

STUDIES OF EMBODIED COGNITION AND METAPHOR

BY

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DISSERTATION

Submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy in Communications and Media  
in the Graduate College of the  
University of Illinois at Urbana-Champaign, 2015

Urbana, Illinois

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## ABSTRACT

Our bodily experiences can exert an influence on determining how we think, feel, and behave. This is because incidental bodily experiences affect how we understand and process abstract social concepts via the use of metaphors. According to this embodied perspective, bodily states or actions can cue metaphorically related social concepts and, in turn, influence our judgments in ways consistent with such physically experienced concepts. Drawing upon research on embodied cognition, in this dissertation I examine whether the way a choice is physically experienced can systemically influence how people respond to choice options. I manipulate bodily experiences at the point of choice by asking people to either draw positively connoted check-marks, or negatively connoted X-marks when making choices.

Across five experiments, I find that different physical acts of choice can convey meanings of metaphorically associated concepts, leading people to make judgments consistent with such bodily experienced concepts. Specifically, compared to negatively connoted X-marking behaviors, performing positively connoted check-marking actions leads people to evaluate both novel and familiar targets as more pleasant (studies 1 and 4), to agree more with statements about controversial social issues (studies 2 and 3), and to choose more target items (study 5). Overall, in this dissertation I confirm the metaphorically related physical and conceptual link and highlight the role of body-based metaphors in the processing of information. The way people physically respond to questions at the point of choice indeed affects their judgments and decisions. Theoretical and practical contributions and implications of these findings are discussed for further investigation.

*Dedicated to my family*

## ACKNOWLEDGMENTS

I would like to express sincere gratitude for the help that my Genie in the lamp, Dr. Patrick Vargas, has given to me. Whenever I felt stuck, I rubbed my magic lamp and then the Genie appeared. With the help of my Genie in a white shirt, I learned how to dance with ideas throughout my doctoral years (I know. It is too metaphorical. However, as I have studied the role of metaphor in this dissertation, the way we think is fundamentally metaphorical.). I would also like to thank all members of my dissertation committee, Dr. Michelle Nelson, Dr. Kevin Wise, and Dr. Tiffany White, for their insightful comments and guidance. I was truly privileged to stand on their shoulders. Outside of my committee, I must thank Dr. Changdae Ham, Dr. Brittany Duff, Dr. John Wirtz, Dr. Sela Sar, and Dr. Jacqueline Hitchon for their invaluable feedback on my dissertation.

Last but not least, I would like to thank my family for the unbelievable support and indescribable love: my parents Jaesoo Yoon and Youngjoo Woo, my wife Jiyoung Kim, my boy Patrick, and my soon-to-be-born boy Daniel. Thank you; you all complete me.

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*All testify to the necessity of seeing mind-body as an integral whole.*

John Dewey (1928, p. 6)

*Man lives in a world of Meaning.*

George H. Mead (1926, p. 382)

## 1. INTRODUCTION

How do people understand the world? How do people come to know about themselves, others, objects, and concepts? Are there any general rules or principles that elucidate the way people understand things? Social scientists, among others, have long been interested in such fundamental questions about the nature of understanding. They have focused on how people understand their external surroundings as well as their internal cognitive operations in order to achieve any form of knowledge. In other words, researchers have attempted to illuminate our understanding of the process of understanding *per se*.

Before further discussion, consider the following example: Two men, Simon and Paul, both of whom get a regular medical check-up. Both feel that they are in good health. A few days after their respective checkups, they receive their own test results: Simon's health report has a lot of check-marks, and Paul's health report has a lot of X-marks, on the table of results. Do Simon and Paul respond differently to the results? If so, who is more frustrated with the test results? Whose palms are sweatier? Perhaps people would assume that Paul, whose report was full of X-marks, might be more discouraged by his test results than Simon.

Here is another example: Two women, Theresa and Lucy, go into the doctor's office to receive a flu shot. Both have undergone a close medical examination recently, and they are in robust health. Before getting the flu shot, a doctor asks them to provide information about their physical conditions in different ways; both are given the same list of symptoms, but Theresa's doctor asks her to complete the form using check-marks and Lucy's doctor asks her to complete the form using X-marks. Will Theresa and Lucy, who are both in excellent health, report the same number of symptoms? If not, who is more likely to consider that the given symptoms are applicable to her?

I shall attempt to provide an explanation of who might feel more symptoms listed in the patient information leaflet shortly; however, first I provide another brief digression into scholars' understanding of human thought and decision making. Historically, researchers like B. F. Skinner argued that human mental processes such as perception and memory are not observable; they had emphasized the study of observable entities, which were human behaviors in physical environments (Miller, 2003; Schwartz, & Reisberg, 1991). This theoretical approach, known as behaviorism, however, could not succeed; researchers observed human behaviors first and then reasoned backwards from their observations to explore subjective mental processes that caused such behaviors (Schwartz, & Reisberg, 1991). After the cognitive revolution in the 1950s, researchers continued their efforts toward an understanding of information processing, by highlighting the function of the brain (Miller, 2003). Researchers have mainly focused on how the mind helps people process information and have provided evidence that human behaviors are based on thoughts derived from both cognitive and affective processing in the brain.

Now consider the first example above again. The reason people chose Paul as the correct answer might be due to their brains' cognitive processes; people might think that the way



something is depicted (*i.e.*, a lot of X-marks) could make Paul discouraged. Yet, one question remains unanswered. How can a given social stimulus (*i.e.*, an X-mark) shape our thoughts and feelings? Human understanding hinges on meaning interpretation (Lakoff & Johnson, 1980). In an attempt to interpret meanings of subjective experiences, people routinely rely on metaphors, which allow them to understand their experiences with rich inferential structures or imagery (Lakoff & Johnson, 1999; Ortony, 1993).

Metaphors can provide important insight into how people think (Lakoff & Johnson, 1980; Meier, Schnall, Schwarz, & Bargh, 2012). For example, people frequently use metaphors or metaphoric expressions in their everyday social world such as *she is feeling down* or *I could see what he meant*, though feeling sadness has nothing to do with the word denoting verticality (*i.e.*, *down*) and understanding what another person intended to express is irrelevant to getting such information through our sense of vision (*i.e.*, *see*). Literally, such metaphors and metaphoric expressions do not make sense. However, people have no trouble understanding the meanings of metaphor and metaphoric expressions and commonly use them in various contexts of thinking and understanding (Lakoff & Johnson, 1999). In the first example described above, Paul might understand the situation metaphorically. Perceiving a lot of X-marks on the test results can involve an abstract social concept associated with X. Because the concept of X has a lot of bad connotations (*e.g.*, dislikes, wrong, against, no), Paul's thoughts, feelings, and behaviors might be guided by such metaphoric meanings associated with X.

However, the body can also affect the processing of information (Gallagher, 2005), which seems counterintuitive and contradicts the direction of human understanding suggested above. For instance, people tended to evaluate cartoons as funnier when they held a pen with their teeth rather than their lips, because stimulating a certain facial muscle (*i.e.*, zygomaticus

which is closely related to smiling) positively affected people's evaluative judgments of cartoons (Strack, Martin, & Stepper, 1988). In addition, when people communicate with others, they commonly use their hands and make gestures as part of ongoing thought processes (McNeill, 1992). If one's hand is waved in the direction of another or oneself, such bodily actions can be closely linked to thoughts of avoidance or approach and, more importantly, can be interpreted as having a meaning of go-away or come-on, respectively.

How do such bodily experiences figure into cognitive operations? Again, previous literature has highlighted the role of body-based metaphors in cognitive processes (Landau, Robinson, & Meier, 2014; Ortony, 1993; De Vega, Glenberg, & Graesser, 2008). When people encounter abstract social concepts, metaphors allow people to conceptualize them or reason about them by using more concrete concepts or experiences, which largely come from sensorimotor domains (Lakoff & Johnson, 1999). In sum, human understanding is closely tied to bodily representations triggered by metaphorically related physical states or bodily actions (Landau et al., 2014).

As is seen in the examples above, bodily states and actions can shape human cognition, and metaphors are determinants of such embodied effects. Metaphors prominently pervade mental processes, and people recruit metaphors to conceive of abstract targets or experiences in their social life (Lakoff & Johnson, 1980). Now think about the aforementioned Theresa and Lucy example. I expect that Theresa, who responded with check-marks, might feel more symptoms listed in the patient information leaflet than Lucy. Why would this be the case? Performing the check-marking action can allow Theresa to physically experience an abstract social concept associated with a check-mark. Compared to X-marking, check-marking has a lot of good connotations such as right, likes, and for. Thus, the way something is physically

experienced (*e.g.*, making certain marks repeatedly) could drive Theresa to think that she would have more symptoms than she actually has.

Drawing upon research on embodied cognition and conceptual metaphor, this dissertation aims to test one important question: if bodily actions can cue metaphorically related social concepts and thus directly make people interpret such concepts, then is it possible to nudge people to behave in a predictable way? In this dissertation, I report five experiments designed to examine whether bodily experiences of marking while making choices affect how people make judgments and decisions. Performing certain marking actions such as drawing check-marks when making choices can be characterized as bodily manipulations of embodied cognition.

Human cognitive processes are situated; they are responses to given contexts or situations (Clark, 1997; Wilson, 2002). Moreover, cognition is action oriented; it is supposed to guide behaviors in various social contexts (James, 1890; Meier et al., 2012; Wilson, 2002). Considering the aforementioned nature of cognition, embodied “cognition” through physical marking actions is also expected to be situated and action oriented. Therefore, like the Theresa example above, physical experiences of marking action might involve abstract social concepts such as the binaries of right and wrong (*e.g.*, correct and incorrect, true and false), likes and dislikes (*e.g.*, good and bad, positive and negative), and for and against (*e.g.*, yes and no, agree and disagree) metaphorically. In this context, I postulate that physical experiences of marking action would, via metaphor, guide people’s subsequent judgments in various decision contexts (studies 1-5).

I also attempt to clarify the embodied processes that cause bodily influences of marking actions. There is at least one similar route by which marking actions could influence behavior - all in the name of automaticity research (Bargh et al., 2012). The marks, themselves, could prime

people. Priming could activate certain concepts and influence behavior by increasing relevant concept accessibility (Bargh, 2006). Thus, I add another set of experimental conditions, which is an alternative instantiation of the marking action, stamping the check or X-marks; the potential explanation of conceptual priming is compared with embodied influences (study 3).

In addition, to identify the situations or contexts that limit such embodied effects on judgments, I further test a possible boundary condition under which effects of embodied experiences are retained or eliminated. In study 5, I test whether question framing would interact with bodily experiences of marking and then influence subsequent judgment in predictable ways.

I organize this dissertation as follows: I review two theoretical perspectives on human information processing – views of information processing for and against the inclusion of a bodily account. I first introduce the traditional cognitive approach that ignored bodily effects on cognitive processes (Barsalou, 2008; Krishina & Schwarz, 2014; Wyer, 1974), and then I discuss theories of embodied cognition as an emerging framework from the traditional cognitive approach (Barsalou, 2008; Landau, Meier, Keefer, 2010). Next, I attempt to explain the power of metaphor (Landau et al., 2014). I will explain how conceptual metaphors are not mere rhetorical devices but cognitive tools, which can shape our thoughts, feelings, and actions (Lakoff & Johnson, 1980; Sandford, 2003). Understanding the role of conceptual metaphor is the theoretical key to fully grasp the underlying process of how bodily experiences figure into cognitive processes (Meier et al., 2012). Subsequently, I provide empirical findings from previous literature and review how and why our thoughts are grounded in bodily experiences. After summing up the review, I point out a research gap and describe the objectives of the dissertation. Finally, I present five experiments that explore the effects of marking actions on

judgments and conclude the dissertation with a general discussion and theoretical implications of my findings.

## 2. LITERATURE REVIEW

### The traditional schema perspective

In what precise way does the mind understand something? After the cognitive revolution in the 1950s, researchers made progress on this fundamental question and provided important insights into the nature of human knowledge by developing models and theories of information processing (Semin, Garrido, & Palma, 2012; Wyer, 1974). These traditional models and theories of information processing assumed that human understanding could be captured through an analogy to machines. Many researchers conceived of human understanding as mechanical and computational (*e.g.*, information acquisition – storage – retrieval, see Sandford, 2003); thus, they tended to treat information processing as an entirely cognitive or mental activity, while the effects of other bodily experiences, such as physical sensations and actions, on information processing were largely neglected.

According to this traditional view, it was schemas – memory-based structures of abstract knowledge representation – that allowed people to understand the world around them (Barsalou, 2008; Krishina, 2014; Landau et al., 2010; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Reimann et al., 2012). Researchers with this focus argued that people process information using their schemas to comprehend something, and those schemas were expected to function as building blocks for understanding the world (Fiske & Taylor, 1991; Landau et al., 2010; Niedenthal et al., 2005).

Though the traditional schema approach advanced a scientific understanding of how people make sense of the world by providing a view about how the nature of human understanding could be analyzed, this view has a blind spot. The traditional schema approach

fails to fully reflect that the body is also tied to the processing of information. When explicating the mechanism through which sensory information is translated into the underlying schemas, this computational approach assumes that such cognitive processes proceed independently of the body (*i.e.*, independent of the initial modalities that help information acquisition, Niedenthal et al., 2005). However, the body can be a source of knowledge and plays an important role in cognitive processes.

Researchers have more recently begun to argue that the body is not simply there to carry the brain around, but rather it can also exert a strong influence on all kinds of cognition (Pfeifer & Bongard, 2007). They have examined an interaction between bodily experiences and information processing. For instance, people who held a cup of hot coffee were prone to form impressions of others as warm, yet people who held a cup of iced coffee were prone to judge others as cold (Williams & Bargh, 2008). This research clearly illustrated that irrelevant physical sensations of warmth and coldness affected how people formed impressions of others. In this context, researchers have proposed a new stance, namely embodied cognition, which is a theory that the body may play a fundamental role in shaping human cognition and, in turn, influence human judgments. If human understanding is indeed grounded in the body, this suggests that people's physical experiences can shape their thoughts, feelings, and behaviors.

#### The emerging perspective: Embodied cognition

In recent years, researchers have proposed theories of grounded cognition and have started to emphasize the role of bodily experiences such as bodily states, actions, and simulations in human cognition (Barsalou, 2008). The core assumption of grounded cognition is that both actual bodily experiences and simulations of such bodily experiences in the brain's modality-

specific systems can cause cognitive states (Barsalou, 2008; 2010; Landau et al., 2010; Niedenthal et al., 2005; Reimann et al., 2012).

The embodied view posits that cognitive representations and processes that are derived from physical interactions with environments are grounded in the modalities of perceptual experience or the body. In other words, bodily experiences or simulations in physical contexts underlie human cognition. Given the fact that human “cognition can be grounded in multiple ways such as bodily states, situated actions, and simulations” (Barsalou, 2008, p. 619), some researchers have attempted to understand human cognition by focusing more on the role of the body including bodily states and situated actions, whereas others have taken into account the role of mental simulation (Barsalou, 2008).

It is important to note that those two primary foci of grounded cognition – (a) bodily states and actions, and (b) mental simulations – have led to different explanations of how bodily experiences figure into cognitive processes. The former account relies on cognitive linguistic theories, which posit that cognitive representations of abstract concepts are structured by bodily experiences in metaphoric ways. The Conceptual Metaphor Theory proposed that people routinely use metaphor to understand abstract concepts (Lakoff & Johnson, 1980); according to this theory people’s bodily states or bodily actions that metaphorically cue meanings of abstract concepts can also drive how people think, act, and decide. For example, physical sensations of weight affect how people think about the abstract concept of importance (Jostmann, Lakens, & Schubert, 2009). People who were asked to hold a heavy clipboard (1,039 grams) tended to judge various social issues (*e.g.*, procedural justice) as more important than those who held a light clipboard (657 grams). Given that people often use weight as a metaphor for importance (*e.g.*,



*weighty negotiations*), physically experienced bodily states encouraged individuals to think about relevant metaphoric concepts and, in turn, influenced how they judge the importance of issues.

However, bodily experiences do not always exert this kind of grounded influence. Sometimes, mental imagery or mental simulation of such bodily experiences is enough to affect human cognition. Though embodied cognitions and mental simulations differ in their cognitive operations and sources, both similarly influence the way people think, feel, and behave. For example, simulating a specific experience in which individuals felt social exclusion elicits a feeling of coldness (Zhong & Leonardelli, 2008). Individuals who were asked to recall a social exclusion experience tended to estimate the room temperature as lower than those who recalled a social inclusion experience. Other research also demonstrated that simulated actions can cause behavioral responses that are expected from actual actions (Morewedge, Huh, & Vosgerau, 2010). For example, people who repeatedly imagined consuming a food many times (*e.g.*, 30 M&Ms) were less likely to eat such food compared to those who imagined consuming the same food fewer times (*e.g.*, 3 M&Ms).

Thus, the latter account of grounded cognition, mental simulation, can shape our thoughts, feelings, and behaviors. Here, mental simulation is “the reenactment of perceptual, motor, and introspective states acquired during experience with the world, body, and mind” (Barsalou, 2008, p. 618). How do people possibly come to understand something through this mental simulation mechanism? According to previous literature on cognitive simulation theories, human cognition depends on the brain’s modality-specific systems, which process information derived from bodily experiences and simulations, for perception, action, and introspection (Barsalou, 1999; 2008; Damasio, 1994). Facilitating mental simulations of experience (*e.g.*, perception or action) leads to neural activations through the brain’s modality-specific systems; thus, certain

experiences can be reenacted by merely simulating perceptual states or actions without the original state or action being experienced (Barsalou, 1999; 2008; Niedenthal et al., 2005).

Taken together, grounded cognition highlighted the roles of the body and mental simulation in human cognition<sup>1</sup>. Though this perspective, grounded (or embodied) cognition, enables researchers to reconsider human cognition with regard to physical interactions with the world, an important question still remains as to how embodied experiences figure into cognitive operations or conceptual systems. People experience the world with their senses and make sense of a given stimulus by using their knowledge about relevant or similar stimuli. However, after observing what people do to capture abstract concepts, researchers found that people are prone to experience and understand abstract concepts by utilizing metaphor (Lakoff & Johnson, 1980).

I argue that metaphor functions as the bridge between human understanding and embodied experiences because both bodily experiences and simulations could affect people's judgments and behaviors in a metaphoric manner. Consider the aforementioned studies: people typically use weight as a linguistic metaphor for importance (*e.g., his opinion is certain to carry weight*). However, people can also interpret the metaphoric relation between weight and importance on a conceptual level; as evidence, bodily states (*e.g., holding a heavy clipboard*) make people think about abstract concepts (*e.g., importance*) and influence their evaluative judgments (*e.g., evaluating issues*). In addition, people routinely use physical warmth or coldness as a linguistic metaphor for interpersonal closeness. The metaphoric relation between physical and interpersonal warmth (coldness) is also observed in a conceptual domain; people who

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<sup>1</sup> Though both direct bodily experiences (bodily states and actions) and mentally simulated experiences can drive human cognition, the research scope in this dissertation is limited to investigating whether the direct body-based experience causes our cognitive representations.

recalled a situation in which they felt social exclusion rated the room temperature as cold, while those who were asked to recall a social inclusion experience rated the room temperature as warm. Mental simulations (*e.g.*, recalling a social exclusion experience) cause people to make sense of abstract concepts (*e.g.*, social distance or loneliness conceptualized as coldness) and subsequently drive their responses (*e.g.*, reporting lower estimates of the temperature).

In sum, metaphor functions as a cognitive mechanism that guides our thoughts, feelings, and behaviors, and it plays an important role in determining embodied influences. Thus, in the following section I provide detailed information about the power of metaphor largely based on the Conceptual Metaphor Theory<sup>2</sup>.

### The power of metaphor

Metaphor is commonly defined as “a figure of speech through which we describe one thing in terms of another” (Landau et al., 2014, p. 4). Metaphor plays an important role in helping people understand and communicate abstract concepts in terms of dissimilar (or even literally unrelated) concepts that are relatively easier to grasp (Lakoff & Johnson, 1980). How can metaphors affect thought?

People are prone to simplify difficult cognitive processes with the help of linguistic metaphor, substituting an easier concept for a more difficult one (Lakoff & Johnson, 1980).

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<sup>2</sup> Different theories (*e.g.*, modal architecture, cognitive linguistic theories, cognitive simulation models, Barsalou, 2008; Niedenthal et al., 2005) have provided explanations of how human cognition can be shaped by bodily experiences. Although these theories differ substantively, they all tend to make similar predictions – physical experiences can have a strong impact on the way people think and make judgments.

Perhaps it is difficult for people to come to understand an abstract domain such as the concept of intimacy or social closeness; however, it is relatively easy to comprehend or directly experience a concrete domain like physical warmth in terms of a bodily temperature. In this context, a metaphoric mapping to the abstract concept (*e.g.*, intimacy) from a distinctively dissimilar concept (*e.g.*, warmth) helps people to understand the meaning of the abstract concept. People commonly use metaphoric expressions or idioms such as *she is warmhearted* or a *warm greeting* (Landau et al., 2014). As Williams and Bargh (2008) have shown, incidental bodily experiences that involve metaphorically related concepts of interpersonal warmth can also shape how people think and behave; holding a warm cup of coffee rather than a cold cup of coffee makes people evaluate others' impressions or personalities as warmer and also makes people behave in a warm manner (*e.g.*, choosing a gift for others). Thus, the underlying processes of the effects of embodied cognition could be identified by theoretical and empirical examination of the role of metaphor (Lakoff & Johnson, 1980; Landau et al., 2010; Meier et al., 2012).

According to the Conceptual Metaphor Theory, metaphors enable people to use conceptual mappings between abstract target concepts and concrete source concepts (Lakoff & Johnson, 1980). Here, the conceptual mapping refers to “a systematic set of associations between elements of a target and analogous elements of the source” (Landau et al., 2014, p. 6). Since conceptual mappings involve metaphorically related sets of mental associations or multimodal representations between corresponding elements of the concepts, metaphors make people draw on their knowledge about concrete source domains as a reference for understanding abstract or even complex target domains (Barsalou, 2008; Landau et al., 2010; Landau et al., 2014; Williams, Huang, & Bargh, 2009). In other words, when people attempt to clarify abstract

concepts on the basis of their knowledge, metaphors operate as machines for generating conceptual mappings between source concepts and target concepts.

Then, in what ways do embodied experiences translate into metaphors that underlie the ways people think about something? Previous literature has demonstrated that when bodily states or actions are metaphorically related to concepts of target, such bodily experiences could profoundly influence how people make judgments about the target. For instance, previous research focusing on a “bodily state” as an embodied mechanism<sup>3</sup> has suggested that: (1) merely holding a hot cup of coffee leads individuals to form impressions of others as warm, because bodily sensations of physical warmth activate metaphorically related concepts of interpersonal warmth or intimacy (William & Bargh, 2011); (2) holding a heavy clipboard causes individuals to evaluate various social issues as important, because physical sensations of weight trigger metaphorically linked concepts of importance (Jostmann et al., 2009); (3) smelling something fishy encourages individuals to be unwilling to cooperate in a trust-based game, because bodily experiences of fishy smells induce feelings of suspicion in a metaphoric manner (Lee & Schwarz, 2014); (4) smelling clean scents stemming from Windex guides individuals to be more willing to donate money to a charitable organization, because such sensory experiences elicit metaphorically related concepts of morality or cleanliness (Liljenquist, Zhong, & Galinsky, 2010); (5) sitting in a hard chair that elicits metaphorically associated concepts of rigidity or strictness makes individuals less agreeable, producing less change in a negotiation task (Ackerman, Nocera, & Bargh, 2010).

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<sup>3</sup> A bodily state here refers to physical experience through the five senses or “an unmoving state of the body” (Krishna, 2012, p. 344).

Furthermore, previous research centering on a “bodily action” (or situated action) as a body-based mechanism<sup>4</sup> has also suggested that: (1) firming muscles (*e.g.*, grasping a pen in one’s fist) improves self-regulation and makes people choose healthier foods, because such bodily actions facilitate metaphorically related thoughts of willpower (Hung & Labroo, 2011); (2) washing hands decreases subjective feelings of guilt, because such bodily actions are related to concepts of purity in a metaphoric manner (Zhong & Liljenquist, 2006); (3) merely using a touch interface (*e.g.*, touching iPad) for online shopping generates a strong endowment effect, because bodily experiences with touch screens elicit metaphorically related thoughts of ownership (Brasel & Gips, 2014); (4) making and holding expansive body postures with open limbs leads individuals to make a risky choice because such physical actions mentally activate abstract concepts of power (Carney, Cuddy, & Yap, 2010); (5) nodding one’s head makes individuals more willing to agree with a persuasive message because such vertical head movements metaphorically imply concepts of yes or validity (Wells & Petty, 1980). All these findings illustrate that physical experiences, bodily states and actions, are inextricably tied to the metaphoric processing of information. Metaphoric mappings between abstract social concepts and concrete concepts derived from embodied experiences shape our understanding, and thus, concrete embodied experiences indeed function as cognitive instruments.

The role of metaphor in embodied cognition is also supported by evolutionary perspectives. Researchers with an evolutionary adaption focus proposed the scaffolding theory, which suggests that, “early sensorimotor experiences serve as the foundation for the later

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<sup>4</sup> A situated action is defined as “a physical movement that is not locomotive in nature” (Krishna, 2012, p. 344).

development of more abstract concepts and goals” (Williams et al., 2009, p. 1287). Like physical supporting structures in building construction, people’s early experiences of physical environments structure their later conceptual knowledge of more abstract concepts. For example, think about how infants come to learn or to know about something. They first begin with basic concepts (*e.g.*, likes), which can be entirely captured through their direct bodily experiences (*e.g.*, touching, grasping). Other related concepts (*e.g.*, dislike) or more abstract concepts (*e.g.*, close relationships like marriage) could be built up from such basic concepts derived from directly experienced aspects of the world. Thus, directly experienced concepts and accompanying metaphorically related actions in early childhood help people understand abstract concepts later in life. Such abstract concepts can be scaffolded onto existing concepts for producing novel concepts (Bargh, Schwader, Hailey, Dyer, & Boothby, 2012; Bergen & Feldman, 2008; Mandler, 1992; Williams et al., 2009). Understandings of the physical environment in early childhood are likely to serve as supporting building structures for the development of more abstract concepts later; and more importantly, such understandings derived from direct experiences lead to the basis for conceptual metaphors as well as conceptual mappings between metaphors and experiences (Lakoff & Johnson, 1980; Landau et al., 2010; Williams et al., 2009).

#### In search of a research gap: Research objectives

Human cognition is grounded within the body (Barsalou, 2010; Kahneman, 2011). However, previous works have not yet demonstrated any effects of embodied experiences at the point of choice; only a few empirical studies attempted to illuminate effects of bodily experiences at the point of choice on our judgments and decisions. For instance, Wells and Petty (1980) and Briñol and Petty (2003) conducted experiments in which they asked participants to

nod or shake their heads while listening to a message. All participants were asked to give their own opinions about the message. The results suggested that participants who were instructed to nod their heads (vs. shake their heads) tended to agree more with a given message. By proposing a self-validation hypothesis, they explicated that those vertical head movements (*i.e.*, nodding) increase participants' subjective confidence in their thoughts, while horizontal head movements (*i.e.*, shaking) decrease participants' confidence in their thoughts. In a similar vein, Cacioppo, Priester, and Berntson (1993) carried out experiments in which their participants were asked to perform one of two situated actions before making actual judgments: one was arm flexion that would be expected to be linked to abstract concepts of acquisition or approach, and another was arm extension that would be expected to be coupled with concepts of withdrawal or avoidance. They examined whether such situated actions would affect participants' judgments. In the arm flexion condition, they instructed participants to place their hands on the bottom of the desk and lift the desk by using their arms. The arm extension condition was manipulated by instructing participants to place their hands on the top of the desk and to press down on it with their hands. Participants were exposed to Chinese pictographs when they engaged in either flexion or extension actions, and then were asked to indicate their preferences toward the pictographs. Participants tended to rate Chinese pictographs presented during arm flexion (vs. arm extension) as more pleasant.

Though those studies yielded promising findings that incidentally experienced bodily actions shape people's thoughts and subsequent judgments, such manipulated bodily actions were performed before people made their actual judgments about unrelated targets rather than at the point of choice. Moreover, those previous studies manipulated bodily experiences through overt head movements (*e.g.*, nodding or shaking one's head) and hand movements (*e.g.*, pressing



or lifting the desk with one's hands), which almost certainly would not happen in a natural choice situation. Based on theories of embodied cognition and the conceptual metaphor theory, I carry out five experiments to explore whether bodily experiences at the point of choice affect people's judgments and decisions. I specifically propose a subtle but natural action at the point of choice that is a marking action. I assume that this physical action can alter people's decision contexts as well as make people think and behave in ways that are consistent with the metaphoric meanings of the actions. Therefore, differential marking actions that metaphorically denote abstract social concepts, such as the binaries of right and wrong (*e.g.*, correct and incorrect, true and false), likes and dislikes (*e.g.*, good and bad, positive and negative), and for and against (*e.g.*, yes and no, agree and disagree) are expected to reliably guide people's thoughts and judgments. I thus argue that performing certain marking actions such as drawing check-marks or X-marks when making choices can function as bodily manipulations of embodied cognition and, in turn, affects our thoughts and judgments.

### 3. DISSERTATION STUDY ONE: PILOT STUDY WITH NEUTRAL STIMULI

#### Introduction

Study 1 was a pilot study examining the effects of bodily experiences at the point of choice that convey metaphorical meanings on human judgment and decision-making. The primary goal of this pilot study was to find preliminary evidence that the way a choice is physically experienced could systemically influence how people actually respond to choice options. In particular, I attempted to establish a link between bodily experiences at the point of choice, marking actions, and decision outcomes consisting of pleasant or unpleasant judgments.

I first manipulated bodily experiences at the point of choice with either a presumably positively valenced check marking action or a negatively valenced X marking action. Adopting novel pictographs and neutral images as experimental stimuli (Payne, Brown-Iannuzzi, & Panter, 2014; Payne, Cheng, Govorun, & Stewart, 2005; Payne, & Lundberg, 2014), I tested the hypothesis that a positively valenced marking action at the point of choice would cause people to evaluate neutral stimuli as more pleasant, whereas a negatively valenced marking action would lead people to rate the same neutral stimuli as less pleasant. I predicted that certain acts of marking (*e.g.*, drawing a check-mark symbol) would influence people's evaluation for novel targets; however, it could also be possible that the hypothesized effect may arise from other psychological experiences such as thought confidence or perceived motor fluency.

For instance, previous research addressed that people tend to use external cues like other people's opinions to validate their thoughts; such external cues to validity play a critical role in enhancing or undermining people's thought confidence, which in turn influences their attitudes (Briñol & Petty, 2003). In the present study, participants might make evaluative judgments by

using direct visual cues derived from the two manipulated marking actions (*i.e.*, check marks). For instance, participants who were asked to draw relatively positive check-marks on their answers (vs. relatively negatively X-marks) might feel confident in their answers (or choices) because such external visual cues could guide them to positively validate their thoughts. More importantly, such improved confidence might elicit favorable thoughts toward novel experimental stimuli (Briñol & Petty, 2003) or might lead participants to actively engage in information processing (Wan, & Rucker, 2013). Therefore, participants' subjective confidence in their answers was measured to rule out an alternative possibility of any positive (or negative) effect derived from increased (or decreased) confidence in responses.

In addition, there is a possibility that one of the two seemingly similar hand movements, either drawing check or X, might be easier to do (*i.e.*, might be done more fluently) and then impact participants' feelings of ease. Both marks require two strokes, but a check-mark does not require one to lift the pen from the paper, so check-marks might be easier to write than X-marks. Previous studies have demonstrated that more fluent sensorimotor actions cause people to have more positive thoughts, feelings, and evaluations (Oppenheimer, 2008). Thus, the subjective experience of motor fluency derived from a given marking action here might lead participants to make their evaluative judgment (*i.e.*, pleasant or unpleasant judgment) based on an irrelevant feature of the experimental manipulation, physical difficulty of the marking action. If making check-marks is a more fluent motion than making X-marks, people may enjoy the former task more than the latter, and therefore rate stimuli more favorably when making check-marks. Given that any experiences of fluency are affectively positive, I decided to control for the influence of motor fluency that could be experienced by the two bodily manipulations of choice (*e.g.*, drawing check vs. X). Thus, in order to rule out those alternative explanations, I further

examined differences in subjective confidence in choice and motor fluency between the experimental conditions.

## Method

### *Participants*

Seventy-eight undergraduate students from a public Midwestern university, 27 males and 51 females ( $M_{\text{age}} = 19.56$ ,  $SD_{\text{age}} = 1.45$ ), participated in the study in exchange for extra course credit. Participants were 50 US citizens and 28 international students, and they were randomly assigned into one of two experimental conditions, a drawing check condition or a drawing X condition. Participants took part in the experiment in groups of two to eight, but they were randomly assigned to experimental conditions individually, not in groups. These two conditions differed only in the marking behavior that participants were asked to do in response to all questionnaire items and the novel stimuli.

### *Procedure*

When participants arrived at the laboratory, they were asked to sign a consent form first. Participants were then seated at rectangular desks that were separated by dark-colored partitions, which prevented them from seeing others' responses to the experimental materials. Afterward, participants were informed that the study aimed to explore whether a relationship exists among their personality traits, media and technology usage, and evaluative judgments of novel stimuli. The experimenter told the participants that they would engage in a paper-and-pencil study. All participants were instructed, via printed instructions that they need to accurately answer the questionnaire items. More importantly, they were informed that the experimenter would input all

responses manually for statistical analysis and thus they were required to draw a specific mark as large as possible over (or next to) the answer. The instruction to draw large marks was intended to corroborate participants' bodily experiences at the point of choice. For example, participants in the check-mark condition were required to draw check on their answers, where participants in the x-mark condition were required to draw X on their answers. This cover story disguised the fact that what the experimenter actually manipulated was whether the participants were engaging in one of the two different marking actions, either a check-marking or a x-marking action. No participants were suspicious of the experimental manipulations and hypothesis.

### *Measures*

First, all participants were instructed to complete two sets of questionnaire items: one set of items that reflected five dimensions of personality traits and a second set to measure media and technology usage. The five dimensions of personality (*i.e.*, Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) were represented by 15 statements (*e.g.*, I don't mind being the center of attention), three from each of the five dimensions. Participants responded using five-point Likert-type scales (1 = Strongly disagree, 5 = Strongly agree). Here, all 15 items were randomly selected from the 60-item NEO Five Factor Inventory (Costa & McCrae, 1992) by using the RAND function from Microsoft Excel.

Media and technology usage was measured by seventeen items randomly selected from the Media and Technology Usage and Attitude Scale (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). To be specific, attitudes toward media (*e.g.*, I feel it is important to be able to access the Internet any time I want) were captured by seven items with response options on five-point Likert-type scales (1 = Strongly disagree, 5 = Strongly agree); media use (*e.g.*, Check your

Facebook page or other social networks) was assessed by eight items with response options on five-point scales (1 = Never, 5 = Several times an hour). However, the two sets of items above were filler items, leading participants to practice their randomly assigned styles of marking before they would be exposed to novel and neutral visual stimuli.

I used two sets of affectively neutral stimuli to control for any unwanted influences of participants' pre-existing preference, affect, and arousal regarding evaluative judgment. In line with this effort, participants' subjective confidence in their own answers and perceived difficulty of the marking action were assessed to ensure that the results of study 1 were solely due to manipulated ways of marking (*e.g.*, drawing check marks on answers) rather than to other psychological experiences.

To be specific, participants were asked to rate their confidence in answers on scales ranging from 1, *Not confident at all*, to 7, *Extremely confident*; 1, *Not certain at all*, to 7, *Extremely certain*; 1, *Not valid at all*, to 7, *Extremely valid* ( $M = 5.77$ ,  $SD = .87$ , Cronbach's  $\alpha = .77$ ). Participants were also asked to rate the difficulty of the marking action through a single, 7-point response item ( $M = 2.32$ ,  $SD = 1.57$ ) anchored at 1 (Not difficult at all) and 7 (Very difficult).

### *Independent variable*

In designing the studies, which demonstrate that bodily experiences at the point of choice can exert an influence on determining our thoughts and feelings, it was critical to find preliminary evidence suggesting that physical activities or bodily experiences cause differential judgments. The two different types of sensorimotor experience were manipulated through two ways of marking action performed by participants. Given that the cognitive linguistic model

(Lakoff & Johnson, 1980) suggests that people experience abstract concepts using metaphors or metaphorically related behaviors, participants were expected to form more favorable attitudes towards unfamiliar stimuli after they had performed a type of positive marking action (drawing check) than a type of negative marking behavior (drawing X).

### *Dependent variable*

After finishing the two sets of filler items, participants were asked to evaluate the visual pleasantness of 20 neutral stimuli; 10 Chinese pictographs and 10 fractal images (see Figure 1). These two types of images were expected to serve as affectively neutral stimuli (Payne et al., 2005), which helped me rule out any possibilities that people's prior preference or attitude toward experimental materials might influence bodily manipulations of choice and subsequent evaluative judgment. All participants were exposed to the same Chinese pictographs and fractal images in the two conditions that were distinguished only by the marking action. To eliminate any ordering effect (*e.g.*, recency or primacy effect), I used four differently-ordered versions of the same questionnaire and all Chinese pictographs and fractal images were mixed up.

Specifically, participants were first exposed to ten random-ordered Chinese pictographs and ten random-ordered fractal images and then were asked to evaluate the visual pleasantness of each stimulus by drawing the same mark they used previously for answering. They were explicitly informed that there were no right or wrong answers and what they needed to do was truthfully evaluate all experimental stimuli with a six-point scale (1 = Extremely unpleasant, 6 = Extremely pleasant) based on their gut reaction.

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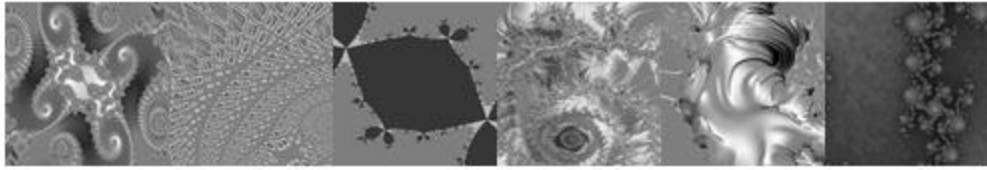


Figure 1. Examples of experimental stimuli

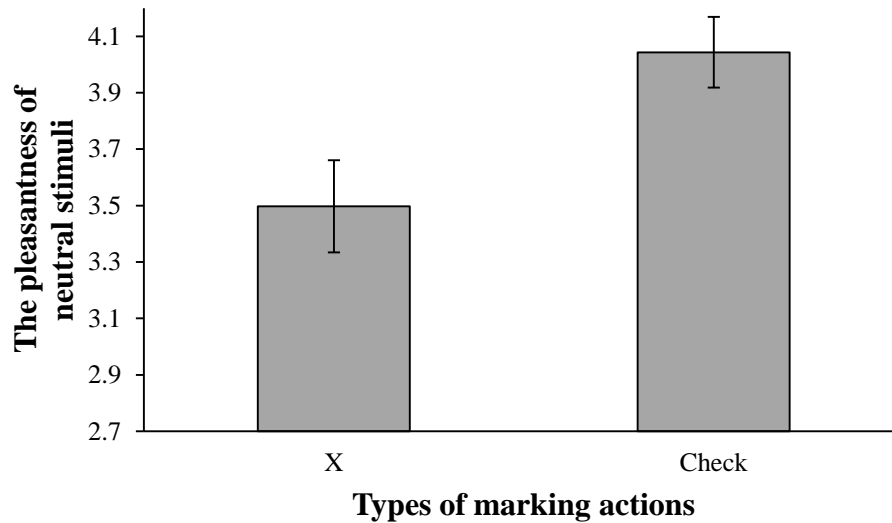
## Results

I examined whether bodily experiences at the point of choice through the two distinctive marking actions influenced evaluative judgment on the two types of novel stimuli. A 2 (types of marking actions: check vs. X) x 2 (types of stimuli: Chinese pictograph vs. fractal image) mixed-model analysis of variance (ANOVA) was performed. The ANOVA yielded a significant main effect of marking actions,  $F(1, 76) = 10.95, p < .01, \eta^2 = .07$ , but no significant interaction,  $F < 1, p = ns$ . This finding indicated that there existed a significant effect of marking actions on participants' evaluative judgments regardless of the types of novel stimuli. Participants who were asked to draw the check-marks on answers ( $M = 3.75, SD = .51$ ) tended to rate neutral visual stimuli as more favorable than those who drew the X-marks ( $M = 3.32, SD = .63$ ).

To confirm how evaluative judgments (*i.e.*, pleasant- or unpleasant judgments) were affected by the physical experiences of choice, I decided to carry out additional separate analyses on the two marking actions. First, I conducted two-tailed independent samples *t* tests to compare participants' evaluative judgment in the check-mark condition with their evaluative judgment in the x-mark condition. Participants in the check-mark condition ( $M = 4.04, SD = .78$ ) rated the 10 randomized Chinese pictographs more pleasant than those in the x-mark condition ( $M = 3.50, SD$



= 1.01),  $t(77) = -2.66$ ,  $p < .01$ , 95% confidence interval (CI) for the difference between the two conditions = [.36, .92], Cohen's  $d = .60$  (see Figure 2).



*Figure 2.* Evaluative judgment of novel stimuli (10 Chinese pictographs) by type of marking (All error bars indicate standard errors, representing precision of the resulting estimates)

Participants in the check-mark condition ( $M = 3.45$ ,  $SD = .62$ ) also evaluated the 10 random-ordered fractal images more favorably than those in the x-mark condition ( $M = 3.13$ ,  $SD = .60$ ),  $t(77) = -2.33$ ,  $p < .05$ , 95% confidence interval (CI) for the difference between the two conditions = [.35, .72], Cohen's  $d = .53$  (see Figure 3).

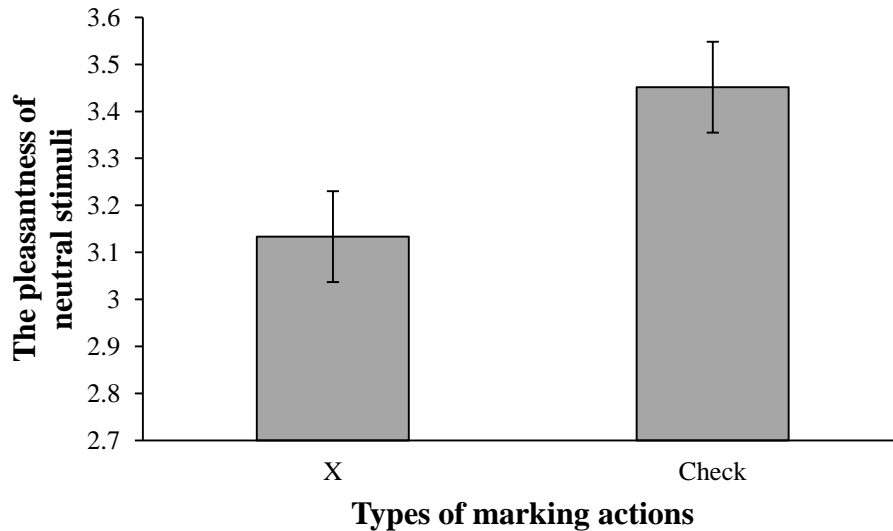


Figure 3. Evaluative judgment of novel stimuli (10 fractal images) by type of marking (All error bars indicate standard errors, representing precision of the resulting estimates)

In addition, there were no significant differences across the two conditions in terms of either participants' confidence in answers ( $t(77) = -.26, p = ns$ ) or perceived difficulty of the marking action ( $t(77) = -1.23, p = ns$ ). The first result suggested that the current results were not confounded by any positive or negative influences of feelings of confidence, indicating that visual cues from the experimental manipulations (*e.g.*, check marks) did not support or undermine participants' subjective confidence and their subsequent evaluative judgments. The latter result addressed that perceived difficulty of the two marking actions also did not differ between experimental conditions, suggesting that any difference in motor fluency did not influence judgments. Thus, I concluded that all participants engaged in evaluative processing in a similar manner.

In addition, though many significant human experiences are universal, the connotative meanings of marks (or symbols) might vary across cultures (Carey, 1989; Lakoff & Johnson,

1980; Osgood, 1975). Since marks (or symbols) are products of social interaction in a given cultural society, culture might constitute the way of construing a certain mark. To ensure that there was no cultural influence (US vs. non-US citizens), a 2 (types of marking actions: check vs. X) x 2 (cultural backgrounds: US citizen vs. non US citizen) mixed-model analysis of variance (ANOVA) was conducted on evaluative judgment of the neutral visual stimuli. This analysis revealed no significant main effect of cultural backgrounds,  $F(1, 76) = 2.71, p = ns$ , and no significant interaction,  $F(1, 76) = 2.15, p = ns$ . This finding indicated that evaluative judgments after performing the two different types of marking action did not differ as a function of cultural background (US citizens,  $n = 50, M = 3.62, SD = .48$  vs. non US citizens,  $n = 28, M = 3.38, SD = .78$ ).

## Discussion

The results of study 1 provided initial support for embodied effects of marking action on evaluative judgment. As hypothesized, evaluative judgment on the same novel visual stimuli hinged on bodily experiences at the point of choice; participants who performed positively connoted check marking actions tended to evaluate novel stimuli as more favorable, while participants who performed negatively connoted X marking actions tended to rate the same stimuli as less favorable. I speculate that physical acts of marking at the point of choice guided participants' subsequent judgments in a metaphoric manner. To elaborate, bodily experiences at the point of choice through both check and X marking actions were expected to be metaphorically associated with abstract social concepts such as the binaries of yes and no, pleasant and unpleasant, positive and negative, correct and incorrect, and agree and disagree, respectively. The results confirmed that such metaphoric associations between abstract social

concepts and bodily acts of marking led participants to evaluate the same affectively neutral stimuli as more or less favorable, respectively.

In addition, in study 1 I attempted to limit any unwanted influence derived from subjective confidence in answers. The findings revealed that bodily manipulations of choice here had no effect on participants' confidence in their answers, which suggested that the self-validation effects did not occur through bodily experiences of check-marking or X-marking. Previous research found that people who were instructed to nod their heads (*i.e.*, vertical head-movements) were more prone to agree with a persuasive message than those who were asked to shake their heads (*i.e.*, horizontal head-movements). Briñol and Petty (2003) argued that those two distinct head-movements facilitate positive or negative thoughts because such head-movements could be misattributed as cues of validity, leading people to feel more or less confident in their thoughts. However, such self-validation effects were not observed in the present study; participants who drew positively connoted check-marks (vs. negatively connoted X-marks) did not exhibit a higher confidence in their answers, so confidence is not a plausible explanation for the findings in study 1.

Because participants were engaged in different marking actions, one might assume that they could feel different levels of task difficulty. Considering that perceived motor fluency derived from a given marking action could affect subsequent judgments, I controlled for any influence of motor fluency that could be experienced by the two bodily manipulations of choice. The findings revealed that bodily manipulations of choice again had no effect on participants' perceived task difficulty; perceived task difficulty stemming from check-marking and X-marking actions did not differ, so task difficulty is not a plausible explanation for the findings in study 1.

Lastly, this study examined whether participants who were U.S. citizens or non U.S. citizens tended to rate novel neutral stimuli as more pleasant after they performed a check-marking action rather than a X-marking action. The results showed that both U.S. citizens and non U.S. citizens interpreted the meaning of the marks similarly.

Though the current findings provided preliminary evidence that given marking actions significantly influenced participants' subsequent judgments, it should be further tested whether bodily manipulations of marking action would cue metaphorically related abstract concepts. In study 1 there is no direct evidence of this. Moreover, it would be meaningful if I could replicate the current findings in a different decision making situation above and beyond evaluative judgment of novel visual stimuli. To further demonstrate the potential impacts of physically experienced marking actions, study 2 included a control group (*i.e.*, drawing neutral O-marks on answers) as well as a set of manipulation check items. A neutral control group allows a better understanding of whether check-marks and X-marks move people in opposite directions, or whether only one type of mark is affecting participants (*e.g.*, the X-mark has no effect, but the check-mark makes people respond more favorably).

In study 2, I will provide an initial test of the hypothesis – that physical experiences of marking action would drive how people make judgments about familiar targets. Study 2 used controversial social policies and issues as targets to be evaluated. One could assume that if people already formed their own beliefs toward such social policies and issues, they might be cognitively biased by their pre-existing beliefs and thus would not be dramatically influenced by physically experienced marking actions. However, if I could replicate and extend the current findings in a more challenging decision making context described above, I can provide: 1) clear and direct evidence for the relationship between the abstract social concepts of check and X (*i.e.*,

aforementioned binaries such as yeas and no, agree and disagree, or positive and negative) and metaphoric marking actions (*i.e.*, check and X-marking), and 2) some support for the hypothesis that bodily acts of marking at the point of choice guide the way in which people respond to not only neutral targets but also familiar targets, leading them to make judgments more consistent with metaphoric meanings of given marking actions.

## 4. DISSERTATION STUDY TWO: REPLICATING STUDY ONE WITH A CONTROL CONDITION

### Introduction

The objectives of study 2 were two-fold. The first goal was to replicate the previous empirical findings in a true experimental setting with a control group. A secondary goal was to tackle a more provocative research problem. People's judgments about targets could be guided not only by the way in which they respond to targets but also their pre-existing beliefs toward targets. If people already have pre-existing beliefs about targets, do bodily experiences at the point of choice sway their responses to such targets? In other words, can certain acts of marking influence their likelihood of acceptance (or rejection) of targets?

To answer this question, I hypothesized that bodily experiences at the point of choice with either a positively connoted check-marking action or a negatively connoted X-marking action would influence people's beliefs about targets, encouraging them to rate such targets as more or less likable. Particularly, assuming that people have at least some opinions on given social policies and issues, I examined whether bodily experiences at the point of choice increase or decrease their level of agreement with such controversial social policies and issues. The design of study 2 was the same as that of study 1, except for the inclusion of an additional control condition. There were manipulation check items for confirming the meanings of check and X-marks.

Previous studies have asserted that the body is reliably associated with the processing of information (Barsalou, 1999, 2008; Landau et al., 2010; Niedenthal et al., 2005; Reimann et al., 2012). As noted above, researchers assume that modally grounded cognitive processes can be

driven by two similar but distinctive bodily experiences: bodily state and action (Barsalou, 2008); both bodily states and bodily actions lead people to make sense of such abstract targets in metaphoric ways (Barsalou, 2008; Clark, 1997; Landau et al., 2010; Wilson, 2002). Empirical findings also have echoed that incidental bodily experiences significantly affect the way people think, feel, and behave (Liljenquist et al., 2010; Meier et al., 2012; Topolinski, Lindner, & Freudenberg, 2014; Williams & Bargh, 2008; Zhong & Liljenquist, 2006).

Given that bodily experiences can cue metaphorically related meanings and convey modality-specific representations about concepts (Lee & Schwarz, 2012), I assumed that physical experiences of choice through marking actions could also be able to influence the degree to which people agree with social issues. Thus, I predicted that a positively valenced check-marking action (compared to a negatively valenced X-marking action or a neutral O-marking action) would cause people to act in a more favorable manner, leading them to evaluate divisive social issues as more agreeable.

To be specific, I argued that if people thought certain marks have a positive or a negative meaning, it would be likely that people drawing such marks feel a positive or negative bodily experience accordingly. Because human cognition is situated and action-oriented by nature (Wilson, 2002), thought and action should not be separated but should be closely coupled. Therefore, in study 2, I expect to observe differences in people's beliefs about three marks where the check-mark, the X-mark, and the O-mark represent a positive, a negative, and a neutral concept, respectively. If true, this result would also imply that merely making marks could encourage people to behave in ways that are consistent with the meanings of marks.



## Method

### *Participants*

In exchange for course credit, 92 participants (23 males, 69 females) between the ages of 19 and 25 years ( $M_{\text{age}} = 21.05$ ,  $SD_{\text{age}} = 1.08$ ) took part in this experiment. They were undergraduate students from a public Midwestern university (77 US citizens and 15 international students).

### *Procedure*

All procedures were similar to those used in study 1. The participants arrived at the laboratory and were asked to sign a consent form first; as a cover story, they were told that they would be taking part in a simple paper-and-pencil study that aimed to examine whether a relationship exists among personality traits, media and technology usage, and attitudes toward social issues. Then, in a between-subjects design, all participants were randomly assigned to one of three experimental conditions. In this experiment, participants were given the same preliminary, or “warm-up,” questionnaire items as in study 1; and participants in study 2 were also instructed that they should draw a specific mark when they chose their answers.

Compared to the design of study 1, there was an additional level of manipulation – a neutral O-mark condition (as a control). The experimenter asked participants to draw either check-marks, O-marks, or X-marks on their preferred choice options, depending on the condition to which they were randomly assigned. As in study 1, participants were informed that the experimenter would input all responses manually for statistical analysis and thus they should to draw as large as possible a specific mark over (or next to) the answer. After participants finished all filler items and outcome variable items, the experimenter additionally asked them to complete

a set of manipulation check measures. Participants provided their beliefs about the meaning of the mark that they were instructed to use for choosing the previous answers.

### *Measures*

All filler measures were identical to those used in study 1. Participants were first given two sets of questionnaire items: one set of items that captured five dimensions of personality and the other set to assess media and technology usage. Again, those two sets of items functioned as filler items, which would lead participants to be fully engaged in certain marking behaviors (*e.g.*, drawing check-marks on answers) before they were actually exposed to attitudinal questions regarding controversial social issues.

### *Independent variable*

Three types of bodily experiences at the point of choice were manipulated through three marking behaviors. Participants' beliefs about three marks were assessed as a manipulation check for the independent measure. Theories of embodied cognition have suggested that thinking about a stimulus is profoundly intertwined with bodily experiences that occurred when the stimulus was initially captured (Barsalou, 1999; Niedenthal, 2007). Therefore, understanding the way in which the target or any target-related information is interpreted is crucial to understanding what abstract mental concepts or psychological meanings people might attribute to their bodily experiences.

Six items with 7-point scales were used to explore participants' beliefs about the meaning of the different marks (*e.g.*, The meaning of "O" can be closer to \_\_\_\_\_; ranging from 1, *bad*, to 7, *good*; 1, *negative*, to 7, *positive*; 1, *unfavorable*, to 7, *favorable*; 1, *incorrect*, to 7, *correct*; 1,

*disagree*, to 7, *agree*; and 1, *false*, to 7, *true* (Cronbach's alphas > .95). Participants only reported their beliefs about the mark that they were instructed to make.

### *Dependent variable*

After completing all filler sections, participants were asked to honestly and accurately indicate their opinions on twenty social issues in a dichotomous manner with either agree or disagree, by drawing the same mark they used for choosing answers before. The social issues used as a dependent measure here (*e.g.*, banning handgun ownership; legalized marijuana; increasing national defense spending) were those that divide Americans the most (GALLUP® Social Poll, 2010-2014, see Appendix). As a primary dependent measure, all statements regarding divisive social issues were mixed up; some social issues were phrased as to endorse liberal perspectives and others were phrased as to represent conservative perspectives. I only used the total number of items that participants agreed with, summed across all of the issues.

## Results

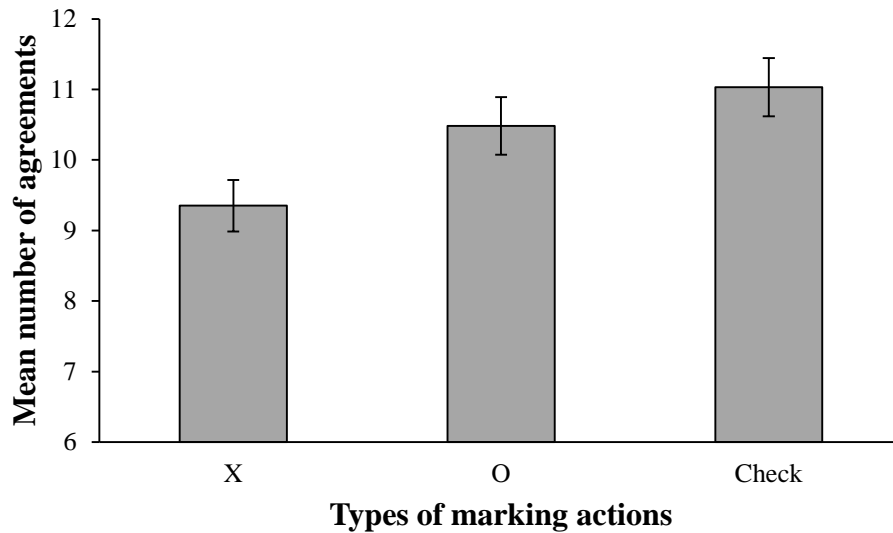
### *Manipulation check*

The participants reported the check-mark ( $M = 5.94$ ,  $SD = 1.09$ ) to be more positive than both the O-mark ( $M = 4.40$ ,  $SD = 1.33$ ,  $t(57) = -4.82$ ,  $p < .001$ , 95% confidence interval (CI) for the difference between the two conditions = [.90, 1.78], Cohen's  $d = 1.28$ ) and the X-mark ( $M = 1.90$ ,  $SD = 1.04$ ,  $t(64) = -15.26$ ,  $p < .001$ , 95% confidence interval (CI) for the difference between the two conditions = [3.41, 4.15], Cohen's  $d = 3.80$ ). Participants felt the O mark to be more positive than the X mark,  $t(60) = -8.25$ ,  $p < .001$ , 95% confidence interval (CI) for the difference between the two conditions = [1.64, 2.49], Cohen's  $d = 2.14$ . Notably, the O-mark

was not significantly different from the midpoint of the scale,  $t(26) = 1.57, p = .13$ , Cohen's  $d = .60$ , suggesting that the O-mark has a neutral connotation. Thus, I concluded that the manipulation was successful in that drawing the check-marks, X-marks, and O-marks guided positive, negative, and neutral bodily sensation, respectively.

### *Hypothesis testing*

The effect of physical marking actions on participants' tendency to agree with controversial statements was analyzed using an analysis of variance (ANOVA) with the marking type as a between-subjects factor. There was a significant effect of marking types,  $F(2, 89) = 5.0, p < .01, \eta^2 = .10$ , as participants drawing the check-marks ( $M = 11.03, SD = 2.30$ ) on their answers were more likely to agree with one side of the controversial social issues than those drawing the O-marks ( $M = 10.48, SD = 2.12$ ) and the X-marks ( $M = 9.35, SD = 2.13$ ) on their choice options (see Figure 4).



*Figure 4.* The embodied effects of marking on participants' tendency to agree with statements about 20 divisive social policies and issues

(All error bars indicate  $\pm 1$  standard error above and below the means)

As hypothesized, participants who drew the check-marks to indicate their answers were more likely to agree with one side of the divisive social issues than those who drew the X-marks on their chosen options,  $t(64) = -3.05, p < .01$ , 95% confidence interval (CI) for the difference between the two conditions =  $[-.05, 1.48]$ , Cohen's  $d = .76$ . Participants who were asked to draw the O-marks on answers also tended to agree more with one side of the controversial social issues than those who drew the X marks,  $t(60) = -2.01, p < .05$ , 95% confidence interval (CI) for the difference between the two conditions =  $[-.27, 1.25]$ , Cohen's  $d = .53$ . However, there was no significant difference in judgments of social issues between the check-mark condition and the O-

mark condition, providing  $t(57) = -.94$ ,  $p = ns$ , 95% confidence interval (CI) for the difference between the two conditions = [-.56, 1.05], Cohen's  $d = .25$ <sup>5</sup>.

As in study 1, participants, 77 US citizens and 15 non US citizens, did not interpret the meanings of marks differently. There was no difference observed in their likelihood of accepting (or rejecting) the controversial social issues between US citizens ( $M = 10.39$ ,  $SD = 2.21$ ) and international students ( $M = 9.53$ ,  $SD = 2.56$ ),  $t(91) = 1.34$ ,  $p = ns$ , 95% confidence interval (CI) for the difference between the two conditions = [-.11, 1.68], Cohen's  $d = .38$ .

## Discussion

The results from study 2 replicated the previous findings of study 1. That is, physical acts of marking at the point of choice led participants to be more likely to agree (check-mark condition) or to disagree (X-mark condition) with assertions about controversial social issues. I argued that 1) bodily experiences of marking would function as metaphoric actions encouraging people to experience metaphorically related abstract social concepts like the binary of agree and disagree, and 2) such metaphoric actions would influence people's tendency to agree or disagree with assertions about social policies and issues.

The findings in study 2 indicated that participants shared beliefs about the three marks; the check-mark, the X-mark, and the O-mark were thought of as having a positive, a negative, and a neutral concept, respectively. This finding supported my broader claim that performing

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<sup>5</sup> A post hoc multiple comparison test (the Tukey HSD pairwise comparisons) revealed that participants who drew the positively-valenced check-marks on choices tended to agree more with one side of the divisive social issues than those who drew the negatively-valenced X-marks on answers ( $p < .05$ ).

marking actions could make people behave in ways that are consistent with the metaphoric meanings of given marks. As I noted earlier, human conceptual systems such as perception and action are situated in a dynamic real-world environment, and conceptual metaphors typically play a role in connecting those cognitive mechanisms (Lakoff & Johnson, 1980; Landau et al., 2010). Thus, metaphorically associated thoughts and actions are not mutually exclusive, and it is impossible to disentangle metaphoric thoughts from actions (Landau et al., 2010; Niedenthal et al., 2005). Since participants' beliefs about the three marks were distinctively different, participants who drew such marks to answer questions were expected to, and did, respond differently.

In addition, the results of study 2 demonstrated that three types of marking actions shifted participants in terms of the given divisive social issues. Specifically, participants who drew positively connoted check-marks tended to show a greater likelihood of agreeing with the divisive social policies and issues compared to those who had drawn negatively connoted X-marks and neutral O-marks. It should be noted that these results do not mean that all participants would entirely change their stance on controversial social issues after performing marking actions. However, it seems unlikely that all participants would have strong opinions on every social policy or issue, and thus, these bodily experiences at the point of choice through different marking actions were swaying at least some participants (some of the time) to be in agreement or disagreement. Therefore, the pattern that emerged in study 2 suggested some evidence that differential marking behaviors might affect at least some participants' tendency to agree or disagree with divisive social policies and issues. The way in which people physically respond to questions could unconsciously determine the psychological meaning of their marking activities and subsequent judgment.

It was also confirmed that all participants (*e.g.*, U.S. citizens and non U.S. citizens) understood the meanings of marks similarly; no significant difference was found in terms of their likelihood of agreeing with the divisive social policies and issues. In sum, my two arguments above were supported. Study 2 first confirmed the metaphoric link between abstract social concepts and the marking actions, and it also provided evidence that bodily experiences of marking action could affect judgments of relatively familiar targets that were expected to be biased by their pre-existing beliefs or preferences.

However, one might account for the results from studies 1 and 2 by asserting that people's cognitive or behavioral responses could be also driven by incidentally activated knowledge structures or situationally increased concept accessibility, namely a priming account. Previous research on automaticity of higher cognitive processes has shown that priming could make people behave in ways consistent with the primes (Bargh et al., 2012). For instance, researchers found that individuals who imagined a typical college professor (*i.e.*, priming intelligence or knowledgeability) tended to show better performance in a general knowledge test, compared to individuals who imagined a typical secretary; their follow-up study also found that individuals who were asked to imagine a typical soccer hooligan (*i.e.*, priming stupidity) tended to exhibit worse performance in the same knowledge test, compared to those who received no priming (Dijksterhuis & van Knippenberg, 1998). These findings suggested that perceiving a typical trait or a typical stereotype leads to the activation of mental representation of a relevant trait or a group and then influences people's subsequent behaviors in ways consistent with attributes of the activated trait or stereotype. It should be noted that priming did not actually make individuals intelligent. Rather, individuals who were primed with a typical professor



tended to alter their behavioral strategies, and those strategies in turn made them think harder and ultimately better.

In sum, priming could affect people's judgment and decision making because it unconsciously influences perceptions and thoughts by making certain trait constructs more or less accessible. I have so far focused on only the effects of embodied experiences at the point of choice, leaving open the possibility that the current findings were due to priming effects. Therefore, study 3 is designed to compare participants' judgments of the same divisive social policies and issues after performing check and X-marking actions and priming check and X-marks.

## 5. DISSERTATION STUDY THREE: RULING OUT CONCEPTUAL PRIMING

### Introduction

In study 2, I found that bodily experiences at the point of choice increased or decreased participants' likelihood of accepting divisive social issues. Together with study 1, this result provided evidence that physically manipulated acts of marking could impact or even shape participants' answers. However, it could be also possible that the act of seeing check- and x-marks, rather than the act of marking, itself, affects participants' judgments. Did positive or negative thoughts or feelings primed through the act of seeing check- and x-marks cause higher or lower levels of agreement with controversial social issues?

There is some evidence that previous processing of a stimulus can exert a significant influence on subsequent processing of a similar or closely related stimulus, without people being aware of this influence (Dijksterhuis & Bargh, 2001). Researchers have demonstrated that human behavior can be triggered or more precisely primed by visual cues. Priming here is defined as "the incidental activation of knowledge structures, such as trait concepts and stereotypes, by the current situational context" (Bargh, Chen, & Burrow, 1996, p. 230).

For instance, one classic study illustrated that the priming of trait concepts affects social perception (Srull & Wyer, 1979). Participants were primed one of two trait concepts, either hostility or kindness, through a sentence construction task. After completing this priming task, they participated in an ostensibly unrelated impression formation test; participants were asked to read behavioral descriptions of a hypothetical target person, but descriptions were ambiguous with respect to the previously primed traits. When participants rated the target person along a series of trait dimensions it was clear that the trait priming manipulations influenced participants'

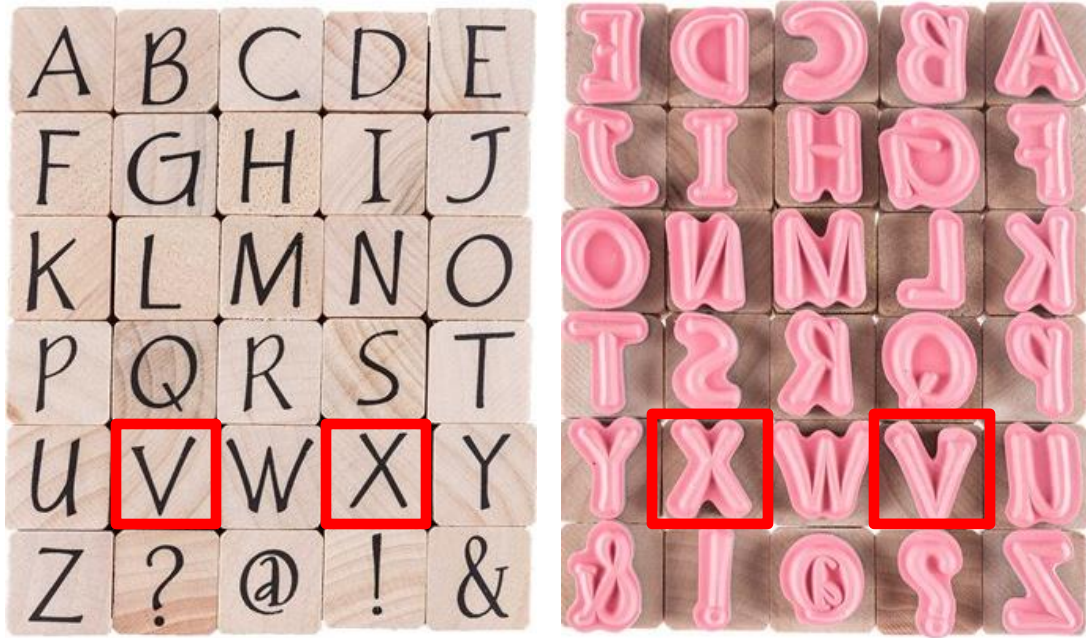
impression formation. Compared to participants who received no priming, participants who were primed with a certain trait (*i.e.*, hostility) were more likely to evaluate the target as having the same trait (*i.e.*, hostile) or semantically-related traits (*i.e.*, unfriendly, dislikable). Priming increased the accessibility of trait concepts and then influenced subsequent impression formation of others.

Another classic study also demonstrated automatic effects of priming on behavior by using stereotypes of the elderly (Bargh et al., 1996). Participants in this study were asked to work on a scrambled-sentence task; they were primed with words closely associated with the elderly stereotype (*e.g.*, Florida, old, grey). After finishing the priming task, the experimenter recorded the amount of time that participants took to walk down the hall, from the doorway of the laboratory to the end of the corridor. People who were primed with the elderly stereotype exhibited a slower walking speed compared to those in a control condition who were primed with neutral words. Researchers speculated that this behavioral priming effect occurred because the elderly stereotype automatically activated knowledge that old people generally walk slowly; and this activated knowledge, in turn, caused people to move slowly. Thus, priming could automatically activate the stereotype and then lead people to even behave in ways consistent with that primed stereotype.

As seen in the aforementioned studies, primed trait concepts can unconsciously (or automatically) influence people's accessibility of the same trait concepts (direct priming) or related concepts (indirect priming) as well as people's likelihood to behave consistent with the primes. Therefore, priming any trait constructs or stereotypes through visual cues can lead people to process relevant information and even behave in line with the primed cues.

Given that both conceptual priming and embodied cognition have their roots in the concept of automaticity of mental processes (Bargh et al., 2012), the underlying mechanism of embodiment is similar to priming in many ways. For instance, like priming effects, physical acts of marking serve as bodily cues that activate metaphorically related physical or psychological concepts, which make such metaphorical concepts or contents more accessible and thereby affect subsequent information processing and behaviors. Thus, there exists a possibility that the previous findings in study 1 and 2 might be due to priming (*i.e.*, perceiving a mark unconsciously activates concepts closely linked to that mark) rather than to the embodied manipulations. As a follow-up study, I replicated study 2 with an additional set of experimental conditions to compare the observed embodied effects with the priming account. To ensure that the results from studies 1 and 2 were mostly due to manipulated marking actions, in study 3 I aimed to explore whether embodied outcomes derived from certain marking actions could also be influenced by primed thoughts or feelings that were triggered by the same marks that people used previously for making judgments.

The priming manipulation took a form of an alternative instantiation of the marking action: stamping the check- or x-marks on answers (see Figure 5). Wooden stamps engraved with the check-mark or the X-mark were used to prime people with the marks on the stamps because those stamps could lead participants to engage in relatively similar sensorimotor activity (*e.g.*, moving a hand) and simultaneously exposed them to the same visual stimuli that are assumed to activate the same metaphorical concepts (*e.g.*, a stamp engraved with a check-mark – good, correct, agree, or yes).



*Figure 5.* Examples of stamps (The two highlighted stamps were used. The letter V was reshaped by cutting off the left edge; thus, it actually looked like a check-shaped mark.)

The participants' ways of marking were manipulated by having people either draw marks on answers (an embodied manipulation) or use stamps engraved with marks to select answers (a priming manipulation). As in previous studies, people used either a check-mark (positive) or a X-mark (negative). To simplify the experiment, and reduce the number of participants required, I dropped the neutral O condition and focused on the total number of "agree" responses summed over the twenty divisive social issues. Thus, the study was a 2 (way of choice: drawing marks vs. using stamps engraved with marks) x 2 (type of mark: a positively connoted check vs. a negatively connoted X) between-subjects factorial design.

If the results from studies 1 and 2 were just additional demonstrations of priming effects, then participants in the drawing and stamping conditions in study 3 should show approximately identical effects; participants who are producing check-marks should show greater agreement

with controversial statements than participants who are producing x-marks. This pattern of results would obtain only a main effect for type of mark. However, if there is something qualitatively different about making check- and x-marks by drawing them instead of seeing check- and x-marks appear as the result of a stamp, then an interaction effect should obtain: the effect of type of mark on level of agreement should be stronger among people who performed embodied checking and X-ing than among people who see checks and Xs appear as a result of stamping.

## Method

### *Participants*

Seventy-nine undergraduate students from a public Midwestern university, 25 males and 54 females, participated individually or in groups of up to eight ( $M_{\text{age}} = 20.18$ ,  $SD_{\text{age}} = .96$ ). They were 71 US citizens and 8 international students. All participants completed study 3 in exchange for extra course credit.

### *Procedure*

The same instructions and procedure from study 2 were used. When participants arrived at the laboratory, they were welcomed and were seated at rectangular desks divided by partitions. As in study 2, the cover story again informed participants that the present study examined whether a meaningful relation exists among personality traits, media and technology use, and attitudes toward social issues. The experimenter asked participants to sign a consent form and randomly assigned them into one of four experimental conditions.

Study 3 was conducted using paper-and-pencil (or stamps) and I repeated a similar procedure to study 2 except that participants were required either to draw a certain mark or to use a stamp engraved with the certain mark to choose their answers. Participants in the stamp condition were given general instructions for the stamp usage. The experimenter told participants that they could press the stamp to the black-colored inkpad and then apply the stamp to their answers. As in study 2, participants were first asked to complete the two sets of filler items that reflected five dimensions of personality traits and a second set to measure media and technology usage. Next, the twenty controversial social issues were judged in a dichotomous manner with either agree or disagree, by drawing either a check or X mark, or by using a stamp imprinted with either a check or X mark. After completing the primary dependent outcome items, participants were asked to answer a set of manipulation check items.

### *Measures*

All measures – the filler items, manipulation check items, and dependent variable - were identical to those used in study 2. Participants' responses to the filler items were not used for further statistical analyses. Again, all filler items aimed at making participants perform given marking actions a sufficient number of times, leading them to 1) be fully engaged in marking actions at the point of choice (*i.e.*, drawing marks condition) or 2) be primed with the marks (*i.e.*, stamping marks).

## Results

### *Manipulation check*

I used the same manipulation check items from the previous study to test participants' beliefs about the meaning of the check and X-marks. Again, participants reported the check-mark ( $M = 5.87$ ,  $SD = .90$ ) to be more positive than the X-mark ( $M = 2.54$ ,  $SD = 1.99$ ,  $t(78) = -15.61$ ,  $p < .001$ , 95% confidence interval (CI) for the difference between the two conditions =  $[3.25, 3.84]$ , Cohen's  $d = 3.53$ ). In addition, such beliefs about targets (*i.e.*, check-mark) did not differ across experimental conditions. A two-way, between participants ANOVA testing effects of marking types (check v. X) and marking actions (drawing v. stamping) on participants' beliefs about the meanings of the marks revealed no effect of marking actions,  $F(1, 75) = 2.00$ ,  $p = ns$ , and no interaction between marking actions and marking types,  $F(1, 75) < 1$ ,  $p = ns$ . Again, only the main effect of types of mark was significant,  $F(1, 75) = 244.73$ ,  $p < .0001$ ,  $\eta^2 = .76$ . Thus, I concluded that the manipulation here was successful, suggesting that participants in all experimental conditions were prone to perceive the check-mark as more positive and the X-mark as more negative.

### *Hypothesis testing*

In studies 1 and 2 cultural backgrounds (*e.g.*, U.S. citizens vs. non U.S. citizens) did not affect the way participants construe the meanings of the marks, so I did not analyze culture further. A 2 (way of choice: drawing marks vs. using stamps engraved with marks) x 2 (type of mark: a positively connoted check-mark vs. a negatively connoted X-mark) ANOVA was performed on participants' likelihood of accepting controversial social issues. The main effect of



way of choice was not significant,  $F(1, 75) < 1, p = ns$ . However, there was a marginally significant main effect of type of mark, showing participants in the positively connoted check-mark condition ( $M = 10.53, SD = 1.96$ ) were more likely to agree with one side of the divisive social issues than those in the negatively connoted X-mark condition ( $M = 9.64, SD = 1.93$ ),  $F(1, 75) = 3.87, p = .05, \eta^2 = .05$ . The interaction between ways of choice and types of mark was also marginally significant,  $F(1, 75) = 2.98, p = .08, \eta^2 = .04$ .

As depicted in Figure 6, participants who were asked to draw check-marks on their answers tended to agree with significantly more controversial social issues ( $M = 10.86, SD = 1.80$ ) than those who were instructed to place X-marks on their answers ( $M = 9.25, SD = 1.92$ ),  $t(40) = -2.77, p < .01$ , 95% confidence interval (CI) for the difference between the two conditions = [.09, 1.70], Cohen's  $d = .86$ . However, the same pattern was not observed between participants who used the stamp engraved with the check-mark ( $M = 10.16, SD = 2.12$ ) and those who used the stamp engraved with the X-mark ( $M = 10.05, SD = 1.90$ ),  $t(37) = -.16, p = ns$ , 95% confidence interval (CI) for the difference between the two conditions = [-.90, .91], Cohen's  $d = .05$ . In addition, further simple effects analyses indicated that participants' tendency to agree with social policies and issues did not differ between when they drew and stamped the check-mark on answers,  $t(39) = 1.13, p = ns$ , 95% confidence interval (CI) for the difference between the two conditions = [-.41, 1.31], Cohen's  $d = .36$  and when they drew and stamped the X-mark on answers,  $t(38) = -1.31, p = ns$ , 95% confidence interval (CI) for the difference between the two conditions = [-.44, 1.26], Cohen's  $d = .42$ .

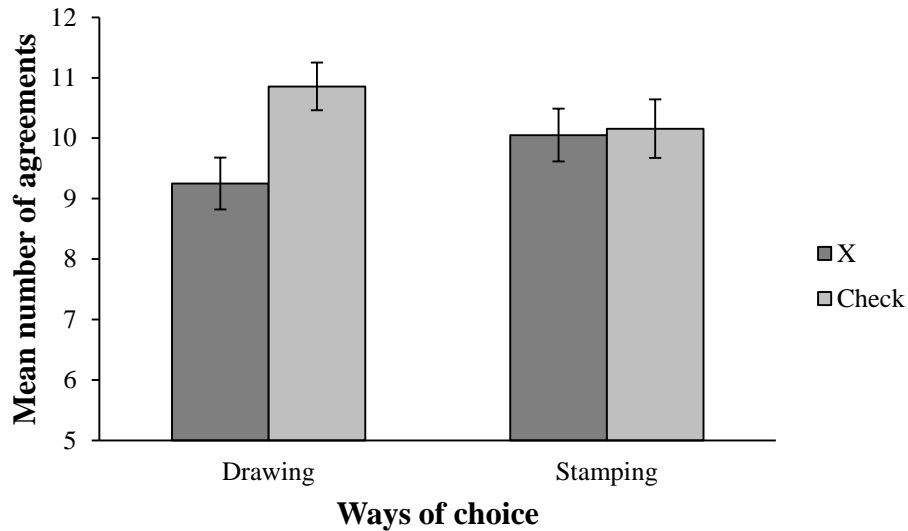


Figure 6. The effects of type of mark by the way of choice on mean number of agreements  
 (The error bars indicate  $\pm 1$  standard error above and below the means)

### Discussion

If the current results were due to conceptual priming effects, there would be no reason to expect any interaction effect; priming and marking manipulations would operate similarly and there would only be a main effect of type of mark. However, the interaction between ways of choice and types of mark was marginally significant ( $p = .08$ ). The planned comparisons indicated that participants who drew the check-marks tended to agree with more of the divisive social policies and issues than those who drew the X-marks ( $p < .01$ ); however, participants who stamped check and X-marks agreed with roughly the same number of statements ( $p = ns$ ). Thus, although the interaction that distinguishes the embodied effects of marking from priming effects was only marginally significant, the results of study 3 provided some support that bodily manipulated marking actions influence participants' judgment above and beyond priming. Similar to priming effects, physical experiences of marking action could serve as bodily cues that

trigger metaphorically associated concepts and, in turn, influence how people think and make decisions. However, as compared with priming effects, embodied cognition effects could be considered as a strong manifestation within the same domain of automaticity effect.

This study also demonstrated that physical acts of marking can convey the metaphorically associated meanings of abstract concepts, and then lead participants to make judgments consistent with such bodily experienced concepts. The way people physically respond to questions can influence participants' subsequent judgment and decision-making in predictable ways.

Again, study 3 provided solid support for my primary hypothesis – physically experienced marking actions at the point of choice affect subsequent judgments and decision making. Furthermore, the alternative explanation of priming was compared with the effects of such embodiment and eliminated; physically experienced marking actions that cue metaphorically related social concepts uniquely alter how people construe their decision situations and ultimately what they chose. Together with studies 1 and 2, study 3 therefore advanced the understanding of embodied cognition and provided important theoretical insights.

Recent research further found that incidental bodily experiences (*e.g.*, postures) could cause physiological changes and thus lead people to shift their behavioral choices (Carney et al., 2010). People tended to take a more risky choice in a gambling task after making and holding high-power poses (*i.e.*, relatively expansive postures with open limbs); others were less likely to take the same risky choice after making and holding low-power poses (*i.e.*, contractive postures with closed limbs). To explicate a possible underlying mechanism of the embodied effects above, the authors provided physiological evidence that high-power poses increased testosterone but decreased cortisol, while low-power poses increased cortisol but decreased testosterone. Given

that levels of testosterone and cortisol reflect dominance and stress respectively, individuals who made high-power poses (vs. low-power poses) experienced increased testosterone as well as decreased cortisol. Differing hormone levels elicited feelings of power and then influenced individuals' willingness to take the gambling risk.

Considering the link between neuroendocrine and behavioral responses above, bodily experienced acts of marking in the dissertation were not only related to metaphorically related social concepts but might also be associated with physiological changes that nudge participants to make certain behavioral choices. However, note that this explication is speculative rather than empirically demonstrated in the current study.

## 6. DISSERTATION STUDY FOUR: EVALUATIVE JUDGMENT IN THE CONTEXT OF CONSUMER BEHAVIOR

### Introduction

Study 1 primarily focused on whether physically manipulated ways of marking influence evaluative judgments of novel and neutral targets. Studies 2 and 3 centered on whether such manipulated ways of marking also nudge people toward being more or less agreeable regarding divisive social policies and issues. These studies demonstrated two major findings: 1) metaphoric concepts (or meanings), such as “yes” and “no” or “likes” and “dislikes” could be activated by bodily actions, and 2) the activated concepts can influence people’s subsequent judgment and decision-making, leading people to evaluate affectively neutral targets as more or less favorable and encouraging people to be more or less agreeable. Taken together, the current study has addressed that physical acts of making that convey the metaphorically related concepts of “yes” and “no” or “likes” and “dislikes” influence people’s likelihood to behave in line with the previously experienced concepts.

Researchers have recently developed the field of sensory marketing, which refers to “marketing that engages the consumers’ senses and affects their perception, judgment, and behavior” (Krishna, 2012, p. 332). Within this new perspective, researchers have explained a role of bodily states or actions in the evaluation of consumer products (Krishna, 2012). In addition, empirical studies have illustrated that bodily sensations guide consumers’ subsequent judgments (Krishina & Schwarz, 2014). For instance, previous studies have revealed a relationship between physical temperature and subjective interpersonal warmth. Zwebner, Lee, and Goldenberg (2014) postulated that people show increased product valuations when they are exposed to physically

warm situations (*e.g.*, in a warm space). They argued that physical warmth activates socio-emotional warmth and in turn results in decreased psychological distance from given consumer products. To test this temperature premium effect, participants were instructed to touch and evaluate a warm or cool pad first. Afterward, the experimenters put a pen on the desk and asked participants to estimate its distance from them. As results, participants who were asked to interact with the warm pad tended to estimate the pen to be physically closer compared to those who had interacted with the cool pad; more importantly, they were willing to pay more money for that pen. Huang, Zhang, Hui, and Wyer (2014) also investigated whether temperature affects consumers' tendency to conform to others' opinions in decision making situations. They found that exposure to a warm temperature caused participants to be more likely to conform with others' opinions because a warm temperature (*vs.* cool) increased subjective feelings of closeness to others, and thus participants tended to evaluate others' opinions as being more valid.

Some sensory marketing researchers have suggested potential links between tactile sensations and metaphorically related psychological concepts. Peck and Shu (2009), for instance, showed that merely touching a product can elicit greater perceived ownership, which in turn leads consumers to have a higher valuation of it. However, this positive haptic effect only occurred when touching resulted in positive sensory experiences (*e.g.*, touching an enjoyable metal Slinky) because negative experiences of touching (*e.g.*, touching Playfoam beads) generated lower affective reactions. Brasel and Gips's research (2014) extended the current knowledge of haptic sensation effects on consumer behavior to an online shopping context. They found that haptic interfaces (*e.g.*, touchscreens) generated stronger levels of endowment leading people to overvalue products that they experienced through the sense of virtual touch, though such interfaces did not actually allow people to touch products during online shopping. Their

findings revealed that sensory experience with touch screens (*e.g.*, tablet) increases psychological ownership, and more importantly, causes people to overvalue virtual products (Brasel & Gips, 2014).

As was suggested by the aforementioned embodied cognition research in a consumer context, physical experiences can make us process metaphorically related mental concepts and then behave in ways that are consistent with the activated concepts' metaphorical meanings. If subtle or incidental bodily sensations (*e.g.*, seeing the X-mark or hearing the X sound in English) could successfully drive consumer cognition and subsequent judgment, overt bodily actions at the point of choice (*e.g.*, drawing X-marks) would have a stronger influence than sensations on how consumers think, feel, and behave.

Therefore, in study 4, I extended my previous findings to the context of consumer research by examining if bodily manipulated acts of marking affect subsequent evaluative judgments of consumer products. I conducted an experiment to explore whether marking actions increase or decrease people's affective responses to actual consumer products – different flavors of coffee. Again, physical actions were expected to influence participants' affective reactions to different coffee flavors (*e.g.*, judgments of liking), leading participants to rate them as more pleasant when answering with check-marks than X-marks.

## Method

### *Participants*

A total of 79 undergraduate students recruited from a public Midwestern university participated in the experiment. Two were eliminated from further analyses because they failed to follow instructions. Thus, 77 undergraduate students (21 males and 56 females,  $M_{\text{age}} = 19.82$ ,

$SD_{\text{age}} = 1.02$ ) participated in this experiment in exchange for extra course credit. They were 72 US citizens and 5 international students; in a between-subjects design, they were randomly assigned to one of two experimental conditions as groups of four to ten.

### *Procedure*

All procedures were identical to those used in the previous studies, except that participants believed that the current study was about the relationship among personality traits, media and technology usage, and their taste evaluations of various coffee flavors. Participants were first seated at rectangular desks divided by partitions and asked to sign consent forms. Afterward, participants were randomly assigned to one of two experimental conditions, either drawing the check-mark condition or the X-mark condition; they were instructed to complete the randomly-selected filler items first. Next, participants were exposed to images of nine different coffee flavors from Folgers Gourmet Selections K-Cup<sup>®</sup>: French Roast, Black Silk, Hazelnut Cream, Vanilla Biscotti, Mocha Swirl, Lively Colombian, Classic Roast, Caramel Drizzle, and Morning Café. Participants were then asked to indicate their evaluations of each of the nine different coffee flavors by drawing the same mark they used for choosing the previous answers. After completing this evaluation task, participants answered questions regarding their demographic characteristics and indicated their general liking for coffee.

### *Measures*

The filler items were identical to those used in previous studies. Again, such items aimed to make participants perform given marking actions a sufficient number of times before they respond to the primary dependent measure. In addition, to limit any confounds associated with



prior attitudes toward or preference for coffee, participants' liking for coffee was assessed by a single item (*e.g.*, "In general, how much do you like coffee?") on a scale ranging from 1, Not at all to 7, Very much ( $M = 4.69$ ,  $SD = 2.03$ ).

### *Dependent variable*

After completing two sets of filler items, participants were exposed to images of Folgers Gourmet Selections K-Cup<sup>®</sup> (see Figure 7), which depicted nine different coffee flavors. I used the RAND function from Microsoft Excel to randomize all flavors and utilized two differently-ordered versions for the taste evaluation task. Before this task, participants were told that they would encounter randomly-selected actual coffee flavors. Participants were asked to think about having those different coffee flavors and then provide their overall evaluations for each coffee flavor on two aspects with response options on six-point scales: how tasty the given coffee flavor was, anchored at 1 = Very poor taste to 6 = Very good taste and how delicious the given coffee flavor was, anchored at 1 = Not at all delicious to 6 = Very delicious. These two questionnaire items were then averaged to generate a single composite ( $M = 3.94$ ,  $SD = .91$ , Cronbach's alpha = .99).

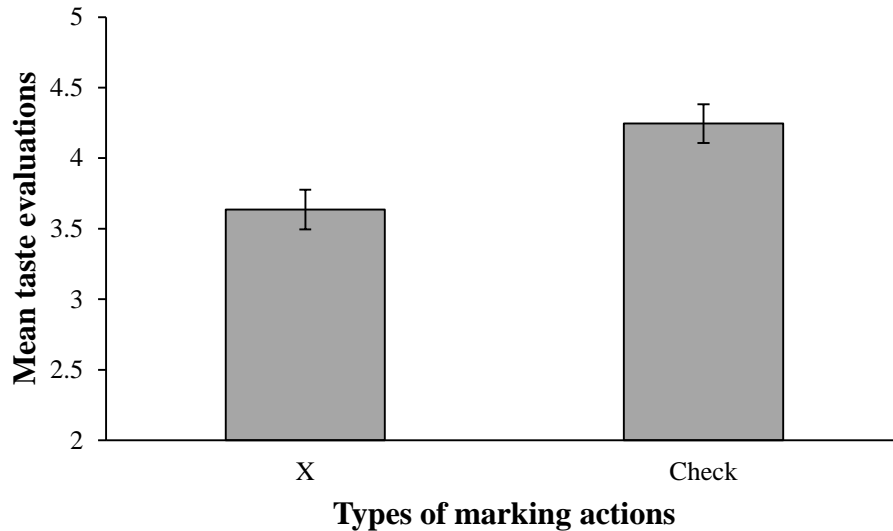


Figure 7. Examples of experimental stimuli, Folgers Gourmet Selections K-Cup<sup>®</sup>

## Results

### *Hypothesis testing*

An independent samples *t* test revealed the hypothesized embodied effect on participants' evaluative judgment. Compared to participants who drew negative X-marks on their answers ( $M = 3.64$ ,  $SD = .87$ ), participants who were asked to draw positive check-marks ( $M = 4.25$ ,  $SD = .85$ ) were more likely to rate flavors of coffee favorably,  $t = -3.10$ ,  $p < .01$ , 95% confidence interval (CI) for the difference between the two conditions = [.44, .99], Cohen's  $d = .71$  (see Figure 8). In particular, participants evaluated the nine random-ordered coffee flavors as tastier after engaging in marking actions that triggered positive mental concepts (*e.g.*, drawing check-marks) while participants reported that the same nine flavors of coffee seemed less delicious after performing marking actions that activated negative psychological concepts (*e.g.*, drawing X-marks).



*Figure 8.* Mean taste evaluations by types of marking actions

(The error bars represent  $\pm 1$  standard error above and below the means)

In addition, I attempted to isolate an alternative explanation that participants' general liking for coffee could influence their evaluative judgments of coffee flavors. An additional test result confirmed that there was no significant difference in terms of liking coffee between the check-mark condition ( $M = 4.97, SD = 1.86$ ) and the X-mark condition ( $M = 4.39, SD = 2.19$ ),  $t(76) = -1.26, p = ns$ .

## Discussion

Replicating previous findings, study 4 demonstrated that bodily experiences of marking action could make participants behave in line with the meanings of previously experienced concepts. Participants who drew check-marks tended to evaluate coffee flavors as more pleasant, whereas those who drew X-marks tended to evaluate coffee flavors as less pleasant. By simply altering the way participants physically respond to consumer products, study 4 provided evidence that differential marking behavior influenced how much participants like different coffees. I speculate that such differential marking caused cognitive processing of metaphorically related concepts like the binaries of good and bad or positive and negative and, in turn, resulted in biased judgments. Physically experienced markings affected judgments in ways consistent with metaphoric concepts related to those marking behaviors.

In addition, as I described in the method section, I attempted to measure participants' general liking for coffee at the end of the paper-and-pencil survey with some demographic questions to rule out an unwanted confounding between their pre-existing preferences for coffee and evaluative judgments of coffee flavors. If participants responded to a question regarding their general liking for coffee after they performed certain marking actions, one might assume

that participants who drew check-marks (vs. X-marks) were prone to say they were avid drinkers of coffee regardless of their pre-existing preferences. However, the result revealed that there was no difference in terms of liking for coffee between the two experimental conditions. Why might this be the case?

Consider Williams and Bargh's (2008) study. In the first experiment, they found that individuals who held a warm cup of coffee (vs. a cold cup of coffee) tended to form impressions of random people as warm. Interestingly, they suggested that bodily sensations of warmth (vs. coldness) unconsciously influenced individuals' feelings of interpersonal warmth and then led to social judgments consistent with such activated feelings of warmth. However, we don't have much knowledge about how long this embodied effect lasts. I speculate that effects of embodiment would not continue beyond a short time period; perhaps, a few minutes following the embodiment manipulation, individuals who previously held the warm cup of coffee would almost certainly form impressions of others based on their gut feelings rather than experimentally induced physical warmth.

Thus, drawing on the example explicated above, the finding that there was no difference in term of liking for coffee across the experimental conditions could be considered as representing the dynamic (*i.e.*, time-variant) nature of embodied cognition. I argue that performing positive marking action such as drawing check-marks could push people toward positive judgments; however, the effects of physically experienced marking may not persist for long time periods. Embodied effects would taper off as soon as people stop making check marks, or put down warm cups of coffee.

## 7. DISSERTATION STUDY FIVE: CONSUMER CHOICE

### Introduction

As demonstrated by studies 1-4, bodily experiences at the point of choice can nudge people to make a particular choice. Physically manipulated check-marking and X-marking actions metaphorically associated with abstract concepts of yes and no, respectively, caused people to make choices in ways that were consistent with such concepts. Thus, like the core assumption of embodied cognition, I found that human cognition is grounded in peoples' physical experiences such as bodily actions.

Given the fact that bodily experiences of abstract concepts can exert an influence on shaping our thoughts and subsequent behaviors, many researchers have so far taken a metaphor-focused approach, mainly centering on whether certain metaphors and metaphoric actions drive cognitive operations and ultimately influence human judgments (Landau et al., 2010). However, as a result of much focus on identifying possible associations between metaphorically related physical and mental concepts, this line of research could not fully capture boundary conditions under which embodied experiences are retained or eliminated. Thus, I adopted a phenomenon-focused approach (Landau et al., 2010), which attempted to find a determinant that might influence the effect of marking actions on judgment.

To provide insight into the impact of metaphoric marking action, in study 5, I posited an additional factor that would shape a choice context in which people make judgments, namely choice architecture. Before I explain this choice architecture further shortly, I review a well-known example of such phenomena. People have witnessed that small changes in decision elements or choice assortment (*i.e.*, organization of choice options) can have a significant impact

on their choices (Kahneman, & Tversky, 1984). For instance, think about the following hypothetical decision making problem below (Tversky & Kahneman, 1981, p. 453).

Decision problem:

*Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.*

*If Program A is adopted, 200 people will be saved.*

*If Program B is adopted, there is a one-third probability that 600 people will be saved and a two-thirds probability that no people will be saved.*

Question: *Which of the two programs would you prefer?*

Researchers found that people preferred Program A (72%) to B (28%) when they were asked to choose a favorable option between the two programs. Considering that people generally prioritize avoiding losses over making gains (Kahneman & Tversky, 2000), this finding suggested that: 1) when gain was framed or highlighted in the choice option, people were more likely to choose that option, and 2) when loss was framed or emphasized in the same choice option, people were less likely to choose that option (Tversky & Kahneman, 1981). Thus, the example above illustrated that people were prone to choose Program A (vs. Program B) because it highlighted gains rather than losses.

Based on such understanding of how people behave, researchers have demonstrated that differentially framing choice options could make people exhibit systematically different choice outcomes and preferences (Kahneman, 2011). In a similar vein, researchers recently coined a term, choice architecture, and argued that the ways questions are framed or presented can shape answers (Johnson et al., 2012; Thaler & Sunstein, 2008; Thaler, Sunstein, & Balz, 2014). Here, choice architecture can be understood as the presentation or organization of possible choice options (Thaler & Sunstein, 2008). Like the examples above, the same question, choice option, and decision outcome can be presented in different ways. Choice architecture plays an important role in organizing a context of judgment or a frame of decision, which can influence people's conceptions regarding possible outcomes and ultimately their actual choices. Thus, if a choice designer frames the same decision problem through either a gain or a loss message frame, or if a choice architect presents the same question in a positive or a negative style of wording, people's judgment and decision making could be affected.

Altering decision frames affects how choice-related information is processed and, more importantly, what is chosen. For instance, having too many choice options (known as choice overload) has a detrimental effect on people's motivation to choose (Iyengar and Lepper, 2000). People were less likely to choose something to buy when they were given too many choices (*e.g.*, choosing one from 4 vs. 24 different jams).

Further evidence of choice architecture effects is evident in the way default options can influence people's choices (Johnson & Goldstein, 2003). People were more willing to be organ donors when the default was to be an organ donor (*i.e.*, the opt-out condition, no choice needs to be made to be a donor but choice is necessary to avoid becoming a donor). However, people were less willing to be organ donors when they were informed that they would have to choose to

be an organ donor (*i.e.*, the opt-in condition, no choice needs to be made to not be a donor, but choice is necessary for becoming a donor). In sum, previous studies successfully pointed out the fact that the way a choice is framed could affect what is chosen.

In study 5 I aimed to take a phenomenon-focused approach by examining a specific context in which people's judgments are more or less likely to be influenced by physical experiences of marking actions. Thus, I proposed another set of conditions that I expected to be affected by bodily experiences at the point of choice – question framing. Question framing was operationally defined as the presentation of a question that is framed through using either a positive or a negative style of language. Question framing here was manipulated as the same question written in positive wording (positive framing) or negative wording (negative framing).

Previous literature regarding the role of conceptual metaphor in thought and action has argued that the same target concept could be mapped onto different metaphoric thoughts and actions; thus, the same abstract target concept could be understood in more than one way (Landau et al., 2010). In other words, the activation of the abstract concepts, check and X (*i.e.*, abstract concepts such as the binaries of yes and no, agree and disagree, and positive and negative), could be achieved through not only a biased thought derived from the way a choice is framed but also a physical sensation derived from the act of marking.

Drawing on prior research in conceptual metaphor theory, I tested a hypothesis that physical experiences of marking action and the framing of questions would interact to influence subsequent consumer judgments. I would expect a meaningful interplay of those two factors in shaping answers; a bodily experienced marking action would have a stronger impact on subsequent judgment and decision making when the metaphoric meaning of given marking



action (*i.e.*, drawing positively connoted check-mark vs. negatively connoted X-marks) is consistent with that of question framing (positive vs. negative framing).

To be specific, when the positively connoted check-marking is matched with the question frame denoting the abstract social concept of likes (*i.e.*, the question written in positive wording), people would choose more targets as likable. In contrast, when the negatively connoted X-marking is matched with the question framed as presenting dislikes (*i.e.*, the question presented in negative language), people would choose fewer targets as dislikable. If this reasoning is correct, most likes would be obtained in a positively-matched condition - the positive check-marking and the positively-framed question condition, while least dislikes would be obtained in a negatively-matched condition - the negative X-marking and the negatively-framed question condition. Choosing by indicating likes and dislikes can result in similar outcomes when one group has most likes (positively matched condition) and another has fewest dislikes (negatively matched condition). Liking eight out of ten items results in choosing eight items, whereas disliking two out of ten items results in choosing eight items. Moreover, a moderate number of likes (or dislikes) would be observed in the two remaining mismatched conditions.

## Method

### *Participants*

One hundred three undergraduate students from a large public Midwestern university ( $M_{\text{age}} = 19.92$ ,  $SD_{\text{age}} = 1.08$ ) completed this experiment in exchange for extra course credit (25 males, 78 females). Participants were 99 US citizens and 4 international students. Run in groups with an upper limit of ten, all participants were randomly assigned into one of four experimental conditions in a 2 (way of choice: drawing check-mark vs. X-mark) x 2 (type of framing: positive

framing vs. negative framing) between-subjects factorial design. In study 5, as in the previous studies, physical acts of choice were manipulated by asking participants either to draw positive check-marks or negative X-marks on their answers. The two types of choice architecture were manipulated by using two distinctive choice frames, either a positively framed question (*e.g.*, how many flavors did you like?) or a negatively framed question (*e.g.*, how many flavors didn't you like?).

### *Procedure*

When participants arrived at the laboratory, they were asked to sign consent forms. Participants were then randomly assigned into one of four experimental conditions and were seated at rectangular desks that were divided by partitions. All participants were led to believe that they were taking part in two unrelated experiments: one was a test of a relation between their personality traits and media and technology usage; the other was a taste test in which they would evaluate different flavors of food offered by the experimenter. In fact, these experiments were a single study.

Participants were explicitly instructed to draw certain marks as large as possible over (or next to) their answers (*e.g.*, drawing check-marks) and were asked to complete filler items that were the same items used in the previous studies. After completing this paper-and-pencil survey, they were thanked and told that the first experiment was finished.

The same experimenter handed out a small packet to each participant, which included the instruction sheet and a set of questionnaire items regarding actual taste evaluation. All participants were told that the second food taste study would take place soon. In order to make the cover story of food tasting plausible, participants were explicitly informed that it would be a

taste evaluation and recognition task with ten different flavors of jelly beans that currently exist on the market. I used Jelly Belly®'s 49 original flavors of jelly bean, and randomly selected ten different flavors of jelly beans from among the 49 flavors for each participant; thus, participants had differently assorted flavors of jelly bean (see Figure 9).

All participants were first asked to taste ten different flavors of jelly beans that were prepared in advance. To prevent any unwanted influence derived from the brand (*e.g.*, brand image or reputation), each participant was served jelly beans in a 2.5 oz stainless steel cup. Next, they evaluated flavors in terms of the number of flavors they liked (positive framing) or flavors they did not like (negative framing) by drawing the same mark they used previously for answering. Afterward, to be consistent with the cover story, participants were asked to recognize the flavors they had tasted; they were exposed to a list of the 49 original flavors of jelly bean and were asked to choose all flavors they thought they had received. After finishing the two tasks, the taste evaluation task and the taste recognition task, I asked participants to indicate their opinions on the overall quality of the jelly beans at the end of the experiment.



Figure 9. Experimental stimuli, Jelly Belly® jelly beans

### *Measures*

All filler measures (*i.e.*, filler items such as personality traits and media and technology usage) were identical to those used in the previous studies and were not further analyzed. In study 5 I used the number of flavors that participants liked after tasting as a primary dependent variable, so for positive frame conditions I summed the number of items each participant marked (because they were told to mark items they liked) and for negative frame conditions I summed the number of items each participant left unmarked (because they were told to mark items they did *not* like). After answering the main dependent measure, all participants were given a follow-up recognition task (*i.e.*, perceived taste - flavor matching task) to be consistent with the cover story of the taste evaluation and recognition test. In particular, participants were exposed to a list of the 49 flavors of jelly bean (*e.g.*, Jelly Belly's The Original Gourmet Jelly Bean<sup>®</sup> such as Buttered Popcorn, Chocolate Pudding) for the taste -flavor matching test, in which they were asked to identify all flavors they previously tasted. However, this recognition memory test was also an unrelated filler task. The overall quality of the assorted jelly bean flavors was measured as a control variable to limit any influence of taste quality derived from differently administered jelly beans. Participants were asked to answer a single question: "on average, the taste of 10 Jelly Bean flavors was \_\_\_\_\_", with response options on seven-point scales, 1, Very poor quality to 7, Very good quality (M = 4.62, SD = 1.49).

### *Dependent variable*

The number of flavors that participants liked was measured as a dependent variable. After engaging in the taste evaluation task (*i.e.*, taste ten different flavors of jelly bean), participants were asked to answer a single question of their choice. Participants in the positive framing condition were asked to answer a question, “How many flavors did you like out of the 10 different flavors you just have tasted?”, which was presented in a positive language. In contrast, participants in the negative framing condition were informed to answer a question, “How many flavors didn’t you like out of the 10 different flavors you just have tasted?”, which seemed similar but was framed in a negative manner. In order to interpret the results more intuitively, the number of flavors that participants left unmarked (in the negative framing condition, only) was calculated. Thus, the mean number of likable jelly bean flavors was used for further statistical analyses ( $M = 5.84$ ,  $SD = 2.28$ ).

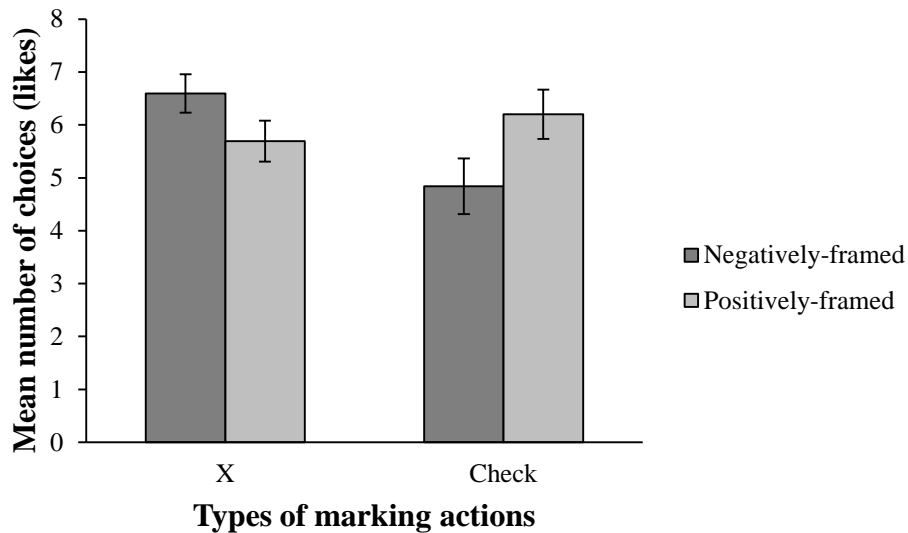
## Results

### *Hypothesis testing*

I found that the overall quality of jelly bean assortments did not differ across experimental conditions (no main effects or interaction were observed), all  $F$ s  $< 2.28$ ,  $p = ns$ ; there was no significant difference in terms of perceived quality of administered jelly beans. To test the main hypothesis, I first carried out a two-way ANOVA on the number of likable jelly beans. No main effects were found, all  $F$ s  $< 2.03$ ,  $p$ s = ns. However, the ANOVA yielded a significant interaction effect,  $F(1, 99) = 6.70$ ,  $p < .05$ ,  $\eta^2 = .06$  (see Figure 10).

Results derived from a simple effects analysis indicated that participants who were asked to draw check-marks on their answers chose marginally more jelly beans as likable when the choice question was positively presented ( $M = 6.20$ ,  $SD = 2.33$ ) rather than when the question

was negatively framed ( $M = 4.84$ ,  $SD = 2.62$ ),  $t(49) = -1.94$ ,  $p = .06$ , 95% confidence interval (CI) for the difference between the two conditions =  $[-.36, 1.58]$ , Cohen's  $d = .55$ . A simple effects analysis also showed that participants who drew X-marks on their answers were prone to choose marginally more jelly beans as likable when the choice question was negatively addressed ( $M = 6.59$ ,  $SD = 1.89$ ) rather than when the question was positively designed ( $M = 5.69$ ,  $SD = 1.98$ ),  $t(52) = -1.70$ ,  $p = .09$ , 95% confidence interval (CI) for the difference between the two conditions =  $[-.25, 1.23]$ , Cohen's  $d = .47$ .



*Figure 10.* Mean number of choices as a function of way of choice and type of framing  
(All error bars represent  $\pm 1$  standard error above and below the means)

The current finding demonstrated that bodily experiences at the point of choice could interact with the choice framing and subsequently influence consumer choices. Particularly, when the way people physically or bodily respond to the question was consistent with the way a

choice was framed, there was a stronger impact of embodiment on participants' subsequent judgment and decision-making.

## Discussion

In study 5 I aimed to demonstrate that the embodied effects of marking action at the point of choice could extend beyond cognitive and affective responses toward experimental targets (*i.e.*, agreements toward divisive social policies and issues, evaluative judgments on novel objects as well as consumer products) to subsequent consumer choices. The results offered empirical support for my hypothesis in that they suggested that physical acts of marking could have a stronger matching effect on subsequent judgments when the metaphoric concepts residing in certain marking actions and question frames were consistent.

In study 5 I found that when people made check-marks, they tended to choose more targets. Thus, in the positive question framing condition, check marking behaviors led to more likes and, in the negative question framing condition, the same check marking behaviors led to more dislikes. In contrast, when people made X-marks on their answers, they were prone to choose fewer targets; so, in the positive question framing condition, X marking led to fewer likes and, in the negative question framing condition, such X-marking led to fewer dislikes. However, since this explication involved the logic of the double-positive and the double-negative, it was difficult to interpret the key findings intuitively. Thus, I interpreted choosing fewer dislikes the same as choosing more likes.

When choosing fewer dislikes and choosing more likes were used interchangeably, clear and consistent patterns were observed. When participants were given a positively-framed question (*e.g.*, how many flavors did you like?), performing positively connoted check-mark

actions (vs. negatively connoted X-mark actions) made them choose more jelly bean flavors as likable. In contrast, when participants were given a negatively-framed question (*e.g.*, how many flavors didn't you like?), performing negatively connoted X-mark actions (vs. positively connoted check-mark actions) encouraged participants to select fewer jelly bean flavors as dislikable; or to put it another way, performing X-marking guided participants to choose more flavors as likable.

Taken together, I speculate that when the embodied ways of choice were matched (vs. mismatched) with the corresponding frames of question, people could easily understand and recruit the metaphoric concepts derived from a decision context. Thus, concrete bodily experiences of marking actions could significantly affect how people understand decision contexts and, more importantly, how they act and decide.

In study 5, I found potential boundary conditions that could limit the embodied effects of marking action on judgments. Just as differential marking behavior leads to different judgments, question framing also facilitates cognitive biases and, in turn, prompts people to make judgments based on such biases. Thus, study 5 provided evidence that question framing could interact with the bodily experiences of marking and then influence subsequent judgment in predictable ways.

Moreover, study 5 provided further support for the dynamic (*i.e.*, time-variant) nature of embodied cognition. In order to control for any unwanted influence stemming from the quality of jelly bean mixtures, I asked participants to indicate the quality of the jelly bean assortments at the end of the survey. Regardless of the inclusion of overall quality as a covariate (*i.e.*, both ANOVA and ANCOVA), study 5 yielded no main effects (all  $F_s < 2.03$ ,  $p = ns$ ) but significant interactions (all  $F_s > 6.70$ ,  $p < .05$ ,  $\eta^2 > .06$ ). However, if bodily experiences of marking action could reliably guide participants' subsequent judgments, I should find at least the main effect of



the way of choice (*e.g.*, drawing check vs. X-marks). As I have speculated in study 4, this result might imply that the embodied effects of marking action could not be continued beyond a short time period. Again, the effects of physically experienced marking could not persist for very long; rather, such effects tend to gradually wear off.

## 8. GENERAL DISCUSSION

The goal of this dissertation was to uncover whether physical acts of marking at the point of choice affect how people make judgments and decisions. Indeed, the body matters, and the physical and conceptual link exists. Across five experiments, I found support for the hypothesis that people's bodily experiences of marking guide their subsequent judgments in a metaphoric manner. To be specific, differential marking behaviors with check and X-marks could reliably shape how people think and make judgments. Study 1 demonstrated that bodily experienced marking actions influence people's evaluative judgments for affectively-neutral stimuli; people who drew check-marks on their answers evaluated neutral visual stimuli (*e.g.*, Chinese pictographs and fractal images) as more pleasant, whereas people who drew X-marks rated the same stimuli as less pleasant. These findings provided preliminary evidence that physical bodily actions play a critical role in determining people's judgments.

The results of study 1, however, raised the question of why people were influenced toward such decisions. Moreover, it would be relatively easy to influence attitudes toward novel stimuli, for which people would not have had pre-existing attitudes. Thus, in study 2, I used relatively familiar stimuli such as social policies and issues for which people might already have some attitudes; and I again examined whether bodily experienced marking actions could cue metaphoric concepts and then influence how people make judgments. The results of study 2 suggested that people share beliefs about the marks; the check-mark, the X-mark, and the O-mark (*i.e.*, for a control group) were thought of as having a positive, a negative, and a neutral connotation, respectively. In addition, I found evidence that physical marking actions lead people to behave in ways that are consistent with the meanings of marks; people who drew positively

connoted check-marks were more likely to agree with assertions about divisive social policies and issues than those who drew negatively connoted X-marks or neutrally connoted O-marks on answers. Therefore, study 2, a stronger test of the hypothesis, demonstrated that differential marking behaviors could also affect people's judgments on more familiar stimuli.

In study 3, I further attempted to replicate study 2 with an additional set of experimental conditions to rule out the possibility that priming could account for my findings in studies 1 and 2. Particularly, the priming manipulation took the form of an alternative instantiation of the marking action, *viz.* stamping the check or X-marks. People in stamping conditions moved their arms, and created, and saw the check and X-marks, but they did not actually draw the check and X-marks. Study 3 provided some support that the results from studies 1 and 2 were due to embodied manipulations of marking actions rather than priming effects. Again, people who drew check-marks agreed with statements about divisive social policies and issues significantly more than people who drew X-marks; however, people who stamped check-marks did not agree significantly more than people who stamped X-marks. These findings provided experimental evidence that embodied experiences of marking action lead to judgments consistent with the metaphoric meanings of such marking actions above and beyond the judgments influenced by arm movements that led to the creation of, and exposure to, check and X-marks (*i.e.*, a priming manipulation).

In study 4 I extended my previous findings to the context of consumer research and explored whether bodily experiences of marking affect people's evaluative judgments of consumer products. The findings provided evidence for the role of the body in people's affective reactions to different consumer products; people rated Folgers<sup>®</sup> coffee flavors as more pleasant when answering with check-marks than X-marks. Study 4 also yielded an unexpected finding. I

initially assessed people's general liking for coffee at the end of the experiment for the purpose of controlling for any unwanted effects that might result from their pre-existing preferences for coffee. I then found that there was no difference in terms of liking for coffee between the two experimental conditions. However, if physical marking actions guide how people make decisions, embodied influences derived from such physical and conceptual links should be observed in liking for coffee. I argue that this finding affords new insight into the dynamic nature of embodied cognition. Note that embodied influences of marking might not take long to "wear off," though such embodied experiences play a direct role in encouraging people to make judgments and decisions.

Finally, in study 5, drawing on research in choice architecture, I proposed a boundary condition in which people's judgments are more or less likely to be influenced by their bodies – question framing. Here, question framing could be understood as ways in which questions are presented. I used two different ways of questioning: one was written in positive wording (*e.g.*, how many flavors did you like?) and another was written in negative language (*e.g.*, how many flavors didn't you like?). I then found that bodily experiences of marking have a greater influence on judgments only when a given marking action and question framing denote a similar metaphoric concept. When people performed check-marking actions, they tended to choose more target items; therefore, question framing played a significant role in determining their judgments. For example, for the positively-framed question, making check-marks led to more likes and, for the negatively-framed question, the same marking behavior led to more dislikes. The opposite pattern occurred in the X-marking conditions. When people performed X-marking actions, they tended to choose fewer target items; so, for the positively-framed question, making X-marks led to fewer likes and, for the negatively-framed question, X-marking led to fewer dislikes.

Assuming the two responses, choosing fewer dislikes and choosing more likes, are interpretable in roughly the same way, the results of study 5 presented a novel explanation for the interaction between differential marking behaviors and question framing on subsequent choices. People who drew positively connoted check-marks chose more jelly bean flavors (Jelly Belly<sup>®</sup>) as likable only when exposed to a positively-presented question; people who drew negatively connoted X-marks selected more jelly bean flavors as likable only when exposed to a negatively-framed question.

Like people's general liking for coffee in study 4, near the end of study 5 I measured the perceived quality of jelly beans to limit any unwanted effects that might result from jelly bean assortments. There was no significant difference in terms of perceived quality of administered jelly beans. Thus, again, the findings provided experimental evidence for the time-variant nature of bodily experiences; physically experienced marking could not persist for very long time periods, rather such embodied influences likely wear off after a short period of time.

Together, the current dissertation presents a foundational set of studies, which provide further support for the theoretical connections between metaphorically related physical and mental concepts. The results suggest that incidentally situated marking actions at the point of choice play a direct role in shaping our thoughts and subsequent judgments in ways that are consistent with such marking actions' metaphoric meanings. None of these results were explained by individual differences such as gender or cultural background (*i.e.*, U.S. citizens vs. non U.S. citizens).

To further investigate whether the results of these dissertation studies are reliably consistent, I carried out a mini meta-analysis. The data from the first four studies were used to calculate the difference between the means: the means derived from the check-marking action

and the X-marking action<sup>6</sup>. Particularly, to corroborate whether participants' judgments and decisions are guided by differential marking actions, I only included conditions derived from the two bodily interventions, drawing check-marks and X-marks. Thus, the O-marking condition from study 2 and the stamping condition from the study 3 were excluded when finding an overall best estimate of a confidence interval (see Table 1).

Table 1.

*The mini meta-analysis: Characteristics of all included studies (n = 261)*

	M <sub>x</sub>	SD <sub>x</sub>	N <sub>x</sub>	M <sub>✓</sub>	SD <sub>✓</sub>	N <sub>✓</sub>	M <sub>✓</sub> - M <sub>x</sub>	Pooled SD	t	sig
Study 1	3.32	0.63	39	3.75	0.51	39	0.43	0.57	3.31	p < .05
Study 2	9.35	2.13	34	11.03	2.3	31	1.68	2.21	3.06	p < .05
Study 3	9.25	1.92	20	10.86	1.8	21	1.61	1.86	2.77	p < .05
Study 4	3.64	0.87	38	4.25	0.85	39	0.61	0.86	3.11	p < .05

I used ESCI (Exploratory Software for Confidence Intervals) developed by Cumming (2012) to perform this meta-analysis (n = 261; 78 males, 183 females; M<sub>age</sub> = 20.09, SD<sub>age</sub> = 1.31). The calculated *Q* (*i.e.*, a measure of the extent of heterogeneity in meta-analysis) was 8.49, which was much larger than *df* = 3. This result indicated that the studies in the meta-analysis were not homogeneous (*p* = .04). Thus, I performed the meta-analysis using the random effects model rather than the fixed effect model (Cumming, 2012).

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<sup>6</sup> The data from the study 5 were not included due to the difficulty of decomposing the logic of the double positive and the logic of double negative.

The meta-analysis suggested that differential marking behaviors affect participants' judgments and decisions. The null hypothesis of no difference between the two marking conditions was rejected,  $p < .001$ , 95% random-effects confidence interval (CI) for the difference between the two experimental conditions = [.34, 1.26]. Thus, the cumulative evidence across the four dissertation studies was considered fairly consistent. As depicted in Figure 11 (see the meta-analytic combination of the four results), physical marking actions indeed affected behavior, showing a positive mean difference between check-marking actions and X-marking actions.

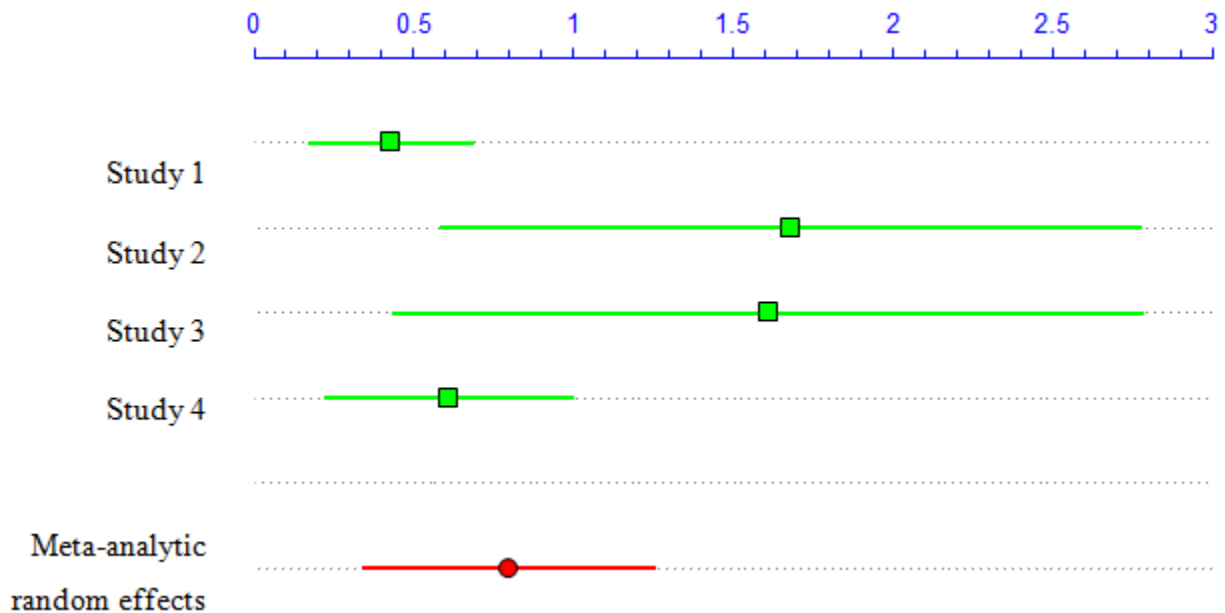


Figure 11. Forest plot indicating difference between the means and meta-analysis (n = 261)

The empirical findings from the five dissertation studies add to the current literature in several ways. First of all, the present dissertation contributed to our understanding of the body-mind link. As the mind controls the body, the body also controls the mind. This bidirectional connection drives people to process given choice-related information using (presumably implicit)

knowledge derived from the body. Drawn on the notion of embodiment to explicate the results, this dissertation demonstrates that performing two hand strokes at the point of choice, making check or X, can lead people to process and understand the same target information differently. To be specific, when people physically respond to questions with positively connoted check, such direct bodily experiences lead people to evaluate targets more favorably, to agree more with targeted issues, and to choose more targets. However, when people physically make negatively connoted X for answering the same questions, they tend to rate targets less favorably, to agree less with given issues, and to choose fewer targets. The two marking actions with check and X indeed differentially influence target information processing and subsequent judgments.

Second, the findings provided novel evidence for the metaphorically related physical and conceptual link in a natural choice setting. This possibility has been investigated by previous literature. For instance, Wells and Petty (1980) suggested that moving one's head up and down (nodding) signifies the abstract social concept of yes, whereas moving one's head from side to side (shaking) implies the abstract social concept of no. They then found that nodders tended to agree more with a persuasive message than shakers. In addition, Cacioppo et al. (1993) proposed that moving something toward one's body denotes the abstract concept of approach, while moving something away from one's body represents the abstract concept of avoidance. They found that individuals who performed an approach-oriented action (*i.e.*, placing one's hands on the bottom of the desk, and then lifting it up) rated novel stimuli as more likable than those who performed an avoidance-oriented action (*i.e.*, placing one's hand on the top of the desk and then pressing it down).

Though those physical actions could cue metaphorically related abstract social concepts such as the binaries of likes and dislikes or for and against, such manipulated bodily actions were



performed before individuals make their actual judgments about unrelated targets rather than at the point of choice. More critically, nodding or shaking one's head and moving something toward or away from one's body were devised for experimental manipulations in the laboratory, and thus such bodily actions were not usually seen in real-world situations in which people make judgments and decisions. Therefore, no empirical research has demonstrated yet whether bodily experiences at the point of choice would be reliably able to influence how people make choices, and more importantly, what is chosen. In this context, the findings in my dissertation studies can shed new light on the embodied influences of making choices. Bodily experiences of marking action at the point of choice can cue metaphorically related social concepts and, in turn, can influence how people think, feel, and behave.

Third, the present dissertation can broaden the scope of bodily influences through marking action. The repeated bodily manipulations of marking when making choices (*e.g.*, drawing check-marks) and the use of various decision contexts (*e.g.*, ratings of novel stimuli, judgments of social policies and issues, affective reactions to stimuli) afforded evidence that a wide range of targets can be metaphorically mapped onto the same source. To be specific, direct bodily experiences of checks and X-marks can be used to capture a wide range of abstract social concepts such as the binaries of likes and dislikes (*e.g.*, pleasant and unpleasant), right and wrong (*e.g.*, correct and incorrect), and for and against (*e.g.*, agree and disagree). This suggested that people might have the ability to selectively use one of the abstract target concepts derived from a metaphorically related direct source concept.

As noted earlier, to understand abstract social concepts or any accompanying experiences, people commonly rub the magic lamp and release the genie, that is, metaphor. Metaphors pervade across situations, and thus, the same target can be metaphorically associated with

diverse sources (Lakoff & Johnson, 1980; Landau et al., 2010). For example, love can be frequently mapped onto the metaphorically related concept of journey; thus people typically use expressions based on such metaphoric association like “I don't think this relationship is going anywhere.” Love can be also metaphorically linked to the seemingly different concept of war. People use metaphoric expressions such as “she conquered my heart.” In this context, researchers addressed that alternative conceptual mappings can be possible depending on given contexts; and more importantly, they argued that such possibility makes people show metaphorically consistent changes. In particular, mapping an abstract target concept A (*e.g.*, intimacy) onto one concrete source B (*e.g.*, physical warmth) leads people to understand some elements derived from the conceptual A and physical B link, while mapping that same target concept A (*e.g.*, intimacy) onto an alternative concrete source C (*e.g.*, physical closeness) makes people construe a different set of elements stemming from the association between metaphorically related abstract concept A and physical concept C.

In contrast, the current finding suggested the different abstract target concepts can be also understood through the same concrete source that are directly experienced by the body. Indeed, I found that physically experiencing the source (*i.e.*, check and X-marks) makes people draw on their knowledge as a reference to understand a wide range of abstract concepts (*i.e.*, the binaries of likes and dislikes, right and wrong, and for and against). However, to what use can this insight be put? I argue that the findings can be uniquely applied to diverse decision contexts such as public opinion polling and prosocial campaigns that aim to change people's attitudes or behavioral intentions (*e.g.*, donation to charity). Regardless of the domains, I expect that bodily experiences of check and X-mark at the point of choice can cue metaphorically related social concepts such as the binaries of likes and dislikes, right and wrong, and for and against; such

activated concepts furthermore influence the way people think about their decision contexts and, in turn, shape their ultimate judgments and decisions.

However, this dissertation could not provide data to determine what physical concepts shaped psychological meanings of the two marking actions. I speculate that differential marking actions end with opposite directionality of hand-movement; for most people, drawing check-marks ends with an upward strike while drawing X-marks ends with a downward strike. Given that the opposite directionality of movement (*e.g.*, up and down) makes people process metaphorically associated concepts (*e.g.*, good is up, bad is down, Lakoff & Johnson, 1980), it might be that the way people write check and X directly cues metaphorically related meanings of marking actions and affects people's thoughts and judgments.

Fourth, in the present dissertation I found that embodied influences cannot persist for very long time periods. This is, to my knowledge, the first empirical demonstration of the dynamic nature of embodied cognition. In particular, the results from studies 4 and 5 suggested that the effect of physically experienced marking actions likely wears off after a short period of time. Researchers have primarily focused on possible embodied influences. Since the earliest empirical research on embodied cognition, it has been shown that bodily experiences reliably lead people to reenact a mental comprehension of metaphorically related abstract concepts; moreover it has been also illustrated that such physical experiences make people come to understand their thoughts about abstract social concepts and subsequently affect their judgments (Barsalou, 1999, 2008; Landau et al., 2010; Niedenthal et al., 2005; Reimann et al., 2012). However, an obvious question remains unanswered: how long do embodied influences last? One possibility involves the time-variant nature of bodily experiences. Abstract social concepts can be understood by body-based cognitive processes in a metaphoric manner. Such bodily

influences on information processing, however, cannot persist for a long time in the absence of further embodied experiences. The body's homeostatic mechanisms might explain the aforementioned dynamic nature of embodied cognition. As seen in the power posing study earlier (Carney et al., 2010), bodily actions (*e.g.*, making high-power poses) not only influence people's feelings and behaviors (*e.g.*, feelings of power, tolerance for a risky choice) but also lead to neuroendocrine changes (*e.g.*, testosterone, cortisol). In order to effectively respond to any changes in external environments, all homeostatic mechanisms in one's body make efforts to maintain a constant or a normal state of the body through primarily neuroendocrine changes (McCall, & Singer, 2012). In this context, I speculate that the homeostatic regulation systems almost certainly attempt to maintain the stability of one's body by sending signals to muscles or organs when people have completed given physical actions; thus, such self-control or self-regulating mechanisms might cause embodied influences to soon disappear. Thus, drawing on a biological account, namely homeostasis, the current dissertation would contribute to the literature by identifying this dynamic nature of embodied cognition.

Last, previous research has mainly focused on the physical and conceptual link by examining "whether metaphor operates at a conceptual level to influence information processing" (Landau et al., 2010, p. 1058). This metaphor-focused approach has yielded empirical evidence of numerous associations between metaphorically related physical and psychological concepts (Bargh et al., 2012; Landau et al., 2010). This dissertation, however, extended the metaphor-oriented perspective by identifying a possible boundary condition that limits bodily experiences of marking on people's subsequent judgments. In other words, I adopted a phenomenon-based approach (Bargh et al., 2012; Landau et al., 2010) and proposed another determinant, question framing, which was expected to interact with physical experiences of choice. Indeed, question

framing, the way a question is framed either in a positive (*i.e.*, written in positive language) or a negative way (*i.e.*, written in a negative language) plays a role in determining embodied influences; bodily experiences of marking exerted a stronger influence on people's judgments when the metaphoric concepts residing in marking actions and question frames were consistent or matched. Therefore, the results in study 5 shed new light on the role of framing in embodied influences at the point of choice and also contributed to research on decision making.

The findings of my dissertation afford theoretical and practical insight into the ways in which people's bodily experiences at the point of choice affect their thoughts, feelings, and behaviors. However, several limitations should be noted, which could be addressed by future research. First, I adopted controversial social policies and issues based on the Gallup<sup>®</sup> poll social series, because such values and beliefs are expected to divide Americans the most. Particularly, I asked participants in studies 2 and 3 to indicate their opinions on 20 divisive social policies and issues in a dichotomous manner by either agreeing or disagreeing. However, I didn't empirically test whether participants in both studies (*e.g.*, undergraduate students aged 19-25 years) have pre-existing beliefs about such social policies and issues; thus, it was unknown how many of them have opinions on these issues, or what direction their opinions lean, or how strong those opinions might be. In an extreme case, one might argue that findings from studies 2 and 3 might be entirely due to participants' tendencies to agree more with policies or issues for which they have no pre-existing opinions at all. As noted before, the current results from studies 2 and 3 did not imply that bodily experiences of marking dramatically sway all people's beliefs toward social issues; it suggested that such physical experiences of check and X-mark affect at least some people's tendency to agree with or otherwise respond to controversial social issues. Although my findings provided evidence that bodily experiences of marking make people think

about divisive social policies and issues in ways that are consistent with the meanings of marks, further investigation is needed to explore whether embodied influences can change people's biased thoughts or pre-existing attitudes about something in predictable ways.

Second, it is also important to note that the priming effect in study 3 was not completely zero. Though it was not significant, people who stamped check-marks ( $M = 10.16$ ,  $SD = 2.12$ ) agreed more with assertions about divisive social policies and issues than those who stamped X-marks ( $M = 10.05$ ,  $SD = 1.90$ ). In addition, there also exists another possibility that bodily experiences of stamping might wipe out the prime. For example, though the two manipulated ways of marking (*i.e.*, for embodiment: drawing check or X-marks, for priming: stamping check or X-marks) make people engage in similar hand movements, people in the stamping condition performed the same physical actions such as pressing a given stamp to the inkpad and applying it when making choices. However, people in the drawing condition had to perform two seemingly different physical actions. It might be possible that the sameness of the stamping action would eclipse the check and X primes. Future research therefore needs to use another way to prime people with the check and X-mark and to examine whether people's judgments derived from the current bodily manipulations are above and beyond the judgments guided by priming.

Third, there is a possibility that the present results in study 3 would reflect another form of priming. Like priming, bodily experiences with check and X-mark make people interpret and understand some concepts without their conscious awareness. Moreover, increased concept accessibility through the body-based metaphor seems a likely mechanism of such embodied effects. Although I found that the body can control the mind by cueing metaphorically related concepts, this dissertation could not address whether embodied effects in human cognition would be considered as a strong instance of priming effect. There were no data on the qualitative

differences between two seemingly similar mechanisms: embodied cognition and conceptual priming. More specific physical concepts should be examined to effectively disentangle any priming effects (or explanations) from embodied experiences at the point of choice.

Last, my attempt to interpret choosing fewer dislikes as another synonymous expression, choosing more likes, helped understand the key findings of study 5 more intuitively. However, choosing fewer dislikes might not always be translated into choosing more likes, because people might feel indifferent when making their choice responses. Thus, future studies would benefit from further investigating the impacts of qualitatively different types of question framing on subsequent judgments.

The results from this dissertation have important practical implications. As noted earlier, the present findings might be uniquely applied to various decision situations such as public opinion polling or consumer choice contexts. For example, differential marking behaviors physically experienced during shopping could influence how people choose. Imagine a hypothetical shopping situation: people walk into the mall, and they encounter a salesperson passing out a promotional flyer, a map with a shopping list of advertised products, and a pencil. The salesperson might ask people to draw check-marks on their preferred items in a list of advertised products. What would be benefits from this strategy? I expect that when the choice is driven by bodily experienced check marking actions, people would choose more items (or at least evaluate advertised products as likable). In other words, physical experiences of check-marking could be designed to alter the atmosphere of the decision situation and ultimately to steer people's subsequent choice behaviors; thus, marketers could benefit from this embodied strategy.

We, human beings, experience and understand the world through our bodies. Human cognition is grounded within our bodies or bodily experiences. Overall, the present dissertation confirms the metaphorically related physical and conceptual link in the context of consumer research and highlights the role of body-based metaphors in the processing of information. How people think and how they make judgments are profoundly guided by incidental bodily experiences at the point of choice; thus, it might be interesting for people to stay awake and keep listening to what their bodies say.



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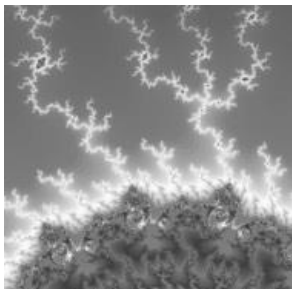
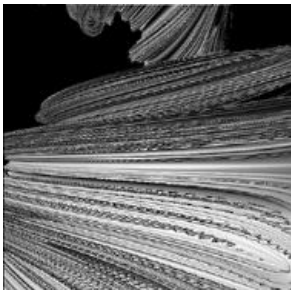
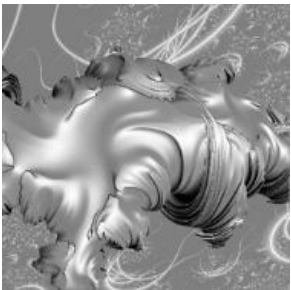
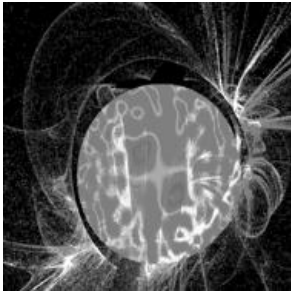
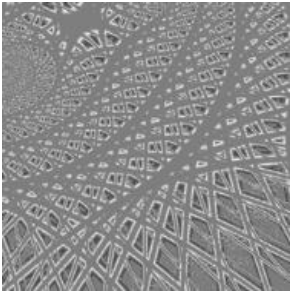
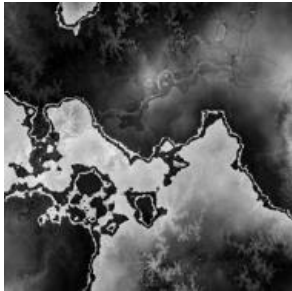
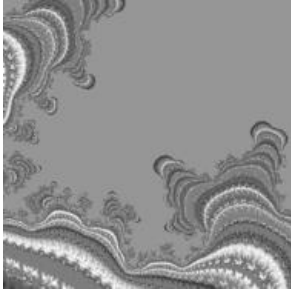
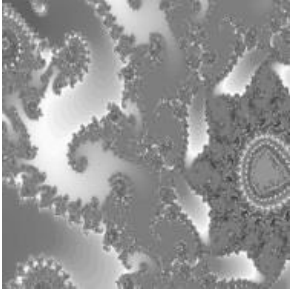
APPENDICES

Appendix A: Experimental materials from Study 1 – Chinese pictographs (Payne et al., 2005)

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Appendix B: Experimental materials from Study 1 – Fractal images (Payne et al., 2014)



Appendix C: Experimental materials from Studies 2 and 3, Social policies and issues

Social policies and issues

Supporting doctor assisted suicide	Legalized the death penalty
Legalized gay or lesbian relations	Divorce
Legalized abortion	Suicide
Having a baby outside of marriage	Cloning humans
Sex between an unmarried man and woman	Polygamy
Buying and wearing clothing made of animal fur	Married men and women having an affair
Medical testing on animals	Banning handgun ownership
Gambling	Legalized marijuana
Medical research using stem cells obtained from human embryos	Increasing national defense spending
Cloning animals	Supporting legal status for immigrants

Note. The 20 divisive social policies and issues were selected based on the results of Gallup® Poll Series 2010-2014, because such policies and issues were expected to divide Americans the most. The results were derived from telephone interviews with a random sample of more than a thousand adults, aged 18 or above, living in all 50 U.S. states and the District of Columbia (<http://www.gallup.com/topic/americas.aspx>).

Appendix D: Experimental materials from Study 4, Folgers K-Cup®



French roast



Hazelnut Cream



Vanilla Biscotti



Black silk



Mocha Swirl



Morning Café



Lively Colombian



Classic Roast



Caramel Drizzle

Appendix E: Experimental materials from Study 5, Jelly Belly®





A&W Cream Soda



A&W® Root Beer



Berry Blue



Blueberry



Bubble Gum



Buttered Popcorn



Cantaloupe



Cappuccino



Caramel Corn