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Muscling Consumers to Optimal Option Differentiation: The Influence of Incidental Muscular Sensations on Option Differentiation

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Muscling Consumers to Optimal Option Differentiation: The Influence of Incidental Muscular Sensations on Option Differentiation

by

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy
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DEDICATION

To my family, for your love, encouragement, and support. To God for your strength.

Without you I would have never been able to see this journey through.
ACKNOWLEDGMENTS

This dissertation would not have been possible without the help of several key people. To my advisor, thank you for being a mentor when I needed guidance, a cheerleader when I needed encouragement, and a father-figure when I needed wisdom. To my Committee, thank you for the feedback, advice and support throughout this process. To my co-hort mate, thank you for your friendship. To my friends and boyfriend, thank you for the much needed distractions.
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ABSTRACT

Marketers often extend product lines by introducing slight variations of existing products (e.g., there are 53 varieties of Crest toothpaste, 15 varieties of Cheerios). As a result, consumers select from assortments containing relatively similar options. Unfortunately, consumers sometimes fail to differentiate among options, and instead consider the different options as similar and choose. Consequently, prior research shows that selecting from choice sets containing relatively similar options can sometimes lead to negative consequences such as decreased satisfaction. In light of these negative consequences, and given the frequency with which consumers choose from sets of similar options, it becomes important to identify interventions that can be used to optimize option differentiation (i.e., to optimize the perceived difference between two similar options or the perceived variety in an assortment). This dissertation proposes that incidental muscular sensations that consumers encounter while performing regular marketplace activities can serve as one such sensory based intervention.

Drawing on theories related to learned associations and classical conditioning, it is proposed that because individuals experience high intensity muscular contractions concurrently with threat/danger, these muscular contractions and the responses they facilitate (i.e., self-protective reflexes) become linked. Through classical conditioning, high (vs. low) intensity incidental muscular sensations eventually activate self-protective reflexes in the absence of any threat or danger. Once activated, self-protective reflexes lead to increased perceptual sensitivity and discriminatory ability, and a sense of unconscious vigilance. Six studies show that the enhanced perceptual sensitivity and unconscious vigilance that result from high (vs. low)
intensity muscular sensations optimize option differentiation, and can help to offset the
decreased satisfaction that is sometimes associated with choosing from relatively similar options.
Theoretical and managerial implications are discussed.
INTRODUCTION

Manufacturers expand product lines by introducing slight variations of existing products to cater to unique consumer preferences (Consumer Reports 2014). For instance, Crest offers 3D Vivid White Toothpaste, Baking Soda and Peroxide Whitening Toothpaste, Crest Pro-Health Whitening Toothpaste, Crest Whitening Expressions and more than 50 other varieties of toothpaste (Crest 2014). As a result of this proliferation or relatively similar options, grocery stores stock an average of 43,000 unique products (Food Marketing Institute 2013), which implies that consumers choose from more than 100 options in product categories such as cereal, pasta sauce, shampoo and toothpaste (Botti and Iyengar 2006). In some cases, consumers even choose from more than a dozen variations of the same brand of product (e.g., there are 53 types of Crest toothpaste, 15 types of Cheerios, etc.) (Consumer Reports 2014).

In addition to having to choose from brand extensions, consumers sometimes have to discriminate between different brands of products which might be similar in terms of the benefits they offer as well as visual packaging features (Miceli and Pieters 2010). For instance, in the context of choosing a toothpaste, rather than differentiating between varieties of Crest, a consumer might instead differentiate between multiple brands of whitening toothpaste (e.g., Crest, Colgate, Aqua Fresh, Aim, etc.).

It should be noted that distinguishing between relatively similar options is not unique to the context of shopping for packaged goods. Rather, the number of options available in market economies has expanded across a number of categories (e.g., clothing, travel options, etc.) (Scheibehenne, Greifeneder and Todd 2010). As Barry Schwartz put it, “consumers have always
had choices, but today options have exploded beyond all reason” (Consumer Reports 2014). In light of the proliferation of options across categories, option differentiation is important in a variety of consumer decision making contexts.

Unfortunately, consumers have a difficult time differentiating between relatively similar options (Miceli and Pieters 2010). This is because, whether a consumer is choosing from different variations of the same brand or different brands, as the number of options in a product category increases, the differences between options tend to get smaller and the decision becomes more difficult to make (Scheibehenne et al. 2010). Consistent with this, industry reports suggest that consumers perceive large assortments, such as those at grocery stores, as confusing and do not want to work hard to process all the information available (Consumer Reports 2014). Consequently, when faced with similar options, consumers sometimes fail to pick up on subtle but important differences, and instead consider the options as similar and choose (Iyengar and Kamenica 2010). In that regard, recent reports show that consumers see fewer differences between brands (Ipsos Marketing 2010; Sanburn 2012) and products (Consumer Reports 2012).

Because consumers sometimes fail to differentiate between options, it is not surprising that prior research shows that when choosing from similar options consumers’ preferences tend to decrease in strength (Chernev 2003), and they become more willing to accept substitutes (Lamberton and Diehl 2013). In addition, if consumers do not pick up on subtle differences between options they might end up selecting options that are not totally aligned with their needs. In that regard, choosing from relatively similar options can lead to decreased consumer satisfaction (Iyengar and Lepper 2000) and increased post decision regret (Gourville and Soman 2005). Finally, sometimes when faced with assortments of similar options, consumers avoid the choice all together (Iyengar, Huberman and Jiang 2004). To summarize the previous discussion,
while marketers introduce extensions that vary only slightly from existing products to cater to unique consumer preferences, prior research shows the choice sets composed of similar options that result from this strategy can have negative consequences in terms of decreased preference strength, decreased satisfaction, increased willingness to accept substitutes, increased post decision regret and increased choice aversion.

Given that many decision contexts involve relatively similar options, and that selecting from choice sets involving similar options can lead to negative consequences for consumers as well as for marketers, it becomes important to identify ways to optimize option differentiation (i.e., to optimize the perceived difference between two products or the perceived variety among an assortment of options). In that regard, marketers and legislators have taken steps to optimize option differentiation by highlighting the differences between options. For instance, Mars Petcare division partnered with IBM to develop kiosks which help consumers differentiate between pet foods and make informed choices (IBM 2014). Additionally, new nutritional labels have been designed to highlight differences in nutritional content and help consumers discriminate between food options (American Heart Association 2014). These interventions center on using informational cues to highlight the differences between options.

This dissertation proposes and empirically investigates an alternative means of helping consumers differentiate between options through the use of a sensory based intervention, (i.e., a sensory oriented tactic). Specifically, this dissertation proposes that incidental muscular sensations (i.e., muscular contractions consumers experience when performing common marketplace activities) can optimize option differentiation. That is, this dissertation proposes and demonstrates that after incidentally experiencing muscular sensations of varying intensities consumers will perceive a pair of similar products as more different and an assortment of similar
items as more varied. But, how might muscular sensations be relevant to consumer decision making contexts which involve differentiating between relatively similar options?

Consumers experience muscular sensations of varying intensities in a variety of decision making contexts, including contexts where they also encounter relatively similar options (e.g., shopping, dining out, sampling products, etc.). For instance, at a grocery store consumers might push difficult (vs. easy)-to-maneuver shopping carts or lift heavy (vs. light) products. At restaurants, consumers might pull out or push in difficult (vs. easy)-to-move chairs, pour from heavy (vs. light) water pitchers or open tightly (vs. loosely) sealed bottles (e.g., ketchup). This research examines whether the high (vs. low) intensity muscular sensations experienced when performing these activities would influence consumers’ subsequent perceptions and decisions when encountering relatively similar options. That is, would option differentiation be optimized after a consumer experienced high (vs. low) intensity muscular sensations? In the context of some of the examples discussed previously, would a consumer pick up on subtle differences between two relatively similar products (vs. consider the products as the same) or perceive greater variety in an assortment if he or she pushed a difficult (vs. easy)-to-maneuver cart out of the way, or lifted a heavy (vs. light) shopping basket before encountering the options?

The answer to this research question yields theoretical as well as practical implications. First, from a theoretical perspective, many studies in the consumer decision making literature have tended to characterize choice sets as containing clear-cut, black and white, extreme alternatives. For instance, prior work has examined consumer choice between healthy and unhealthy food options (Chandon and Wansink 2007), virtues and vices (Chernev 2011), and hedonic and utilitarian goods (Dhar and Wertenbroch 2000) among others. However, given the recent proliferation of relatively similar options available to consumers, decision making might
not always involve choosing from a set of black and white, clear cut alternatives (e.g., fruit salad vs. chocolate cake). Instead, in many cases, choice sets contain alternatives that more closely resemble varying shades of gray (e.g., regular cake vs. fat free cake vs. low sugar cake vs. low carb cake, etc.), and choosing involves distinguishing between these different shades. Studies that have examined consumer decision making when similar options are involved have focused on how organizing the options in different ways (Lamberton and Diehl 2013) as well as how the consumer’s mindset (Miceli and Pieters 2010; Xu, Jiang and Dhar 2013) influence similarity perceptions. This dissertation departs from prior studies by examining how a sensory based intervention (i.e., incidental muscular sensations) can optimize option differentiation.

Second, despite the prevalence of incidental muscular sensations in the marketplace, the sensory marketing literature has tended to focus on the traditional five senses (i.e., vision, touch, audition, olfaction and haptics). The muscular sense, which is distinct from touch (Wade 2003), has been referred to as the “sixth” (Smith 2011) and “forgotten” sense (Berthoz 2000) and is virtually ignored in the sensory marketing literature. In the consumer behavior literature, the few studies which have examined the influence of the muscular sense focus on consciously exerted flexion. For instance, Hung and Labroo (2011) investigate how firming muscles through maintaining specific bodily poses influences consumer willpower, and; Zhang and Li (2012) focus on how carrying weight influences judgments of importance. The current work departs from prior studies by examining incidental sensations which consumers would likely not be consciously aware of. To the best of this author’s knowledge, the influence of incidental muscular sensations on consumer decision making has not been studied, and incidental muscular sensations remain unexamined in the sensory marketing literature.
Finally, work related to the influence of bodily sensations on consumer behavior (e.g., Hung and Labroo 2011; Zhang and Li 2012; among others) has relied on theories of embodied cognition to explain the effects of bodily cues. In contrast, this dissertation draws on literature related to learned associations between threat/danger and incidental muscular contractions as well as conditioned responses to threat/danger to explain the influence of incidental muscular sensations.

From a managerial perspective, despite increasingly high investments to expand product lines by introducing slight variations of existing products, consumers perceive few differences between products (Consumer Reports 2012). This dissertation offers marketers an inexpensive means of helping consumers to differentiate between products. Specifically, the results of this dissertation suggest that marketers might be able to strategically design products and ambient factors to encourage muscular sensations of varying intensities with the goal of optimizing option differentiation and increasing post-choice satisfaction.

This dissertation draws on literature which shows that muscular sensations occur concurrently with threat/danger in both humans and animals, and links it with literature which shows that high intensity sensory cues that occur concurrently with threat can activate self-protective reflexes. Self-protective reflexes are designed to aid humans and animals in detecting and responding to a threat if one were present (Lang, Davis and Öhman 2000; Öhman 1997). Specifically, self-protective reflexes facilitate adaptive behavioral responses such as enhanced perceptual sensitivity and discriminatory ability (Becker et al. 2011), speeded information processing (New, Cosmides and Tooby 2007) and an overall sense of unconscious vigilance (Lidell et al. 2005; Szechtmann and Woody 2004). Building on 1) the link between muscular sensations and threat/danger, and 2) the responses that stem from activating self-protective
reflexes, it is proposed that incidentally experiencing muscular sensations of high (vs. low) intensity will lead to optimize option differentiation by subconsciously activating self-protective reflexes.

Six studies lend support to this prediction. Specifically, the findings demonstrate that after experiencing high (vs. low) intensity incidental muscular sensations consumers perceive a pair of similar products as more different (study 1A) and an assortment of similar items as more varied (study 1B). In support of the theorization that high intensity muscular sensations activate self-protective reflexes, this dissertation shows that after experiencing high (vs. low) intensity incidental muscular sensations, individuals process information more quickly and prefer “safer” (i.e., lower risk but lower reward) options (study 1C). Additionally, when self-protection is activated before individuals experience muscular sensations, there is no difference in option differentiation based on intensity of muscular sensations (study 2). While it was predicted that deactivating self-protection through a relaxation task should attenuate the effects of muscular sensations, the findings show that, as a testament to the difficult deactivation of self-protection (Szechtman and Woody 2004), high (vs. low) intensity sensations still optimize option differentiation even when a relaxation task is present (study 3). Finally, muscular sensations can offset some of the negative consequences associated with choosing between similar options (e.g., decreased satisfaction) by encouraging consumers to be more vigilant when choosing (study 4).

The next section elaborates on the link between muscular sensations, threat/danger and self-protective reflexes to build a framework for the proposed hypotheses. This is followed by a discussion of six experimental studies which empirically test the proposed hypotheses.
Incidental Muscular Sensations, Threat/Danger, and Associative Learning

Muscular sensations have been linked to threat/danger throughout history (Flykt 2006). This is because in both humans’ and animals’, muscular contractions are experienced concurrently with threat (Moskowitz 2004). For instance, animals automatically tense up when they sense a predator just as individuals’ muscles contract when they see a cockroach or wake up to a strange noise. Even babies experience muscular contractions when they encounter something or someone unexpected (Bond 2011; Choliz, Fernandez-Abascal and Martinez-Sanchez 2012). Thus, incidental muscular sensations and threat/danger are repeatedly paired throughout an individual’s life.

Research in the domain of classical conditioning and associative learning has demonstrated the profound effects that the repeated pairing of stimuli can have on responses. To elaborate, classical Pavlovian conditioning shows that when a neutral/conditioned stimulus is repeatedly paired with a stimulus that elicits a response (i.e., an unconditioned stimulus), the neutral stimulus becomes associated with the response, and eventually the neutral stimulus can elicit the response in the absence of the non-neutral stimulus (Morgan and King 1988; Pavlov 1927; Rescorla 1988). For instance, Pavlov noticed his dog’s hard-wired response to salivate in the presence of food, and began ringing a bell every time he fed the dog. Over time the dog learned to associate the sound of the bell with the food. Eventually the dog would salivate when
he heard the bell even if there was no food present (Pavlov 1927). Conceptually speaking, Pavlov showed that pairing a conditioned stimulus (i.e., the bell) with an unconditioned stimulus (i.e., the food) could lead to the conditioned stimulus eliciting a conditioned response (i.e., salivating to the sound of the bell).

Applying the principles of classical conditioning to the context of the present research, threat/danger would act as an unconditioned stimulus which elicits perceptual and behavioral responses that facilitate detection and minimization of threats (unconditioned responses), as will be discussed in the next section. Due to the repeated pairing of brief, high intensity incidental muscular sensations (conditioned stimulus) and threat/danger (unconditioned stimulus), overtime muscular sensations and threat/danger have become linked as demonstrated in prior research (e.g., Bond 2011; Choliz et al. 2012; Moskowitz 2004). Building on this link between incidental muscular sensations and threat/danger, this dissertation proposes that muscular sensations alone (i.e., in the absence of threat) will elicit perceptual and behavioral responses which would facilitate the detection and minimization of threat if one were present. Put differently, this dissertation proposes that the repeated pairing of brief, high intensity muscular contractions and threat/danger will lead high (vs. low) intensity incidental muscular sensations to activate automatic responses to threat even in the absence of any threat/danger. Next, this research discusses the automatic perceptual and behavioral responses to threat/danger.

Responses to Threat/Danger

As noted previously, individuals have hard-wired responses that are elicited in response to threat or danger (Öhman 2005). One category of responses are “quick and dirty” pre-attentive
reflexes which are a type of self-protective mechanism that aid humans and animals in detecting and responding to potential danger or rare catastrophic threats (Öhman 1997; Szechtman and Woody 2004). While most organisms never actually encounter the type of threats self-protective reflexes are designed to deal with, it is still functionally adaptive that organisms possess the ability to detect and respond to these threats, because in the event that such a threat does occur, if it is not detected and responded to the consequences can be deadly.

Because danger can take on different forms, humans and animals are not conditioned to respond to a specific set of threatening stimuli. Rather, self-protective reflexes are activated by a broad range of subtle, indirect and even subliminal cues which can be unrelated to any imminent threat or danger (Hinds et al. 2010). Activating cues tend to be simple, high intensity sensory cues which have come to be associated with threat or danger (Lang et al. 2000; Öhman 1997). For instance, bright lights, loud noises (Lang et al. 2000) and rapidly onset stimuli (Yantis and Johnson 1990) can activate self-protective reflexes since these types of stimulation are often associated with danger (Öhman 1997). As these examples suggest, activating cues do not have to be directly related to threat, they can merely coincide with it (Öhman and Mineka 2001). That is, self-protection is activated when contextual cues associated with threat are present (Miller, Maner and Becker 2010). Moreover, while activating cues tend to be intense enough to trigger a reflexive response, they are not so intense as to make an individual consciously aware of their occurrence (Esteves, Dimberg and Öhman 1994; Hinds et al. 2010). To summarize, self-protective reflexes are highly sensitive and can be activated by a variety of sensory cues. The sensitivity of self-protective reflexes has been attributed to the higher risks associated with false positives (i.e., responding to a threat when none exists) compared to false negatives (i.e., failing to respond to a threat when one does exist) (Öhman 1997).
When self-protective reflexes are activated, they facilitate adaptive responses (i.e., responses that aid an organism in identifying a threat if one were present so that it could then respond to the threat). More specifically, self-protection facilitates “perceptions, cognitions and behaviors associated with greater survival success in ancestral environments,” (Griskevicius et al. 2006, 282). From a physiological perspective, self-protection has been proposed to facilitate adaptive responses by stimulating the hypothalamic-pituitary-adrenal (HPA) axis. Stimulating the HPA axis leads to a state of vigilance whereby resources are mobilized so that an organism can detect and respond to potential threats (Szechtmann and Woody 2004). Thus, one behavioral outcome of activating self-protective reflexes is an overall state of unconscious vigilance.

Vigilance is a state of activation, readiness or sustained attention (Parasuraman 1984; Rosenberg et al. 2013), in which perceptual sensitivity is enhanced, and organisms probe the environment and engage in in-depth information search which often involves assessing ambiguous stimuli of uncertain significance (Hinds et al. 2010) to identify potential threats (Szechtmann and Woody 2004). Vigilance has been shown to facilitate the detection of subtle differences (Rosenberg et al. 2013). Additionally, when individuals are vigilant they are not only more likely to detect and respond to stimuli, but they tend to do so more quickly (i.e., with shorter reaction times) (Parasuraman 1984). Consistent with this, prior research shows that activating self-protective reflexes leads to faster (New, Cosmides and Tooby 2007), more efficient information processing (Becker et al. 2010) and enhanced perceptual sensitivity and discriminatory ability (Becker et al. 2011). For instance, in one study, Becker et al. (2011) find that the enhanced perceptual sensitivity that results from self-protection leads individuals to more accurately discriminate between friends and enemies. In another study, Becker et al. (2010) show that when primed with self-protection (vs. a control prime), individuals more efficiently encode
the facial characteristics of threatening individuals. More specifically, individuals are better able
to recall faces of threatening individuals with similar amounts of visual attention. In the context
of a dangerous situation, it makes adaptive sense for self-protective reflexes to lead to speeded
information processing and enhanced perceptual sensitivity, since threats would need to be
detected and responded to quickly (Roese and Olson 2007).

As noted previously, threat/danger comes in many forms and so self-protective reflexes
are activated by a range of stimuli. Moreover, because the behavioral responses that result from
activating self-protective reflexes are below conscious awareness, and individuals are typically
not aware of the cue that activates self-protective reflexes, perceptive and behavioral responses
(i.e., enhanced perceptual sensitivity and discriminatory ability, speeded information processing
and unconscious vigilance) extend to a wide range of stimuli which might be unrelated to the
initial activating cue (Holbrook, Sousa and Hahn-Holbrook 2011).

It should be noted that the generality of responses elicited by activating self-protective
reflexes makes these reflexes distinctly different from fear based systems which lead to fight or
flight responses to a narrow set of stimuli (Woody and Szechtman 2011). In addition, self-
protective reflexes differ from fear based systems in at least three other ways. First, according to
Woody and Szechtman (2011), cues which activate self-protective reflexes tend to be more
subtle than cues which activate fear based systems, since the former can be unrelated to
imminent threat and many only suggest hidden risk. Second, the emotional state associated with
activating self-protection is anxiety or a state of wariness whereas the emotional state associated
with fear based systems is fear. Finally, while fear is the behavioral output that stems from
activating fear based systems, vigilant probing of the environment in search for information
results from activating self-protection (Woody and Szechtman 2011). In summary, there are several important differences between self-protective reflexes and other fear based systems.

The effects of self-protective reflexes are proposed to be long lasting. Thus, while self-protective reflexes are easy to activate, they are not as easy to deactivate. In fact, one distinguishing characteristic of self-protective reflexes is their tendency to deactivate slowly (Szechtmann and Woody 2004). In that regard, self-protective reflexes remain active until they are terminated by feelings of security or calmness, or counteracting visceral or motor cues (Woody and Szechtman 2011). The difficult deactivation of self-protective reflexes is functionally adaptive since, even if a threatening individual or a predator leaves an area, he or she may still return and so it is beneficial for the organism to remain in a state of vigilance (Szechtman and Woody 2004).

To summarize, prior research shows that self-protective reflexes are activated by a broad range of cues, and once activated these reflexes facilitate responses that would help an organism identify and respond to a threat if one were present (e.g., enhanced perceptual sensitivity, speeded information processing and an overall sense of unconscious vigilance). Finally, the effects of activating self-protection have been proposed to be long lasting in order to maximize the likelihood of detecting a threat if one were present. Next, the proposed link between self-protective reflexes and incidental muscular sensations is discussed.

Muscular Sensations and Self-Protective Reflexes

As previously mentioned, self-protective reflexes are activated by a range of high intensity sensory cues (Hinds et al. 2010; Lang et al. 2000; Öhman 1997) which may not be
directly associated with any imminent threat, but occur concurrently with threat/danger and hence are associated with it (Öhman and Mineka 2001). In that regard, this dissertation proposes that muscular sensations and more specifically high (vs. low) intensity incidental muscular sensations might be one such activating cue.

While prior research has not linked incidental muscular sensations with self-protective reflexes, there is evidence to support the link between high (vs. low) intensity muscular sensations and some of the behavioral responses which result from activating self-protective reflexes. That is, while the prior research shows that muscular sensations can lead to speeded information processing (Bourne 1955) and unconscious vigilance (Agnew, Pyke and Pylyshyn 1966), these effects have not been attributed to activation of self-protection. Additionally, prior studies have focused on individuals’ responses to consciously exerted muscular flexion rather than incidental muscular sensations. Nonetheless, the findings of these studies still provide preliminary support for the link between muscular sensations and the perceptual and behavioral responses discussed previously. Next, is a brief discussion of the findings of these prior studies.

There is a rich stream of literature in applied psychology dating back to the beginning of the twentieth century which suggests that muscular sensations of a “moderate” intensity have a facilitating effect on task performance (Tomporowski and Ellis 1986). Early studies in this stream show that individuals learn syllables more quickly and remember them better when they learn while squeezing a hand dynamometer (i.e., when their muscles are contracted and they experience muscular sensations) compared to when they do not squeeze the dynamometer (Bills 1927). However, later studies show that rather than facilitating learning, muscular sensations merely facilitate or speed up responding (Bourne 1955). Other researchers have expanded on the findings of these early studies and shown that the facilitating effects of muscular sensations also
extend to non-cognitive, sensory oriented tasks. Specifically, Agnew, Pyke and Pylyshyn (1966), investigate how muscular sensations, task feedback and exposure to a visual stimulus influence individuals’ performance in distance judgment tasks. They have individuals squeeze a dynamometer for three seconds just before they are asked to judge the distance between spots placed different distances apart. They find that all three factors: inducing strong (vs. mild) intensity muscular sensations just before the task, increasing viewing time from 10 milliseconds to 1 second, and telling participants the distance after completing a trial all positively influence performance. Interestingly, Agnew, Pyke and Pylyshyn (1966) find that muscular sensations have the greatest influence on performance when task complexity is high (i.e., no task feedback is provided) suggesting that muscular sensations facilitate performance by increasing vigilance. In combination, these studies are consistent with the prediction that incidental muscular sensations will activate self-protective reflexes which will facilitate adaptive behavioral responses (i.e., speeded information processing, enhanced perceptual sensitivity and an overall state of unconscious vigilance). Thus, while prior studies have focused on consciously exerted muscular flexion there is still evidence to support the link between muscular sensations and the perceptual and behavioral responses discussed previously.

In light of the association between muscular sensations and potential threat/danger, and the fact that prior research has proposed that high intensity cues which occur concurrently with threat activate self-protective reflexes (Lang et al. 2000; Öhman 1997), this dissertation proposes that through classical conditioning incidental muscular sensations might have developed into a sensory cue that activates self-protective reflexes. Thus, this dissertation predicts that high (vs. low) intensity incidental muscular sensations experienced in the absence of any threat or danger will unconsciously activate self-protective reflexes which will subsequently facilitate the same
perceptual (i.e., enhanced perceptual sensitivity and discriminatory ability) and behavioral responses (i.e., speeded information processing and an overall sense of unconscious vigilance) that would be experienced if threat/danger was present.

Overall, building up on 1) the co-occurrence of muscular sensations and threat/danger, 2) literature which shows that self-protective reflexes are activated by high intensity sensory cues that occur concurrently with threat/danger and 3) research which shows that muscular sensations lead to speeded information processing and vigilance, this dissertation predicts that high (vs. low) intensity incidental muscular sensations which consumers might experience in marketplace contexts will activate self-protective reflexes which will lead to the behavioral responses discussed previously, ultimately resulting in optimal option differentiation. Next, this dissertation discusses in detail how the behavioral responses which result from activating self-protective reflexes will lead to optimal option differentiation.

**Self-Protective Reflexes and Optimal Option Differentiation**

As mentioned previously, self-protective reflexes facilitate adaptive responses such as enhanced perceptual sensitivity and discriminatory ability, speeded information processing and a sense of unconscious vigilance. The relevant question for this research is: how will these responses influence consumer decision making, and specifically how will they optimize option differentiation? Before addressing this question it is important to reiterate exactly what is meant by optimizing option differentiation.

As noted previously, optimizing option differentiation refers to optimizing the perceived difference between options. In the context of comparing a pair of options, this would involve a
judgment of how similar or different a consumer perceives the options to be. In the context of comparing an assortment of options, this would involve a judgment of how much variety a consumer perceives an assortment to have. These definitions are consistent with prior work which shows that perceived similarity is inversely related to perceived variety (Hoch, Bradlow and Wansink 1999; Lamberton and Diehl 2013).

Building on prior research which shows that self-protection enhances perceptual sensitivity (Becker et al. 2011; Szechtman and Woody 2004), this dissertation predicts that high (vs. low) intensity incidental muscular sensations will activate self-protective reflexes which will optimize option differentiation. It is predicted that after experiencing high (vs. low) intensity incidental muscular sensations, the perceived difference between a pair of options and the perceived variety in an assortment will increase. That is, if a consumer were to compare two relatively similar products (e.g., Post Raisin Bran vs. Kellogg’s Raisin Bran) or an assortment of similar cereals (e.g., Honey Nut Cheerios, Honey Nut Cheerios Medley Crunch, Oats & Honey Cheerios with Protein, Apple Cinnamon Cheerios, Cinnamon Burst Cheerios), he/she would rate the two raisin brans as more different and the assortment of Cheerios as having more variety after experiencing high (vs. low) intensity incidental muscular sensations. Formally stated:

\[ H1: \text{High (vs. low) intensity incidental muscular sensations will optimize option differentiation. Specifically, after experiencing high (vs. low) intensity incidental muscular sensations, a) the perceived difference between a pair of products, and b) the perceived variety in an assortment should increase.} \]

\[ \text{Extremely High Intensity Sensations and Option Differentiation} \]

The muscular sensations elicited by many marketplace activities might not be intense enough to reach threshold levels of awareness, however in some cases muscular sensations are of
a very high intensity and would not remain below consciousness (e.g., opening a very tightly sealed jar, pushing/pulling open a heavy door). Prior research shows that upon experiencing increasingly high intensity muscular sensations, individuals’ thoughts tend to shift from being unrelated to the task eliciting the sensations to being totally consumed by it (Balague et al. 2012). In addition, it stands to reason that devoting resources to physical tasks would leave fewer resources available for subsequent judgment and decision making (Kahneman 1973).

Furthermore, if muscular sensations are of a very high intensity consumers may become aroused or depleted which could lead to impaired processing and decreased vigilance (Pham 1996; Sanbonmatsu and Kardes 1998). In the context of the present research, these findings would suggest that option differentiation will not increase monotonically as the intensity of muscular sensations increase. Rather, at some point, these other processes (i.e., decreased resource availability, arousal and depletion) should begin to take over and there should not be any incremental increase in option differentiation between individuals who experience high and very high intensity sensations.

This prediction is also consistent with work in the domain of applied psychology, which has examined how different intensities of muscular sensations influence performance. This work suggests a curvilinear relationship between intensity of sensations and performance whereby performance improves up to a point after which increasing the intensity of muscular tension leads to diminished performance (Courts 1939; Wood and Hokanson 1965). For instance in one study, Levin (1967) examined how different intensities of muscular sensations (none, very light, medium and very high) influenced performance on a paired-associates task. The results show that errors were lowest when medium intensity muscular sensations were induced during testing and highest when very high intensity muscular sensations were induced during testing. The
results also show that while physiological arousal (i.e., heart rate) increases monotonically as a function of tension, the relationship between the intensity of muscular sensations and performance follows an inverted U.

Building on these insights, in the context of the present research, it is predicted that there will be a non-monotonic relationship between intensity of muscular sensations and option differentiation whereby high (vs. low) intensity incidental muscular sensations will optimize option differentiation. However, there will be no difference in option differentiation between very high (vs. high) intensity sensations. Formally:

\[ H2: \text{ High (vs. low) intensity muscular sensations will optimize option differentiation. However, there will not be a difference in option differentiation between very high (vs. high) intensity muscular sensations.} \]

**Muscular Sensations and Preference for Safe (vs. Risky) Options**

Activation of self-protection “facilitates perceptions, cognitions and behaviors associated with greater survival success” (Griskevicius et al. 2006, 282). In that regard, individuals become more risk averse when self-protection is activated since, when an individual is focused on protection he/she would want to avoid taking on additional risk (Li et al. 2012). For instance, to avoid social risks which might stem from diversion, individuals tend to conform to the choices of others when self-protection is activated (Griskevicius et al. 2006). Along similar lines, loss aversion or the general tendency to overweigh losses compared to equivalent gains (Kahneman and Tversky 1979) is enhanced when self-protection is activated because, when an individual is focused on protecting him/herself from danger he/she would be even more sensitive to potential losses and better served by avoiding the losses than accumulating rewards or gains (Li et al. 2012). In the context of the present research, if the proposed theorization is correct and high (vs.
low) intensity muscular sensations activate self-protective reflexes, then after experiencing high (vs. low) intensity muscular sensations individuals should be more risk averse. So, when given a choice between relatively “safe” and “risky” options, individuals should have a greater preference for safer (i.e., less risky) options after experiencing high intensity sensations. Thus, enhanced preference for safe (vs. risky) options will provide evidence for self-protection as the proposed process.

H3: After experiencing high (vs. low) intensity incidental muscular sensations, individuals will have a greater preference for safe (vs. risky) options.

Self-Protection and Speed of Information Processing

Prior research shows that information processing tends to be sped up when self-protection is activated (Hinds et al. 2010; New et al. 2007). This speeded information processing has been proposed to occur to help individuals respond to threat since, when a potential threat is present individuals would need to evaluate the threat and respond as quickly as possible to escape any potential danger (Roese and Olson 2007). Consistent with this, prior research shows that when self-protection is activated individuals more quickly and accurately discriminate between potential friends and enemies (Becker at al. 2011). In the context of the present research, if the theorization is correct and the effect of high (vs. low) intensity muscular sensations is driven by activation of self-protective reflexes, then information processing should be sped up after individuals experience high (vs. low) intensity incidental muscular sensations. Because response latencies are used as an indicator of speed of information processing high (vs. low) intensity incidental muscular sensations should lead to shorter response latencies. Formally stated:

H4: High (vs. low) intensity incidental muscular sensations should lead to shorter response latencies.
Externally Activating Self-Protection Attenuates the Effect of Muscular Sensations

If, as proposed, high intensity muscular sensations optimize option differentiation by activating self-protective reflexes, then the effect should be attenuated when self-protection is activated before individuals experience muscular sensations (since self-protection would be active even when individuals experience low intensity muscular sensations). Furthermore, as discussed previously, the relationship between intensity of muscular sensations and option differentiation is predicted to be non-monotonic so it is unlikely that option differentiation would continue to increase when self-protection is activated prior to the muscular task, and sensations are of a high intensity (vs. when self-protection is not activated and sensations are high intensity).

To summarize, it is proposed that when self-protection is activated before individuals experience incidental muscular sensations, there should be no difference in option differentiation based on the intensity of muscular sensations. So, the effects of muscular sensations on option differentiation should persist in the absence of a self-protection prime but should be attenuated when a self-protection prime is present. Formally:

H5: High (vs. low) intensity incidental muscular sensations will optimize option differentiation in the absence of a self-protection prime, but this effect will be attenuated in the presence of a self-protection prime.

Deactivating Self-Protection Attenuates the Effect of Muscular Sensations

The key prediction of this dissertation is that high (vs. low) intensity incidental muscular sensations activate self-protective reflexes, which subsequently facilitate adaptive responses which are reflected in optimal option differentiation. If this theorization is correct, then the
effects of muscular sensations on option differentiation should persist when self-protective reflexes remain activated after the muscular sensation eliciting task, but should be attenuated when self-protective reflexes are deactivated. In that regard, relaxation can counteract the effects of muscular tension (Marr 2006) and should deactivate self-protection. This is consistent with research which shows that self-protective reflexes are deactivated when an individual has an “internal affective signal” (Woody and Szechtmam 2011, 1021) which is associated with a feeling of security or calmness (Glickman and Schiff 1967). Thus, it is predicted that high (vs. low) intensity incidental muscular sensations will optimize option differentiation in the absence of a subsequent relaxation task, but this effect will be attenuated when participants are made to relax after experiencing these sensations. Formally stated:

H6: High (vs. low) intensity incidental muscular sensations will optimize option differentiation in the absence of a relaxation task, but this effect will be attenuated in the presence of a relaxation task.

Muscular Sensations, Post-choice Satisfaction and Decision Justification

When individuals choose from relatively similar options they sometimes experience decreased satisfaction with the chosen option (Iyengar and Lepper 2000). Given the recent proliferation of relatively similar options, it is important for managers to identify ways to offset this decreased satisfaction since consumers often choose from similar options. In that regard, prior research shows that unconscious vigilance can increase post-choice satisfaction (Dijksterhuis and van Olden 2006). Building on this finding, if the theorization about self-protective reflexes being activated by high (vs. low) intensity sensations is correct, then the unconscious vigilance that results from activating these sensations should lead to increased post-choice satisfaction despite choosing from similar options. Moreover, if high intensity sensations
lead to unconscious vigilance and subsequently increased post-choice satisfaction, a practical implication of this research would be in showing that one way to overcome the decreased satisfaction that can result from choosing from similar options is through high (vs. low intensity) incidental muscular sensations.

In the event that it would not be possible for a manager to induce muscular sensations (e.g., in an online shopping environment) it would be important to encourage post-choice satisfaction through an alternative means. In that regard, prior research shows that justification increases vigilance in decision making (LeBoeuf and Shafir 2003; Simonson and Staw 1992), and therefore should increase post-choice satisfaction. Additionally, if in fact muscular sensations enhance unconscious vigilance, then the effects of muscular sensations should persist when vigilance is not activated through an alternative means, but there should be no difference in post-choice satisfaction based on the intensity of muscular sensations when vigilance is activated through an alternative task. So, in summary, it is proposed that high (vs. low) intensity incidental muscular sensations will lead to increased post-choice satisfaction in the absence of decision justification, but there should be no difference in post-choice satisfaction based on incidental muscular sensations when individuals are asked to justify their choices. Formally stated:

H7: Post-choice satisfaction will be greater after individuals experience high (vs. low) intensity incidental muscular sensations, but there will be no difference in post-choice satisfaction when individuals are asked to justify their decisions.
EMPIRICAL STUDIES

The proposed hypotheses are tested in a series of six experimental studies. Figure 1 represents the overall conceptual framework and shows how the set of studies tests the different pieces of the framework. Briefly, study 1A tests the basic prediction that high (vs. low) intensity incidental muscular sensations optimize option differentiation in terms of increased differences between similar options. Study 1B expands on this basic finding and tests the idea the high (vs. low) intensity sensations optimize option differentiation in terms of greater perceived variety in an assortment, and also the idea that there will not be a significant difference in option differentiation between individuals who experience high and very high intensity sensations. Study 1C provides evidence that the effects of high (vs. low) intensity incidental muscular sensations are driven by activation of self-protective reflexes by examining how high (vs. low) intensity sensations influence speed of information processing and preference for safe (vs. risky) options. Study 2 examines how activating self-protective reflexes prior to experiencing muscular sensations influences option differentiation (i.e., the moderating effect of a self-protection prime). Study 3 investigates how deactivating self-protective reflexes after experiencing muscular sensations influences option differentiation (i.e., the moderating effect of a subsequent relaxation task). Finally study 4 examines a downstream consequence of incidental muscular sensations in terms of post-choice satisfaction. Additionally, study 4 explores the moderating effect of decision justification.

The robustness of the effect of incidental sensations is demonstrated through the use of a number of different muscular sensation eliciting tasks. Specifically, muscular sensations are
elicited through opening a jar (study 1A), squeezing a dynamometer (study 1B), opening a hand sanitizer bottle (study 1C and 3), lifting a package (study 2) and pulling out a chair (study 4).
**STUDY 1A: INCIDENTAL MUSCULAR SENSATIONS AND PERCEIVED DIFFERENCES BETWEEN OPTIONS**

The purpose of study 1A was to test hypothesis 1A, and examine the basic effect of incidental muscular sensations on optimizing option differentiation. This study focused specifically on the perceived difference between a pair of products.

*Design, Participants, Procedure*

Study 1A had a single factor between subjects design with two experimental conditions (intensity of muscular sensations: low vs. high). Participants were randomly assigned to one of the two experimental conditions.

Intensity of muscular sensations was manipulated through a jar opening task. All participants received a one-ounce jar of strawberry jam. To manipulate high intensity muscular sensations, the lid on the jam jar was closed tightly by turning the factory sealed lid approximately 30 degrees clockwise (i.e., tighter). In the low intensity conditions, the jar was opened and then closed very loosely by fitting the lid onto the jar.

Participants were told that they would be asked to perform a series of unrelated tasks. The first task involved sampling a jam. Participants were asked to open the jar and sample and evaluate the jam. Subsequently, as part of an “unrelated study” individuals were asked to evaluate a pair of barbecue corn chips. One package of the corn chips was listed as having 149
calories per one ounce serving. The other package of corn chips was listed as having 178 calories per one ounce serving. Participants looked at images of the corn chips and then were asked to rate the difference in calorie content between the two types of corn chips (1 = small, 7 = large) (adapted from Thomas and Morwitz 2009).

As a manipulation check, towards the end of the survey, participants were asked to rate the effort they exerted in opening the jam jar (1 = no effort, 10 = maximal effort) (adopted from Borg 1982).

At the very end of the survey, participants were asked to write down what they thought was the purpose of the study.

Forty undergraduate students (46.3% Females, Mean age = 22.2) participated in this study in exchange for extra credit towards their course grade. One participant correctly guessed the purpose of the study. The responses for this participant were not included in the final analysis leaving a total sample size of 39.

Results

Manipulation check. Consistent with the intended manipulation, participants in the high (vs. low) intensity incidental muscular sensations conditions reported having to exert more effort to open the jar ($M_{\text{high}} = 3.90$ vs. $M_{\text{low}} = 2.58$; $F(1, 37) = 4.82, p < .05$)

Optimal option differentiation. A one factor ANOVA with intensity of muscular sensations as the independent factor and perceived difference as the dependent factor revealed that participants who experienced high (vs. low) intensity incidental muscular sensations
perceived the difference in calorie content between the two corn chips as larger ($M_{\text{high}} = 3.40$ vs. $M_{\text{low}} = 2.63$; $F(1, 37) = 4.16, p < .05$). Please refer to Figure 2.

Discussion

The results of study 1A support hypothesis 1A and provide preliminary evidence for the prediction that high (vs. low) intensity incidental muscular sensations can optimize option differentiation in the context of enhanced perceived differences between similar products, since it would be optimal for consumers to pick up on subtle differences in calorie content. Please refer to Table 1 for a summary of the results of all empirical studies.

Next, study 1B tests hypothesis 1B (that high intensity muscular sensations optimize option differentiation in terms of increased perceived variety in an assortment), and hypothesis 2 (that there will be no difference in option differentiation between individuals who experience high and very high intensity sensations), and builds on the findings of study 1A in three key ways. First, while in study 1A, participants evaluated a pair of similar products, in study 1B participants evaluated an assortment of similar products. Second, in study 1B the intensity of incidental muscular sensations is calibrated to each participant’s strength. Finally, three different levels of intensity (i.e., low vs. high vs. very high) of muscular sensations were manipulated to show that there is a non-monotonic relationship between intensity of muscular sensations and option differentiation.
<table>
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<tr>
<th>Study</th>
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<tr>
<td>1A</td>
<td>Test H1A</td>
<td>(Intensity of muscular sensations: low vs. high) between subjects</td>
<td>H1A supported (high intensity muscular sensations optimize option differentiation in terms of greater perceived product differences)</td>
</tr>
<tr>
<td>1B</td>
<td>Test H1B and H2</td>
<td>(Intensity of muscular sensations: low vs. high vs. very high) between subjects</td>
<td>H1B supported (high intensity sensations optimize option differentiation in terms of greater perceived variety)  H2 supported (there is no difference in option differentiation between high and very high intensity muscular sensations)</td>
</tr>
<tr>
<td>1C</td>
<td>Test H3 and H4</td>
<td>(Intensity of muscular sensations: low vs. high) between subjects</td>
<td>H3 supported (high intensity sensations lead to increased preference for safe options)  H4 supported (high intensity sensations lead to faster information processing)</td>
</tr>
<tr>
<td>2</td>
<td>Test H5</td>
<td>2 (Intensity of muscular sensations: low vs. high) X 2 (Prime: self-protection vs. control) between subjects</td>
<td>H5 supported (effect of muscular sensations on option differentiation is attenuated when self-protection is primed externally)</td>
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<td>3</td>
<td>Test H6</td>
<td>2 (Intensity of muscular sensations: low vs. high) X 2 (Relaxation task: present vs. absent) between subjects</td>
<td>H6 not supported (the effect of muscular sensations on option differentiation persists in the presence of a relaxation task)</td>
</tr>
<tr>
<td>4</td>
<td>Test H7</td>
<td>2 (Intensity of muscular sensations: low vs. high) X 2 (Decision justification: present vs. absent) between subjects</td>
<td>H7 supported (high intensity sensations lead to greater post-choice satisfaction, but the effect is attenuated when individuals have to justify their decisions)</td>
</tr>
</tbody>
</table>
FIGURE 2: RESULTS FOR STUDY 1A

Perceived Difference between Options

Intensity of Muscular Sensations

Low
High

1.5
2
2.5
3
3.5
4
STUDY 1B: EXTREMELY HIGH INTENSITY INCIDENTAL MUSCULAR SENSATIONS AND PERCEIVED VARIETY

The purpose of study 1B was to calibrate the intensity of muscular sensations to each participant’s individual strength, and to demonstrate a non-monotonic relationship between intensity of sensations and option differentiation using a different and larger assortment of products than were used in study 1A.

Design, Participants, Procedure

Study 1B had a one factor between subjects design with three experimental conditions (intensity of muscular sensations: low vs. high vs. very high). The study had two parts, an initial calibration exercise as well as the main experimental exercise. The purpose of the initial calibration exercise was to determine each participant’s maximum grip force so that the intensity of muscular sensations that was manipulated in the main experimental task would be calibrated to each participant’s strength.

Participants came to the lab and were told that they would be asked to test out a hand gripping device (i.e., a dynamometer). They were shown how to use the device and then, in the first part of the session, they were instructed to squeeze the trigger on the dynamometer as hard
as they could three times. Following prior research (e.g., Hutchinson and Tenenbaum 2007), the highest force of three pulls was recorded and used as the participant’s maximum grip force level.

In the main experimental exercise, intensity of muscular sensations was manipulated by having participants squeeze the dynamometer to a specific number (i.e., force level) that represented 30% (low intensity muscular sensations), 50% (high intensity muscular sensations) or 100% (very high intensity muscular sensations) of their maximum force as determined during the calibration exercise. These force levels were based on prior research (e.g., Tenenbaum and Connolley 2008). As a manipulation check, after squeezing the hand gripping device to the level determined by the experimental condition participants rated how much effort they exerted when squeezing the hand gripping device (1 = no effort, 7 = maximal effort).

Next, as part of an “unrelated” task, participants were told to imagine that they were shopping for a salty snack to bring to a party. They were shown an assortment of eight salty snacks including pretzels, cheese curls, tortilla chips, pita chips, onion rings, BBQ potato chips, potato chips and multi-grain chips. They were asked to evaluate the variety in the assortment (“How much variety do you think there is in this assortment?” 1 = very little variety, 7 = very much variety) (Townsend and Kahn 2014).

Eighty-four undergraduate students participated in this study in exchange for extra credit towards their course grade; however, six students failed the manipulation check as will be discussed next. The data from these individuals were not included in the analysis leaving a final sample of 78 (49.3% Females, Mean age = 21.28).

Results
**Manipulation check.** Some participants did not follow directions during the calibration exercise. Consequently, self-reported effort to squeeze the hand gripper (1 = no effort, 7 = maximal effort) was used as a manipulation check. Participants in the low intensity muscular sensations condition who reported a value of 5 or higher were considered as failing the manipulation check, since the intended manipulation was to squeeze to 30% of their maximum force level. In a similar vein, participants in the very high intensity muscular sensations conditions were considered as having failed the manipulation check if they reported a value of 3 or lower, since the intended manipulation was to squeeze to 100% of their maximum force level. These standards resulted in six participants failing the manipulation check and hence being removed from the final sample.

The final sample showed significant differences in self-reported effort based on the experimental condition \(F(2, 74) = 60.56, p < .01\). Follow up tests showed that, consistent with the intended manipulation, participants in the low intensity conditions reported exerting less effort than participants in the high intensity condition \(M_{\text{low}} = 2.61\) vs. \(M_{\text{high}} = 4.03; F(1, 74) = 27.37, p < .01\); and the very high condition \(M_{\text{very high}} = 6.00; F(1, 74) = 121.07, p < .01\). Participants in the high intensity condition also reported exerting less effort than participants in the very high intensity condition \(F(1, 74) = 41.81, p < .01\).

**Option differentiation.** A one-way ANOVA with perceived variety as the dependent factor and intensity of muscular sensations as the independent factor showed significant differences in perceived variety based on the intensity of muscular sensations participants experienced \(F(2, 75) = 3.28, p < .05\). To test hypothesis 1B, that high intensity muscular sensations would lead to increased variety perceptions, follow up tests were conducted to compare variety perceptions in the low and high intensity conditions. In support of hypothesis
1B, these tests showed that participants who experienced high intensity muscular sensations perceived more variety in the assortment of salty snacks than participants who experienced low intensity muscular sensations ($M_{\text{low}} = 4.68$ vs. $M_{\text{high}} = 5.30$; $F(1, 75) = 3.35, p < .08$). It should also be noted that there was a significant difference in variety perceptions between individuals who experienced low and very high intensity sensations ($M_{\text{very high}} = 5.60$; $F(1, 75) = 5.93, p < .05$).

To test hypothesis 2, that there would be no difference in option differentiation between individuals who experienced very high and high intensity muscular sensations, follow up tests were conducted to compare variety perceptions in the high and very high intensity conditions. In support of hypothesis 2, there was not a significant difference in perceived variety based on the intensity of muscular sensations between participants who experienced high intensity muscular sensations and participants who experienced very high intensity sensations ($M_{\text{high}} = 5.30$ vs. $M_{\text{very high}} = 5.60$; $F(1, 75) = .65, p = .42$). Please refer to Figure 3.

Discussion

The results of study 1B support hypotheses 1B and 2, and provide additional evidence for the influence of incidental muscular sensations on option differentiation. Specifically, the results show that after experiencing high (vs. low) intensity muscular sensations individuals perceive a large assortment of similar products as having more variety (hypothesis 1B). In addition, the results show that the relationship between intensity of muscular sensations and option differentiation is non-monotonic (hypothesis 2) since there was no difference in perceived variety between participants who experience high and very high intensity sensations.
It should be noted that the results of study 1B showed that there was a significant
difference in perceived variety between low and very high intensity muscular sensations
however, prior research related to how physical exertion influences arousal and depletion (Pham
1996; Sanbonmatsu and Kardes 1998) would predict that as the intensity of muscular sensations
increases this difference at some point may become non-significant. One potential reason that
there was a significant difference in perceived variety between the low and very high intensity
conditions could be related to the intensity of sensations in the very high condition compared to
the physical tasks used in prior studies. Specifically, in prior studies the physical task spanned
several minutes (e.g., Pham 1996; Sanbonmatsu and Kardes 1998); however in the present study
the muscular sensation inducing task was very short in duration and thus may not have been so
intense as to become exhausting.

The focus of study 1B was to examine perceived variety in an assortment of similar items
(i.e., salty snacks). This study did not examine whether intensity of muscular sensations
influenced healthy choices. Due to the focus on perceived variety rather than healthy (vs.
unhealthy) choices, the results of this study cannot be directly compared with the results of the
Hung and Labroo (2011) snack bar study (study 4). These authors find that individuals with a
health goal choose a greater proportion of healthy snacks when they choose while weaving a pen
tightly (vs. loosely) between their fingers. Because Hung and Labroo (2011) do not report how
varied individuals perceived the snack assortment to be it is not clear how their results square off
with the results of study 1B.

Overall, study 1A and study 1B provide evidence of the basic effect of muscular
sensations on option differentiation. Next, study 1C provides evidence for self-protective
reflexes as the mechanism driving the effects of muscular sensations by examining the influence
of incidental muscular sensations on preference for risky (vs. safe) options, and also the effect of incidental muscular sensations on speed of information processing.

FIGURE 3: RESULTS FOR STUDY 1B
STUDY 1C: INCIDENTAL MUSCULAR SENSATIONS, PREFERENCE FOR SAFE OPTIONS AND SPEED OF INFORMATION PROCESSING

The purpose of study 1C was to provide evidence for hypothesis 3, the prediction that high (vs. low) intensity incidental muscular sensations lead to a higher preference for safe (i.e., less risky) options. In addition, study 1C also tests hypothesis 4 and provides support for the theorization that self-protective reflexes are driving the effects of muscular sensations by showing that information processing is speeded when individuals experience high (vs. low) intensity muscular sensations. As noted previously, prior research shows that individuals process information faster and more efficiently when self-protection is activated (Becker et al. 2010; New et al. 2007). In study 1C, speed of information processing is assessed through the use of response latencies.

Preference for safe (vs. more risky) options was assessed through a budget allocation task in which preference for a safe option was demonstrated through a greater amount of the budget being allocated to the safer (i.e., lower risk, lower reward) option.

Design, Participants, Procedure

Study 1C had a one factor between subjects design with two experimental conditions (intensity of muscular sensations: low vs. high). Participants were invited to a computer lab to participate in a series of unrelated studies.
Incidental muscular sensations were manipulated through an initial task that involved opening a screw-top bottle of hand sanitizer. The intensity of muscular sensations was varied by making the top easier or more difficult to twist off. Specifically, in the high intensity muscular sensations conditions, one drop of super glue was applied to the underside of the cap. In the low intensity muscular sensations conditions there was not any super glue applied to the cap. To decrease suspicion about the true purpose of the manipulation, after opening the hand sanitizer, participants were asked to apply it and then evaluate it.

The focal task involved allocating a hypothetical budget across two financial options. Participants were told to imagine that they had $5400 and were asked to allocate it in any way they wanted between two different financial options. One option had a higher potential gain and also a higher potential loss than the other. Specifically, participants were told that option 1 had an “85% chance of gaining 12% and a 15% chance of losing 4.5%.” and option 2 had an “85% chance of gaining 24% and a 15% chance of losing 9.0%” (Zhou and Pham 2004, 128). Thus, option 1 represented the “safe” option and option 2 represented the “risky” option.

Response latencies were recorded unobtrusively by timing the duration participants spent on the page containing the budget allocation task. More specifically, the amount of time from when participants reached the page containing the budget allocation task until they completed the task and clicked the “next” button to advance to the next page was recorded as the response latency.

Fifty-three university students (52.8% Females; Mean age = 22.7) participated in exchange for course credit.
Results

Budget allocation. Hypothesis 3 was tested using a one-way ANOVA with intensity of muscular sensations as the independent factor and dollar amount allocated to the “safe” option as the dependent factor. As predicted, the results showed that participants allocated a larger proportion of the budget to the “safe” option (i.e., the option with the lower risk and also the lower reward) when they experienced high intensity muscular sensations ($M_{\text{low}} = $2127.52 vs. $M_{\text{high}} = $3036.67; $F(1, 51) = 4.06, p < .05$). Please refer to Figure 4.

Response latencies. To test hypothesis 4, that high (vs. low) intensity incidental muscular sensations would lead to shorter response latencies, a one-way ANOVA with intensity of muscular sensations as the independent factor and response latencies (in seconds) as the dependent factor was conducted. The results showed that participants completed the budget allocation task significantly faster when they experienced high intensity muscular sensations ($M_{\text{low}} = 64.03$ vs. $M_{\text{high}} = 45.88; F(1, 51) = 5.70, p < .05$) suggesting that information processing was sped up after individuals experienced high intensity muscular sensations. Thus, hypothesis 4 is supported. Please refer to figure 5.

Discussion

The results of study 1C support hypothesis 3 and hypothesis 4 and show that individuals have greater preference for safe (i.e., less risky) options when they experience high (vs. low) intensity incidental muscular sensations. This is consistent with prior research which shows that self-protection increases loss aversion (Li et al. 2012). Additionally, consistent with the
theorization that self-protective reflexes are driving the effects of incidental muscular sensations, participants processed information more quickly after experiencing high (vs. low) intensity incidental muscular sensations.

To summarize, using three different means of eliciting incidental muscular sensations, the results of study 1 (1A, 1B, and 1C) show that high (vs. low) intensity sensations optimize option differentiation. There is also evidence that these effects are due to high intensity sensations activating self-protective reflexes since individuals tend to have a greater preference for safe (vs. more risky) options and also process information more quickly after experiencing high (vs. low) intensity incidental muscular sensations.

Next, study 2 provides more direct process evidence that high (vs. low) intensity incidental muscular sensations optimize option differentiation by activating self-protective reflexes through a priming task.

![Figure 4: Results for Study 1C – Allocation to “Safe” Option](image)

**Figure 4: Results for Study 1C – Allocation to “Safe” Option**
FIGURE 5: RESULTS FOR STUDY 1C – RESPONSE LATENCIES
The purpose of study 2 was test hypothesis 5 and provide additional process evidence to show that the effects of incidental muscular sensations are driven by self-protective reflexes. Specifically, study 2 aimed to show that the adaptive responses (i.e., enhanced perceptual sensitivity and discriminatory ability, speeded information processing and unconscious vigilance) that result from activating self-protective reflexes optimize option differentiation by showing that the effects of muscular sensations are attenuated when self-protection is activated before participants experience incidental muscular sensations.

Design, Participants, Procedure

Study 2 had a 2 (intensity of muscular sensations: low vs. high) X 2 (prime: self-protection vs. control) between subjects design. One hundred and twenty one university students participated in this study in exchange for extra credit towards their course grade. Two students did not follow directions and their responses were removed from analysis leaving a final sample of one hundred and nineteen (46.2% Females; Mean age = 21.64).

Participants were invited to the lab to participate in a series of studies on consumers’ product evaluations. The first task was a movie evaluation which served as the manipulation for the prime condition (i.e., self-protection or control). Specifically, participants were asked to
watch segments from two movies. In the self-protection conditions, participants viewed scenes from *Salem’s Lot* and *The Ring*. These movie clips have been used to prime fear in prior research (i.e., Dunn and Hoegg 2014). Moreover, fear is an emotional cue that increases perceived vulnerability to threat and activates self-protection (Miller et al. 2010), and is often used to manipulate self-protection (Becker et al. 2011; Griskevicius et al. 2009). In the control conditions participants viewed scenes of the same length from two different documentaries.

After viewing the movies, participants completed a few filler measures about the movies, to decrease suspicion about the true purpose of the movie evaluation task. Next, participants were asked to complete a mood evaluation. The mood evaluation asked participants to rate how fearful (1 = not at all, 7 = very much) they felt. This measure served as the manipulation check. It should be noted that participants were asked about their emotional state rather than to report self-protection, because prior research shows that individuals are better at reporting their emotions than they are at reporting subconscious reflexes such as self-protection (Maner et al. 2005).

The third task involved participating in an “unrelated” study on product evaluations. The true purpose of the task was to manipulate muscular sensations and then capture the dependent measure. Intensity of muscular sensations was manipulated through the use of heavy and light coffee packages. Participants were asked to evaluate a potential coffee package. A burlap coffee sack was placed on the floor under each participant’s chair. Participants were asked to pick up the package from under their chair and place it on the table to evaluate it (i.e., lift the coffee package). The weight of the bag was altered to manipulate the intensity of muscular sensations. Specifically, in the high intensity conditions, a brick was inserted into the burlap bag. In the low intensity conditions, a floral foam brick was inserted into the burlap bag. So, the coffee package...
weighed 3.83 pounds in the high intensity sensations conditions and 0.15 pounds in the low intensity sensations conditions. After evaluating the coffee package, participants completed the focal task which involved evaluating the perceived variety in an assortment of Godiva chocolate truffles.

**Results**

*Manipulation check.* Consistent with the intended manipulation, individuals exposed to the self-protection prime reported being more fearful than individuals exposed to the control prime ($M_{self-protection} = 2.6$ vs. $M_{control} = 1.37$; $F (1, 117) = 24.61, p < .01$).

*Key finding.* A 2 (muscular sensations) x 2 (prime) ANOVA on perceived variety revealed a marginally significant main effect of muscular sensations which showed that after experiencing high (vs. low) intensity incidental muscular sensations participants perceived the assortment of chocolates as more varied ($M_{high} = 6.03$ vs. $M_{low} = 5.75$; $F (1, 115) = 2.79, p < .10$). In addition, as predicted, there was also a marginally significant interaction between muscular sensations and the prime on perceived variety ($F (1, 115) = 3.26, p < .08$). Hypothesis 5 predicted that high (vs. low) intensity muscular sensations should optimize option differentiation in the absence of a self-protection prime, but this effect should be attenuated when a self-protection prime was present. In support of hypothesis 5, follow up tests showed that in the absence of a self-protection prime, variety perceptions were greater when individuals experienced high (vs. low) intensity incidental muscular sensations ($M_{high} = 6.50$ vs. $M_{low} = 5.72$; $F (1, 115) = 5.17, p < .05$). However, as predicted, in the presence of a self-protection prime there was no difference in perceived variety.
between participants who experienced high and low intensity incidental muscular sensations 
($M_{\text{high}} = 5.74$ vs. $M_{\text{low}} = 5.77$; F (1, 115) = .01, $p = .92$). Please refer to figure 6.

Discussion

The results of study 2 provide direct evidence for the theorization that self-protection is 
driving the effects of incidental muscular sensations. Specifically, the results show in the absence 
of a self-protection prime, high (vs. low) intensity incidental muscular sensations optimize option 
differentiation. However, when self-protection is activated before individuals experience 
incidental muscular sensations, there is no difference in option differentiation between 
individuals who experience high and low intensity muscular sensations.

Next, study 3 provides additional evidence for self-protection as the process driving the 
effects of muscular sensations on option differentiation.

FIGURE 6: RESULTS FOR STUDY 2
STUDY 3: DEACTIVATING SELF-PROTECTION ATTENUATES THE EFFECT OF MUSCULAR SENSATIONS

The purpose of study 3 was to test hypothesis 6. Specifically, the objective of study 3 was to provide additional evidence for the theorization that self-protective reflexes are driving the effect of incidental muscular sensations on option differentiation by showing that the effects of muscular sensations are attenuated when self-protective reflexes are deactivated through a relaxation task.

Design, Participants, Procedure

Study 3 had a 2 (intensity of muscular sensations: low vs. high) x 2 (relaxation task: present vs. absent) between subjects design.

Participants were told they would be asked to complete a series of unrelated tasks. The first task involved evaluating a hand sanitizer. The true purpose of this initial task was to induce incidental muscular sensations. Participants were given a 1.0 fluid ounce bottle of hand sanitizer that had a twist cap. High intensity sensations were manipulated by placing one drop of super glue on the underside of the bottle cap. No super glue was applied to the bottle cap in the low intensity sensations conditions. Similar to the procedure used in Study 1C, participants were asked to open the sanitizer, apply it to their hands, and then evaluate it.
The second task was a movie evaluation. Following, Pham, Hung and Gorn (2011) participants were told that a researcher was pretesting different movies to use in later studies. Participants were asked to view one of two movies. In the relaxation present conditions, participants watched a movie clip which contained soft, slow music and images of flowers, and discussed breathing. In the relaxation absent conditions, participants watched a movie clip about robotic technology. Both movie clips were of the same length. After watching the movie clip, participants were asked to list their thoughts and then rate the movie on a series of items including two items which assessed their feelings of relaxation (i.e., calming/not calming and relaxing/not relaxing) and served as the relaxation manipulation check ($\alpha = .92$). This manipulation was adopted from prior research (Pham, Hung and Gorn 2011).

The third task involved viewing an assortment of Godiva chocolate truffles and rating the perceived variety in the assortment. Specifically, participants were asked to rate the variety in the assortment (1 = very little variety, 7 = very much variety), and respond to the statement “the assortment of chocolates offers a lot of variety” (1 = strongly disagree, 7 = strongly agree). That is, study 3 used a multi-item measure of perceived variety.

The final task involved completing a manipulation check measure for intensity of muscular sensations. Specifically, participants were asked to rate how much effort they exerted to open the hand sanitizer bottle (1 = no effort, 7 = maximal effort).

Ninety-nine university students (52.5% Females, Mean age = 22.07) participated in this study in exchange for extra course credit.
Results

**Manipulation checks.** Consistent with the intended manipulation, participants in the high (vs. low) intensity sensations conditions reported exerting more effort to open the hand sanitizer bottle ($M_{\text{high}} = 4.0$ vs. $M_{\text{low}} = 2.30$; $F (1, 96) = 19.68, p < .01$). Additionally, consistent with the intended manipulation, participants in the relaxation present conditions reported being more relaxed than participants in the relaxation absent conditions ($M_{\text{present}} = 5.89$ vs. $M_{\text{absent}} = 3.49$; $F (1, 97) = 94.91, p < .01$).

**Key results.** Hypothesis 6 predicted that in the absence of a relaxation task, high (vs. low) intensity sensations would optimize option differentiation, but that there would be no difference in option differentiation based on intensity of muscular sensations in the relaxation present conditions. To test this hypothesis, a variety index was created by averaging responses to the two variety measures ($\alpha = .79$). A 2 (intensity of muscular sensations) x 2 (relaxation) ANOVA with the variety index as the dependent factor revealed a significant main effect of muscular sensations which showed that individuals in the high intensity conditions perceived the assortment as more varied than individuals in the low intensity conditions ($M_{\text{high}} = 5.76$ vs. $M_{\text{low}} = 5.05$; $F (1, 95) = 5.43, p < .05$). The main effect of relaxation was not significant ($F (1, 95) = .50, p = .48$). The interaction between muscular sensations and relaxation was also not significant ($F (1, 95) = .44, p = .51$). Follow up tests showed that in the relaxation absent conditions there was no difference in variety perceptions based on the intensity of muscular sensations ($M_{\text{low}} = 5.05$ vs. $M_{\text{high}} = 5.55$; $F (1, 95) = 1.44, p = .23$). However, in the relaxation present conditions individuals who experienced high intensity sensations perceived the assortment as having more...
variety ($M_{\text{low}} = 5.06$ vs. $M_{\text{high}} = 5.96$; F (1, 95) = 4.33, $p < .05$). Thus, hypothesis 6 was not supported. Please refer to figure 7.

**Discussion**

It was predicted that high (vs. low) intensity incidental muscular sensations would optimize option differentiation in the absence of a relaxation task, but this effect would be attenuated when a relaxation task was present. This prediction was not supported. Instead, the results of study 3 showed that there was no difference in option differentiation when relaxation was absent but high (vs. low) intensity incidental muscular sensations optimized option differentiation in the presence of a relaxation task.

There are several possible explanations for this finding. One explanation may be that the robot movie unintentionally induced fear and activated self-protection. Consistent with this, when listing thoughts, several participants in the relaxation absent conditions reported that the movie was “kind of freaky”, “weird”, “really freaky”, “and strange”. Other participants mentioned: “the robots are very creepy”, “this is a scary prospect”, and “the robot with legs looked like something that would steal children”. Since the results of study 2 showed that the difference in option differentiation between individuals who experienced high and low intensity incidental muscular sensations was attenuated when self-protection was activated via a self-protection prime, this could explain why there was no difference in option differentiation based on muscular sensations in the relaxation absent conditions.

Additionally, participants in the relaxation absent conditions reported being more aroused than participants in the relaxation present conditions ($M_{\text{relaxation absent}} = 4.06$ vs. $M_{\text{relaxation present}} =$
2.91; F (1, 96) = 10.36, p < .01). Because prior research shows that arousal impairs processing and decreases vigilance (Pham 1996; Sanbonmatsu and Kardes 1998) it is not surprising that there was no difference in option differentiation between individuals who experienced high and low intensity muscular sensations after watching the control video.

Another possible explanation for the observed pattern of results could relate to the difficulty of deactivating self-protective reflexes. As noted previously, self-protection is slow and difficult to deactivate (Woody and Szechtmman 2011). While prior research suggests that self-protective reflexes are deactivated when an individual has an “internal affective signal” (Woody and Szechtmam 2011, 1021) which is associated with a feeling of security or calmness (Glickman and Schiff 1967), it is possible that the relaxing video was not strong enough to deactivate self-protection. This might explain why high (vs. low) intensity incidental muscular sensations optimized option differentiation in the presence of relaxation.

Next, study 4 examines the influence of muscular sensations on actual product choices as well as post-choice satisfaction. Additionally, study 4 also shows that unconscious vigilance (which is one response elicited by activating self-protection) is driving the effects of muscular sensations by showing that the difference between high and low intensity muscular sensations is attenuated when vigilance is enhanced through another means (i.e., decision justification).
FIGURE 7: RESULTS FOR STUDY 3
The purpose of study 4 was fourfold. First, this study identifies another relevant outcome of experiencing high (vs. low) intensity muscular sensations in terms of post-choice satisfaction. Second, study 4 involved an actual choice between two similar products. Third, study 4 involved a new manipulation of incidental muscular sensations (i.e., having individuals pull out a chair that was either slightly wedged under a table or freely moving). Finally, study 4 provided evidence that high (vs. low) intensity muscular sensations were activating self-protective reflexes by showing that the difference between high and low intensity sensations was attenuated when vigilance was enhanced through decision justification.

Design, Participants, Procedure

Study 4 had a 2 (intensity of muscular sensations: low vs. high) x 2 (decision justification: present vs. absent) between subjects design.

Intensity of muscular sensations was manipulated through pulling out a chair. The lab where this study was conducted had office type rolling chairs with an arm rest on each side. In the high intensity conditions, the arm rests on the chair were slightly wedged under a table. In the low intensity sensations conditions, the chair was kept at the same height but the arm rests were not wedged under the table (i.e., the chair rolled freely). Please refer to Appendix A for an image
of chair position used to manipulate incidental muscular sensations. Upon entering the lab, participants were instructed to have a seat at the table and then complete a survey.

The survey involved choosing between two similar sunscreens. Participants were told that they would be given some information on two sunscreens and would be asked to choose which sunscreen they would like to have. They were informed that they would be given a bottle of the sunscreen they choose to keep. One sunscreen was a 1.0 ounce tube of 30 SPF Banana Boat brand sunscreen. The other sunscreen was a 1.5 ounce tube of 30 SPF Target brand sunscreen.

To manipulate decision justification, participants in the justification present conditions were told that they would be asked to provide rationale for their sunscreen choice. In the justification absent conditions participants, were not told anything about justifying their choice. This manipulation is based on prior research (e.g., LeBoeuf and Shafir 2003).

After selecting a sunscreen, participants were given a tube to have, and asked to sample the sunscreen and rate how satisfied they were with their choice (1 = not at all satisfied, 7 = very satisfied). Post-choice satisfaction represented the key dependent measure.

One hundred and six university students (52.0% Females; Mean age = 21.67) participated in this study in exchange for extra credit; however, two participants did not complete the dependent measure leaving a final sample size of one hundred and four.

Results

Pretest. A pretest with a different group of students, who did not participate in the main study, confirmed that individuals in the high intensity sensations conditions reported that it was
more difficult to pull out the chair than participants in the low intensity sensations conditions ($M_{\text{high}} = 3.56$ vs. $M_{\text{low}} = 2.35$; $F (1, 31) = 4.57, p < .05$).

**Differences in choice.** To see if there were differences in choice of sunscreen based on intensity of muscular sensations a 2 (intensity of muscular sensations) x 2 (decision justification) logistic regression was performed. The results showed there were no significant main effects (muscular sensations: Wald = .22 $p = .64$; justification: Wald = .005, $p = .94$). The interaction was also not significant (Wald = .24, $p = .63$). Thus, there was no difference in choice of sunscreen based on intensity of muscular sensations.

**Post-choice satisfaction.** The results of a 2 (intensity of muscular sensations) x 2 (decision justification) ANOVA on and post-choice satisfaction revealed a significant interaction effect ($F (1, 100) = 7.79, p < .01$). The main effects were not significant (muscular sensations: $F (1, 100) = .03, p = .87$; justification: $F (1, 100) = 2.04, p = .16$). Consistent with hypothesis 7, follow up tests showed that in the absence of decision justification, post-choice satisfaction was higher among individuals who experienced high (vs. low) intensity incidental muscular sensations ($M_{\text{high}} = 5.63$ vs. $M_{\text{low}} = 4.86$; $F (1,100) = 5.26, p < .05$). However, when individuals were told they would have to justify their choice, those who experienced low intensity muscular sensations were marginally more satisfied with their choice ($M_{\text{high}} = 5.27$ vs. $M_{\text{low}} = 5.95$; $F (1, 100) = 2.95, p < .09$). Please refer to figure 8.

**Discussion**

Using a new manipulation of muscular sensations, the results of this study show that when individuals do not have to justify their choice, they are more satisfied with the products.
they choose after experiencing high (vs. low) intensity incidental muscular sensations. However, when individuals know they will have to justify their choice, the difference in post-choice satisfaction based on intensity of muscular sensations is marginally attenuated. This finding suggests that one possible way to overcome decreased satisfaction that is sometimes associated with choosing between similar products (e.g., Iyengar and Lepper 2000) is through inducing unconscious vigilance through high (vs. low) intensity muscular sensations. Additionally, while inducing incidental muscular sensations represents a covert way to increase post-choice satisfaction, decision justification represents a more overt means of inducing the same effect. Finally, because there was no difference in the actual sunscreen selected, this study shows that differences in sunscreen cannot be driving the increase in post-choice satisfaction.

**FIGURE 8: RESULTS FOR STUDY 4**
GENERAL DISCUSSION

Conclusions and Implications

Marketers expand product lines by introducing extensions that in some cases vary only slightly from existing products, leading to a proliferation in similar options (Consumer Reports 2014). While marketers often introduce these new products to cater to unique consumer preferences, prior research shows that selecting from choice sets which contain relatively similar options can lead to negative consequences in terms of decreased customer satisfaction (Iyengar and Lepper 2000), decreased preference strength (Chernev 2003), increased willingness to accept substitutes (Lamberton and Diehl 2013), and increased post decision regret (Gourville and Soman 2005). This dissertation proposed that high (vs. low) intensity incidental muscular sensations might be able to counteract some of the negative effects that stem from choosing between similar options by optimizing option differentiation.

Across six studies, this dissertation shows that after experiencing high (vs. low) intensity incidental muscular sensations individuals perceived relatively similar options as more different (study 1A), and assortments as more varied (study 1B) a phenomenon referred to as optimizing option differentiation. The effects of muscular sensations extend to behavioral outcomes, whereby individuals are more satisfied with the options they choose after experiencing high (vs. low) intensity incidental muscular sensations (study 4). The effect of incidental muscular sensations on option differentiation is non-monotonic, since there is no difference in option
differentiation between individuals who experience high and extremely high intensity sensations (study 1B). This finding suggests that there is a narrow range within which increasing the intensity of muscular sensations will optimize option differentiation, however increasing the intensity of muscular sensations beyond that range will not provide incremental increases in option differentiation.

The results of the studies reported herein also suggest that the effects of incidental muscular sensations are driven by activation of self-protective reflexes. Specifically, consistent with the theorizing that high (vs. low) intensity incidental muscular sensations activate self-protective reflexes, the findings show that individuals allocate a larger proportion of a budget to safe (vs. risky) options after experiencing high (vs. low) intensity muscular sensations, and also do so more quickly (study 1C). Additionally, when self-protection is activated before individuals experience high (vs. low) intensity muscular sensations, the effects of these sensations on option differentiation are attenuated (study 2). Finally, consistent with the prediction that unconscious vigilance results from activating self-protection, the effect of incidental muscular sensations on post-choice satisfaction is attenuated when vigilance is induced through decision justification (study 4).

The findings of this dissertation offer conceptual as well as practical insights. From a conceptual perspective, this dissertation contributes to the literature on sensory marketing by demonstrating the effects of a previously under-examined sensory cue (i.e., muscular sensations). Prior research in the sensory marketing space has primarily focused on five senses (i.e., vision, olfaction, audition, gustation and haptics). The muscular sense which is distinct from haptics/touch (Wade 2003) has received less attention. Furthermore, literature related to the effects of embodied cognition on consumer decision making has focused on how consciously
exerted flexion related to maintaining specific bodily positions/poses (e.g., flexing the calf muscle or weaving a pen through the fingers) (Hung and Labroo 2011) or carrying packages of different weights (Zhang and Li 2012) influences consumer decision making. This dissertation builds on this prior work by showing that even incidental muscular sensations, which consumers might not even be aware of can have important effects on consumers. Additionally, while prior studies have drawn on theories related to embodied cognition to explain the effects of muscular flexion, this dissertation also adds to the literature by offering an alternative theoretical lens from which to examine the influence of bodily cues. Specifically, this dissertation suggests that due to the repeated pairing of incidental muscular contractions and threat/danger, responses to threat/danger (i.e., self-protective reflexes) become conditioned to occur when an individual experiences incidental muscular sensations.

Additionally, the findings of this dissertation add to the literature on self-protection. First, this dissertation identifies incidental muscular sensations as a sensory cue that appears to activate self-protective reflexes. Prior literature in this stream shows that other high intensity sensory cues such as bright lights or loud noises can activate self-protection (Lang et al. 2000). To the best of this author’s knowledge prior research has not shown that high intensity muscular contractions can activate self-protection. Second, the findings of this dissertation also contribute by reaffirming the difficulty of deactivating self-protective reflexes. Prior research suggests that self-protection is difficult to deactivate, but can be deactivated by counteracting visceral and motor cues that induce a feeling security or calmness (Glickman and Schiff 1967; Szechtman and Woody 2004; Woody and Szechtman 2011). However, the findings of this dissertation suggest that even a relaxation task may not be intense enough to deactivate these reflexes.
Finally, this dissertation contributes to the literature on choice. Prior research has often characterized choice sets as containing black and white extreme alternatives such as healthy and unhealthy foods (Chandon and Wansink 2007), virtues and vices (Chernev 2011), or hedonic and utilitarian options (Dhar and Wertenbroch 2000). Because studies which have focused on choice sets containing similar options or shades of gray show that such choice sets can sometimes lead to negative responses (Iyengar and Kamenica 2010; Iyengar and Lepper 2000), a handful of studies have focused on helping consumers to choose from sets of similar options (e.g, Lamberton and Diehl 2013; Miceli and Pieters 2010; Xu et al. 2013; among others). However, studies focusing on helping consumers choose from sets of similar options have primarily focused on informational interventions such as organizing the options in different ways (Lamberton and Diehl 2013) or consumer oriented interventions such as inducing different mindsets (Miceli and Pieters 2010; Xu et al. 2013). This dissertation departs from prior studies by considering a sensory based intervention in terms of incidental muscular sensations. This is an important departure because sensory cues tend “fly under the radar” (Krishna 2012), and therefore evoke less consumer resistance than other types of interventions. Thus, while consumers sometimes have negative reactions to marketing tactics, it is less likely that they will respond negatively to sensory based tactics.

From a practical perspective, the key finding of this dissertation, that high (vs. low) intensity incidental muscular sensations optimize option differentiation and increase post-choice satisfaction can be used by marketers to strategically design packages and retail/restaurant environments to encourage muscular sensations of varying intensities. It should be noted that while the studies reported in this dissertation equated optimizing option differentiation with maximizing option differentiation, in actuality the “optimal” level of option differentiation may
vary from stakeholder to stakeholder. Consequently, different stakeholders would be wise to encourage different intensities of muscular sensations. For instance, a retailer such as Target or Wal-Mart wanting to encourage the sale of their private label brands might want consumers to perceive products as similar, because if a consumer perceived a national brand and the store brand as more similar he/she might be more inclined to purchase the store brand. Thus, for a retailer such as Target or Wal-Mart optimizing option differentiation might involve minimizing the perceived difference between options. In that regard, Target or Wal-Mart might encourage low intensity muscular sensations by using easy-to-maneuver shopping carts or lightweight shopping baskets to decrease option differentiation. In contrast, for a jeweler whose profits are dependent on selling the most expensive product optimizing option differentiation might involve maximizing the perceived difference between options. Thus, the jeweler would be best served by encouraging high intensity muscular sensations in hopes that customers would pick up on the subtle differences between stones. The jeweler might therefore be inclined to use heavy doors at the store entrance or difficult to pull out stools at the jewelry counter. In a similar vein, a candle/fragrance store owner who wanted to ensure that customers perceived the variety in her product assortment might consider using tightly (vs. loosely) sealed jars so that consumers would experience high intensity muscular sensations while sampling the products. Finally, a restaurant owner who wanted to ensure that a diner was vigilant in selecting his or her entrée might use difficult (vs. easy) to pull out chairs or have heavy (vs. light) water pitchers to induce high intensity muscular sensations. In the event that a marketer was not able to induce high intensity muscular sensations, he/she may be able to enhance consumer vigilance through encouraging decision justification. For instance, a retailer might use in-store signage mentioning “what will your mother say?” to encourage shoppers to justify their choices. Collectively, these examples
suggest that stakeholders can manipulate products or ambient features to encourage muscular sensations of varying intensities depending on whether they want to increase or decrease option differentiation.

Second, the findings of this dissertation also have implications for retailers that have taken steps towards making shopping and dining out physically easier. To elaborate, recently there has been a trend towards making shopping and dining out as effortless as possible. (Food Marketing Institute 2012). In that regard, measures have been taken to decrease muscular sensations in the marketplace. For instance, an increasing number of retailers are implementing self-scan technology which eliminates the need for consumers to unload and reload shopping carts at the checkout (Van Ness 2011). Other stores are now offering personal shopping assistants (e.g., J Crew, Macy’s, Anthropologie) which eliminate the need for consumers to carry their items around the store. Even some of the measures online retailers are taking will minimize muscular sensations. For instance, Amazon launched a frustration free packaging initiative which aims to eliminate difficult to open plastic clam shell packaging (Lane 2008). The findings of this dissertation suggest that eliminating muscular sensations and making shopping effortless might not be the best strategy if option differentiation is important. As a caveat, it should be noted that the results of this dissertation (i.e., study 1B) suggest that there is an optimal intensity of muscular sensations and beyond that increasingly high intensity muscular sensations will not increase option differentiation. Moreover, at some point increasingly high intensity sensations might even lead to arousal or depletion (e.g., Pham 1996; Sanbonmatsu and Kardes 1998). Thus, managers would be wise to carefully monitor the intensity of muscular sensations the majority of consumers experience.
Limitations and Directions for Future Research

There are several limitations to the studies reported herein which yield opportunities for future research. First, all of the studies reported herein were conducted in 30 minute lab sessions, thus claims about how long the effects of muscular sensations will persist cannot be made. To address this limitation, future research might examine the effects of incidental muscular sensations over a longer time period. Examining the effects of muscular sensations over a longer period would allow future researchers to test the proposition that once activated self-protective reflexes are slow to deactivate (Szechtmen and Woody 2004). Additionally, the studies reported herein were conducted in carefully controlled laboratory environments to enhance internal validity. Future research should examine the effects of incidental muscular sensations in more ecologically valid settings to gauge how likely these effects are to occur in less controlled environments.

Second, this dissertation study focused on intensity of muscular sensations and did not examine how performing (vs. not performing) an activity that involves incidental muscular sensations would influence option differentiation. It is not clear whether option differentiation would be extremely low in the absence of any muscular contraction. Future research might investigate how experiencing incidental muscular sensations of varying intensities compared to not experiencing any muscular sensations influences consumers’ responses.

Third, in this dissertation muscular sensations were elicited by having participants perform different tasks with their hands (e.g., pull out a chair, open a jar, lift a package, etc.) and so muscular sensations were elicited primarily in the hands and arms. It is not clear how sensations of varying intensities that stimulate muscular contraction in other parts of the body...
might influence option differentiation. While Hung and Labroo (2011) found the same effects of muscular flexion on willpower when the flexion occurred in arms and in the legs, claims cannot be made about the effects of incidental muscular sensations that occur in different regions of the body. Future research might examine this.

Fourth, while study 1B calibrated the intensity of muscular sensations to each individual, the purpose of this dissertation was to examine the subconscious effects of incidental muscular sensations. Accordingly, in all studies except for study 1B all participants performed the same task. Because there are likely individual differences in perceived intensity of muscular sensations among individuals of different body sizes, it is likely that the perceived intensity of sensations was not exactly the same for every participant. Moreover, a store or restaurant owner or product designer would likely have a difficult time identifying a task that induced sensations of the same intensity for all consumers. In light of this, one option might be for marketers to design products or factors in ambient environments so that they induce muscular sensations that are perceived as high intensity by most individuals. They can also supplement the muscular task through packaging or advertising messages that increase decision justification, since decision justification leads to the same effects as high intensity muscular sensations (study 4).

Finally, while the results of the studies herein provide evidence that the influence of incidental muscular sensations is driven by activation of self-protective reflexes, there was not concrete mediating evidence of this process mechanism. Thus, there are possibly other processes that could play a role in driving the effects of incidental muscular sensations. For instance, it is possible that consumers might feel weak after experiencing high intensity incidental muscular sensations and then compensate for this weakness by exerting more mental effort in viewing the focal products. While it is not clear how perceived weakness could explain the preference for
safe (vs. risky options) or the shorter response latencies observed in study 1C, future research could explore this.
REFERENCES


APPENDIX A: IMAGE OF CHAIR POSITIONS USED TO INDUCE INCIDENTAL MUSCULAR SENSATIONS

High Intensity Incidental Muscular Sensations

Low Intensity Incidental Muscular Sensations
APPENDIX B: IRB APPROVAL LETTER

8/30/2013

Courtney Szocs, M.B.
University of South Florida
Department of Marketing
4202 East Fowler Ave., BU 3527
Tampa, FL 33620

RE: Expedited Approval for Initial Review
IRB#: Pro00014254
Title: Consumer Decision Making
Study Approval Period: 8/30/2013 to 8/30/2014

Dear Ms. Szocs:

On 8/30/2013, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents outlined below.

Approved Item(s):
Protocol Document(s):
IRB Protocol (updated August 29)

Accepted Item(s):
Consent/Assent Document(s):
Script for announcing extra credit opportunity
Informed Consent (Mars Bar)
Informed Consent (Marshall Center)
Informed Consent Form (Revised August 14)
Debriefing Script (Dissertation) (Updated August 15)(0.03)

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review
category:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your study qualifies for a waiver of the requirements for the documentation of informed consent as outlined in the federal regulations at 45 CFR 46.117(c) which states that an IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board
7/30/2014

Courtney Szocs, M.B.A.
USF Department of Marketing
4202 East Fowler Ave.
Tampa, FL 33620

RE: Expedited Approval for Continuing Review
IRB#: CR1_Pro00014254
Title: Consumer Decision Making

Study Approval Period: 8/30/2014 to 8/30/2015

Dear Ms. Szocs:

On 7/30/2014, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents outlined below.

Approved Item(s):
Protocol Document(s):
IRB Protocol (updated August 29)

The waiver of documentation of informed consent has been renewed.

The IRB determined that your study qualified for expedited review based on federal expedited category number(s):

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.
We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

John Schinka, Ph.D., Chairperson
USF Institutional Review Board