Push Yourself a Bit Harder: The Impacts of Force-based Gestures on Consumer Decisiveness and Self-Regulation

Research-in-Progress

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Abstract

The emergence of force-based gestures (e.g., peek and pop) brings more functionalities to mobile interaction. Although it is believed that peek and pop could facilitate user navigation experience, the psychological and behavioral effects of force-based gestures remain unexplored. This study aims to investigate whether and how force-based gestures (gentle tap vs. hard press) influence mobile consumer decision making. Drawing on Embodied Cognition Theory and Mobile Application Usability literature, we propose that hard press (compared with gentle tap) could make consumers more decisive and thus lead to faster decisions; moreover, hard press (compared with gentle tap) could also facilitate willpower summoning and thus enhance consumer self-control. We also propose that these effects are contingent on visual responsiveness. Accordingly, a 2 by 2 lab experiment is designed. Potential theoretical contributions, practical implications as well as future research directions are discussed.

Keywords: Embodied Interaction, Mobile Commerce, Consumer Decision Making, Self-Regulation

Introduction

The prevalence of smartphones has brought gesture-based interaction accessible to everyone. Simulating real-world interaction, touch gestures (e.g., tap, swipe, flick, drag, and pinch) are often associated with natural and intuitive interaction experiences (Saffer 2008). Currently, most touchscreen devices can detect hand-device contact point and recognize motion-based touch gestures such as swipe and pinch. Since the introduction of Apple 6s/6s plus, force-based touch gestures such as peek (i.e., a hard press which is typically used when a user wants to trigger a content preview without leaving the current page) and pop (an even harder press which is typically used when a user wants to get detailed information after a preview is triggered) are gradually becoming popular on smartphones. It is widely adopted in iOS applications such as Facebook, Twitter, Instagram and Kitchen Stories. Facilitated by pressure-sensitive displays, users could apply different actions by exerting different pressure to the screen, which brings a new dimension of interaction to mobile experience (Heo and Lee 2011a). Although it is believed that the hard-press-triggered preview feature could improve user navigation experience, the effects of these force-based touch gestures on human cognition and behavior remain unexplored.

The gestures we utilize to interact with devices do shape our thoughts and influence our behavior. Recently there is a surge of interest on the effects of gesture-based interaction (compared with mouse-based interaction) on consumer behavior. For example, Brasel and Gips (2014) found that using devices that differed in degrees of touch (touchpad on laptop, mouse and iPad) would influence perceived ownership and consumer endowment of the focal product; furthermore, they found that consumers making hotel selections on touchscreens (compared with mouse) relied more on tangible attributes such as decoration and furniture over intangible attributes such as WiFi (Brasel and Gips 2015). Similarly, Shen et al. (2016) found that consumers were more likely to choose an affect-laden (e.g., a chocolate cake) alternative over the cognitively-superior option (e.g., a fruit salad) on touchscreens compared with using mouse. They explained that it was because reaching out to touch the products on a touch-interface made the consumption experience more vivid than using a mouse to click on a non-touch interface and the vivid mental consumption experience made a hedonic option more desirable. All these findings are consistent with an embodied view of human cognition, i.e., embodied cognition, which suggests that bodily states and actions could facilitate human mental activity (e.g., mentally simulating interaction with a product) and influence consumer judgment and behavior (Barsalou 2008; Wilson 2002).

Despite highlighting the important role bodily action plays in stimulating consumer mental simulation, embodied cognition theory also suggests that bodily experience could also influence consumer judgment and behavior by activating the abstract concepts that the bodily experience associates with (Niedenthal et al. 2005). For example, bodily actions like covering or turning a page on the rejected alternatives trigger the concept of "choice closure" and thus increase consumer overall choice satisfaction (Gu et al. 2013). It is also found that affectionate gestures like hug associating with the concept of "love" could enhance consumer's attitudes towards the focal product (Hadi and Valenzuela 2014). Furthermore, bodily actions not only influence the overall choice experience, but also affect consumer preference and choice. For example, Hong and Sun (2012) found that physical coldness increases liking of romance movies as consumer seeks to reduce social coldness activated by physical coldness by watching romance movies instead of other movies (e.g, action, thriller, comedy). Similarly, Hung and Labroo (2011) discovered that firming one's muscles could lead to healthier food choices as firming muscles is usually associated with endurance regimens. As a specific type of bodily action, force-based touch gestures (a gentle tap vs. a hard press) may convey different metaphorical information. This is because the amount of pressure applied by an individual usually depends on the purpose or intention of the action. When induced or required to exert force at a certain level, consumers might naturally and unconsciously think about the purpose or meanings the gesture represents. Therefore, it motivates us to investigate whether and how force-based touch gestures could influence consumer overall decision making experience (i.e., decision time) and their choice (preference for utilitarian products) through the process of embodiment.

Furthermore, it is important to understand when embodied meanings could be triggered by physical actions (Meier et al. 2012). Prior literature suggests that the effect of bodily action on the activation of embodied concepts relies on the learned association between the two (Van den Bergh et al. 2011). As in the physical world, objects respond to our interactions with them. When interacting with mobile devices, people may expect a similar level of responsiveness from app elements, which is facilitated by visual feedbacks like animation responding to gestures (Lee et al. 2015). It is believed that when correctly used,

animation could increase the sense of direct manipulation and mobile usability (Hoehle and Venkatesh 2015). In addition, visual feedback not only indicates that the app is working and responding properly to the user's input, but also may deliver information. For example, sliding animations (compared with fading animations) cued object persistence and fostered user memory and navigation performance (Liverence and Scholl 2015). However, whether animation can facilitate or inhibit the delivery of metaphorical information associated with the gestures remains unknown.

Motivated by these research gaps, this study intends to explore the effects of force-based gestures in the context of mobile commerce. Specifically, we aim to examine the extent to which force-based gestures and the visual feedback they trigger (i.e., visual responsiveness) interactively influence consumer decision time and choice. We hypothesize that a hard press (versus a gentle tap) is more likely to make the consumers more decisive and self-disciplined. Moreover, the positive effect of hard press on consumer decisiveness is more salient when coupled with higher visual responsiveness (i.e., prompt animation); however, the positive effect of hard press on consumer self-regulation is more salient when coupled with lower visual responsiveness (i.e., gradual animation).

Theoretical Foundation

Embodied Cognition

While certain psychological theories view the mind as an abstract information processor whose connections to the outer world are of little importance, embodied cognition scholars argue that the mind needs to be understood in the context of its relationship to the body (Barsalou 2008; Niedenthal et al. 2005). Rather than relying solely on abstractions that exist independently of their physical instantiation, theories of embodied cognition argue that cognition is both supported and constrained by the architecture of bodies and brains. As a consequence, bodily action is capable of influencing consumer behavior. For example, merely nodding (versus shaking) one's head results in more positive attitudes (Tom et al. 1991). Adopting an expansive bodily posture with open limbs (versus a contractive position with closed limbs) induces financial risk-taking (Carney et al. 2010). Sitting in a hard wooden chair (versus soft cushioned chair) decreases negotiation flexibility (Ackerman et al. 2010). These and many other studies suggest that body critically modulates consumer decision-making.

The basic idea underlying these emerging findings on embodied cognition is that memories are composed of experiences that are multimodal and spread throughout the body, and not stored purely in the brain (Bargh 2006; Lakoff and Johnson 1999; Lakoff and Johnson 2008; Landau et al. 2010). Hence, as gestures arise from our daily interaction with the world, they might be linked to these experience and purposes and thus have the capability to deliver abstract information (Goldin-Meadow and Beilock 2010). As a specific type of bodily action, force-based gestures (a gentle tap vs. a hard press) may convey different metaphorical information. This is because the amount of pressure applied by an individual usually depends on the purpose or intention of the action. When induced or required to exert force at a certain level, people might recall the feelings, experiences and purposes related to such force.

Although gestures may always represent an embodied cue, the evaluative transfer may be contingent on appropriate and facilitating contextual conditions. For example, affectionate gestures (e.g., hugging, stroking) can serve as embodied cue of object attachment and this embodiment could be translated into enhanced product attitudes. However, this effect is contingent on the existence of facilitating conditions via the presence of humanlike characteristics in the target object (Hadi and Valenzuela 2014). As most embodied cognition studies only focus on the identification of the metaphorical information a bodily action embodies, more research are needed to examine the boundary conditions and mediators (Meier et al. 2012).

Furthermore, there has also been a surge of interest in embodied interaction, i.e., an approach to interaction design that places an emphasis on understanding and incorporating our relationship with the world around us, both physical and social, into the design and use of interactive systems (Dourish 2004). Thus, embodied cognition informs that interaction design involving bodily movements and gestures should utilize the interactional mapping based on embodied schema and metaphor. A stream of studies demonstrated that metaphor-based design (e.g., moving hand up to louder the sound, moving hand down to lower the sound) will lead to faster learning and enjoyable experience than non-metaphor-based design

(e.g., moving hand down to louder the sound, moving hand up to lower the sound) (Antle et al. 2009; Hurtienne and Israel 2007; Hurtienne et al. 2015a). Such metaphor-based design also delivers an intuitive interaction experience, i.e., the users' unconscious application of prior knowledge leads to effective interaction (Blacker and Popovic 2015).

Embodied cognition theory has several implications for studying the interplay between human behaviors and mobile devices. First, it highlights that our bodily interactions with mobile devices are capable of influencing our thought and behavior. However, prior embodied interaction literature mainly focused on identifying embodied schema to design metaphor-consistent interaction and improve usability. The effects of bodily interaction with devices on user cognition and behavior are underexplored. Second, although bodily actions may convey metaphorical information, embodiment effects might not always happen. There is a need to understand the boundary conditions of such effects. Drawing on embodied cognition theory, our study aims to demonstrate that in addition to improving navigation performance, force-based touch gestures could potentially influence consumer behavior; and identify the boundary condition of such effects.

Mobile Application Usability

Over the last decade, the concept of mobile application usability has been the focus of much research in information systems. Defined as the degree to which a mobile application can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use (Venkatesh and Ramesh 2006), mobile application usability highlights a mobile application should be functionally easy to use; more importantly, it should serve a specific context or purpose. In the context of mobile commerce, many studies investigate how to improve mobile commerce usability by delivering aesthetic interfaces, building trust, and improving search performance (Li and Yeh 2010; Ngai and Gunasekaran 2007) However, mobile consumers still suffer from casual browsing and indecisiveness, which leads to an inefficient decision process (Xu et al. 2016); moreover, it was found that people tend to be more hedonic seeking when making decisions on their smartphones, which leads to more hedonic and unhealthy choices (Shen et al. 2016). Hence, it is important to understand whether and how force-based gestures could improve the usability of mobile commerce applications by improving consumer decision process and helping them to make an informed and wise choice.

In addition, the unique features of touchscreen devices determine that the antecedents of mobile application usability differ from those of traditional web usability. As various functionalities must be accessed via their limited input/output facilities on a small smartphone, effective user interface (UI) design becomes vital (Hoehle and Venkatesh 2015). Mobile UI consists of gestures as input and their visual feedback (e.g., animations) as output. A series of studies have investigated how different gesture sets influence learnability, sense of control, physical fatigue and user performance (Billinghurst and Vu 2015; Golod et al. 2013; Kim and Song 2014; Ruiz et al. 2011). As most touchscreens can only detect contact location, most touch gestures are motion-based, such as pinch and pan. However, the emergence of pressure-sensitive displays makes force-based gestures possible. Force-based gestures allow users to interact with mobile devices with a wide and expressive range of pressure and thus make experience like painting on a touchscreen more intuitive (Heo and Lee 2011a; Heo and Lee 2011b; Hurtienne et al. 2015b). In fact, force-based gestures improve the diversity of touch gesture set and afford more functionalities. Prior literature found that people could correctly remember and utilize gestures varied in force to control web browsing and e-book applications, which provide more functions (e.g., turning 3 pages with one hard press) than non-force-supported applications (Heo and Lee 2011b). Adding to this stream of literature which demonstrates that force-based gestures are able to provide more intuitive and diverse functions, our study aims to investigate whether mobile applications involving pressing gesture would lead to different consumer decision process and choice compared with mobile applications that only involve tapping gesture.

Together with gestures, the visual feedback (e.g., animation) triggered by gestures is also an important antecedent of mobile application usability. In real world interaction, the external objects respond to our bodily actions. However, to simulate a natural interaction experience, designers usually use animations. For example, page turning animation responding to our swiping gesture makes the experience more intuitive. Appropriate animation can communicate status and provide feedback, enhance the sense of direct manipulation and help people visualize the results of their actions (Hoehle and Venkatesh 2015).

Constrained by the screen size, mobile information is presented on different pages or layers; therefore, transitions between them become vital. In particular, visual responsiveness, which is defined as the extent to which the system responds to user input properly and in a timely manner, is an important antecedent of interactivity and mobile usability (Lee et al. 2015). Although it is suggested that transition animations should be fast in response to gestures, slower transition animations are also adopted especially when designers want to highlight a process (Saffer 2013). Although the number of touch gestures is limited, when paired with different visual feedback, the same gesture may convey different meanings. In this study, we investigate two types of visual feedback in response to force-based gestures, i.e., a prompt show-up transition (high responsiveness) and a gradual show-up transition (low responsiveness).

In summary, as extant gesture-related studies mainly focus on the design of more intuitive mobile UI but not on the psychological effects of gestures, it motivates us to investigate the psychological and behavioral effects of force-based gestures, which might determine whether a mobile application could help a user to make a good decision efficiently. Moreover, mobile application usability literature also suggests that animation and gesture are indivisible in mobile interaction design. Therefore, we aim to investigate whether visual responsiveness has the potential to moderate the embodiment effects.

Hypothesis Development

Drawing on Embodied Cognition Theory, our study aims to examine the metaphorical information that force-based gestures (gentle tap vs. hard press) convey and how they interact with visual responsiveness to influence consumer decision time and their final choice. The research model is presented in Figure 1.

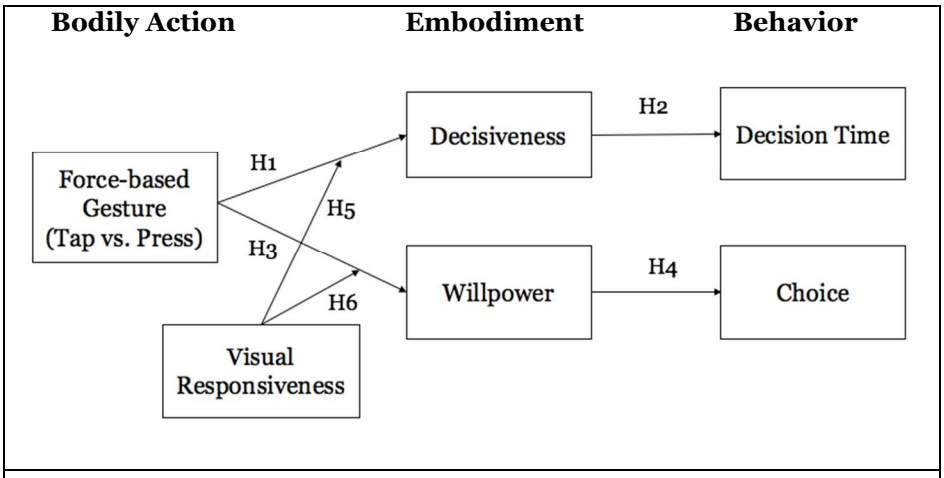

Figure 1. Research Model

Force and Decisiveness

Embodied cognition literature suggests that perceptual-motor patterns are an integral part of the multimodal representation of concepts (Barsalou 2008; Niedenthal et al. 2005). Hence, the sensations a person feels can drive experiences offering similar sensations to become more accessible in the memory. Hard press, push and force in daily language is often used to convey a sense of compulsion and an urge to take action, as indicated by figurative phrases such as "force to obey" and "push yourself". When exerting an intense force on a screen, consumers might also experience a mental force pushing them to take action in decision tasks.

When making purchase decisions, consumers might experience a state of choice difficulty, which consequently delays decision making. This state is termed as "indecisiveness" (Rassin 2007). Indecisiveness might be caused by many factors, such as too many options, difficulty in trade-off, uncertainty about product performance (Anderson 2003), which are often experienced by mobile consumers. Compared with a gentle tap, a hard press is more likely to map a metaphor of "approach". Such an illusion of approach caused by bodily action has been identified as a strong indicator of liking (Hadi and Block 2014; Labroo and Nielsen 2010). If we do not like something, we tend to avoid, instead of

exerting force to explore. Hence, a hard press on products may lead to overall better evaluation and trust towards the products, making consumers more willing to choose among them.

In addition, being able to press something harder inspires a sense of power, which is defined as the perception of one's ability to influence another person or the environment (Anderson et al. 2012). Prior literature suggests that powerful individuals (compared with powerless individuals) demonstrate greater willingness to engage in action (Galinsky et al. 2003). A stream of studies revealed that power and confidence could be induced by body postures, such as sitting up or stretching (Briñol et al. 2009; Roberts and Arefi-Afshar 2007). Feeling of power reduces consumer confirmatory information processing and increases their action intention (Fischer et al. 2011). Hence, it is plausible that hard press, which provides an illusion of power and control, will increase consumer decisiveness.

Indecisiveness predicts a number of undesirable behaviors, such as compulsive hoarding, procrastination, and overall delays in decision-making (Frost and Shows 1993). For example, when indecisive, people take more time to reach a decision and tend to gather more information (including more information on the ultimately chosen option) before being able to make a decision with confidence (Rassin 2007). Therefore, when consumers are primed with decisiveness with bodily actions like a hard press, they will make a quicker decision. Hence, we propose that

H1: Compared with a gentle tap, a hard press leads to higher decisiveness.

H2: Increased decisiveness leads to a shorter decision time.

Force and Self-Regulation

Force also has potential to influence consumer self-regulation. For most people, self-regulation poses a dilemma, which arises in situations where a person must undergo immediate pain (and/or avoid immediate pleasure) to achieve long-term benefits (Fischer et al. 2011; Fishbach et al. 2003). Such dilemma is also experienced by mobile commerce users. For example, when ordering food on iPad in a restaurant, people face a self-regulation dilemma whenever they have to forgo immediately pleasurable indulgent food in favor of less tasty but healthy food to achieve long-term health benefits. Prior literature suggests that mobile users are more vulnerable to self-control failure as touching on hedonic products make the enjoyable consumption experience more vivid and tempting (Shen et al. 2016).

The embodied cognition theory suggests that bodily actions could potentially boost willpower, i.e., the capacity to override one's impulses and automatic or habitual responses. For example, Hung and Labroo (2011) found that merely firming one's muscles can firm willpower which will in turn enhance self-control. This is because muscle firming often accompanies endurance regimens in daily life. When people struggle to overcome challenges or endure physical pain, they tend to pump fists and clench jaws. Hence, merely firming one's muscles can also serve as a situational cue that primes willpower strengthening. Similarly, a hard press also triggers muscle firming, which is a metaphor of endurance and resistance. This bodily endurance state might facilitate mental resistance thus improving willpower. In addition, force is often associated with self-control in daily language, as indicated by phrases like "push yourself harder" and "hold on to". Therefore, when induced to exert force on a touchscreen, consumers might summon their willpower unconsciously.

In addition, prior literature suggests that willpower helps an individual to resist tempting but unhealthy food, consume unpleasant but necessary medicine, or attend to disturbing but essential information (Gailliot et al. 2007; Hung and Labroo 2011; Job et al. 2010). Hence, with the summoned willpower induced by hard presses, consumers are more likely to override their impulses, which leads to choice of a cognitively-superior utilitarian option instead of an affect-laden hedonic option. Therefore, we propose that

H3: Compared with a gentle tap, a hard press increases willpower.

H4: Increased willpower leads to more utilitarian choice.

Moderating Role of Visual Responsiveness

We have theorized that touch gestures varied in force would lead to different level of decisiveness and self-regulation. In this section we identify conditions in which such activation is more likely to occur. Mobile

application usability literature suggests that visual feedback (e.g., animation) responding to gestures should facilitate the expression of gestures (Hoehle and Venkatesh 2015; Lee et al. 2015). When paired with different animations, the same gesture may convey different information. In particular, visual responsiveness is an important dimension of visual feedback. Defined as the extent to which responses in a communication are perceived as relevant and timely, visual responsiveness has been found to be positively related to perceived interactivity and control (Lee et al. 2015). However, although it is suggested that transition animations should be fast and responsive to gestures, slower transition animations are also adopted especially when designers want to highlight a process (Saffer 2013).

In mobile interaction, users' actions and gestures are usually paired with transition animations, which inform users that the application is working properly and provide a smooth interaction experience (Hoehle et al. 2016). For example, when a consumer press or tap on a product image in mobile commerce applications, they could trigger a preview layout above the current page. People could tap on the preview to jump to product page, or tap on other areas of the current page to leave the preview. The showing up of the preview layer triggered by gentle tap or hard press could either be prompt (high responsiveness) or gradual (low responsiveness). Prior literature suggests that a lower responsiveness will reduce perceived interactivity and sense of control (Cyr et al. 2009; Johnson et al. 2006). If a consumer exerts force (versus taps) on the touchscreen, he or she is more likely to expect a prompt response as they invest more effort. Thus, when paired with a slower response, people will feel a lower sense of power and control. Such powerless feeling might make people more suspicious and indecisive. Although force still embodies compulsion and approach, embodied sense of power induced by hard press drops dramatically when coupled with slower animation. Thus, the positive effect of hard press on decisiveness will be less salient. In contrast, when a visual feedback is prompt and responsive, both with gentle tap and hard press, consumers experience a higher sense of control. As hard press is also associated with liking and compulsion, it elevates consumer's decisiveness significantly. Thus, we posit that:

H5: There is an interaction effect between force-based gestures and visual responsiveness on consumer decisiveness. That is, the positive effect of hard press on decisiveness is more salient when coupled with a prompt animation than when coupled with a gradual animation.

Although differing in responsiveness, animated transitions always take some time to complete the transformation (Trapp and Yasmin 2013). Prior literature suggests that the action of force is responsive to visual stimuli, i.e., the duration and intensity of visual stimuli influence human force duration and intensity (Ulrich et al. 1998). When the preview layer appears promptly after a consumer presses on the image, he or she will release the press right after. Thus, the action of a short press might not be strong enough to trigger willpower. Accordingly, hard press is not likely to contribute to a significant gain in willpower compared with gentle tap. In contrast, when coupled with a gradual animation, the action of press will last a bit longer, which provides a stronger metaphor of willpower summoning. In this case, hard press is more likely to increase willpower compared with gentle tap. Therefore, we hypothesize that:

H6: There is an interaction effect between force-based gestures and visual responsiveness on consumer willpower. That is, the positive effect of hard press on willpower is more salient when coupled with a gradual animation than when coupled with a prompt animation.

Methodology

To test the hypotheses, a 2 (force-based gesture: gentle tap vs. hard press) by 2 (visual responsiveness: high vs. low) between-subjects lab experiment will be conducted. A mobile commerce application has been prototyped. With the prototype, participants could browse product catalog page displaying 6 options (3 fruit salads and 3 cakes). Prior literature suggests that fruit salads and cakes are representative for utilitarian and hedonic food respectively (Zhang et al. 2004). A pretest will be conducted to demonstrate that the 6 options do not differ significantly in attractiveness. We select food as our stimulus because food-purchase decisions are now increasingly available on mobile devices and self-control in food choice is important for human well-being. Force-based gesture would be manipulated. In the press condition, participants need to hard press on product image, which will trigger a preview showing short descriptions about each option, e.g., ingredients and price. In the tap condition, participants could tap on product image to trigger the preview. If they want to know more about the option, they could tap the preview to visit product page, which displays detailed description, ingredients, and nutrition. Visual responsiveness

will be manipulated with the speed of preview layer appearance animation, i.e., after participants press/tap a product image on the catalog page, the preview layer appears either promptly or gradually. As prior literature suggests that low responsiveness might lead to negative emotions and attitudes, which may confound our results, we will pretest so that our gradual animation is acceptable to participants but differs with prompt animation in terms of perceived responsiveness.

Participants will be randomly assigned to each condition. First, we will show the participants how to use the mobile application with bodily actions directly. After a demonstration of the prototype, they will be asked to make a choice among the six options. After the participants make their decision, they will be asked to answer a post-experimental survey. Visual responsiveness adapted from Lee et al. (2015) will be measured as a manipulation check. We will also capture the presses that participants apply on the screen and check whether they exert different levels of pressure as instructed. Decisiveness and willpower will be measured with items adapted from Pereira (2014) and Hung and Labroo (2011), respectively. Decision time will be measured as the total duration participants take to complete the choice task. Choice will be coded into 0 if salad is chosen and coded into 1 if cake is chosen. Decision process (emotional vs. rational) will be captured as an additional measure of consumer preference (hedonic vs. utilitarian) (Shiv and Fedorikhin 1999). We will also measure device weight, familiarity with force-based gestures, physical effort, difficulty and naturalness of the action, as well as participants' diet-health awareness and indecisiveness tendency as control variables.

Discussion

This study aims to contribute to the embodied interaction literature by investigating how force-based gestures (gentle tap vs. hard press) influence consumer behavior. The prevalence of mobile, wearable and gestural-controlled devices in recent years lead to a surge of research on embodied interaction, which highlights the important role the body plays in HCI (Marshall et al. 2013). However, most embodied interaction literature focused on identifying embodied schema (i.e., cognitive structure between bodily action and the associated conceptual concepts) and utilizing such embodied schema to deliver more intuitive and natural interaction. This study suggests that the bodily action to interact with IT artefacts might have impact on human cognition and behavior. Thus, when designing for bodily interaction with devices, designers should not only consider learnability and intuitiveness, but also consider the potential psychological or behavioral effects the interaction might bring. Specifically, we identify two concepts a hard press might deliver, i.e., decisiveness and willpower. Hence, we contribute to consumer decision making and self-control literature by studying a simple but useful bodily action, i.e., a harder press. Our study also contributes to embodied cognition theory by identifying the boundary condition for embodiment effects in mobile interaction context, i.e., visual responsiveness. In prior embodied cognition literature, boundary conditions of embodiment effects are typically individual personality or existing knowledge, which determines the strength of body-cognition association. Furthermore, we suggest that visual feedback could be a potential factor that can be manipulated to strengthen or weaken the effects of gestures.

Our study has several practical implications. First, we suggest that a harder press could increase consumer decisiveness and self-regulation. However, such effects are contingent on visual feedbacks. If our predictions are true, mobile applications involving difficult decisions should induce users to hard press more and provide faster transition animations; mobile applications involving self-regulation functions should also induce users to hard press more but provide slower transition animations. This study also suggests that when designing gesture or physical based interactions, designers need to think about the potential impacts such gestures might exert on user cognition and behavior.

As our study aims to investigate the causal impact of force-based gestures on consumer behavior, we require the participants to interact with products by either tap or press on product image, which leads to a preview layer. However, in real mobile commerce applications, a tap usually directly links to product page. The use of "press-to-preview" feature is voluntary. Therefore, we seek to test our model with objective data as more mobile commerce applications are testing such feature. In addition, our current study only investigates two metaphors that force could convey, which are relevant to the consumer decision making context. In future studies, we could examine other embodied effects of force and the potential usage of force-based gestures in other contexts.

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