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The influence of image interactivity upon user engagement when using mobile touch screens

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ABSTRACT

Touch screens are a key component of consumer mobile devices such as smartphones and tablets, as well as an increasingly common self-service component of information retrieval on fixed screens and mobile devices in-store. The ubiquity of touch screens in daily life increases consumer accessibility and extended use for shopping, whilst software innovations have increased the functionality of touch screens, for example the extent to which images respond to fingertip control. This study examines how users engage with interactive visual rotation and tactile simulation features while browsing fashion clothing products on touch screen devices and thus contributes to retail touch screen research that previously focused on in-store kiosks and window displays. Findings show that three dimensions of user engagement (endurability, novelty and felt involvement) are positively influenced by both forms of manipulation. In order to examine the extent to which touch screen user engagement varies with individual preferences for an in-store experience, the paper also examines whether user engagement outcomes are mediated by an individual's need for physical touch. Findings indicate that the need for touch does not explain the variance between individuals. We conclude that touch screen technology complements the physical retail environment.

1. Introduction

Touch screens have transitioned from being present on consumer mobile devices such as smartphones and tablets to becoming an increasingly popular self-service technology present within the retail environment in a range of forms such as information kiosks, window displays and check-outs (Tüzün, Telli, & Alır, 2016). Touch screen technology has a strong appeal for consumers as it allows them to use their fingertips and removes the need for any intermediary devices (i.e. a mouse or a stylus) when retrieving information (Benko, Wilson, & Baudisch, 2006). Survey evidence shows that touch screen presence increases intention to visit a physical store amongst 65% of UK consumers (Gilmartin, 2016) and thus the in-store touch screen provides a competitive response to online challengers (RSR, 2016a) by allowing consumers to find out more about products or customise their shopping experience. The ubiquity of touch screens on both consumer mobile devices as well as being fixed in-store increases consumer accessibility and enables extended use both in-store and outwith the store (Gilmartin, 2016; RSR, 2016b; Shankar et al., 2016). In the UK and US, mobile traffic now constitutes the greatest proportion of ecommerce traffic (eMarketer, 2016) and online shopping is the most popular web browsing activity for smartphone users in the UK (Deloitte, 2016).

There is a recognised need for research that examines consumer perceptions of specific touch screen features on mobile devices (Blazquez, 2014; Pantano & Priporas, 2016). For fashion retailers in particular, ensuring the effectiveness of screen-based product views is a widely discussed challenge (Eroglu, Karen, Machleit, & Lenita, 2001; Kim, Kim, & Lennon, 2007; Klatzky & Peck, 2012) and mobile marketing requires a distinct set of competencies (Ström, Vendel, & Bredican, 2014). Chung's (2015) experimental study found use of touch screens to browse an item of clothing led to greater shopper engagement, which subsequently led to higher satisfaction with shopping, higher purchase intentions and more positive product evaluations. Focusing on psychological ownership,

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Brasel and Gips (2014) found that browsing on touch screen devices led to higher product valuations than on PCs, concluding that consumer perceptions of online products are filtered through the lens of the interfaces used to explore them.

It is important for retailers to understand the opportunities to enrich the customer shopping experience on mobile devices and in-store touch screens, as mobile marketing requires a distinct set of competencies (Ström et al., 2014). Touch screens have the potential to enhance the in-store customer experience by bringing the benefits of online shopping to ecommerce-savvy consumers (Gilmartin, 2016; RSR, 2016b). Developments in image interactivity technology (IIT) improve product presentation techniques by enabling customers to manipulate images in real-time rather than simply viewing static images. For example, single- and multi-finger gestures such as flicking, rotating and even pinching can be used to access and interact with product views on touch screens (Orzechowski et al., 2012; Padilla, Orzechowski, & Chantler, 2012). IIT has a positive impact on fulfilling users' hedonic needs and positively influences affective aspects of the consumer experience (Kim & Forsythe, 2007; Lee, Kim, & Fiore, 2010; Teo, Oh, Liu, & Wei, 2003). Consequently, it contributes to positive attitudes towards the retailer (Wu, 2005). It is important to determine the extent to which IIT innovation on mobile devices results in user engagement, since the result of failing to engage consumers could be a lost sale, a disloyal consumer or a failure to transmit information online (O'Brien & Toms, 2008). In contrast, engaged shoppers are likely to purchase more items, more frequently than non-engaged shoppers (Shankar et al., 2016). However, there is a paucity of research that examines consumer perceptions of specific touch screen features on mobile devices (Blazquez, 2014).

This study contributes to the literature on how differences in IIT influence user engagement when browsing clothing images. It links emerging touch screen technology to the stream of research into user engagement commenced by O'Brien and Toms (2008; 2010; 2013). The use of innovative technologies contributes to increasing the value of online retail (Kim & Forsythe, 2007) and if consumers consider their browsing experience as a success and feel highly involved in their shopping task, this should lead to an increased intention to purchase, improvement of the overall online experience, revisit intention or time spent in the website (Lee et al., 2010; Merle, Senecal, & St-Onge, 2012; Park, Lennon, & Stoel, 2005). In this study, data was gathered using a between-subjects design to test the effect of two sensory stimuli, vision and simulated touch, whilst controlling for the individual trait of need for touch whilst shopping. The remainder of this paper will explain the conceptual background, describe the method, report the results, discuss implications for practitioners and researchers and conclude with limitations and recommendations for further research.

2. Literature review

2.1. User engagement

The construct of user engagement combines behavioural, cognitive and affective responses when using computer-based tools (O'Brien & Toms, 2008; Wiebe, Lamb, Hardy, & Sharek, 2014). User engagement occurs progressively from initial "users' assessment of, and interaction with, interactive media interfaces, followed by deeper absorption with media content and behavioral outcomes" (Oh, Bellur & Sundar, 2015, p3). User engagement is particularly suitable as a way of understanding responses to touch screen technology for the acquisition of product information, as it incorporates both hedonic perceptions such as flow (Trevino & Webster, 1992), utilitarian interface experiences such as perceived usability (Davis, 1989) and task-technology fit (Goodhue & Thompson, 1995). As such, it provides a "succinct lens" through which to unify and address several established strands of human-computer interaction research (Wiebe et al., 2014, p. 124).

O'Brien and Toms (2010) proposed six dimensions of user engagement: (1) Aesthetics, the visual appearance of the website, (2) Endurability, perceived task-technology fit resulting in intention recommend to others, (3) Felt Involvement, cognitive immersion in task, (4) Focussed Attention, flow state that results in temporal and environmental disassociation, (5) Novelty, pleasurable cognitive stimulation and (6) Perceived Usability, the degree of cognitive effort and affective frustration experienced during use. The User Engagement scale was developed by O'Brien and Toms (2008; 2010; 2013) through a survey using the scenario of general online shopping activity (O'Brien & Toms, 2010) and book purchase in a laboratory experiment comprising search tasks (O'Brien & Toms, 2013). However, neither study examined user engagement in the context of consumer acquisition of product information. The process of evaluation of alternatives is an important stage of the shopping process (Shankar et al., 2016).

Continued research is needed due to the dynamic and complex nature of user engagement, the documented fluidity of scale items, and the need to guage whether the measure allows meaningful comparison between different task contexts (O'Brien & Cairns, 2015) and different application features. Research is also needed to compare user engagement in response to different sensory software stimuli. There is scant research that makes finer-grained comparison to human-computer interaction, with exceptions being Visinescu Sidorova, Jones and Prybutok (2015) who examined the effect of 3D vs 2D image manipulation upon cognitive absorption leading to purchase intention and Xu and Sundar (2016) who differentiated how interactivity and non-interactive elements within a website influence cognitive processing of content. To address these gaps, the present study investigates how different forms of IIT influence user engagement with fashion clothing information.

2.2. Image interactivity technology and fashion retailing

Image interactivity technology (IIT) is a website feature that enables the "creation and manipulation of product or environment images to simulate (or surpass) actual experience with the product or environment" (Fiore, Kim, & Lee, 2005, p. 39). This is particularly relevant for clothing products, which suffer from sensory impoverishment when retailed online. There has been sustained development of IIT for the fashion retailing context resulting in a range of IIT features including the ability to rotate and zoom into product features, the ability to assemble distinct clothing images into one image through mix and match technology, and the ability to simulate the appearance of clothing upon a body form through a virtual fitting room (Lee et al., 2010; Merle et al., 2012). Each of these features differs in the range of interactivity and the approximation to physical vision and touch (Yu, Lee, & Damhorst, 2012). A high level of interactivity positively influences affective aspects of the consumer experience (Lee et al., 2010).

Advances in IIT enable the artificial recreation of tactile and visual sources of product information for more intuitive and interactive websites, which, in turn, allow consumers to digitally interact with products using their fingertips in a more natural manner than using a keyboard and mouse. It is therefore closer to the way in which shoppers would actually interact with the item in a physical context (Orzechowski et al., 2012; Padilla et al., 2012). Overmars and Poels (2015) examined IIT that simulates stroking gestures in the context of two textile products (a scarf and a blanket) and showed that use improves product understanding. They highlighted the need for extending research to other ways in

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which people handle fabrics, such as scrunching.

Vision and touch make different contributions to product evaluation (Guest & Spence, 2003; Schifferstein, Otten, Thoolen, & Hekkert, 2010). There is also a need to connect these insights beyond product understanding to include user engagement as an experience that results from interaction.

2.3. Influence of vision upon user engagement

Online images of merchandise are high-involvement elements of a website (Eroglu et al., 2001). Vision is preferred to judge the macrostructural properties of a product, such as size and shape (Spence & Gallace, 2008). Visualisation technologies, such as 360° product rotation, support evaluation of the shape, size, flow and movement of garments, which can lead to more realistic judgments (Kim & Forsythe, 2007; Schlosser, 2003; Yu et al., 2012). Park et al. (2005) found 360° rotation on a website to positively affect consumer mood and reduce perceptions of purchase risk, leading to increased purchase intent. Compared with static images, IIT also enables users to form more vivid mental images of products, resulting in more realistic judgments (Schlosser, 2003). We formulate the following research proposition (RP) that IIT allowing 360° rotation will result in a greater positive user engagement response than viewing static pictures.

RP1. IIT serving the primary function of vision (visual rotation) has a positive and significant effect on user engagement.

2.4. Influence of touch upon user engagement

Tactile cues shape perception of the microstructural features of a product and material information such as texture (Guest & Spence, 2003; McCabe & Nowlis, 2003). IIT scrunch and pinch features simulate tactile interaction to provide an approximation of touch-related experience attributes such as texture and weight (Overmars & Poels, 2015). Overmars and Poels (2015) found that simulated stroking gestures increased perceived diagnosticity of product experience attributes and increased perceptions of control. Based on this we propose:

RP2. IIT serving the primary function of touch (tactile function) has a positive and significant effect on user engagement.

2.5. The relative influence of touch and vision upon user engagement

In-store, shoppers may touch, rub and crumple textiles to estimate qualities such as softness, stretch or roughness (Orzechowski, 2010). Although there is a gap between handling a physical textile and the perceived qualities of a textile displayed on a screen (Gallace & Spence, 2014), tactile simulation in online environments increases cognitive product evaluation (Daugherty, Li, & Biocca, 2008). Since touch is preferred to gather information offline about material properties, such as texture (McCabe & Nowlis, 2003; Spence & Gallace, 2008), we propose:

RP3. IIT serving the primary function of touch (tactile function) has a greater impact on user engagement than IIT serving the primary function of vision (visual rotation).

2.6. The mediating influence of the need for touch

The need for touch (NFT) whilst shopping is an individual trait defined as "a preference for the extraction and utilization of information obtained through the haptic system" (Peck & Childers, 2003, p. 431). Individuals with a high NFT are more likely to access haptic or touch-based information than those individuals with a lower NFT. Peck and Childers (2003) also differentiated between those who touch products for the sensory pleasure of the experience, and the instrumental dimension related to those who touch for a rational purpose. As such, NFT plays an important role in the consumer's choice of shopping channel (Citrin, Stem, Spangenberg, & Clark, 2003) so that individuals with a high NFT are unlikely to find online shopping desirable for products that encourage tactile interaction (Dennis, Jayawardhena, & Papamatthaiou, 2010). Hence, we propose that NFT will mediate the degree of user engagement that is experienced when using IIT for vision and touch:

RP4. NFT will mediate the relationship between IIT use and user engagement.

3. Methodology

3.1. Design and participants

A between-subjects experiment with two levels of image interactivity (visual rotation and simulated tactile scrunch) was conducted to understand the effects of different IIT features on user engagement. A total of 218 student subjects participated and were recruited from two UK universities with an incentive of entry into a prize draw for a £50 online shopping voucher. A student sample was chosen to reflect trends in online shopping patterns in the UK which show that younger consumers (16–24 years old) buy more clothes online than in-store (Mintel, 2014). The achieved sample were predominantly female (87%), had purchased online in the last six months (89%) and browsed online for fashion every week (77%). These characteristics reflect statistics which indicate that more female than male shoppers use mobile devices when browsing and purchasing clothes online (Mintel, 2014).

3.2. Materials and procedure

A digital tool called Shoogleit (Padilla & Chantler, 2011) was used to create interactive product visualisations from pre-recorded video by merging visual and tactile inputs (see Fig. 1). Shoogleit adds user-controlled interactivity to any object on a touch screen by merging user gestures on mobile devices with animations matching the gesture on a real object. The garments selected were a ladies chiffon dress and a mens cotton shirt. Pilot tests amongst 20 participants determined that the garments and fabrics selected were perceived as having visual and tactile attributes (Overmars & Poels, 2015). To control for model preference in the visual treatment, the models' heads were cropped.

We used a two-step procedure with the experimental treatment followed by a self-completed paper questionnaire. After giving informed consent, participants were randomly allocated to either the control, vision or touch experimental groups. Female participants were assigned to the chiffon dress and male participants were assigned to the cotton shirt. Established principles of experimental research design (Field & Hole, 2002) were followed. Experiments took place in rooms with no other stimuli that could affect the results. In each group, each subject was asked to browse the clothing item on an iPad for up to 5 min as if evaluating it for possible purchase and then after browsing, given the paper questionnaire to complete within 15 min.

The control group (n = 46) were given static images of the front and back of the garment on the model to view on an iPad (see Fig. 2). The vision group (n = 79) used Shoogleit rotate technology on an iPad. This allowed them to use their fingertips to rotate the

Fig. 1. Shoogleit multi-gesture interface on touch screen (Orzechowski et al., 2012).

Fig. 2. Ladies chiffon dress and mens shirt static image.

model in the garment through 360° (see Fig. 3). The touch group (n = 92) used Shoogleit scrunch technology on an iPad, which enabled them to pinch and scrunch a section of the clothing fabric with their fingertips (see Fig. 4). This group was also provided with a laminated picture of the front and back view of the garment on the model so they could relate the fabric section to the whole garment.

3.3. Measures

3.3.1. User engagement

User Engagement was measured through the application of 10 items drawn from the highest factor loading items of O'Brien and Toms' (2010) User Engagement scale. Responses were measured on a 7 point Likert scale (1 = totally disagree to 7 = totally agree).

Fig. 3. Ladies chiffon dress and mens shirt visual rotation.

Fig. 4. Chiffon fabric and shirt fabric "scrunch" tactile simulation.

Five of the six proposed dimensions of user engagement were selected. "Aesthetics" was dropped since this sub-scale measures response to the visual quality of the shopping website as a whole, whilst this study focuses upon an isolated website feature and not the total site. Scale reliability was acceptable with a Cronbach's alpha value of 0.78, which is comfortably over the suggested α of 0.7 (De Vellis, 2003) and scores were calculated for an overall measure of user engagement. The User Engagement scale data was normally distributed.

3.3.2. Need for touch

NFT was measured on a 7 point likert scale (1 = totally disagree to 7 = totally agree) with 6 items adapted from Peck and Childers' (2003) scale, which contained three items each relating to sensory and instrumental dimensions (Lee, Chang & Cheng, 2014). The NFT scale was reliable with Cronbach's alpha value of 0.79. The NFT data showed slight negative skewness and kurtosis. However, this is unlikely to make a significant difference to the analysis, and with large samples, the risk of an underestimation of variance is low (Tabachnick & Fidell, 2013).

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4. Results

The data analysis reports the main effects between User Engagement and IIT (scrunch and rotate) and explores whether NFT acts as a covariate for this relationship.

4.1. Influence of vision and touch on user engagement

Table 1 presents the mean scores for each of the experimental conditions. Columns give each experimental condition and rows show measures for the dimensions of user engagement according to O'Brien and Toms (2010). The first column shows the control condition, where participants viewed only static images. The results show the lowest mean average of 1.34 for novelty, which indicates that participants tended to totally disagree that they felt curiosity or interest during their browsing experience. There was a tendency to somewhat disagree that static images provided focused attention, which comprises experiences of flow and task absorption. In contrast, there was total agreement that the browsing experience using static images delivered perceived usability and a tendency to somewhat agree that there was felt endurability and felt involvement. This means that participants tended to agree that they felt in control and not frustrated or mentally taxed when viewing static images and also felt that their goals had been successfully achieved and remained involved in the browsing experience.

The second column shows the average means for the visual rotation condition with the lowest mean of 3.15 for focused attention, which indicates that participants did not feel high immersion in the browsing task while using this technology. However, they somewhat agreed with felt involvement, endurability and perceived the technology as novel compared to the static pictures. The highest mean of 5.52 is for the perceived usability construct, even higher than its mean for the tactile simulation condition, which shows the importance of visual simulation for product judgement.

The third column shows the average mean for the tactile simulation/scrunch condition. With the exception of perceived usability, this condition comprises the highest average means for all constructs, demonstrating that scrunch technology focuses attention, generates involvement and endurability and is perceived as novel.

A one-way analysis of variance (ANOVA) was used to test difference in user engagement between participant groups (Table 2). Results show that there is a significant effect of experimental condition (static picture, rotation, scrunch) upon user engagement ($F(2,112) = 8.55$, $p = .00$ ($r = 0.07$). Planned contrasts using Tukey's HSD test shows that there were significantly different scores between the control condition (static picture) and the treatment groups (rotate and scrunch), but that there was not a significant difference in user engagement between the rotate and scrunch condition. Results support RP1 and RP2 in that both rotate and scrunch IIT have a positive and significant effect on user engagement. However, there is no support for RP3 as there is no statistically significant difference between the scrunch (touch) and rotate (visual) conditions.

Differences in types of interaction are more apparent when examining the means for all dimensions (Table 1), with the highest mean always seen for the scrunch (touch) condition, followed by rotate (vision). The biggest differences between the two were found in the "involvement" and "novelty" constructs. Static (control) pictures were always the lowest. This indicates that providing IIT for consumers when browsing clothing on a touch screen helps them to feel more engaged, hence there is support for both RP1 and RP2. However, the difference between rotate and scrunch condition is not statistically significant and thus RP3, which hypothesized that tactile simulation would have a greater impact upon user engagement than visual rotation, is not supported. This may be explained by respondents wishing to interact with and see with the whole garment rather than just a section of the fabric. This seems commensurate with the physical experience of shopping for clothes, since consumers may be more likely to pick up a garment on a hanger and turn it around rather than feeling the fabric.

4.2. Mediating influence of need for touch

A one-way between-groups ANCOVA (Analysis of Covariance) was conducted to understand whether NFT during browsing had an effect on respondents' User Engagement when using IIT. The Levene's test of equality of error variances showed that we did not violate assumptions; our variances were not equal ($p = 0.27$). The covariate NFT was not significantly related to user engagement ($F, 2, 214 = 0.74$, $p = 0.39$, $r = 0.06$) but there remained a significant effect of IIT upon user engagement after controlling for NFT ($F(2, 214) = 8.26$, $p = 0.00$, partial eta squared $= 0.072$). Therefore, RP4 was not supported. NFT does not act as a covariate between IIT and user engagement, which suggests that the IIT succeeds in fulfilling a tactile function.

5. Discussion

This paper contributes empirical evidence of user engagement with touch screen interactivity. Results show that visual rotation and tactile simulation features on a touch screen, specifically an iPad, contribute to an increase in user engagement when compared to a static image. Our work makes a methodological contribution both in its adaption of the O'Brien and Toms (2010) User Engagement scale but also through showing that a reduced scale of 10 items is reliable.

The results confirm that the presence of IIT contributes to a higher level of user engagement and therefore provides a means of increasing the multisensory enjoyment and entertainment value of browsing on a touch screen. Even if IIT cannot fully translate the physical properties of clothing to the touch screen, it nevertheless contributes to improving the tactile information related to high-involvement components for fashion consumers (Eroglu et al., 2001) and product features that are related to touch properties (McCabe & Nowlis, 2003).

This paper makes two theoretical contributions: firstly by connecting emerging touch screen technology to a relatively new

Table 1
Means for each user engagement dimension.

Dimension	(a) Control condition	(b) Visual rotation	(c) Tactile simulation
Focussed Attention	2.59	3.15	3.32
Felt Involvement	4.26	4.91	5.40
Endurability	4.50	5.11	5.08
Novelty	1.34	4.63	4.95
Perceived Usability	5.62	5.56	5.45

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Table 2
Results of Post Hoc Comparison of IIT use on User Engagement.

Dependent variable	(a) Control condition	(b) Visual rotation	(c) Tactile simulation
User Engagement	4.15* (b, c)	4.71* (a)	4.71* (a)

Notes: *$p<0.05$ Superscript letters a, b, or c indicate those conditions that are significantly different from the mean value.

psychological construct and scale and meeting a research need for investigating user engagement in different contexts; secondly, by presenting results that show that the individual trait of need for touch does not influence the direct relationship between the sensory stimuli of vision and simulated touch with user engagement. This provides support for work indicating that smartphone use satisfies a range of individual psychological needs, including need for touch (Lee, Chang & Cheng, 2014).

There are practical implications for both online and offline retailers. The devices used in online shopping have evolved from PC to mobile and as a result, retailers need to redesign interaction to enhance the user experience (Bilgihan, Kandampully, & Zhang, 2016). The challenge here is related on the one hand to the development of technologies capable of delivering credible and reliable tactile sensations over distance, and on the other to the use marketing strategies that somehow allow people to 'touch before buying'. Our experiment uses an iPad touch screen device which is readily available on the market for use by retailers.

We show that Shoogleit IIT provides a way of overcoming the lack of physical experience for online retailers of fabric and apparel products. We show that IIT enables the consumer to evaluate the product and so increases user engagement, which is a holistic measure of both hedonic and instrumental responses to the mobile browsing process, reducing the physical-digital divide and thus enabling retailers to create engaging shopping websites. Results suggest that consumer uptake of IIT for browsing fabric and apparel products on touch screens would be positive, given the greater level of engagement that was experienced in the two experimental conditions, compared to the control condition where only static pictures were presented. Since engagement with the technology is one of the main factors influencing consumers to choose one website or application over others (Calder, Malthouse, & Schaedel, 2009), retailers should provide augmented types of IIT to create a more immersive mobile shopping experience.

Shoogleit IIT provides a way of overcoming the lack of physical experience for online retailers of fabric products. By adopting such technology, online retailers of fabric and apparel products could potentially increase the value of product information presented, engage their consumers more effectively in an active shopping experience, increase the number of unique and repeat traffic visitors for a site, and ultimately establish an online competitive advantage. Furthermore, better virtual product experiences could enhance how consumers learn by saving time and eliminating unnecessary information. By using IIT, online retailers could begin to establish a virtual product experience that alters the way consumers interact with products and mimics the physical shopping experience to a greater degree than seen before.

6. Limitations and suggestions for future research

We acknowledge that our research is limited by the fact that participants interacted with the technology in an experimental setting and therefore the general set-up of the study did not fully represent the natural context of online browsing and shopping. Future research might be replicated using field trials either in the home environment over an extended period of time of in a retail environment where goods might not be physically available due to stock limitations. Data was gathered using a self-report survey and future research might supplement this method with eye-tracker data or galvanic response sensors to provide greater insight into the influence of online stimulation on consumer behaviour.

Overall however, our results provide support for future research that seeks to develop commercially viable (and realistic) touch screen interfaces that could bring the tactile attributes of the physical shopping experience to online shopping. The rapid development of mobile augmented reality suggests that there is potential for retail settings to become smarter and add customer value (Dacko, 2016). Incremental advances in technology, such as IIT, contribute to bridging the gap between a static experience and a truly haptic one. To conclude, this study connects with a growing literature on engagement as a behavior across a range of devices and applications. The results provide a foundation for additional research into the role of visual and tactile interactivity within the broader field of user engagement and immersion.

7. Conclusion and implications

This study examined how user engagement is related to IIT visual (product rotation) and touch-related features (fabric scrunch) when browsing fashion apparel. In addition, we tested the extent to which the need for touch strengthens or weakens any identified relationship. Data was collected using a two-step experimental design which tested the differences in user-engagement between three conditions: static image (the control condition), product rotation and scrunch. Empirical results provide three insights (1) the presence of IIT results in increased user engagement compared to the control condition, (2) visual or touch-related features are equal in their effect (3) a user's need for touch does not affect their engagement response to IIT. The implication for retailers is that IIT can create an immersive shopping experience that overcomes the need for physical touch and thus improves the quality of the online shopping experience. The implications for researchers of human-computer interaction are that IIT satisfies the sensory need for touch and thus there is a scope to revisit prior research into the influence of individual psychological traits upon technology response.

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