

Touchscreen Interface and Product Textural Incongruence Effect on Product Haptic Perceptions

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Citation: Germirli, S. (2024). Touchscreen Interface and Product Textural Incongruence Effect on Product Haptic Perceptions. INTERNATIONAL JOURNAL OF ECONOMICS, MANAGEMENT, BUSINESS AND SOCIAL SCIENCE (IJEMBIS), 4(2), 691-699.

<https://cvodis.com/ijembis/index.php/ijembis/article/view/372>

Received: February 29, 2024

Accepted: April 1, 2024

Published: May 6, 2024

Abstract.

The wide spread of online shopping causes more customers to browse and purchase products through devices with touchscreens (e.g., smartphones, tablets) every day at an ever-increasing pace, allowing them to touch only touchscreen interfaces rather than textures of products. Touchscreen interfaces are glasslike and may feel different than the products consumers evaluate. This haptic incongruence between the touchscreen interface and the product's expected texture can cause the haptic dimensions of a product to become more salient and might affect haptic perceptions. This research aims to explore the effect of product-touchscreen interface textural congruence on haptic perceptions of the product. It consists of three experimental studies showing the significant relationships between the incongruence of touchscreen interface texture and product haptic properties, haptic vividness, haptic elaboration, perceived ownership through identification, physical control, and knowledge. These consequently positively influence the attitude toward the product, purchase intention, and endowment.

Keywords: *Haptic elaboration, Haptic vividness, Ownership, Textural incongruence, Touchscreen interface*

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1. Introduction

Sensory marketing engages the consumers' senses and affects their perception, judgment, and behavior (Krishna, 2010). From a managerial perspective, sensory marketing can be used to create subconscious triggers that define consumer perceptions of abstract notions of the product, such as the brand's personality, or to affect the perceived quality of

an abstract attribute like its color, taste, smell, or shape (Krishna, 2012). From a research perspective, sensory marketing implies understanding sensation and perception as it applies to consumer behavior. In a way, sensory marketing provides the understanding of sensation and perception in marketing—to consumer perception, cognition, emotion, learning, preference, choice, or evaluation (Krishna, 2012). Sensation and perception are different stages of processing of the senses. Sensation is the imposition of the stimulus upon the receptor cells of a sensory organ—it is biochemical (and neurological) in nature. Perception is the awareness or understanding of sensory information.

Touch is the first sense to develop in the womb, and the last sense one loses with age. Even before we are born, we start responding to touch and also start touching ourselves (Krishna, 2012). Although advances have been made in recent years, research within the domain of haptics (touch) in marketing is, in many respects, still in its infancy (Elder et al., 2010). There is a clear need for research in haptics within sensory marketing literature.

The haptic sensory literature review shows that most of the research has been conducted in the last decade (academic works containing “haptic,” “tactile,” and “touch” in their titles are investigated through Scopus). Previous research shows that touch enhances the purchase experience (Peck & Childers, 2003), leads to greater confidence in product judgments (Peck & Childers, 2003), and increases the amount consumers are willing to pay for products (Peck & Shu, 2009). Three aspects of the purchase experience determine motivation to touch: the product, the consumer, and the environment. Research by Klatzky and Lederman (1992; 1993) shows that objects differ in material properties by texture, hardness, temperature, and weight. Touch lets us sense these differences more effectively than other senses (Klatzky & Lederman, 1992; 1993).

1.1. Product Haptic Importance

Haptic perception has two essential purposes for consumers: to obtain product-related information in order to make a more informed purchase decision and to invoke hedonic sensory experiences (Klatzky & Peck, 2012). Haptics are essential in evaluating a product’s material properties, including texture, hardness, temperature, and weight (Klatzky et al., 1991), because they provide unique information that cannot be obtained through vision (Lindauer et al., 1986). Haptic input is thus of particular importance in evaluating products where material properties are salient characteristics. For such products, haptics is diagnostic, which is predictive of material properties relevant to product performance (Grohmann et al., 2007). The relative importance of haptics varies across product categories (McCabe & Nowlis, 2003), and haptic input is more critical in product categories consisting of products of high haptic importance where haptics is diagnostic (Grohmann et al., 2007).

1.2. Touchscreen Interface and Product Textural Congruence

As computer usage has shifted from desktop computers and laptops to smartphones and tablets, interfaces have shifted from mouse and touchpads to touchscreens at an ever-increasing pace. These interface changes, in turn, cause changes in consumers’ responses as digital interfaces fundamentally change the experience of the content they view (Rokeby, 1998). Touchscreens have rapidly become a primary means of computer interaction, and this interface has become increasingly important in online consumer behavior (Brasel & Gips, 2014).

Due to the increasing use of smartphones and tablets worldwide, online retail continues to expand to take advantage of the growing mobile population. In 2022, mobile retail e-commerce spending in the United States surpassed 387 billion U.S. dollars, more than double the spending done in 2019 prior to the COVID-19 pandemic (Statista, 2023). Consumers browse and shop for products through touchscreens; they can only touch touchscreen interfaces rather than the products themselves.

In this research, we aim to investigate the effect of congruence between the textural properties of products consumers browse online and the touchscreen interface consumers browse through. Touchscreen interfaces are glasslike and may feel different than the products consumers evaluate. This haptic incongruence between the touch screen and the product can cause haptic dimensions of a product to become more salient and might affect haptic perceptions. This research aims to manipulate product-touchscreen interface textural match.

1.3. Haptic Imagery and Perceived Ownership

When individuals are allowed to touch an object, they report a greater sense of ownership of the object (Peck & Shu, 2009; Shu & Peck, 2011). When consumers shop online, they cannot touch products before purchase. Previous research shows that imagining touch can be a surrogate for touch (Peck et al., 2013). Imaging is a cognitive process in which sensory information is represented in working memory (MacInnis & Price, 1987) and may operate as a mental recreation of experience involving multiple senses. Bone and Ellen (1992) suggest that imagery may involve sight, taste, smell, and haptic sensations. Touch is the primary way by which consumers obtain haptic information, such as texture, hardness, temperature, and weight, from products (McCabe & Nowlis, 2003; Peck & Childers, 2003) and through which consumers manipulate objects (i.e., through physical control) (Peck et al., 2013).

Pierce et al. (2003) suggest three paths through which perceived ownership emerges: physical control of an object, intimate knowledge of an object, and identification with an object (Pierce et al., 2003). Haptic imagery has the same effect on perceived ownership as physical touch (Peck et al., 2013). It leads to perceptions of physical control, which increases perceived ownership, that is, feeling the sense of ownership of the object (Peck et al., 2013).

In essence, the vividness of the haptic imagery determines the perception of physical control and the feeling of ownership (Peck et al., 2013). The more vivid the haptic imagery, the greater the perception of physical control and, consequently, the stronger the perception of ownership (Peck et al., 2013). Haptic vividness is the mental visualization of touch and the intensity and clarity of images that arise (Peck et al., 2013). When past experiences are integrated, haptic elaboration emerges, integrating previously stored information in the haptic imagery (Kamleitner & Feuchtl, 2015). Physical control over an object, intimate knowledge of an object, and identification with an object are three possible paths to perceived ownership (Pierce et al., 2001; 2003). Although physical control of an object is shown to be an antecedent of perceived ownership (Peck et al., 2013), the intimate knowledge of an object and identification with an object, which is hypothesized to be the other two antecedents of perceived ownership, have not been empirically tested (Peck & Shu, 2009; Shu & Peck, 2011).

Previous research shows that the more information acquired about the target object of ownership, the more intimate the bond between the individual and that object (Beggan & Brown, 1994; Rudmin & Berry, 1987). Knowing an object intimately leads it to become part of the self (Beaglehole, 1932) and creates greater feelings of ownership (Pierce et al., 2001; 2003). Relevantly, as one invests their time, energy, values, and identity in a target object, it becomes attached to them, and they own it in much the same way as they own themselves (Durkheim, 1957). Investing an individual's self into objects and identification with them causes the self to become one with the object and develop feelings of ownership towards that object (Rochberg-Halton, 1980).

If knowledge and identification are, in fact, antecedents, we would expect that vividness and elaboration of haptic imagery would result in greater perceived ownership through them. This research investigates the two unexplored paths to perceived ownership: intimate knowledge of an object, identification with an object, and physical control over an object. We claim that the incongruence of touchscreen interface texture and product haptic properties leads to haptic vividness and haptic elaboration, leading to perceived ownership through physical control over a product, intimate knowledge of a product, and identification with a product. Perceived ownership is expected to affect attitude toward the product and purchase intention.

This research explores the effect of the textural incongruence of touchscreen interface and product on haptic vividness, haptic elaboration, and perceived ownership, affecting product attitude and purchase intention.

2. Research Methods

2.1. Pretest

Two groups of products are chosen to be used in the study, which are expected to be high-haptic importance products with textural properties congruent and incongruent to touchscreen interface texture. Products that are expected to have congruent haptic properties are glass trinket, plastic torch, glass vase, porcelain plate, and silver tray. Products that are expected to have incongruent haptic properties are cotton, napkin, wooden trinket, towel, and cashmere sweater.

To measure the congruence of haptic properties, 38 undergraduate student participants are asked to touch the products and the touchscreen (iPad tablet) interface for 15 seconds each, using only their index fingers, and write down any thoughts and feelings to describe the texture of the products they touch. Participants are blindfolded during the test, so the vision does not interfere with haptics. Participants' writings were coded by content and rated by independent coders, so inter-coder reliability is measured. The number and the cognitive and verbal responses are also used in earlier research as measures of the process (Cacioppo & Petty, 1981).

Objects with textures that are most congruent (glass vase) and most incongruent (cotton towel) with the touchscreen interface texture are chosen to be included in the main study based on the haptic properties of slipperiness, smoothness/roughness, softness/hardness.

Furthermore, an independent-sample t-test is conducted to compare the textures of the touchscreen and the two products based on participants' evaluations of textural properties: slipperiness, smoothness/roughness, and softness/hardness. There is no significant difference found between product 1 (glass vase) and touchscreen (iPad tablet) $p > 0.05$, while

there are significant differences found between product 2 (towel) and touchscreen, and products 1 and 2 ($p=0.00$), showing that the textural properties of product 1 and tablet are found to be congruent, while textural properties of product 2 and tablet are perceived to be significantly incongruent.

It is also found that the groups do not exhibit significant differences in their product involvement and product category involvement; product involvement is measured through a 2-measure 5-point scale with items such as, "This [product] is appealing" ($\alpha = 0.76$) and product category involvement measured through a 2-measure 5-point scale with items such as, "I am knowledgeable about this product category" ($\alpha = 0.67$) (Higie & Feick, 1989). No significant difference is found between the products for product involvement and product category involvement during the manipulation check tests of each study.

2.2. Main Tests

Three studies were conducted to measure the participants' evaluations of product 1 (glass vase) and product 2 (cotton towel) based on different versions of visuals.

Study 1 aims to compare participants' evaluations of the images of product 1 and 2, study 2 aims to compare evaluations of the product 2 image and product 2 image with a claim, and study 3 aims to compare evaluations of the product 2 image with a claim and product 2 image with a person.

Participants are seated at the table and asked to browse through the touchscreen for the products. The touchscreens are placed on the table in front of them; they are not allowed to hold the touchscreens up or touch anything besides their screens. They are asked to browse through the touchscreen for the products and directed to use zooming options to see them. To evoke haptic imagery, the instructions read: Please evaluate the [product] as if you were considering buying it. Please take one full minute to evaluate the [product] through your touchscreen. Please close your eyes and imagine touching the [product]. Imagine holding it in your hands. Think about how it would feel for 10 seconds minimum.

Following these procedures, haptic vividness is measured through a 3-measure 7-point scale (Grohmann et al., 2007) with the items "I could imagine moving my fingers on the product," "I felt that I could examine the texture of the product," and "I felt as if the product was in my hands" ($\alpha = 0.83$) (Peck et al., 2013). Haptic elaboration is measured through a 2-measure 5-point scale with items such as, "When evaluating the product, I felt as though I could imagine what it would be like to use the product" ($\alpha = 0.46$) (Kamleitner & Feuchtl, 2015). Physical control over the object is measured through a 2-measure 7-point scale (Grohmann et al., 2007) with the items "When evaluating the product, I felt as though I could move it" and "I had physical control over it" ($\alpha = 0.72$) (Peck et al., 2013). Intimate knowledge of an object is measured through a 2-measure 7-point scale with the items; "When evaluating the blanket, I felt as though I know it very well and I have intimate knowledge about it" ($\alpha = 0.65$) (Smith & Park, 1992).

Identification with an object is measured through a 2-measure 7-point scale adapted from the self-brand connection scale with the items; "When evaluating the product, I felt as though I identify myself with it and I relate myself to it" ($\alpha = 0.85$) (Escalas, 2004). Perceived ownership is measured through a 3-measure 7-point scale with the items; "I feel like this is my product," "I feel the personal ownership of the product," and "I feel like I own this product" ($\alpha = 0.78$) (Peck et al., 2013). Attitude toward the product is measured through a 4-

measure 5-point scale anchored by endpoints “Very negative” and “Very positive” with items such as, “All in all, I evaluate this product” ($\alpha = 0.82$). Purchase intention is measured through a 5-point scale anchored by endpoints “Definitely not possible” and “Definitely possible” with the items “If I had the chance, I would purchase this product.” Endowment is measured by first asking how much they would pay for the product (WTP), then informing them that someone else wanted to purchase it from them, and how much they would accept to give up the product (WTA) (Kahneman et al., 1990; Reb & Connolly, 2007). The endowment ratio is calculated by WTA/WTP (Brasel & Gips, 2014).

Study 1 recruited 100 university students (female = 62%) to participate in the study. (Age M=22.34, median=22). Participants are randomly assigned to product 1 image (Fig. 1) or product 2 image (Fig. 2) conditions, with 50 participants evaluating each product. Study 2 recruited 101 university students (female = 56%) to participate in the study. (Age M=21.46, median=21). Participants are randomly assigned to the product 2 image (N=50) or the product 2 image with claim conditions (N=51) (Fig. 3). Study 3 recruited 100 university students (female=53%) to participate in the study. (Age M=21,10, median=21). Participants are randomly assigned to product 2 image with a claim (Offers dryness to you and your loved ones with its silky soft texture, 100% cotton, Color: White, Size: 50x80 cm) (N=50) or product 2 image with a person conditions (N=50) (Fig. 4).



Figure 1



Figure 2



Figure 3

Figure 4

3. Results and Discussion

Study 1 found that there are significant differences in haptic elaboration between condition 1 (M=3.44, SD=0.89) and condition 2 (M= 3.80, SD=0.91) $F(1, 98) = 4, p=0.04$; product identification between condition 1 (M=2.92, SD=1.05) and condition 2 (M= 3.75, SD=0.95) $F(1, 98) = 17.08, p=0.00$; perceived ownership between condition 1 (M=2.55, SD=0.89) and condition 2 (M= 3.09, SD=1.04) $F(1, 98) = 7.92, p=0.00$; attitude toward product between condition 1 (M=3.25, SD=0.75) and condition 2 (M= 3.82, SD=0.69) $F(1, 98) = 16.03, p=0.00$; purchase intention between condition 1 (M=2.60, SD=0.93) and condition 2 (M= 3.38, SD=1) $F(1, 98) = 16.241, p=0.00$; while there are no significant differences found in haptic

vividness, product knowledge, and physical control between the products. Study 2 found that there is a significant difference in haptic elaboration between condition 1 ($M=3.80$, $SD=0.91$) and condition 2 ($M= 4.16$, $SD=0.80$) $F(1, 99) = 4.41$ $p = 0.04$. Study 3 found a significant difference in perceived product knowledge between condition 1 ($M=3.78$, $SD=0.83$) and condition 2 ($M= 3.13$, $SD=1.04$) $F(1, 99) = 12.09$, $p=0.00$.

Moreover, there is a positive correlation found between haptic vividness and haptic elaboration $r=0.55$, haptic vividness and perceived physical control $r=0.71$, haptic elaboration and perceived ownership $r=0.51$, identification and attitude toward the product $r=0.59$, and identification and purchase intention $r=0.53$.

Also, MANOVA tests show that dependent variables of perceived ownership, attitude toward the product, purchase intention, and endowment are significantly affected by haptic elaboration on (Wilks $\lambda=0.63$ $F(36, 414) = 1.49$ $p<0,05$, partial $\eta^2 = 0.11$); product knowledge (Wilks $\lambda=0.12$ $F(44, 163)=2,73$ $p=0,00$, partial $\eta^2 = 0.41$); product identification (Wilks $\lambda=0.02$ $F(52, 165) = 5.10$ $p=0.00$, partial $\eta^2 = 0.60$); and physical control (Wilks $\lambda=0.08$ $F(40, 161) = 3.74$ $p=0.00$, partial $\eta^2 = 0.46$)

Univariate tests show that perceived ownership is significantly affected by product knowledge ($F(11, 45) = 2.15$ $p < 0.05$, partial $\eta^2 = 0.34$); product identification ($F(13, 45) = 2.32$ $p < 0.05$, partial $\eta^2 = 0.40$); physical control ($F(10, 45) = 2.97$ $p < 0.05$, partial $\eta^2 = 0.40$). Attitude toward the product is significantly affected by product identification ($F(13, 45) = 7.67$ $p<0.05$, partial $\eta^2 = 0.69$); physical control ($F(10, 45) = 2.27$ $p<0.05$, partial $\eta^2 = 0.34$). Purchase intention is significantly affected by product identification ($F(13, 45) = 2.48$ $p<0.05$ partial $\eta^2 = 0.42$). Endowment is significantly affected by product knowledge ($F(11, 45) = 11.59$ $p<0.05$ partial $\eta^2 = 0.74$); product identification ($F(13, 45) = 27.91$ $p<0.05$ partial $\eta^2 = 0.89$); physical control ($F(10, 45) = 18.57$ $p<0.05$ partial $\eta^2 = 0.80$).

4. Conclusion

This research consists of three studies experimentally proving the significant relationships between the incongruence of touchscreen interface texture and product haptic properties, haptic vividness, haptic elaboration perceived ownership through identification, physical control, and knowledge. These consequently positively influence the attitude toward the product, purchase intention, and endowment.

This research extends the current literature by an early exploration of the role of interfaces in shaping consumer behavior and emphasizes that marketing interfaces can generate effects similar to content. Methodologically, it shows that researchers conducting computer-based research should record the interface used in study protocols in addition to stimuli response. This work also adds to the literature on consumer touch, showing that touch has relevant effects even when it is not on the product, interpersonal, or imagined. Indeed, even though interface touch is non-diagnostic, it can still generate psychological ownership.

This research aims to help researchers determine when physical stimuli are necessary and when haptic imagery may suffice. By better understanding identification with the product, it may be possible to enhance the effect of haptic imagery on perceived ownership by encouraging identification with an object. Similarly, reducing perceived ownership by discouraging product identification may also be possible.

Managerially, this research has important implications for online marketing. Consumers in these environments are likely to experience greater uncertainty due to the absence of haptic sensory input. We aim to show that the textural congruence of the product and touchscreen interface through which consumers browse products has essential effects on product evaluations. This shows that marketers must consider these effects concerning the different product categories sold online and implement marketing strategies accordingly.

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