee. Thank you for providing me the inspiration, motivation, and support to get through this stage of our journey together.

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CHAPTER 1

INTRODUCTION

As firms continue to strive for a competitive advantage in a largely commoditized marketplace, it has become increasingly important to understand the role that the senses play in shaping consumer behavior. While vision has historically captivated the attention of researchers, emerging work focuses on the senses of smell, touch, taste, and sound. Within my dissertation, I focus on the interplay of cognition and sensory perception, addressing the impact of advertising on the sensory experience (Essay 1: "The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste"), as well as how incorporating sensations within the advertisement can influence consumer behavior (Essay 2: "Mental Simulation and the 'Visual Depiction Effect': When Visual Stimuli Facilitate Sensory Experience").

I build from recent models of cognition which state that our perceptual experiences are utilized to form our cognitions. One key component of these cognitive models is that our initial perceptions, both conscious and nonconscious, are stored in memory and are simulated or played back upon subsequent encounters with not only the object itself, but also representations of that object, such as verbal and visual depictions. In my first essay, I focus on the deliberate consequence of including verbal perceptual

information in advertising on the consumption experience. More specifically, I show that advertisements that verbally depict multiple sensory experiences lead to better taste perceptions than advertisements that verbally depict only the taste sensory experience. In my second essay, I address the impact of vision on mental simulation of interacting with products, and consequent purchase intentions stemming from this mental simulation. Specifically, I show that way in which an object or product is visually depicted can facilitate mental simulation and thereby affect purchase intentions.

The first part of my dissertation explores the ability of advertisements to elicit sensory related cognitions and ultimately affect sensory experience. I chose taste as the sensation of interest due to its multisensory nature, and therefore was exploring the impact of advertising on taste. Taste (or flavor) is comprised of inputs not only from the tongue, but from the other four senses as well (i.e., smell, sound, vision, touch). Across a series of three studies, I test whether advertisements incorporating these additional sensory experiences through verbal copy can lead to higher taste perceptions than advertisements focusing on purely taste sensations. Indeed, I find that the multisensory ads lead to more positive sensory thoughts during a consumption experience and ultimately result in higher evaluated taste of the products (studies 1 and 2). Since the effect of the advertisement is driven by differences in the cognitions generated, I show that inhibiting the ability to think by imposing cognitive load (requiring participants to memorize unrelated information during the presentation of the advertisements) reduces the effects of the multisensory advertisement on taste perceptions (study 3). The results of my studies exhibit that sensations are generated both from the perceptual properties of the stimulus (e.g., the food item), as well as from external information. Furthermore, the

studies show that advertising can have a significant impact not only on pre-purchase attitudes and purchase intentions, but also on the consumption experience itself.

The second part of my dissertation focuses on the effects of visual product depictions within advertising to encourage mental simulation or interaction with the product. A recent body of literature within cognitive psychology holds that all thoughts are derived from the perceptual experiences we have with objects, with bodily states and mental simulations driving the creation of our cognitions. This research presents several testable hypotheses. If our brains mentally simulate interacting with products simply upon perception of the object (e.g., in visual form), then this simulated interaction should have similar consequences as actual interaction, specifically leading to higher purchase intentions when the simulation is facilitated. Across four studies I find that simply altering the way in which a product is depicted can lead to differences in behavioral intentions (studies 1-4). Additionally, due to the close link between cognition and perception and the resources each utilizes, I propose and show that blocking the ability to perceive inhibits the ability to mentally simulate this interaction with the product depicted. Indeed, I show that the effects of visual stimuli facilitating mental simulation are not only attenuated when the resources used for simulation are blocked, but can actually be reversed (study 2). In an additional study (study 3), I posit and find this simulation to be operative at a more automatic level than deliberate imagery, with differential consequences resulting from directions to imagine. Finally, I find that the effects of mental simulation are not globally positive, with negative consequences stemming from the simulation of aversive stimuli.

With my dissertation I contribute to the growing literature within cognitive psychology, and to an increasing extent, consumer behavior, examining the interplay between cognition and perception. I provide unique behavioral evidence for this connection both at a deliberate (essay 1) and more automatic (essay2) level. My contribution should facilitate additional exploration of this promising field.

I begin my dissertation by presenting my first essay: “The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste.” Following this essay I move to my second essay: “Mental Simulation and the “Visual Depiction Effect”: When Visual Stimuli Facilitate Sensory Experience.” I end with a brief conclusion which places my contributions in a broader context and discusses the scope of my research.

CHAPTER 2

The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste

Food advertising is big business. Kraft Foods spent $1.5 billion in 2007 on advertising in the U.S. alone, whereas PepsiCo spent $1.31 billion, and McDonalds spent $1.14 billion (Advertising Age Data Center). The financial importance of this domain begs the question, how should one advertise for food? A quick glance at current ads shows the obvious: mention the taste of the food. This is expected since the ad is for food after all. The less obvious and consequently seldom used solution is to bring attention to the unique multisensory aspects of taste perception. In this research we suggest how and why multisensory advertising for food ads can enhance taste perceptions.

In this article we explore whether other senses are so physiologically closely tied to taste that mentioning them will make no difference, and whether an ad in general can impact taste perceptions. By exploring if the ad can affect taste itself, we test an additional possible effect of the ad. While food advertising is typically used to spark interest in the food or an intention to buy it, it is not usually used for affecting taste perception. Further, if the ad does affect taste, then we are also suggesting that taste is affected by cognition and is not automatically incorporated into perceptions. Besides looking at the effect of ads on taste perception, we additionally explore what happens to

consumers' thoughts about the food (how they change) when the ad is changed. We also examine if these thoughts drive the change in taste perception.

This research has both theoretical and substantive implications. First, we show that ads can affect sensory perceptions, and that sensory thoughts mediate the effect of ads on perception. More specifically, we show that ads mentioning senses other than taste can increase positive sensory thoughts about the food and consequently taste. Second, we show that the processing of ads is deliberate and cognitive so that the enhancing effect of multiple-sense ads is reduced when cognitive resources are constrained. Our hypotheses are supported across three experiments.

Our research has many practical implications for ad executives and managers since it can easily and readily be applied in directing ad copy for food products. In the rest of the article, we build our conceptual framework and hypotheses, elaborate on the experiments, and end with conclusions and ideas for future research.

Literature Review and Hypotheses

One of the main focal points of this article is to explore the interaction of cognition and sensory perception, and in particular, taste. Taste is a curiously unique sensation, as it is comprised not only of one sensory input (i.e., from the tongue), but is also created by incorporating multiple sensory inputs. As such, taste is suggestible and ambiguous. We propose that in addition to a reliance on intrinsic cues from the food itself, taste is susceptible to extrinsic cues such as advertising.

We begin our literature review with a brief overview of the neuroscience and physiology literature addressing the intrinsic, multisensory composition of taste. We then focus on the more critical dimension of taste perception to our research: the impact of extrinsic cues such as advertising.

Effect of Intrinsic Cues on Taste Perception—What is Taste Perception?

When we think of taste perception, we immediately think of sensations on the tongue. However, despite our seemingly constant exposure to food, we have remarkable difficulty in discerning one taste from another with just our taste buds. Part of this ineptitude stems from the limited number of distinct tastes that we can detect. Until recently, our taste buds were known to detect only sweet, sour, salty, and bitter tastes. A new taste, umami, discovered in 1909 (Ikeda 2002), only recently received neurophysiological support for its existence as a distinct taste receptor (Chaudhari, Landin, and Roper 2000). Unfortunately, even with the addition of this fifth taste, it is still difficult to accurately judge the complex sensation of taste. However, taste is not physiologically comprised of sensations from taste buds only, but also relies heavily on input from the other senses.

Imagine eating a handful of popcorn. It is impossible to simply focus on the sensations of your tongue. Don't the mouth-watering smell of the butter, the feel of the popcorn in your hands and mouth, the popcorn's warmth, the way it sounds when you chew it, as well as its visual appearance, all lead to an overall multisensory taste experience? The fact that every sense has some role in generating taste has, in fact,

recently received neurophysiological support (Rolls 2005; Small and Jones-Gotman 2001). Rolls (2005) shows that the pure effects of gustatory stimuli are represented in the primary taste cortex (frontal operculum/insula), whereas the convergence of multiple sensory inputs used to represent taste occurs in part of the orbitofrontal cortex, referred to as the secondary taste cortex (Rolls 2005).

The primary accompanying sense for taste is olfaction, or how the food smells (Small and Prescott 2005). In fact, smell impacts taste both before (orthonasal) and after (retronasal) food enters our mouth (Rozin 1982). Smell plays such an integral role in taste perception that without it, it is difficult to distinguish a potato from an apple, or wine from apple juice (Herz 2007). The intrinsic visual appearance of the food also contributes to the sense of taste in generating expectations and perceptions of flavor (Dubose, Cardello, and Maller 1980) and can ultimately dominate gustatory cues altogether (Hoegg and Alba 2007). The sound the food makes when bitten plays a key role in taste perceptions for certain food items (e.g., potato chips, celery, crackers), impacting perceived freshness as well as quality (Zampini and Spence 2004). Relatedly, the texture (de Araujo and Rolls 2004) and temperature of food can affect taste. Recent research has shown that temperature sensations on the tongue are directly related to taste. Specifically, warming the tongue elicits sweet and bitter tastes, whereas cooling the tongue leads to sour and salty taste perceptions (Cruz and Green 2000).

It is thus evident from the physiology and neuroscience literature that taste is derived from multiple intrinsic sensory components, including smell, vision, sound, and touch (including texture and temperature). However, the automaticity of these inputs is largely unexplored, leaving the question as to whether or not advertising incorporating

these cues will impact taste perceptions. This question addresses the automaticity of intrinsic cues, as well as the general impact of extrinsic cues, such as advertising, on taste perceptions. We next focus on relevant literature within consumer behavior and psychology addressing the impact of extrinsic cues on taste perceptions, and formally present our hypotheses.

Effect of Extrinsic Cues on Taste Perception

Let us distinguish first between a more deliberate top-down process for taste perception versus a more automatic bottom-up process. Top-down processing holds that external information provided about the food is processed more deliberately, and that it affects taste perception in a cognitive manner, whereas bottom-up processing would suggest that information about the food is processed more automatically and heuristically, driven by inherent aspects of the stimulus such as the intrinsic cues discussed earlier (Smith and Kosslyn 2007). Sometimes it is questionable which process is working. Also, both processes may operate simultaneously and interact with one another. One instance where top-down processes have a large impact on perceptions is with ambiguous or suggestible experiences (Hoch and Ha 1986). Within the present context, the ambiguity of a taste experience would then lead to more susceptibility to, and increased utilization of external influences in forming overall taste perceptions. We look at such outside influences both in more bottom-up and more top-down processing contexts.

Research examining more automatic, bottom-up processing effects in taste perceptions includes Raghunathan, Naylor, and Hoyer (2006) which examines the effect

of labeling a food item as either healthy or unhealthy. The authors receive support for an unhealthy equals tasty intuition that consumers hold, whereby food categorized as unhealthy results in higher taste perceptions than food categorized as healthy. They provide support for an automatic, bottom-up process by showing that in an implicit association test (IAT), individuals are quicker to categorize unhealthy (vs. healthy) foods as tasty. Krishna and Morrin (2008) demonstrate the automatic effect of another extrinsic cue, product haptics, on taste perception. In multiple experiments, they show that the haptic quality of glasses from which water and other drinks are consumed can affect taste perception. They argue that the haptic effect on taste is automatic and that more deliberate processing would make people realize that the containers are non-diagnostic for taste and should not affect their perception. Thus, even extrinsic cues can operate in a more automatic manner in influencing taste perceptions.

Moving to more controlled top-down processing, which is the proposed mechanism for the effects in the present research, Allison and Uhl (1964) explore the impact of brand name on subsequent taste preferences. The authors administer a blind taste test of beers (by removing identifying labels) to experienced beer drinkers and find that participants cannot correctly discriminate between the beers. However, when the beers are labeled, the participants rate their favorite beer higher than the others. This would be considered top-down deliberate processing with people linking their preferred brand name with the better tasting beer. Lee, Frederick, and Ariely (2006) additionally show that such extrinsic cues not only alter preferences among beers, but can change one's taste experience altogether. In their studies, the stated ingredients (whether the beer had balsamic vinegar or not) affect the taste experience. Levin and Gaeth (1988) show

that the specific verbalization of fat amount in meat (e.g., 75% lean or 25% fat) affects the perceived leanness and taste of the meat. Recently, Hoegg and Alba (2007) show the impact of several extrinsic cues for orange juice, including brand name, price, and region of origin on taste discrimination and taste preference. Their findings include a national brand receiving better taste evaluations than a store brand, and differences in the color of orange juice leading to greater perceived taste differences than differences in brand labels. This could again be top-down processing with people expecting, for instance, that a national brand uses better oranges and should have better orange juice.

Top-down deliberate processing of ads, with the ad content affecting initial perceptions, has been shown in prior research comparing verbal and visual ads. Famously, Mitchell and Olson (1981) show that a verbal ad (Brand I Facial tissues are soft) results in the tissues being perceived to be less soft than a visual ad (picture of a kitten). Edell and Staelin (1983, 46) suggest that the verbal message of the ad is processed more cognitively and can guide the processing of the picture contained within the ad. Our research contributes to prior research on the impact of cognitions on consumer behavior, in that we are subjecting participants to an actual consumption experience where they will evaluate a sensation. In prior research such as Mitchell and Olson (1981) and Edell and Staelin (1983), subjects simply judged the product by looking at the ad. Nonetheless, this research suggests that the content of ads can be processed cognitively and could affect taste perception by framing the overall experience.

Prior research also demonstrates that the ad can guide the types of thoughts generated. Using verbal protocols, Edell and Staelin (1983) find that an objective ad (e.g., a car is 4 wheel drive) results in fewer support arguments and more counterarguments

than a subjective ad (car drives well on snow). For food ads, a multiple-sense ad should direct sensory thoughts which can be about all five senses to be more positive compared to the single-sense ad which focuses on taste alone. The ad can explicitly mention the niceties of all five senses. However, even if it does not—for instance, if we consider just an ad slogan like "taste is all 5 senses"—the mere fact that the ad is mentioning all five senses is suggestive that the food rates high on all five senses; therefore the ad should direct thoughts for all sensory modalities to be positive.

The literature presented on the effect of extrinsic cues on taste perception should work in concert with the literature on the physiological composition of taste. We propose that the cognitions generated by an extrinsic cue, such as an ad, will impact sensations and ultimately affect taste perceptions. As taste is composed of all five senses, thoughts about all five senses should affect taste. Ads mentioning all five senses would be more likely to direct thoughts about these senses to be positive compared to ads which talk about taste alone. Additionally, perceived taste should be better the more positive sensory thoughts one has, and be worse the more negative sensory thoughts one has. Hence, the surplus of positive over negative thoughts should drive taste perception.

With the effects depending largely on thought generation and cognition, we anticipate the availability of cognitive resources to impact the ad taste effects. Specifically, with top-down or largely cognitive processing, the introduction of cognitive load should distract attention away from the ad (Nowlis and Shiv 2005; Shiv and Nowlis 2004) and attenuate the effect that the ad has on taste perceptions.

More formally, we propose that:

H1: Perceived taste for food will be better with ads that mention multiple senses (multiple-sense ads) compared to ads that mention taste alone (single-sense ads).

H2a: There will be more positive sensory thoughts with a multiple- versus a single-sense ad.

H2b: The number of positive minus negative sensory thoughts will mediate the effect of ad on perceived taste.

H3: Cognitive load will reduce the effect of a multiple-sense versus single-sense ad on the number of positive thoughts for food and on taste perceptions.

[Insert Figure 2.1 about Here]

Figure 2.1 represents the conceptual framework supported across our studies. We test our set of hypotheses in a series of three experiments, using different foods as stimuli (chewing gum, potato chips, and popcorn) to test for the robustness of our results.

Study 1: Ad Slogan, Sensory Thoughts, and Taste

In this study, we test if multiple-sense ads result in higher perceived taste compared to single-sense ads (hypothesis 1), more positive thoughts compared to single-sense ads (hypothesis 2a), and if sensory thoughts mediate the effect of ads on perceived taste (hypothesis 2b). In order to conduct a strong initial test of our process, we use very

simple ad slogans, with one focusing explicitly on taste ("Long Lasting Flavor") and the other on the general sensory experience ("Stimulate Your Senses"). We posit that even at this very general level, drawing attention to sensory experiences beyond taste will result in more sensory thoughts, and consequently better taste perceptions.

Method

Pre-test. Pre-tests were conducted with 27 participants recruited from a business school lounge. Each participant filled out a brief questionnaire which contained one of two ad slogans. One questionnaire contained the multiple-sense slogan (*Stimulate Your Senses*), whereas the other contained the single-sense slogan (*Long Lasting Flavor*). Participants were asked to give their overall evaluations of the slogans on three separate dimensions (1 to 7 scales anchored at 1=bad/unfavorable/dislike, and 7=good/favorable/like). These three items were combined to form the attitude toward the ad scale (α = .94; Mitchell and Olson 1981). We then compared the means of the scale for both slogans and found no significant difference (M_{multiple} = 4.90, n = 13, M_{single} = 4.73, n = 14), (p > .5). It should also be noted that the number of words in the multiple- and single-sense slogans were intentionally kept the same.

Design and Procedure. Fifty-four undergraduates participated in groups with a maximum size of 10 in exchange for course credit. Each participant was randomly assigned to one of the two conditions (single-sense ad or multiple-sense ad), placed in front of a folder, and presented with a cover sheet with the following instructions:

A food distributor has recently created a new line of chewing gum which is being test marketed in several areas across the country. You will have the opportunity of trying this gum today. Below is the tagline for the gum:

Participants then read one of the two slogans and were told to ask the experimenter for the piece of gum when done reading. The gum was the peppermint flavor of Wrigley's Extra brand, served to the participants on a plate with the packaging removed. Before turning the page to answer the questions, participants were instructed to chew the gum. Then, while chewing, participants were asked to write down any thoughts that came to their mind. Note that the multiple-sense slogan did not list any specific senses that would be readily available to participants when listing their thoughts. Following the thought listing section, participants rated the taste of the gum on a seven-point scale (1=very poor taste, 7=very good taste). Upon completion of the questionnaire, participants were given a debriefing report and were dismissed.

Results and Discussion

Results. An ANOVA on taste perceptions revealed the hypothesized effect of single- versus multiple-sense slogans on perceived taste ($M_{multiple} = 5.39$, $M_{single} = 4.77$), ($F(1, 52) = 6.60$, $p < .05$), with the slogan, "Stimulate Your Senses" leading to higher taste perceptions than "Long Lasting Flavor." This result provides support for hypothesis 1, whereby multiple-sense advertising leads to higher taste perceptions than single-sense advertising.

Participants' thoughts were coded for valence as positive (e.g., "It's good and flavorful"), negative (e.g., "I don't really like the flavor"), and neutral (e.g., "It's minty"). The thoughts were further coded by content as being primarily sensory (e.g., "I like the texture"), brand-related (e.g., "I prefer Orbit gum"), or slogan related (e.g., "Not very stimulating"). Thoughts were rated by two independent coders and inter-coder reliability was 91.3%; disagreements were resolved through discussion. Table 1 presents the average number of thoughts by condition.

[Insert Table 2.1 about here]

Participants listed a few thoughts on the slogan (.04 per subject for both single- and multiple-sense ads), and the brand (0.19 and 0.18 per subject for the single- and multiple-sense slogans, respectively), but the vast majority of listed thoughts were sensory in nature (1.81 and 2.64, for the single- and multiple-sense slogans, respectively). The mean number of total sensory thoughts was significantly higher for the multiple-sense slogan (M = 2.64*)* than for the single-sense slogan (M = 1.81), ($F(1, 52) = 5.66$, $p < .05$). Within the total sensory thoughts, there were also more positive thoughts in the multiple-sense condition than in the single-sense condition ($M_{multiple} = 1.82$, $M_{single} = .92$), ($F(1, 52) = 7.65$, $p < .01$), supporting hypothesis 2a. Proportionally, most of the sensory thoughts were positive, and there was a significantly higher proportion of positive sensory thoughts in the multiple- (69%) versus single-sense (51%) conditions ($z = 1.97$, $p < .05$). There were no significant differences between negative and neutral proportions. As shown in table 1, there were directionally more thoughts concerning smell, taste,

vision and feel (haptics) for the multiple-sense versus single-sense ad. We are most interested, however, in the balance of positive over negative sensory thoughts. This measure captures the overall valence of the participant's sensory thoughts, which we anticipate drives the effect of the slogan on taste perceptions. Number and type of cognitive verbal responses have also been used in earlier research as measures of process (Cacioppo and Petty 1981). Consistent with this reasoning, we find that the net thoughts are significantly more positive in the multiple-sense slogan condition than in the single-sense slogan condition (1.29 vs. 0.38), ($F(1, 52) = 4.75$, $p < .05$).

Mediation tests involved additional analyses to determine if the effect of the slogan on taste perceptions was mediated by the number of net positive sensory thoughts. The first criterion of mediation was met (Baron and Kenny 1986), as the ANOVA reported earlier shows a significant effect of slogan on perceived taste ($F(1, 52) = 6.60$, $p < .05$). We also received support for the second criterion of mediation by showing a significant relationship between the slogan condition and net positive sensory thoughts ($F(1, 52) = 4.75$, $p < .05$). An ANCOVA run with perceived taste as the dependent variable, slogan as the independent variable, and net positive sensory thoughts as the covariate provides support for the third criterion of mediation. The initial significant main effect of slogan on perceived taste is now only marginally significant ($F(1, 51) = 3.15$, $p =.082$); whereas the net number of positive sensory thoughts has a significant effect on perceived taste ($F(1, 51) = 8.94$, $p < .01$). As indicated by the Sobel (1982) test ($z = 1.8$, $p < .08$), these results are suggestive of the net positive sensory thoughts mediating the effect of ad slogans on perceived taste.

Discussion. In study 1, we obtain support for hypothesis 1 finding that multiple-sense ads result in better taste perception versus single-sense ads. Multiple-sense ads also result in significantly more net positive sensory thoughts than single-sense ads, supporting hypothesis 2a. Further, the number of net positive sensory thoughts mediates the effects of the slogan on taste perceptions, supporting hypothesis 2b. Study 2 addresses two limitations of study 1, namely, the single-item dependent variable, and the general ambiguity of the slogans used in study 1, which could affect the perceived amount of informativeness contained in the slogans. Addressing these limitations will help to more fully explicate the theoretical and practical implications of our research. In study 2 we also use potato chips to test the robustness of the effects obtained in study 1.

Study 2: Ad, Sensory Thoughts, and Taste

We created two ads for study 2. One of these ads described different sensory experiences (taste, smell, texture) when eating potato chips, whereas the other ad described an equal number of taste experiences when eating potato chips. The single-sense (multiple-sense) ad read:

> *Our potato chips deliver the taste you crave. From the first bite you'll savor the rich barbecue flavor (smell) and enjoy the delicious salty taste (crunchy texture) - our potato chips are the perfect choice for all your snacking.*

To further ensure that the multiple-sense did not have more perceived information than the single-sense slogan, we carefully pre-tested the ads.

Method

Pre-test. The two ads were pre-tested on complexity and informativeness, as well as on other standard attitude toward the ad measures. The pre-tests were conducted with 46 undergraduate students enrolled in an introductory marketing course and employed a between subjects design. After reading the ad, participants answered a series of questions regarding their opinions and attitudes toward the ad. Participants rated the degree to which they agreed or disagreed with two statements about the ad (the ad was: informative/complex; 1=strongly disagree, 7=strongly agree). We also captured overall evaluations of the ads on three separate dimensions (1 to 7 scales anchored at 1=bad/unfavorable/dislike, and 7=good/favorable/like; Mitchell and Olson 1981). These three items were combined to form an attitude toward the ad scale ($\alpha = .83$).

Evaluations of the ads did not differ across the three dimensions (all $p > .35$). Particularly, the ads were perceived equal on informativeness ($M_{single} = 4.61$, $M_{multiple} = 4.74$), ($p > .5$), complexity ($M_{single} = 2.91$, $M_{multiple} = 2.57$), ($p > .35$), and overall attitude toward the ad ($p > .5$).

Design and Procedure. The experiment used a one-factor between-subjects design, with the ad (multiple- or single-sense) serving as the manipulated factor. We chose barbecue flavored, kettle-cooked potato chips to be the food eaten during the experiment. Ninety-two undergraduate students participated in the study in exchange for course credit and in groups with a maximum size of 10. Participants were first introduced to the project with a page describing the purpose of the research, which was to evaluate

ads and products that either currently exist on the market or are in a testing phase. Participants then read the ad for the potato chips. Upon reading the ad, participants were instructed to raise their hands to ask the experimenter for the potato chips. The experimenter then placed a plain white cup of chips with a napkin in front of the participant. Participants then ate the chips before moving on in the questionnaire. All instructions were contained in the questionnaire, including when to ask the experimenter for the food item, and were thus self-paced.

Measures. Participants began the questionnaire by listing any thoughts they had while eating the chips. Then they were asked to evaluate the chips on three dimensions: the overall quality (1=very poor quality, 9=very good quality), the overall taste (1=very poor taste, 9=very good taste), and how delicious the potato chips were (1=not at all delicious, 9=very delicious).

Results and Discussion

Results. We conducted an ANOVA with the three taste measures combined into one scale as the dependent measure ($\alpha = .92$), and ad as the independent variable. We found support for the hypothesized effect of ad on taste (hypothesis 1), with the multiple-sense ad leading to significantly higher taste perceptions than the single-sense ad ($M_{\text{multiple}} = 6.78$, $M_{\text{single}} = 5.67$), ($F(1, 90) = 9.56$, $p < .005$).

We posited that sensory thoughts would mediate the effects of ad on taste perceptions (hypothesis 2b). Cognitive responses were coded in an identical manner to

study 1. Again we find more positive sensory thoughts in the multiple-sense condition (M = 1.98) than in the single-sense condition (M = 1.25), ($F(1, 90) = 8.90$, $p < .005$), supporting hypothesis 2a. The proportion of the positive sensory thoughts was again significantly greater in the multiple- (68%) versus single-sense (40%) conditions (z = 4.49, $p < .01$). In addition, the net positive sensory thoughts were greater in the multiple-sense condition (M = 1.70) than in the single-sense condition (M = 0.29), ($F(1, 90) = 20.44$, $p < .001$). We conducted additional analyses to check for mediation. As reported, the first two criteria for mediation were met, with the ad having a significant effect on both taste perceptions and net positive sensory thoughts. An ANCOVA was run to check for the third criterion of mediation, with perceived taste as the dependent variable, ad as the independent variable, and net positive sensory thoughts as the covariate. The initial significant impact of ad on taste perceptions is no longer significant ($F(1, 89) = .17$ $p > .5$), while the net number of positive sensory thoughts has a significant effect on perceived taste ($F(1, 89) = 50.81$, $p < .001$). Thus net positive sensory thoughts again mediate the effect of ad on taste perceptions as indicated by the Sobel (1982) test ($z = 2.8$, $p < .01$). These results add support further to hypothesis 2b.

Discussion. The findings of study 2 provide corroborating support for the process involved in the effect of advertising on taste perceptions. The multiple-sense ad was effective in generating more positive sensory thoughts and better taste perceptions, supporting hypotheses 1 and hypothesis 2a. Further, the number of net positive sensory thoughts was found to mediate the effects of the ads on taste perceptions, supporting hypothesis 2b.

A remaining question, however, is to what extent these sensory effects depend on effortful, deliberative processing. The effectiveness of the ads in the prior studies was mediated by sensory cognitions. Therefore, would the effects of the ads obtain if participants were limited in their cognitive capacity? In study 3, we address any moderating role of cognitive load on the ad-taste effect.

Study 3: Cognitive Load as a Moderator of the Ad-Taste Effect

The effects of ads on taste perceptions in the prior studies are mediated by sensory thoughts. These results are consistent with our theoretical framework that the effects are largely cognitive or top-down in nature. Therefore, we anticipate the introduction of cognitive load to attenuate our effects, leading to less dissimilar taste perceptions across ad conditions (hypothesis 3). Put another way, we are arguing that the multiple-sense ad (vs. a single-sense ad) has a smaller effect on enhancing taste perceptions under cognitive load.

Initially, this hypothesis may seem at odds with results from recent research on in-store sampling and distraction (Nowlis and Shiv 2005; Shiv and Nowlis 2004). The main findings across these articles is that distracting consumers (imposing cognitive load) while taste testing will lead to a heightened focus on the affective experience versus any informational input; this increases the subsequent likelihood of choosing a more affective product from a set of products (e.g., milk chocolate vs. soy chocolate) and also increases consumption pleasure. At a superficial level, we seem to be arguing that load will decrease and not increase consumption pleasure from food as these studies have found.

However, note that while ads are informational, the ads in our experiments lead to affective (sensory) thoughts, so distraction from the ad is a distraction from affective consequences. As the results from our prior two studies show, the multiple-sense ads we employ lead to affectively valenced consequences (i.e., more positive sensory thoughts and heightened taste perceptions). Hence, we argue that a distraction from the ads will reduce the taste enhancing effect of the multiple-sense ad. We now test hypothesis 3.

Method

Design. A 2 (ad: multiple-sense or single-sense) x 2 (cognitive load: yes or no) between subjects full factorial design was used in study 3. One hundred and twelve undergraduates participated in the experiment as part of a subject pool. We used popcorn as the food product in this study. The brand name for the popcorn, Emerald Aisle, was fictitious in order to limit confounds related to prior brand exposure. The ads below were used to describe the popcorn in the single-sense (multiple-sense) conditions:

> *Emerald Aisle popcorn delivers the taste (smell) of a movie theater in your own home. You'll taste (see) the perfect amount of butter and salt in every handful. With its delicious, buttery flavor (texture) and a taste that dances on your tongue (crunch that's music to your ears), Emerald Aisle popcorn is the perfect choice for all your snacking.*

Pre-test. The two ads were pre-tested on 40 participants to ensure equivalence in participants' overall attitudes towards the two ads ($\alpha = .97$; Mitchell and Olson 1981),

informativeness, and complexity, as in the prior pre-tests. A comparison of the means across ads showed no difference for any of the measures (all $p > .5$).

Procedure. Participants completed the study in groups with an upper limit of 10 people. Before being given the ad, participants in the load condition were given a separate task. In this task, participants were given a sheet which contained the roster for a fifth grade class. They were instructed to remember which first name went with which last name. Similar tasks have been shown to be cognitively taxing in earlier research (Gilbert, Giesler, and Morris 1995; Gilbert and Hixon 1991). Participants were given one minute to examine the class roster and then moved to the next questionnaire which contained the popcorn ad (participants in the no load condition moved directly to the popcorn questionnaire). To be consistent with the cover story for imposing cognitive load, participants were given a memory test after they completed the questionnaire related to the ad. This test asked two questions on the names of students in the fifth grade class (e.g., What is Jay's last name?").

The popcorn used was the private-label brand from a local grocery store. Each participant was handed a napkin and a white plastic cup half-full of popcorn. The cups of popcorn were prepared before each experimental session, and participants were not exposed to the packaging. Each participant was instructed to eat the popcorn first before moving on to answer the questions. The first question given to participants was to list any thoughts they had while eating the popcorn. Participants then answered questions regarding their perceptions of the taste of the popcorn. Similar to study 2, participants reported how they perceived the taste (1=very poor taste, 7=very good taste), quality

(1=very poor quality, 7=very good quality), and deliciousness (1=not at all delicious, 7=very delicious) of the popcorn. These items were combined to form a three-item scale measuring taste perceptions (α = .90). After completing the questionnaire, participants in the cognitive load condition were given the memory test questions. Participants were also given the opportunity to report any suspicions they had regarding the purpose of the study. No participant correctly guessed or showed insight into the experimental hypotheses.

Results and Discussion

We conducted an ANOVA with taste perception as the dependent variable and ad and cognitive load as independent variables. There was a significant main effect of ad on taste perceptions with the multiple-sense ad leading to higher taste perceptions than the single-sense ad ($M_{multiple}$ = 4.14 vs. M_{single} = 3.63), ($F(1, 108) = 6.39$, $p < .05$), adding further support to hypothesis 1. This main effect was qualified by the hypothesized two-way interaction of load and ad on overall taste perception ($F(1, 108) = 7.79$, $p < .01$). The main effect of load was not significant ($p > .15$). Figure 2 graphically presents the cell means of taste perceptions by condition.

[Insert Figure 2.2 about here]

Simple effect tests revealed a significant difference between the multiple- and single-sense ads in the no load conditions ($M_{multiple}$ = 4.67, M_{single} = 3.48), ($F(1, 108)$ =

13.60, $p < .01$), with taste perceptions in the multiple-sense ad condition being significantly higher; however, there was no significant difference between the multiple- and single-sense ads in the load condition ($p > .8$). This is consistent with hypothesis 3.

Additional simple effect tests revealed a significant difference between the load and no load conditions when subjects were exposed to the multiple-sense ad ($M_{\text{load}} = 3.73$, $M_{\text{no load}} = 4.67$), ($t(108) = 2.92$, $p < .01$), with taste in the no load condition being significantly higher. Simple effect tests also show that the effect of the single-sense ad on perceived taste is not significantly different across the two load conditions ($M_{\text{load}} = 3.79$ $M_{\text{no load}} = 3.48$), ($t(108) = 1.00$, $p > .3$).

We also conducted an ANOVA with net positive sensory thoughts as the dependent variable and ad and load as the independent variables. Thoughts followed a similar pattern to taste perceptions, such that there was a significant main effect of ad with the multiple-sense ad leading to more net positive thoughts than the single-sense ad ($M_{\text{multiple}} = 0.25$ vs. $M_{\text{single}} = -0.39$), ($F(1, 108) = 4.80$, $p < .05$). This main effect was also qualified by the hypothesized two-way interaction of ad and load ($F(1, 108) = 4.16$, $p < .05$).

As in prior studies, we wanted to determine if net positive sensory thoughts mediate the relationship between the independent variables (ad and load) and the dependent variable (taste perceptions). As already shown, the first two criteria of mediation are met, as the interaction of ad and load on taste perceptions was significant, and the interaction of ad and load on net positive sensory thoughts was also significant. We conducted an ANCOVA to check for the final criterion of mediation with ad and load as the independent variables, net positive sensory thoughts as the covariate, and taste

perceptions as the dependent variable. The prior significant interaction of ad and load on taste perceptions is no longer significant (p = NS), whereas the net positive sensory thoughts are significant ($F(1, 108) = 42.03$, $p < .001$) A Sobel (1982) test conducted supports mediation ($z = 1.95$, $p = .05$), again adding support to hypothesis 2b.

The results of study 3 add further support to our hypotheses, and also establish potential boundary conditions for our effects. Taste perceptions differed between single- and multiple-sense ad conditions only when cognitive resources were available. That is, when participants could appropriate an ample amount of cognitive resources to the multiple-sense ad, the overall taste perception was better than in the single-sense condition. In the condition where cognitive resources were constrained, there was no difference in perceived taste between the multiple- and single-sense ads. This experiment further demonstrates the cognitive nature of the effects and contributes theoretically by showing that the effect of distraction during a consumption experience may be contingent upon the type of information presented.

General Discussion

Research on sensory perception within marketing has largely focused on the study of vision (Krishna 2007 for a review), with the other senses receiving scattered attention; however, this attention is intensifying (Peck and Childers 2008 for a review). A primary objective of this article is to contribute to the growing literature on sensory perception within marketing in showing that advertising copy for a food product can affect resulting cognitions during consumption and ultimately affect taste perceptions. Through a series

of three studies, we show that multiple- versus single-sense ads lead to heightened taste perceptions, within some boundary conditions.

With study 1 (chewing gum), we showed that a simple slogan could affect taste perceptions. Specifically, we showed that a multiple-sense slogan lead to higher taste perceptions than a single-sense slogan. Study 2 (potato chips) replicated and extended these results by showing the effect of verbal sensory advertising on taste perceptions. Study 3 (popcorn) further explicated the deliberate, top-down nature of our results, showing that the effect of the ad on taste perceptions is moderated by cognitive resource availability. Further, studies 1-3 show the mediating effect of net positive sensory thoughts on perceived taste.

Our research makes important contributions to both the consumer behavior and sensory perception literatures. Our contribution to marketing is an explication of the effects of ads on taste perception. This extends the impact of advertising beyond typical evaluation variables such as awareness and purchase intentions. We demonstrate that ads (for food) can have a significant impact on perceived taste. We also contribute to perception research by providing evidence for the impact of verbal stimuli on sensory evaluations. Lastly, we make an attempt to bridge the gap between physiology and neuroscience and consumer behavior, showing promising potential for future research.

The impact of cognition on perception warrants further attention and provides a fruitful arena for future research. We specifically focused on the cognitive impact of the extrinsic cue of advertising on sensory perception, but thoughts generated by other extrinsic cues could be equally as intriguing. Relevant neuroscience literature has shown that verbal labels of smells (e.g., cheddar cheese or body odor) affects the perception of

the smell itself by inhibiting activation of smell areas in the brain for unpleasant smells (De Araujo et al. 2005). Should these processes occur in a more deliberative manner as shown across our studies, we may gain valuable insight into the effects of cognitions on perceptions through behavioral methodologies as well. Further, in our studies the stimuli used were generally pleasant, leading to congruence between the advertisement and consumption experience. However, should there be marked incongruity between the extrinsic cue and the consumption experience, one could explore the potential dominance of cognitions over sensory perceptions or vice versa. Our cognitions shape our experiences in a top-down manner, but the bottom-up influences of perceptions obviously play a role as well. This interaction of both cognition and sensory perception warrants future attention.

With our research we chose to focus on the deliberate, cognitive determinants of sensory perceptions; however, future research could also address ways to affect these perceptions below consciousness, as much of what we do and perceive is driven by automatic processes (Bargh and Chartrand 1999). For example, it is possible that visual stimuli are processed more automatically than verbal stimuli in an advertising context, and could affect taste perceptions even under cognitive constraint. Indeed, pictures of food lead to similar neural activation patterns in the orbitofrontal cortex as verbal descriptions, and additionally activate areas associated with reward (Simmons, Martin, and Barsalou 2005). Therefore, it would be worthwhile to explore the impact of pictures used in isolation of verbal framing on sensory perceptions.

Managerial implications of this research follow directly from our results. Despite the conventional wisdom that taste is comprised of multiple sensory inputs, advertising

within the food and beverage industry rarely addresses perceptions beyond taste. The results from our studies suggest that advertising should include multiple sensory attributes of the products as this has a significant impact on perceptions of the product. These findings are particularly relevant for the food industry, including packaged goods and restaurants, as they continue to spend billions of dollars in advertising the taste of food, one of our most pleasurable and sensory experiences.

TABLE 2.1: GUM THOUGHT MEANS BY SLOGAN CONDITION—STUDY 1

Condition	Multiple-Sense	Single-Sense	Total
Positive minus negative	1.29	0.38	0.85
Total sensory	2.64	1.81	2.24
Positive	1.82	0.92	1.39
Negative	0.54	0.54	0.54
Neutral	0.29	0.42	0.35
Taste	1.46	1.08	1.28
Smell	0.5	0.31	0.41
Sight	0.18	0.08	0.13
Texture	0.5	0.35	0.43
Sound	0	0	0

FIGURE 2.1: CONCEPTUAL FRAMEWORK

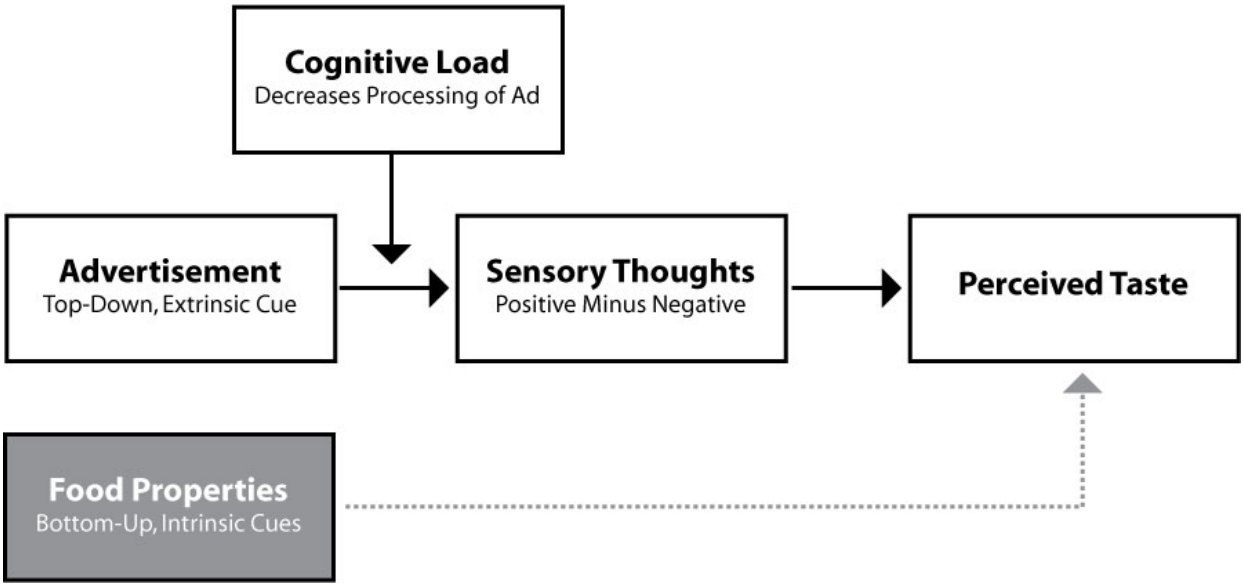
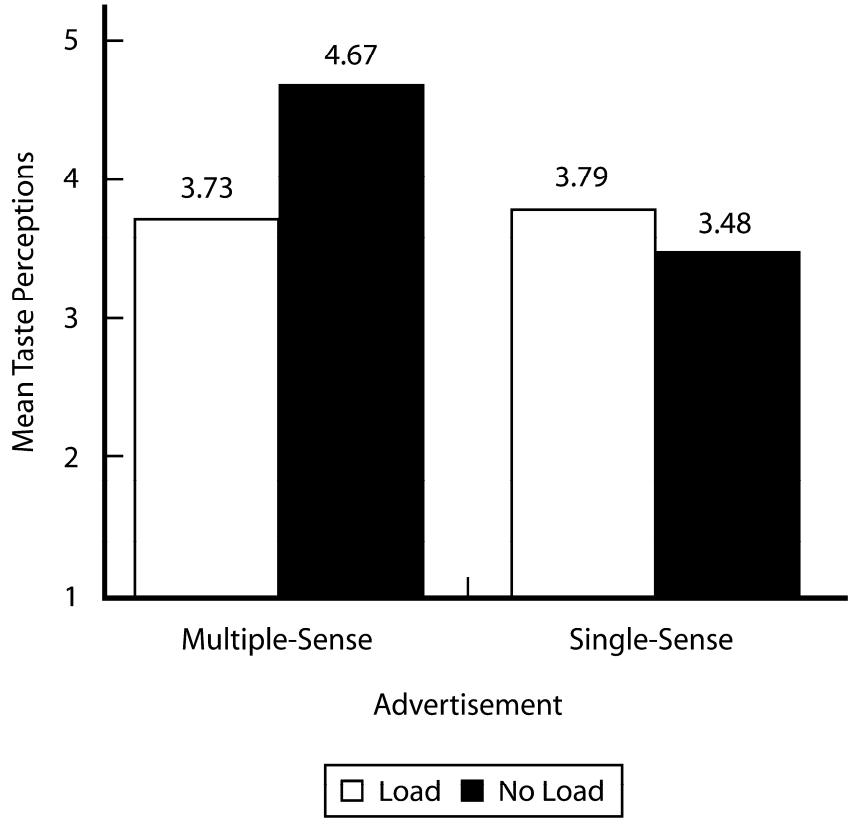


FIGURE 2.2: STUDY 3: MEANS OF PERCEIVED TASTE (POPCORN)



References

Advertising Age Data Center: http://adage.com/datacenter/article?article_id=127915&search_phrase=top%20spenders

Allison, Ralph I. and Kenneth P. Uhl (1964), "Influence of Beer Brand Identification on Taste Perception," *Journal of Marketing Research,* 1 (August), 36-39.

Baron, Reuben M. and David A. Kenny (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology*, 51, 1173-82.

Bargh, John A. and Tanya L. Chartrand (1999), "The Unbearable Automaticity of Being," *American Psychologist*, 54 (July), 462–79.

Cacioppo, John. T. and Richard E. Petty (1981), "Social Psychological Procedures for Cognitive Response Assessment: The Thought-Listing Technique," in *Cognitive Assessment*, ed. Thomas V. Merluzzi, Carol R. Glass, and Myles Genest, New York: Guilford Press, 309-42.

Chaudhari, Nirupa, Ana Marie Landin, and Stephen D. Roper (2000), "A Metabotropic Glutamate Receptor Variant Functions as a Taste Receptor," *Nature Neuroscience*, 3 (2), 113-119.

Cruz, Alberto and Barry G. Green (2000), "Thermal Stimulation of Taste," *Nature*, 403 (6772), 889-92.

de Araujo, Ivan E. and Edmund T. Rolls (2004), "Representation in the Human Brain of Food Texture and Oral Fat," *The Journal of Neuroscience, 24*(12), 3086-3093.

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

DuBose, Cynthia N., Armand V. Cardello, and Owen Maller (1980), "Effects of Colorants and Flavorants on Identification, Perceived Flavor Intensity, and Hedonic Quality of Fruit-Flavored Beverages and Cake," *Journal of Food Science,* 45 (5), 1393-99.

Edell, Julie A. and Richard Staelin (1983), "The Information Processing of Pictures in Print Advertisements," *Journal of Consumer Research,* 10 (June), 45-61.

Gilbert, Daniel T., R. Brian Giesler, and Kathryn A. Morris (1995), "When Comparisons Arise," *Journal of Personality and Social Psychology,* 69 (August), 227-36.

Gilbert, Daniel T. and J. Gregory Hixon (1991), "The Trouble of Thinking: Activation and Application of Stereotypic Beliefs," *Journal of Personality and Social Psychology*, 60 (April), 509-17.

Herz, Rachel (2007), *The Scent of Desire: Discovering our Enigmatic Sense of Smell*, New York: William Morrow.

Hoch, Stephen J. and Young-Won Ha (1986), "Consumer Learning: Advertising and the Ambiguity of Product Experience," *Journal of Consumer Research,* 13(September), 221-33.

Hoegg, Joandrea and Joseph W. Alba (2007), "Taste Perception: More Than Meets the Tongue," *Journal of Consumer Research,* 33 (March), 490-498.

Ikeda, Kikunae (2002), "New Seasonings," *Chemical Senses,* 27 (9), 847-49.

Krishna, Aradhna (2007), "Spatial Perception Research: An Integrative Review of Length, Area, Volume, and Number Perception," *Visual Marketing: From Attention to Action,* ed. Michel Wedel and Rik Peters, Marketing and Consumer Psychology Series. New York: Lawrence Erlbaum Associates, 167-92.

Krishna, Aradhna and Maureen Morrin (2008), "Does Touch Affect Taste? The Perceptual Transfer of Product Container Haptic Cues," *Journal of Consumer Research*, 34 (April), 807-18.

Lee, Leonard, Shane Frederick, and Dan Ariely (2006), "Try It, You'll Like It: The Influence of Expectation, Consumption, and Revelation on Preferences for Beer," *Psychological Science,* 17 (12), 1054-58.

Levin, Irwin P and Gary J. Gaeth (1988), "How Consumers are Affected by the Framing of Attribute Information Before and After Consuming the Product," *Journal of Consumer Research,* 15 (December), 374-78.

Mitchell, Andrew A. and Jerry C. Olson (1981), "Are Product Attribute Beliefs the Only Mediator of Advertising Effects on Brand Attitude?" *Journal of Marketing Research*, 18 (August), 318-32.

Nowlis, Stephen M. and Baba Shiv (2005), "The Influence of Consumer Distractions on the Effectiveness of Food-Sampling Programs," *Journal of Marketing Research,* 42 (May), 157-168.

Peck, Joann and Terry L. Childers (2008), "If it Tastes, Smells, Sounds, and Feels Like A Duck, Then it Must Be A….: Effects of Sensory Factors on Consumer Behaviors," in *Handbook of Consumer Psychology,* ed. Curtis P. Haugtvedt, Paul M. Herr, and Frank R. Kardes, New York: Psychology Press, 193-219.

Raghunathan, Rajagopal, Rebecca W. Naylor, and Wayne D. Hoyer (2006), “The Unhealthy= Tasty Intuition and its Effects on Taste Inferences, Enjoyment, and Choice of Food Products,” *The Journal of Marketing,* 70 (October), 170-84.

Rolls, Edmund T. (2005), “Taste, Olfactory, and Food Texture Processing in the Brain, and the Control of Food Intake,” *Physiology & Behavior,* 85 (May), 45-56.

Rozin, Paul (1982), "Taste-Smell Confusions and the Duality of the Olfactory Sense.” *Perception & Psychophysics,* 31 (April), 397-401.

Shiv, Baba and Stephen M. Nowlis (2004), “The Effect of Distractions While Tasting a Food Sample: The Interplay of Informational and Affective Components in Subsequent Choice,” *Journal of Consumer Research,* 31 (December), 599-608.

Simmons, W. Kyle, Alex Martin, and Lawrence Barsalou (2005), “Pictures of Appetizing Foods Activate Gustatory Cortices for Taste and Reward,” *Cerebral Cortex,* 15 (10), 1602-08.

Small, Dana M. and Marilyn K. Jones-Gotman (2001), “Neural Substrates of Taste/Smell Interaction and Flavor in the Human Brain,” *Chemical Senses,* 26 (8), 1034.

Small, Dana M. and John Prescott (2005), “Odor/taste Integration and the Perception of Flavor,” *Experimental Brain Research,* 166 (October), 345-57.

Smith, Edward E and Stephen M. Kosslyn (2007), *Cognitive Psychology: Mind and Brain*, Upper Saddle River, NJ: Pearson Prentice Hall.

Sobel, Michael E. (1982), “Asymptotic Intervals for Indirect Effects in Structural Equations Models,” in *Sociological Methodology,* ed. Samuel Leinhart, San Francisco, CA: Jossey-Bass, 290–312.

Zampini, Massimiliano and Charles Spence (2004), "The Role of Auditory Cues in Modulating the Perceived Crispiness and Staleness of Potato Chips," *Journal of Sensory Studies*, 19 (5), 347-63.

CHAPTER 3

Mental Simulation and the "Visual Depiction Effect": When Visual Stimuli Facilitate Sensory Experience

For years marketers have included instructions for consumers to imagine using their product. Slogans like "Imagine the Possibilities" from Intel and Apple, or simply "Imagine" from Samsung, encourage consumers to transport themselves into a state where 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 us to imagine using the product in the absence of such pleas? Can just the way in which a product is visually depicted affect whether or not we imagine using the product? Is this something the advertiser should give attention to? Within this paper we build on recent models of cognition and perception to show that by including an instrument for product usage, or altering the way a product is visually depicted can elicit a simulation of sensory experience, with consequences on behavioral intentions.

Why should visual product depiction affect the playback of sensory experiences? A consumer's daily life is filled with innumerable sensory experiences. From the familiar

ringing sound of one's alarm clock, to the smell of another's perfume, to the act of eating a deliciously decadent piece of chocolate cake, one's senses are constantly engaged. These sensory experiences are not simply perceived and dismissed, but are coded and stored in our brains neurally in the modality in which they were perceived (Barsalou 1999, 2008). Ultimately, these sensory experiences are utilized to represent conceptual knowledge of objects, events, and even ideas. This link between our sensory experiences and cognition forms the theoretical base of recent models of grounded cognition (Barsalou 1999, 2008; Gibbs 2006; Wilson 2002). Specifically, the theory 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) had participants either nod their head up and down or shake their head from side to side while hearing an editorial message. The researchers find that nodding one's head up and down (vs. side to side) led to increased persuasion of the message. Additionally, participants holding a pen between their teeth (facilitating the muscles used during smiling) evaluated 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 (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 individuals 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 present 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 the way an object is visually depicted can facilitate mental simulation of interacting with the product, with significant consequences on behavioral intentions. We propose that visual depictions that lead to more (vs. less) mental simulation will result in higher (vs. lower) purchase intentions for the item depicted. Across a series of four studies we provide support for this primary hypothesis, while additionally explicating the process involved.

In the first set of studies (studies 1a and 1b), we show that visual stimuli 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 is shown to impact the visual depiction effect. Our third study contrasts our effects with more directed forms of imagery. Finally, with our fourth study we explore the visual depiction effect for negatively valenced stimuli.

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 which 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 upon 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 (Gonzalez 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).

This playback of prior sensory experiences is similar to the construct of imagery within cognitive psychology and consumer behavior. However, the distinction within the grounded cognition literature between imagery and mental simulation focuses on the level of deliberation and conscious thought required. Specifically, "whereas mental imagery typically results from deliberate attempts to construct conscious representations in working memory, other forms of simulation often appear to become active automatically and unconsciously outside working memory (Barsalou 2008, 619)." Our intention within the present research is to explore the more automatic form of mental simulation.

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 upon our knowledge of prior interactions to simulate interaction with present 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. These stimuli included animals, faces, houses, and tools. The researchers proposed that due to the connection between vision and motor response, and the fact that tools were the only

category shown that facilitated this connection, viewing and naming tools should lead to activation in premotor areas of the brain. Indeed, the researchers received support for their hypotheses as viewing tools (versus other objects) led to greater activation of the left ventral premotor and left posterior parietal cortices, areas associated with motor response. Using positron emission tomography (PET), Grèzes and Decety (2002) show similar results. The researchers had participants complete several different tasks while viewing images of objects, including determining whether the object was upright or inverted, naming the object silently, as well as silently naming the action the object is used for. Interestingly, each of these tasks was associated with 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. One of the earlier sets of findings 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 more in alignment (Tucker and Ellis 1998). Specifically, if the object's handle was oriented toward the right hand, the right-hand keypress was significantly faster than the left-hand keypress. The researchers propose that mental simulation of the motor response leads to this quickened response time as the mind is ready for interaction. This paradigm was also used to explore motor simulation of abstract objects as well (Symes, Ellis, and Tucker 2007). Again, if the orientation of the abstract object corresponded to the hand of response, categorization response times were faster.

Additional research has shown that not only the orientation of the object, but also the size of the object plays a role in simulated motor response (Tucker and Ellis 2001). In one experiment, participants were instructed to distinguish whether an item presented was natural or manufactured. Participants were to indicate their responses by pressing one of two buttons held in their hand. One of the buttons was pressed by using the index finger and thumb (precision grasp – such as that used to hold a small marble), while the other button was pushed by using the other three fingers and palm of the hand (power grasp – such as when one holds a baseball bat). The items presented varied in size, but were those that could be either held with a precision grasp (e.g., grape) or a power grasp (e.g., banana). One key finding from the study was an interaction between object size and the grasp used for response. Specifically, when participants viewed larger objects, they were quicker to categorize with the power grasp than the precision grasp. Conversely, when small objects were presented, participants were quicker to categorize with the precision grasp than the power grasp. These findings provide behavioral support for the connection between vision and motor response.

Based on the literature reviewed, it appears that visual stimuli (e.g., products) can result in mental simulation of motor activity (e.g., interacting with the product). 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). As such, we propose that:

H1: Visual Depiction Effect: Visual stimuli depicting a product which facilitate more (vs. less) mental interaction with the product (more 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.

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). Unnava, Agarwal, and Haugtvedt (1996) provide behavioral evidence for the competition between visual imagery and visual perception, as well as auditory imagery and auditory perception. Specifically, when ads were presented visually (auditorily), participants were worse at remembering information that elicited visual (auditory) imagery during the presentation of the message. The perception of the sensory information competed with the ability to imagine, leaving fewer resources for remembering.

Recent research also shows that blocking the ability to perceive has consequences on cognition. One set of studies (Oberman, Winkielman, and Ramachandran 2007) demonstrates this by using the fact that mimicry is purported to be a key component in recognizing emotion (Adolphs et al. 2000). Oberman, Winkielman, and Ramachandran

(2007) had participants bite a pen, thereby activating the facial musculature used during smiling (zygomaticus major). This activation of the musculature reduced participants' ability to mimic facial expressions (they cannot smile if they are biting a pen), particularly smiling expressions. Consequently, participants were worse at recognizing happy faces when biting the pen than when not biting the pen.

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 furrowing one's brow. The study was conducted with two conditions—one experimental condition prior to the treatment and one two weeks after. Participants in the study were given a series of sentences containing various emotions and were told to indicate when they understood the sentence. 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. These results provide further behavioral support for the link between perceptual activity and 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.

The prior literature suggests that if one occupies perceptual resources corresponding to those used in mental simulation, it will attenuate the effects of visual product depiction on simulated product interaction and hence on purchase intentions. We hypothesize that:

H2: Impeding mental simulation by occupying perceptual resources will attenuate the visual depiction effects on behavioral intentions.

Automaticity of Process. We also examine the extent to which consequences from mental simulation differ from more deliberate forms of mental imagery. As mentioned earlier, theories of grounded cognition claim that while imagery is a directed form of mental simulation, other types of mental simulation occur at a more automatic level, outside of working memory (Barsalou 2008). We anticipate that the difference of alternate visual product depiction on purchase intention will be larger with automatic mental simulation than with direct instructions to imagine interacting with the product. This is purported to be the case as individuals imagining interaction with the product should be able to mentally pick up and rotate the object, such that the initial depiction and orientation is of less importance. We propose that:

H3: Instructions to imagine using the product depicted will attenuate the impact of alternate visual product depiction on behavioral intentions.

Valence of Stimuli. For a negative or aversive experience, the ability to mentally simulate the experience should make it more negative, and result in more negative behavioral intentions. Thus, for negative stimuli, we anticipate that:

H4: Visual stimuli (depicting a product) which facilitate more (vs. less) mental simulation will result in lower behavioral intentions when the valence of the stimulus is negative.

Figure 1 shows the conceptual framework, as well as a brief overview of the contribution each experiment makes to the proposed model.

[Insert Figure 3.1 about Here]

Studies 1a and 1b establish the basic visual depiction effect. This basic effect (H1) is also tested in the other three studies. Study 2 provides support for the proposed mental simulation by imposing perceptual constraints (testing H2). In study 3, we demonstrate the difference between the more automatic form of mental simulation and the more deliberate form of imagery, testing hypothesis 3. Finally, in study 4, we test that the visual depiction effect will be reversed for negatively valenced stimuli (H4).

Study 1: Testing the Basic Visual Depiction Effect

Study 1a: Yogurt

Overview and Method

Study 1a tests our basic hypothesis (H1) that visual stimuli depicting a product which 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 figure 3.2). Two versions of the stimulus feature a spoon either on 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/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.

[Insert Figure 3.2 about Here]

One hundred and twenty-one participants were recruited 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 which 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 prior to analysis in all subsequent studies.

Our main hypothesis (H1) is that the orientation of the spoon handle will influence the participant's behavioral (i.e., purchase) intentions. As such, our analysis focused on the participant's 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 nor in any of the subsequent studies, and is not discussed further].

Thirteen percent of the subjects 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 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 ($M_{match} = 5.76$, $M_{mismatch} = 4.70$; $F(1, 118) = 4.20$, $p < .05$).

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 condition should lead to higher purchase intentions than the control condition. Additionally, there should not be a significant difference between the mismatch and control conditions as mental simulation is not facilitated. Two planned contrasts supplement the initial findings. In exploring the difference between the match and 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 ($M_{match} = 5.76$, $M_{control} = 4.45$; $F(1, 118) = 6.20$, $p < .05$). A separate contrast was conducted to explore the difference between the mismatch and control conditions. As hypothesized, there is no significant difference between the mismatch and control conditions ($M_{mismatch} = 4.70$, $M_{control} = 4.45$; $F(1, 118) = .37$, $p > .10$) for stated purchase intentions.

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 the hamburger (see figure 3.3).

[Insert Figure 3.3 about Here]

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 ($M_{match} = 4.63$, $M_{mismatch} = 3.06$; $F(1, 92) = 9.00$, $p < .01$), replicating the findings from study 1a and providing additional support for hypothesis 1.

The match condition led to significantly higher purchase intentions than the control condition ($M_{match} = 4.63$, $M_{control} = 3.30$; $F(1, 92) = 6.55$, $p < .05$), and there was no significant difference between the mismatch and control conditions ($M_{mismatch} = 3.06$, $M_{control} = 3.30$; $F(1, 92) = .22$, $p > .10$).

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 which facilitate less mental simulation. The inclusion of control conditions 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 as orienting the product toward the participant's non-dominant hand. Understanding this effect of the instrument to facilitate mental simulation is key as it explains the process for the effect and moves the findings beyond the effect of orientation. It is not "orientation" per se which 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 2 that impeding mental simulation by occupying perceptual resources will limit the impact of the visual depiction effect on purchase intentions. Support for hypothesis 2 will further back our mental simulation account for the visual depiction effect. Since prior literature has shown that cognition and perception utilize 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 (H2). 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 either on the left or right side of the plate. The advertisement contained a short headline "Serving Happiness" and an accompanying logo (see figure 3.4).

[Insert Figure 3.4 about Here]

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 impact 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 either in their *non-dominant* hand, their *dominant* hand, or 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 *non-dominant* 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 non-dominant hand. Therefore, the mismatch condition where the fork is orientated toward the participant's non-dominant 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)

x 4 (simulation block: none, dominant hand, non-dominant hand, both hands) between subjects. 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 which would advance on their own after five seconds. They were to view the advertisements and then answer questions about the advertisements, as well as about the physical endurance task.

Per the condition that the participants were in, they were told to either pick up the clamp with their dominant hand, non-dominant hand, pick up one clamp in each hand, or were told to 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 one 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 sequence (the other three advertisements were immaterial). Following 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 one 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 PANAS scale (Watson, Clark, and Tellegen 1988). Following the scale, participants also reported their handedness and gender. In order 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 x 4 ANOVAs with the positive and negative dimensions of the PANAS scale 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 subjects were in a match or mismatch condition. Our key hypothesis is with regards to the interaction between orientation and simulation blocking on purchase intentions. We initially conducted a 2 x

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 3.5 graphically presents the means. Planned follow-up contrasts reveal the predicted patterns of results.

[Insert Figure 3.5 about Here]

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 ($M_{match} = 4.55$, $M_{mismatch} = 3.37$; $F(1, 313) = 4.88$, $p < .05$). Within the *non-dominant* simulation blocking condition, as predicted, the match condition led to significantly higher purchase intentions than the mismatch condition, replicating prior results ($M_{match} = 4.43$, $M_{mismatch} = 3.62$; $F(1, 313) = 4.16$, $p < .05$). 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 non-dominant 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 no the simulation block and non-dominant hand conditions. Specifically, we find that purchase intentions for the cake are significantly higher in the mismatch condition than in the match condition ($M_{match} = 3.85$,

$M_{mismatch}$ = 4.83, $F(1, 313) = 5.62$, $p < .05$). These results, though not entirely unexpected, are surprising given their magnitude. The results suggest that when the dominant hand is physically engaged, participants are simulating with their non-dominant 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 mismatch orientation conditions (M_{match} = 3.97, $M_{mismatch}$ = 4.17, $F(1, 313) = .20$, $p > .10$).

Discussion

The results from study 2 are largely supportive of our hypotheses (H1 and H2). 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 not 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 in the present context leads to consequences on behavioral intentions. While study 2 points to the connection between mental simulation and physical perception, in the next study, we focus on the difference between mental simulation and imagery.

Study 3: Automatic versus Controlled Imagery (Hammer)

Overview and Method

In this study, we test whether the effects of visual product depiction on mental simulation obtained in our earlier studies are more automatic than other forms of imagery (we test H3). We anticipate that instructions to fully imagine interacting with the stimulus should attenuate the basic visual depiction effect, since given instructions to imagine, individuals can mentally pick up and rotate the object, and the initial orientation of the object should be of less importance.

To test for the robustness of the visual depiction effect, in study 3 we use the picture of a hammer which is oriented either 45 degrees counterclockwise or 45 degrees clockwise from perpendicular (see figure 3.6). An orientation 45 degrees counterclockwise from perpendicular would be a match between orientation and handedness for right-handed participants. Likewise, an orientation 45 degrees clockwise from perpendicular would be a match for left-handed participants.

[Insert Figure 3.6 about Here]

Study 3 uses a 2 (product orientation: 45 degrees clockwise or counterclockwise from perpendicular) x 2 (imagine instructions: yes or no) between subjects design. Sixty-nine undergraduates participated in the study in exchange for course credit. The procedure for study 3 follows closely that employed in the prior studies. Participants in the no imagine instructions conditions were told to view the product for as long as they wished before proceeding to answer the questions. Participants in the imagine condition were told, "For the product on the following page, we would like you to IMAGINE using the product for its intended use." They were also told to view the object for as long as they wished. Participants then viewed the object (the hammer) in one of the two orientations and then answered questions regarding the hammer and about themselves. Similar to the prior studies, the dependent variable is purchase intentions of the hammer.

Results

As in the prior studies, we recoded the initial orientation of the product to represent a match or mismatch with the participant's dominant hand. We next conducted a 2 x 2 ANOVA with orientation and imagery instructions as the independent variables and purchase intentions as the dependent variable. Resulting from this analysis is a significant main effect of orientation, with the match condition leading to significantly higher purchase intentions than the mismatch condition (M_{match} = 5.29, $M_{mismatch}$ = 4.68; $F(1, 64) = 4.90$, $p < .05$). This main effect of orientation is qualified by a significant

interaction between orientation and imagery instructions ($F(1, 64) = 4.46$, $p < .05$). The main effect of imagery instructions was not significant ($p > .10$). We anticipated the effects of visual product depiction on purchase intentions to be attenuated in the presence of controlled imagery instructions. As such, we should replicate our findings from the prior studies when no imagining instructions are present. However, when participants are instructed to imagine, the orientation of the product should make little difference in purchase intentions. Indeed, this is what we find. Follow up contrasts reveal that when participants are not given instructions to imagine using the hammer, the match condition leads to significantly higher purchase intentions than the mismatch condition (M_{match} = 5.74, $M_{mismatch}$ = 4.53; $F(1, 65) = 9.35$, $p < .01$). When participants are instructed to imagine, there is no significant difference in purchase intentions between the orientation conditions (M_{match} = 4.84, $M_{mismatch}$ = 4.81; $F(1, 65) = .01$, $p > .5$).

While not hypothesized, another result we obtain is that mental simulation (no instructions to imagine—implicit imagery) may increase purchase intention to a larger extent than more deliberate forms of imagery (direct instruction to imagine interaction with the product—explicit imagery). In the match condition, we note that purchase intentions are significantly higher with no instructions than with ($M_{no\ instructions}$ = 5.74 vs. $M_{instructions}$ = 4.84; $F(1, 65) = 5.85$, $p < .05$); there is no significant difference in the mismatch condition where automatic imagery may be more difficult ($M_{no\ instructions}$ = 4.53 vs. $M_{instructions}$ = 4.81; p =.5).

Discussion

As mentioned earlier, theories of grounded cognition claim that while imagery is a directed form of mental simulation, other types of mental simulation occur at a much more automatic level, outside of working memory (Barsalou 2008). Whether this distinction between more automatic and controlled forms of mental simulation exists remains an open question (Kent and Lamberts 2008; Moulton and Kosslyn, 2009).

Results of study 3 are supportive of this automatic form of mental simulation—automatic simulation is easier with the dominant hand, but not with the non-dominant which needs more deliberate instructions to imagine using it. In study 4, we test whether the basic visual depiction effect is reversed for negatively valenced stimuli (H4).

Study 4: 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, as it is familiar. Although the findings from study 2, in which the connection between perceptual activity and mental simulation is shown, does much to rule out this perceptual fluency account, study 4 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, Winkielman, and Schwarz 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 different 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 nine-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 ($F(1, 65) = 51.4$, $p < .01$).

Method

The stimuli for study 4 were created by taking an image of a bowl tomato soup with a spoon on one side and flipping it over a vertical axis to create two mirror images of the soup. Thus, as in study 1a, the spoon was either on the right or 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 figure 3.7). The design for study 4 is thus a 2 (orientation: match, mismatch) x 2 (valence: positive, negative) between subjects factorial design.

[Insert Figure 3.7 about Here]

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 the purpose of the experiment. No participant showed insight into the experimental hypotheses or manipulations. .

Results

Of the 158 participants, 19 (12%) were left-handed. The data was 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 3.8. 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 ($M_{positive} = 5.91$, $M_{negative} = 3.52$).

[Insert Figure 3.8 about Here]

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 ($M_{match} = 6.59$, $M_{mismatch} = 5.33$, $F(1, 154) = 4.93$, $p < .05$). 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 1. Per hypothesis 4, when the stimuli are negatively valenced, we should see a reversal of this effect. Indeed, supportive of hypothesis 4, we find that within the negatively valenced condition the match condition leads to significantly lower purchase intentions than the mismatch condition ($M_{match} = 3.02$, $M_{mismatch} = 4.08$, $F(1, 154) = 3.92$, $p = .05$).

Discussion

The findings of study 4 establish boundary conditions to the prior results, but more importantly help to explicate the process underlying our results. Specifically, the results of study 4 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 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.

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 paper 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 where perceptual resources were differentially engaged, including conditions where participants held a clamp in their dominant hand, non-dominant hand, both hands, or did not hold a clamp. When the clamp was held in the participant's non-dominant 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.

In study 3, we examine whether our proposed process of mental simulation has different consequences from a more deliberate form of mental imagery. We find that it does—automatic mental simulation occurs with the dominant hand, but not with the non-dominant hand, which needs more deliberate instructions to imagine using it. As such, the visual depiction effect is attenuated with deliberate imagery—deliberate imagery facilitates mental product interaction to more similar extents with these alternate depictions compared to more automatic imagery.

Should mental simulation underlie our results, a negative experience should become more aversive. Study 4 results are consistent with this logic. Study 4 also provides additional evidence that fluency does not 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.

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.

Many other such orientations 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. Similarly, having the bottle top off of a soda, opening the driver's door in a car advertisement, or folding down the sheets of the side of a bed positioned toward the consumer are all very subtle ways of facilitating consumer mental simulation.

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 impact not just advertising, but product packaging as well, and designers should focus on incorporating these instruments of simulation in the outer package design.

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. Study 3 suggests that implicit imagery may have a stronger impact on purchase behavior than explicit imagery. More research can be done here to explicate when and how mental simulation will differ from more deliberate forms of imagery.

Another theoretical avenue to pursue is the interplay between simulated experience and current product experience. Prior literature within sensory experience and consumer psychology 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 (Braunn 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 present 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.

FIGURE 3.1: CONCEPTUAL FRAMEWORK

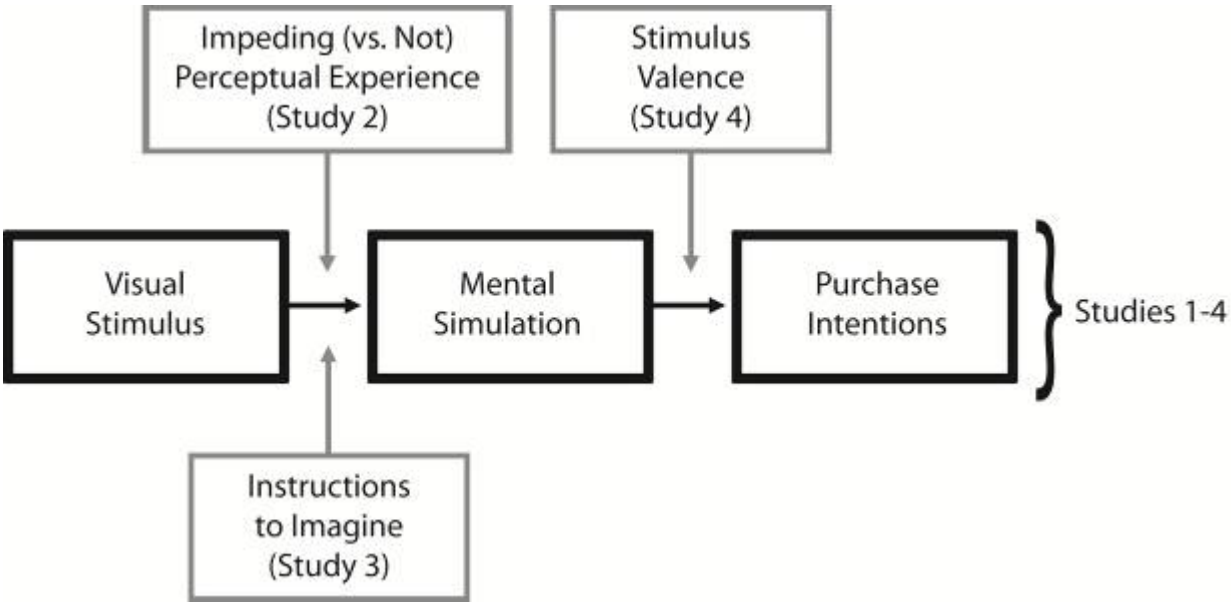
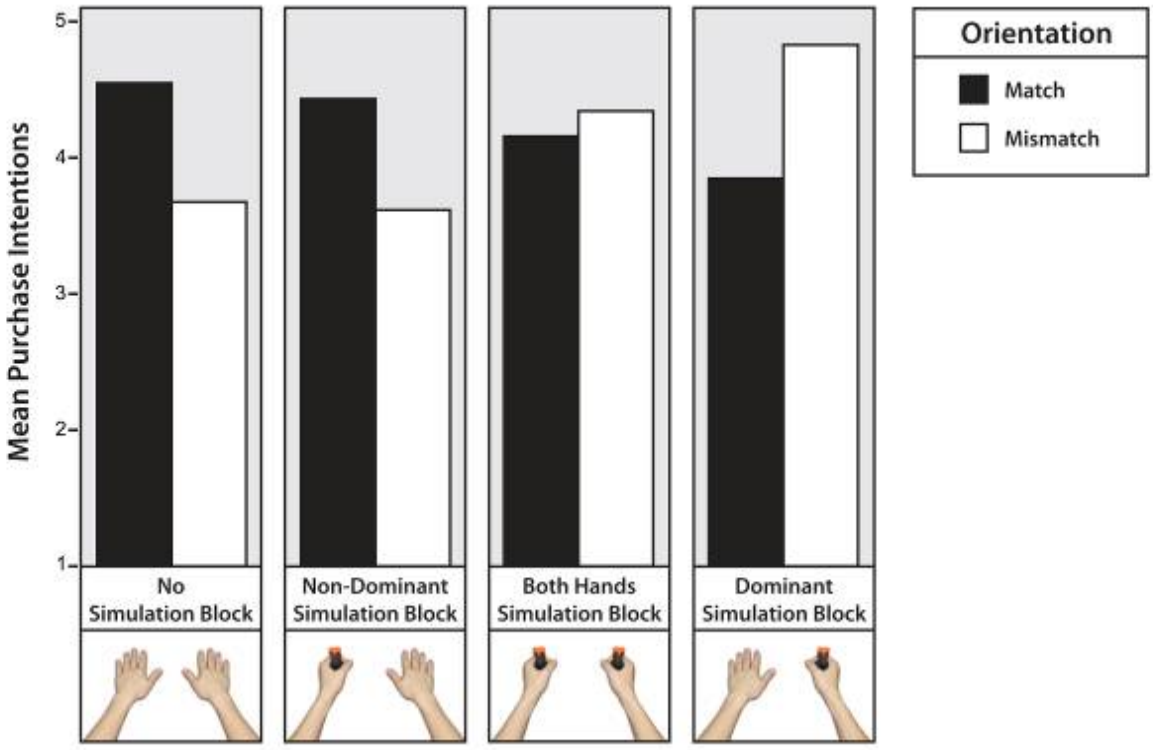


FIGURE 3.2: STIMULI USED IN STUDY 1A

FIGURE 3.3: STIMULI USED IN STUDY 1B

FIGURE 3.4: STIMULI USED IN STUDY 2

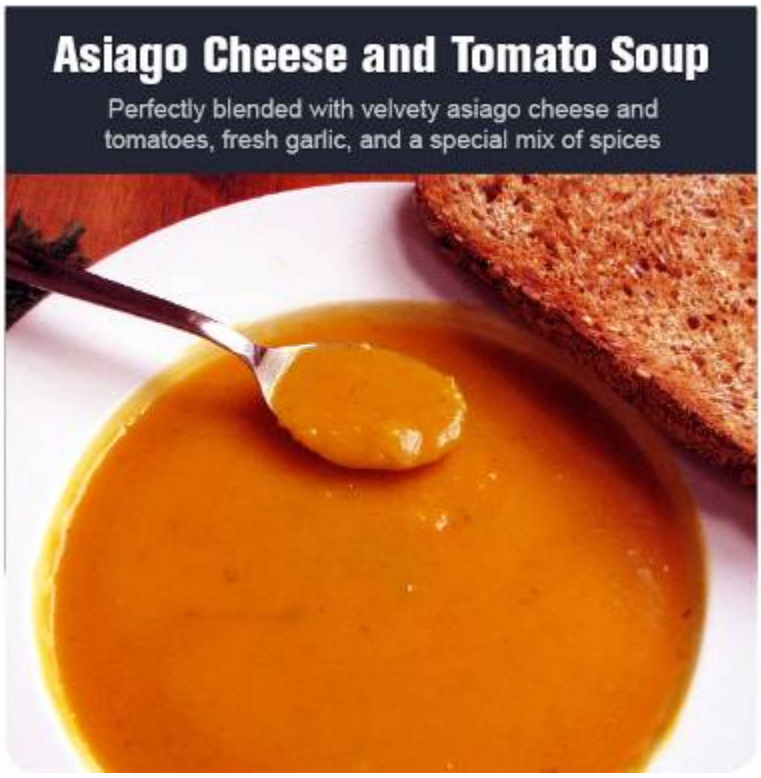
FIGURE 3.5: MEAN PURCHASE INTENTIONS BY CONDITION—STUDY 2



Note: The images shown above are for a right-handed participant

FIGURE 3.6: STIMULI USED IN STUDY 3

FIGURE 3.7: STIMULI USED IN STUDY 4



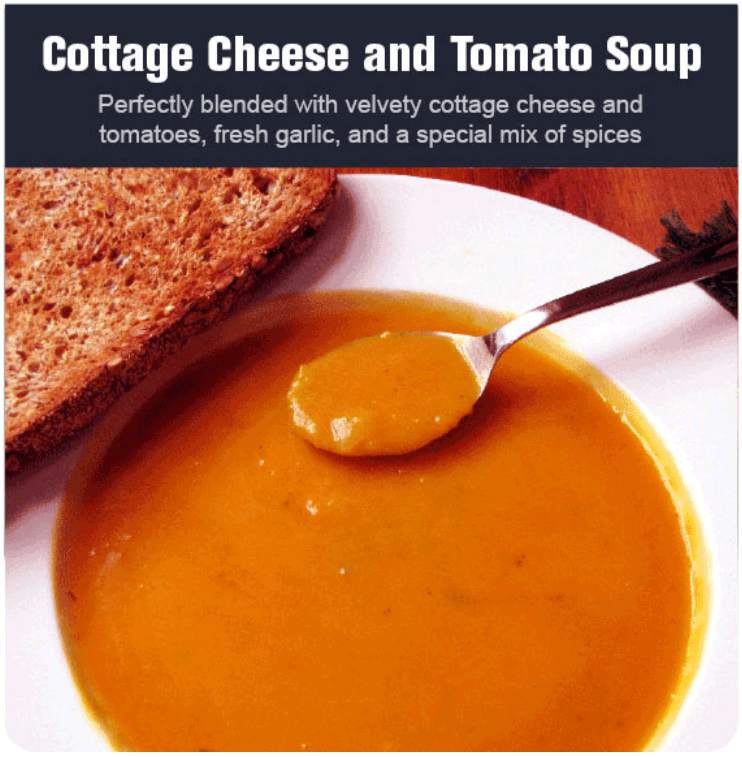
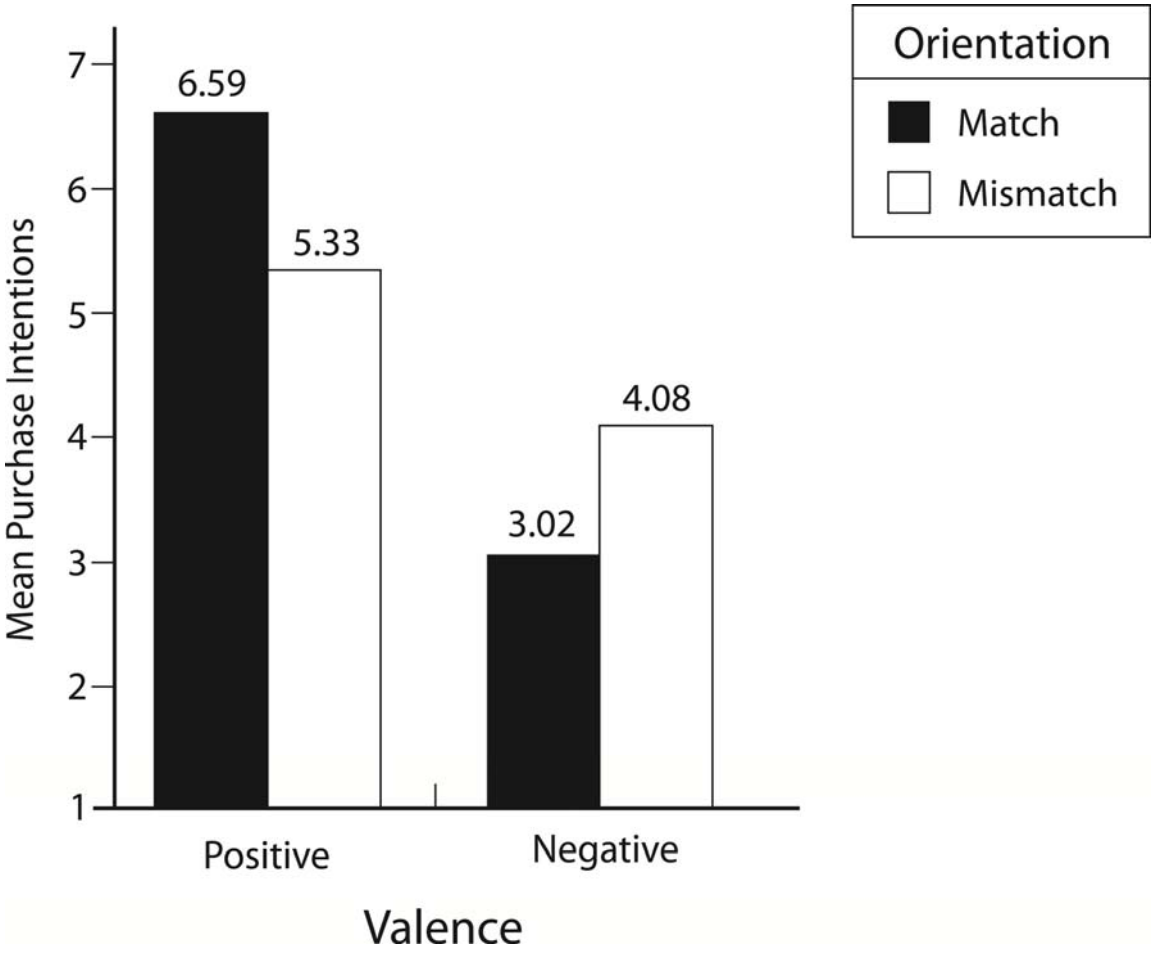


FIGURE 3.8: MEAN PURCHASE INTENTIONS BY CONDITION—STUDY 4



References

Adolphs, Ralph, Hanna Damasio, Daniel Tranel, Greg Cooper, and Antonio R. Damasio (2000), "A Role for Somatosensory Cortices in the Visual Recognition of Emotion as Revealed by Three-Dimensional Lesion Mapping," *Journal of Neuroscience,* 20 (April), 2683-90.

Allison, Ralph I. and Kenneth P. Uhl (1964), "Influence of Beer Brand Identification on Taste Perception," *Journal of Marketing Research,* 1 (August), 36-39.

Anderson, Craig A. (1983), "Imagination and Expectation: The Effect of Imagining Behavioral Scripts on Personal Influences," *Journal of Personality and Social Psychology,* 45 (8), 293-305.

Barsalou, Lawrence W. (1999), "Perceptual Symbol Systems," *Behavioral and Brain Sciences,* 22 (8), 577-660.

_____(2008), "Grounded Cognition," *Annual Review of Psychology,* 59, 617-45.

Bone, Paula F. and Pam S. Ellen (1992), "The Generation and Consequences of Communication-Evoked Imagery," *The Journal of Consumer Research,* 19 (June), 93-104.

Braun, Katherine A. (1999), "Postexperience Advertising Effects on Consumer Memory," *Journal of Consumer Research,* 25 (March), 319–334.

Cacioppo, John T., Joseph R. Priester, and Gary G. Berntson (1993), "Rudimentary Determinants of Attitudes: II. Arm Flexion and Extension have Differential Effects on Attitudes," *Journal of Personality and Social Psychology,* 65 (7), 5-17.

Chao, Linda L. and Alex Martin (2000), "Representation of Manipulable Man-made Objects in the Dorsal Stream," *NeuroImage,* 12 (10), 478-84.

Elder, Ryan S. and Aradhna Krishna (2010), “The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste,” *Journal of Consumer Research,* 36 (February), 748-56.

Gibbs, Raymond W., Jr. (2006), *Embodiment and Cognitive Science.* New York, NY US: Cambridge University Press.

González, Julio, Alfonso Barros-Loscertales, Friedemann Pulvermüller, Vanessa Meseguer, Ana Sanjuán, Vicente Belloch, and César Ávila (2006), "Reading Cinnamon Activates Olfactory Brain Regions," *NeuroImage,* 32 (2), 906-12.

Gregory, W. L., Robert B. Cialdini, and Kathleen M. Carpenter (1982), "Self-Relevant Scenarios as Mediators of Likelihood Estimates and Compliance: Does Imagining Make it So?" *Journal of Personality and Social Psychology,* 43 (7), 89-99.

Grèzes, J. and J. Decety (2002), "Does Visual Perception of Object Afford Action? Evidence from a Neuroimaging Study," *Neuropsychologia,* 40 (2), 212-22.

Havas, David A., Arthur M. Glenberg, Karol A. Gutowski, Mark J. Lucarelli, and Richard J. Davidson (2010), "Cosmetic use of Botulinum Toxin-A Affects Processing of Emotional Language," *Psychological Science,* 21 (July), 895-900.

Hoegg, Joandrea and Joseph W. Alba (2007), “Taste Perception: More Than Meets the Tongue,” *Journal of Consumer Research,* 33 (March), 490-498.

Jeannerod, Marc (2001), “Neural Simulation of Action: A Unifying Mechanism for Motor Cognition,” *Neuroimage,* 14, S103-S109.

Kent, Christopher and Koen Lamberts (2008), The Encoding–Retrieval Relationship: Retrieval as Mental Simulation,” *Trends in Cognitive Sciences,* 12 (3), 92–98

Kisielius, Jolita and Brian Sternthal (1984), "Detecting and Explaining Vividness Effects in Attitudinal Judgments," *Journal of Marketing Research,* 21 (2), 54-64.

_____(1986), "Examining the Vividness Controversy: An Availability-Valence Interpretation," *The Journal of Consumer Research,* 12 (March), 418-31.

Kosslyn, Stephen M., Giorgio Ganis, and William L. Thompson (2001), "Neural Foundations of Imagery," *Nature Reviews. Neuroscience,* 2 (September) 635-42.

Lee, Leonard, Shane Frederick, and Dan Ariely (2006), “Try It, You'll Like It: The Influence of Expectation, Consumption, and Revelation on Preferences for Beer,” *Psychological Science*, 17 (12), 1054-58.

Levin, Irwin P. and Gary J. Gaeth (1988), “How Consumers are Affected by the Framing of Attribute Information Before and After Consuming the Product,” *Journal of Consumer Research*, 15 (December), 374-78.

MacInnis, Deborah J. and Linda L. Price (1987), "The Role of Imagery in Information Processing: Review and Extensions," *Journal of Consumer Research,* 13 (3), 473-91.

McGill, Ann L. and Punam Anand (1989), "The Effect of Vivid Attributes on the Evaluation of Alternatives: The Role of Differential Attention and Cognitive Elaboration," *The Journal of Consumer Research,* 16 (September), 188-96.

Moulton, Samuel T. and Stephen M. Kosslyn (2009), "Imagining Predictions: Mental Imagery as Mental Emulation," *Philosophical Transactions of the Royal Society B: Biological Sciences,* 364 (May), 1273-80.

Oberman, Lindsay M., Piotr Winkielman, and Vilayanur S. Ramachandran (2007), "Face to Face: Blocking Facial Mimicry can Selectively Impair Recognition of Emotional Expressions," *Social Neuroscience,* 2 (3-4), 167-78.

Petrova, Petia K. and Robert B. Cialdini (2005), "Fluency of Consumption Imagery and the Backfire Effects of Imagery Appeals," *Journal of Consumer Research,* 32 (December), 442-52.

Petrova, Petia K. and Robert B. Cialdini (2008), "Evoking the Imagination as a Strategy of Influence," *Handbook of Consumer Psychology,* ed. Curt Haugtvedt, Paul Herr, and Frank Kardes, Mahwah, NJ: Lawrence Earlbaum Associates, Publishers, 505-524.

Rauscher, Frances H., Robert M. Krauss, and Yihsiu Chen (1996), "Gesture, Speech, and Lexical Access: The Role of Lexical Movements in Speech Production," *Psychological Science,* 7 (7), 226-31.

Reber, Rolf, Piotr Winkielman, and Norbert Schwarz (1998), "Effects of Perceptual Fluency on Affective Judgments," *Psychological Science,* 9 (January), 45-48.

Rolls, Edmund T. (2005), “Taste, Olfactory, and Food Texture Processing in the Brain and the Control of Food Intake,” *Physiology and Behavior,* 85 (May), 45-56.

Schlosser, Ann E. (2003), "Experiencing Products in the Virtual World: The Role of Goal and Imagery in Influencing Attitudes Versus Purchase Intentions," *The Journal of Consumer Research,* 30 (September), 184-98.

Simmons, W. K., Alex Martin, and Lawrence W. Barsalou (2005), "Pictures of Appetizing Foods Activate Gustatory Cortices for Taste and Reward," *Cerebral Cortex,* 15 (October 1), 1602-08.

Strack, Fritz, Leonard L. Martin, and Sabine Stepper (1988), "Inhibiting and Facilitating Conditions of the Human Smile: A Nonobtrusive Test of the Facial Feedback Hypothesis," *Journal of Personality and Social Psychology,* 54 (5), 768-77.

Symes, Ed, Rob Ellis, and Mike Tucker (2007), "Visual Object Affordances: Object Orientation," *Acta Psychologica,* 124 (2), 238-55.

Tucker, Mike and Rob Ellis (1998), "On the Relations between seen Objects and Components of Potential Actions," *Journal of Experimental Psychology: Human Perception and Performance,* 24 (6), 830-46.

_____ (2001), "The Potentiation of Grasp Types During Visual Object Categorization "*Visual Cognition*, 8 (6), 769–800.

Unnava, H. Rao, Sanjeev Agarwal, and Curtis P. Haugtvedt (1996), "Interactive Effects of Presentation Modality and Message-Generated Imagery on Recall of Advertising Information," *The Journal of Consumer Research,* 23 (June), 81-88.

Watson, David, Lee Anna Clark, and Auke Tellegen (1988), "Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales," *Journal of Personality and Social Psychology*, 54 (June), 1063-70.

Wells, Gary and Richard Petty (1980), "The Effects of Over Head Movements on Persuasion: Compatibility and Incompatibility of Responses," *Basic and Applied Social Psychology*, 1 (3), 219-30.

Williams, Lawrence E. and John A. Bargh (2008), "Experiencing Physical Warmth Promotes Interpersonal Warmth," *Science*, 322 (10), 606-07.

Wilson, Margaret (2002), "Six Views of Embodied Cognition," *Psychonomic Bulletin & Review*, 9 (12), 625-36.

Zatorre, Robert J. and Andrea R. Halpern (2005), "Mental Concerts: Musical Imagery and Auditory Cortex," *Neuron,* 47, 9-12.

Zatorre, Robert J. et al. (1996), "Hearing in the Mind's Ear: A PET Investigation of Musical Imagery and Perception," *Journal of Cognitive Neuroscience,* 8 (1), 29-46

Zhong, Chen-Bo and Geoffrey J. Leonardelli (2008), "Cold and Lonely: Does Social Exclusion Literally Feel Cold?" *Psychological Science,* 19 (9), 838-42.

CHAPTER 4

Conclusion

With my dissertation I focus on the interplay between cognition and sensory perception. Building upon recent models of cognition, I propose and show that our cognitions affect sensory perceptions at both deliberate and more automatic levels, with important consequences on consumer behavior. The context in which my results are shown is directly relevant to marketers; however, the contribution of my dissertation extends to cognitive psychology in general.

Within my dissertation, I explore the impact of visual and verbal information on sensory perception within an advertising context. In my first essay, I show how altering the amount of sensory information conveyed prior to a consumption experience leads to differential cognitions. These cognitions in turn shape the consumption experience, ultimately affecting taste perceptions. The results of the series of studies in my first essay exhibit that top-down influences can directly impact bottom-up perceptions, or perceptual properties of the stimulus (e.g., the food item). They additionally show that the effect of advertising goes far beyond the standard pre-purchase attitudes and intentions, and affects actual consumption.

In my second essay, I continue to build upon the relationship between cognition and sensory perception by exhibiting the effects of visual product depictions within

advertising to encourage mental simulation or interaction with the product. The results of these studies provide compelling support for the connection in resources shared between cognition and perception. Additionally, the studies show that advertisements can alter our intentions through very subtle manipulations of visual stimuli. The fact that these effects differ from those stemming from deliberate imagery warrants future attention.

Taken as a whole, my dissertation provides a foundational understanding of some of the ways marketers can utilize the connection between cognition and sensory perception to inform consumer behavior. I also provide empirical evidence to help solidify the theoretical framework within a broader context of cognitive psychology. It is my aim to continue this exploration and contribute to the development of this exciting research arena.