감성과학
제20권 4호, 2017
<연구논문>

pISSN 1226-8593
eISSN 2383-613X
Sci. Emot. Sensib.,
Vol.20, No.4, pp.65-78, 2017
https://doi.org/10.14695/KJSOS.2017.20.4.65

The Effects of Swiping Orientation on Preference and Willingness to Pay: The Interaction Between Touch Interface and Need-For-Touch

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Abstract

The current study examined the influence of individual trait such as Need-For-Touch level (NFT; high vs. low) and swiping orientation (vertical vs. horizontal) on product evaluation and preference when using touch-screen interface like a smart phone and a tablet. Swiping is one of the most common interaction techniques for changing pages or searching some aligned pictures on touch-screen interface and it can be used in vertical and horizontal orientations. The experiment revealed a significant interaction between swiping orientation and NFT on preference, however the interaction on change-in-price of given products was only marginally significant. To be specific, high NFT participants reported higher preference for horizontal-swipe than vertical-swipe products, but such difference did not occur with low NFT participants. The current study illustrates the influence of swiping orientation and NFT on product preference and it provides a new perspective of design principles especially for online shopping websites.

Key words: Need-For-Touch (NFT), Swiping Orientation, Preference, Willingness to Pay, Touch Interface

1. Introduction

Individual-use mobile media, including smart-phone and tablet computer, have brought completely new way of accessing information via Internet. Besides using mouse, being able to directly use our fingers to operate brings better interaction experiences. Previous studies mostly focused on design of interaction techniques in mobile devices, such as clicking, dragging, scrolling, swiping and so on (Sundar et al., 2014) while few actually paid attention to the details and how they might differ in user experience. We choose the swiping technique on touch screens and explore the possible influence of different orientation (horizontal and vertical) on people's preference for products when shopping online. We also take Need-For-Touch (NFT) into consideration since previous studies have revealed individual differences in terms of preference for sensory forms of information (Heckler et al., 1993), which in turns, can result in differences in attitudes, preference, evaluation and

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decision making (Peck & Childers, 2003a; 2006; 2008). The study aims at exploring the mechanism of swiping on touch screen devices as well as NFT and their possible interaction, in terms of preference for products and perceived price of given products.

2. Background

2.1. Swiping Technique & Orientation

Besides conventional personal computers, mobile devices are becoming more and more important and irreplaceable. The mobility and portability of mobile devices bring different kinds of user experiences as well as interaction between users and devices. These differences thus bring new patterns of user behaviors associated with information access on mobile media (Kim et al., 2011; Zhang et al., 2014). There are a lot of previous studies focusing on the design and features of interaction techniques in mobile devices, including swiping, clicking, scrolling, sliding, zooming, dragging and so on (Nakamura et al., 2008; Sundar et al., 2014). Among all the interaction techniques, swiping is a new trend that draws more and more attention (Lim, 2015; Moon, 2015; Ulm, 2010).

Websites are traditionally accessed via desktop computers or laptops but in recent years they have become more accessible via mobile devices. What's more, touch screen devices are more than just a portable version of computers. Users interact with devices not via a mouse but directly using their fingers, in different gestures and different ways. People tap, double tap, tap on press (on release), drag, grab, drop, flick, touchdown and hold, slide to scroll, slide to hold, spin to scroll, pinch (to shrink) and spread (to enlarge) to interact with the devices (Bragdon et al., 2011). Some gestures are not able to be done directly via mouse; some others can, but are not as easy as in touch interface. With a rich set of flexible gestures, touch screen devices may call for different ideas in design of presenting information. Dou & Sundar (2016) found in their study that adding horizontal swiping into interaction techniques in mobile website design can bring positive effects in users' behavioral intentions. Their data suggest that swiping technique can engage users, induce users' perceived enjoyment and make users want to revisit the website. To sum up, the design of mobile websites for touch screen devices should be different and swiping technique may well paly a crucial role.

Traditional websites are designed in a vertical way that users scroll or move up and down to access contents. Mobile websites, however, are relatively new to the world. Most of them are essentially a mobile version of the original websites, and consequently the design and contents are the same with the original ones. For many users, the vertical way of presenting information in most websites is so familiar to all users that there seems no need to think about why. As in many languages (e.g. English and Korean), people read and write from left to right, and from top to bottom. For these users, the vertical way of presenting contents is natural and convenient because people can keep reading and moving their eyes in a similar way no matter how long the contents may be: they generally read from left to right and move back to the left side of the next line. Moreover, users interact with computer websites via mouse, and there is even a scroll wheel for computer users to conveniently scroll vertically to access and explore information.

The horizontal way which requires users to scroll horizontally for more contents, however, may introduce certain gap in reading process between columns or pages. A lot of mobile applications as well as mobile websites have already applied horizontal swiping techniques into their user interface (UI) design, especially for image-heavy contents. The vertical way of presenting contents, especially long text contents which is the main form of websites in early years, is natural and reasonable. However, as mentioned before, the design of mobile

websites is different and does not necessarily need to follow the desktop websites. Different patterns of users' interaction with devices naturally bring different kinds of user experience, which is important for most UI designers. According to Quinn's (2012) research, “iPad users have an overwhelming instinct to swipe horizontally through a full screen photo gallery, regardless of portrait or landscape orientation.” Furthermore, just as we generally turn pages horizontally while reading books, either on paper or via an eReader (Warr & Chi, 2013), such patterns have already been widely applied in design. For example, the layout of news contents on tablets are generally designed in a way that users swipe horizontally between stories and vertically throughout the text of one story in practice. Burnett et al. (2013) and Billinghurst & Vu (2015), Functions and roles may differ depending on the type of movement. For example, horizontal swipe gestures could mean pagination (backward or forward) whereas vertical swipe could mean volumes up and down. Taken together, horizontal swiping is mainly used to obtain new and different contents, just like moving to the next page when reading an e-book, or to the next kind or page of information where pagination differs; vertical swiping is mainly used to obtain the rest part of certain continuous contents, or to adjust the volume or brightness.

There has been a lot of research recently, comparing different kinds of influence that horizontal and vertical swiping may bring. Kim et al. (2016) compared horizontal and vertical control types on a touch-screen mobile phone and their study suggested that horizontal pagination was similar or better for information search in mobile websites, although most users were more familiar with vertical scrolling, which was at present the only type provided by most search engines. They found that with horizontal pagination, users spent less time to identify correct results and the search accuracy was higher when correct answers were located on the back page. Jeoug & Liu (2017) compared reaction time, error ratio and physical demand one subjectively felt of a simple task where participants are told to move the point in the screen of a tablet between horizontal and vertical condition. They found a higher accuracy rate and a lower physical demand on condition of horizontal dragging and swiping. The study showed that horizontal and vertical swiping brought different influences to participants while fulfilling the simple stimulus-response task.

Besides the aforementioned simple stimulus-response task, it is also hard to find much research about swiping orientation of touch display regarding the influence on evaluation. In the current study, we aim at exploring whether there is any influence of swiping orientation on evaluation in a shopping game. Also we believe that the design of desktop and mobile websites should be considered differently and the swiping orientation matters. In the current study, we aim at comparing horizontal and vertical swiping techniques in user experience when using touch screen devices.

2.2. Need-For-Touch

There are different patterns of purchasing behaviors. Some consumers spend a lot of time and energy touching products to make careful decisions while some do not always need to directly touch and feel the products.

Studies show that touching products do have an effect on consumers' attitude towards products and can influence purchasing behavior. Peck & Childers (2003b) conceptually defined NFT as “a preference for the extraction and utilization of information obtained through the haptic system” and designed the scale to measure the individual differences in this preference. It has been found in previous study that individuals who are more internally motivated to directly touch products (high NFT) show more preference for and more reliance on haptic information (Klatzky et al., 1993; Yang & Kim, 2011; Krishna & Morrin, 2008). For high NFT consumers, haptic information is more salient so they are more likely to use haptic information for product judgement (Peck & Childers, 2003b). One way of

explaining this finding is through attention and memory. According to Peck & Childers (2003a), individuals with high NFT tend to attend to haptic information and they are more likely to form richer mental product representation. Also they can elaborate these information than low NFT. This would make high NFT judge product based on haptic information.

Individual with high NFT tend to be more confident in their judgment for product quality, preference and purchase intention if they can directly touch the products in a store. However when they are doing online shopping when they cannot actually touch the products, they will suffer more negative influence of the absence of direct haptic information, compared with those with low NFT. In other words, when they are not able to directly touch the products, individuals with high NFT will experience disappointment and frustration while those with low NFT may pay more attention to the visual and text information for evaluation instead of being bothered by the absence of haptic information. Therefore the influence of the level of NFT on consumer behavior show distinct patterns if the way and environment of shopping differs. Researchers found that compared with individuals with low NFT, those with high NFT reported more preference if they directly touched the products (Yang & Kim, 2011).

Recently, researchers found that in online shopping scenarios, compared with computers or laptops, touch-screen interfaces could create stronger perceived psychological ownership over products (Brasel & Gips, 2014). As they reported in their study, for products of which haptic information was important (e.g. sweatshirts), the touchscreen brought more endowment than the mouse, but for products under low-haptic condition (e.g. New York City walking tours), no significant difference was detected. In this sense, besides directly touching products, touching the screen itself actually has an effect on consumer behavior including product evaluation, compared with traditional way of using mouse to access content online. There are some ways to overcome the limitation of online shopping that one cannot actually touch products. Kim & Han (2017) did their research on tactile imagination by providing multisensory information. They found that tactile imagination was elaborated when the provided visual and tactile information were matched.

Yazdanparast & Spears (2013) did research about the variables that can reduce the frustration of high NFT consumers when they could not touch products on online-shopping condition. They found that for high NFT consumers, positive mood, price promotions and level of situation-specific products expertise can raise their evaluation of products. Furthemore, according to Yazdanparast & Spears (2012), high NFT consumers follow analytical, feature-by-fearure processing strategy and low NFT consumers rely on a relational processing strategy.

In the current study, we aim at digging deeper under the condition of online shopping using touch screen. Especially we add this very important factor - NFT - to explore the possible differences of consumer behavior between those who are more internally motivated in examine haptic information and those who are not. high NFT group in particular rely on their analysis. The mood or information that is helpful in analysis process can reduce their frustration for the lack of tactile information in online shopping. As mentioned before, horizontal swiping brought lower physical demand and better performance in simple stimulus-response task. If the same goes for cognitive element, it is highly likely that swiping orientation can influence high NFT group on their evaluation of products. Based on previous study, vertical swiping is more related to obtaining more information within one whole content while horizontal swiping to obtaining new kinds of contents which are not that closely related. In this way, representation of swiping direction may influence high NFT group so that when analysis different contents in series, horizontal orientation can contribute to analysis process. On the other hand, vertical direction is of help of processing

related information so it may influence low NFT group's evaluation. As a matter of fact, it is hard to find such research that explores individual differences related to evaluation and the role of swiping orientation. In the current study, the individual difference is NFT, based on which participants were divided into two groups and we explored the influence of swiping direction on products evaluation in shopping game. We think different swiping orientations may bring different user experience when using touch screen devices, which also differs according to users' NFT.

2.3. Willingness-To-Pay, Preference, PANAS

Generally Willingness To Pay (WTP) is a widely used term in economics that refers to the maximum amount of money that an individual (or a group) will pay for a product or service (Cameron & James, 1987; Krishna, 1991; Varian, 1992). It can be viewed as human preference and is highly context dependent. In experimental studies, measurements such as WTP and product preference are widely used (Camacho-Cuena et al., 2004; Gao et al., 2010; Shin et al., 1992; Sirgy, 2015; Ubilava et al., 2010) due to their high correlation with purchase behavior in real life. WTP was also found to be related with consumer satisfaction (Homburg et al., 2005). According to research of meta-analysis, under the condition of purchasing products, the ratio of contingent valuation and revealed preference was found up tp 89% (Carson et al., 1996).

In the current study, participants were request to evaluate products under the circumstance of online shopping. product preference and WTP are used to measure the participants' evaluation of given products.

Positive and Negative Affect Schedule, or PANAS (Watson et al., 1988), was developed to measure positive affect and negative affect, the two broad and largely independent factors in emotional experience (Rossi & Pourtois, 2012). The original version that has been widely used consists of two 10-item mood scales that describe different states, feelings and emotions. Participants report the score of each item on a 5-point likert scale accordingly. PANAS has been regarded as a reliable, valid and efficient scale and has been widely used to measure feelings, states, affect and mood (Barsade, 2002; Fredrickson & Joiner, 2002; Gross & John, 2003; Mano & Oliver, 1993; Zeng et al., 2009). Considering the current study is conducted in Korean towards Korean native speakers, we choose the Korean version of the Positive and Negative Affect Schedule (Lee et al., 2003).

According to previous study, there exists association between affect and vertical position: positive words and evaluation tend to be associated with up position while negative with down position (Meier & Robinson, 2004). Meanwhile, emotions and affects can also influence consumer behaviors (Cohen et al., 2008; Mano & Oliver, 1993; Oliver, 1993; Phillips & Baumgartner, 2002). In the current study, we simply want to focus on the interaction between swiping orientation and individuals' NFT, rather than users' affects at that time. As a consequence, we decide to take participants' affects into consideration and make sure the possible differences in WTP and product preference between horizontal and vertical swiping conditions do not come from the influence of affects and emotions.

To sum up, we aim to explore the influence of swiping orientation and individuals' NFT on consumer behavior, which is in the case measured by WTP and preference for products, using the touch screen in online shopping scenarios. And we think that the differences among conditions could result from distinctions in participants' affect. If there is no difference due to affect, then it is likely to be the result of a different direction. According to the aforementioned studies as well as a great quantity of application cases in design and development, our research questions are as follows:

Q1: For individuals with high NFT, they differ in preference for products under two different conditions

of swiping orientation - vertical and horizontal - when using touch screen in an online shopping scenario.

Q2: For individuals with high NFT, they differ in WTP under two different conditions of swiping orientation - vertical and horizontal - when using touch screen in an online shopping scenario.

Q3: The differences in preference for products and WTP do not result from affects.

3. Method

3.1. Participants

Sixty-four undergraduates who took at least one course of Department of Psychology in Yonsei University participated in the current experiment. They received one credit in exchange. Four of them encountered system error and could not finish the experiment. Therefore there are sixty participants between the ages of 20 and 27(Mean Age = 23.75, SD = 2.34; 38 females and 26 males) left for analysis.

3.2. Design

There are two independent variables in the current study: swiping orientation and level of NFT. Before experiment, participants were randomly assigned to either horizontal or vertical group regarding swiping orientation. For horizontal group, participants were instructed to use their forefinger to swipe the current page from right to left to go to the next page; for vertical group, they were instructed to use their forefinger to swipe the current page from bottom to top to go to the next page. When analyzing data, participants were then divided into two groups - NFT-high and NFT-low - based on the result of NFT test. Therefore it is a 2(orientation: horizontal vs. vertical) × 2(NFT: high vs. low) between subject design.

There are two dependent variables: preference for products and WTP. After seeing pictures of each product, participants were instructed to report their preference using a seven-point scales ranging from 1 to 7, and they described how much they would like to pay for the product which were later used to calculate their WTP.

The data analysis was conducted using IBM SPSS Statistics 22.0.

3.3. Materials

Participants were randomly assigned to one of the two (30 in vertical and 30 in horizontal) conditions. Each participant completed the experiment using Microsoft Surface Pro 3, with a touch screen of a 3:2 aspect ratio at a resolution of 2160×1440, alone in a cell. There was no mouse provided so that they needed to fulfill all tasks using their fingers. They were told to imagine themselves shopping online. The whole experiment, including instructions, was in Korean.

After reading the instructions, participants were asked to finish NFT test, which was a seven-point Likert scale ranging from -3 to 3. For the item, the '-3' option was assigned with *strongly disagree* while the '3' option was assigned with *strongly agree*. There were 12 statements in total and participants were instructed to report the level of agreement for each, by touching the screen with their finger to select the according number.

After the NFT test, all eight products that would be demonstrated and evaluated later in the core task were displayed in advance. Participants were simply told to write down the price they would like to pay for each product. The prices collected here were viewed as base-price or pre-price, which would be later used to calculate each participant's WTP.

Then the core task began, which consisted of two practice trials and eight experimental trials. In each trial, a GIF animation (Fig. 1) consisting five pictures (in the orientation of front-left-back-right-front as a rotating display) of one product were demonstrated. In every GIF animation, before the pictures of products, there was a

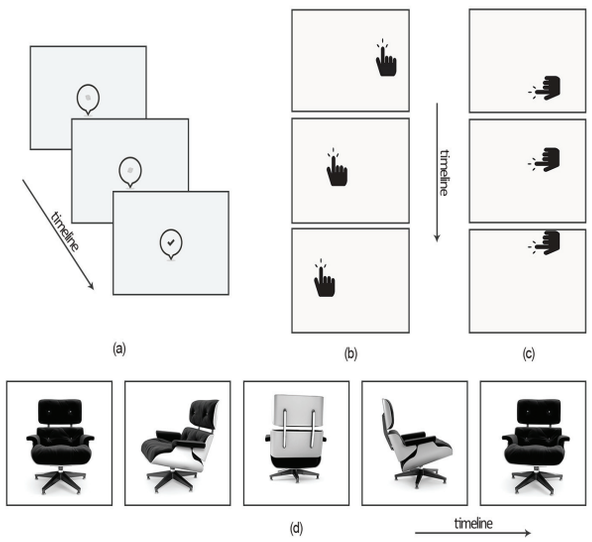

Fig. 1. GIF animation in experiment

(a) the animation of loading, serving as visual fixation; the GIF consists of 131 frames, each lasting for 20ms; (b) the animation informing participants to turn to the next page by swiping from right to left; the GIF consists of 20 frames, each lasting for 20ms except for the first frame which lasted for 1000ms; (c) the animation informing participants to turn to the next page by swiping from bottom to top; the GIF consists of 20 frames, each lasting for 20ms; (d) an example of demonstration of one product; there are five frames in total, each lasting for 3000ms, in the order of front-left-back-right-front.

loading animation in the center, serving as a visual fixation. After all five pictures, at the end of each trial, participants were prompted to swipe the current page to the next one, either horizontally or vertically according to the experiment condition, to fulfill measurement of preference and price (post-price) of the demonstrated product. There were three statements in the measurement of preference, which were also seven-point likert scale ranging from 1 to 7, with '1' being *strongly disagree* and '7' being *strongly agree*. For price of the product, participants just wrote down the number they thought reasonable.

After finishing all 10 trials, participants reported their affect by using PANAS. There were 20 statements in total, with 10 stating positive affect (e.g. enthusiastic, excited, proud, all in Korean) and 10 stating negative affect (e.g. scared, distressed, guilty, all in Korean). Participants were instructed to report the level of agreement for each, using their finger to select the according number. Again for the item ranging from 1 to 7, the '1' option was assigned with *strongly disagree* while the '7' option was assigned with *strongly agree*. Later in analysis, we calculated the average value of both positive affect and negative affect for each participant.

3.4. Procedure

The procedure of the experiment is demonstrated in Fig. 2. After entering the cell, participants first report their gender and age and read the instructions via computer and completed NFT test. Then they were demonstrated with all 8 products and were told to write down the willingness to pay for each product. After that they had to complete the core task of the experiment: within each trial they needed to watch the GIF animation and report the price (post-price) and preference for the product displayed in the animation. Finally each participant's affects were measured using PANAS.

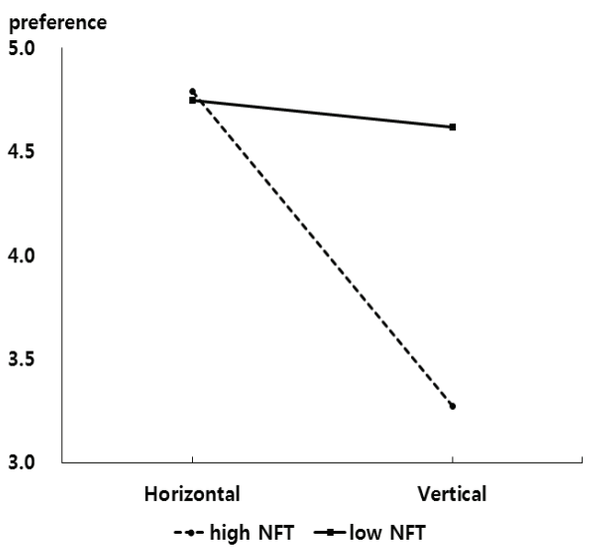

Fig. 2. Preference for products

4. Result

Dependent variables of current study were preference and WTP. For the analysis, we divided each groups based on the median value of NFT score. Further on,

we define participants above median score as high NFT group and the rest as low NFT group. Scores of descriptive statistics for each factor are shown in Table 1.

In case of preference for conducts, we conducted two-way ANOVA analysis and there was a main effect of swiping orientation, $F(1, 56) = 10.24$, $p < .01$, $\eta^2 = .16$. Participants who swiped the page horizontally (M = 4.77, SD = .67) reported significantly higher preference for products than those who did vertically (M = 4.17, SD = .85). Also, there was significant main effect of NFT, $F(1, 56) = 5.22$, $p < .05$, $\eta^2 = .09$. High NFT group (M = 4.69, SD = .69) showed lower preference than low NFT group (M = 4.26, SD = .89). The interaction between swiping orientation and NFT was found significant, $F(1, 56) = 6.17$, $p < .05$, $\eta^2 = .10$. As shown in Fig. 2, when high NFT group (M = 4.79, SD = .73) was assigned horizontal direction, there was no difference in preference compared to low NFT group (M = 4.75, SD = .61). However, in case of vertical direction high NFT group (M = 3.27, SD = .70) showed lower preference than low NFT group (M = 4.62, SD = .76). We conducted simple main effects test to see if the difference between NFT groups in vertical direction condition was statistically significant. Result revealed that the difference between high NFT groups was statistically significant, $F(1, 56) = 11.37$, $p < .01$. In other word, in vertical direction condition, preference for items was lower among high NFT group than low NFT group (Fig. 2).

This result seems to compensate the frustration caused by need for touch when high NFT group manipulated the device horizontally. We further deal with this topic in discussion.

In case of WTP, we also conducted two-way ANOVA analysis for WTP price. Basically the pre-price can be viewed as base-price of products because they were reported when participants were presented with all products at once, before the core task of focusing on each product carefully and touching the screen to swipe the page to the next product. As expected there was no main effect of swiping orientation on pre-price, $F(1, 56) = 1.09$, $p > .05$, $\eta^2 = .04$, or NFT, $F(1, 56) = .85$, $p > .05$, $\eta^2 = .03$.

However, we did not think it was accurate to merely use pre-price because it only serves as a reference point for people to see what products we have. Of course, participants were instructed to type in any reasonable price for products as they thought and the huge individual differences should not be ignored here. Nonetheless, the people who saw the product would have determined the price a bit more carefully in post-price because they saw what kind of product they had. As a result, the variation in the individual seems to have been somewhat reduced. Therefore, we conducted an analysis concerning post-price responses.

Table 1. Descriptive statistic of variables according to Swipe direction and NFT group

Direction	NFT group	NFT	preference	WTP	positive affect	negative affect
Horizontal direction	low	-0.93 (4.04)	4.75 (.63)	147369.71 (90674.69)	3.53 (.98)	2.61 (1.03)
	high	15.27 (7.34)	4.79 (.75)	154834.29 (65951.20)	3.46 (1.25)	2.75 (.86)
Vertical direction	low	2.20 (8.23)	4.62 (.78)	102120.00 (72781.67)	3.09 (1.03)	2.74 (.92)
	high	17.2 (3.08)	3.27 (.72)	93246.67 (36308.41)	4.02 (1.00)	2.57 (1.22)

We found a significant main effect of swiping orientation, $F(1, 56) = 8.92$, $p < .01$, $\eta^2 = .14$. People gave a generous price to the product when they swiped horizontally (M = 151102, SD = 76685.15) than vertically (M = 97683.33, SD = 55739.61). No main effect of NFT was found, $F(1, 56) = .00$, $p > .05$, $\eta^2 = .00$. The interaction (Fig. 3) between swiping orientation and NFT was not significant, $F(1, 56) = .21$, $p > .05$, $\eta^2 = .00$. In many previous studies, preference and WTP are known as predictors of purchase intention, but there are also researches that did not discover any correlation. In our study we did not find any correlation between the two variables($r = .22$, $p > .05$).

The result of PANAS further suggested that the differences found in preference did not result from differences in positive or negative affect. For positive affect, we found no main effect of swiping orientation $F(1, 56) = 2.72$, $p > .05$, $\eta^2 = .05$, or NFT, $F(1, 56) = .11$, $p > .05$, $\eta^2 = .00$, nor the interaction, $F(1, 56) = .00$, $p > .05$, $\eta^2 = .00$. Also for negative affect, we found no main effect of swiping orientation $F(1, 56) = .02$, $p > .05$, $\eta^2 = .00$, or NFT, $F(1, 56) = .00$, $p > .05$, $\eta^2 = .00$, nor the interaction, $F(1, 56) = .39$, $p > .05$, $\eta^2 = .01$.

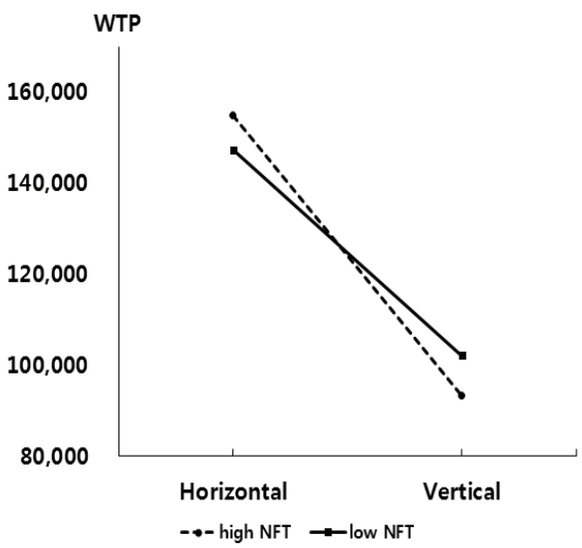

Fig. 3. WTP for products

5. Discussion

The current study is designed to explore the influence of swiping orientation and individuals' NFT on WTP and product preference when using touch screen device to shop online.

The experiment result reveals a significant interaction on preference between the swiping orientation and NFT level. Only individuals with high NFT who prefer to obtain information from touch modality differ in product preference under different orientation condition, while individuals with low NFT shows no such difference. For those with high NFT, horizontal swiping makes for higher preference compared with vertical swiping. Further analysis shows that there is no difference of positive and negative affect (measured by PANAS) depending on the NFT levels and swiping orientation.

Interestingly, many studies showed similar result. For example, Yazdanparast and Spears (2013) discovered that since their need for touch cannot be satisfied, purchase intention of high NFT group decreased in online shopping environment. However, researchers also found that offering discount information or change in mood could counterbalance this dissatisfaction. Also several researches demonstrate presenting report on return policy or product quality through product name and price information can compensate for lack of touch(Kirmani & Rao, 2000; Peck & Childers, 2003b).

Current research also proposes similar finding as preceding studies which suggests controlling direction in tactile environment can compensate for lack of touch. Results revealed that this effect was not an outcome of positive or negative affect. However, further research is required to explain if horizontal swiping motion actually gratified the need for touch or if it was merely an effect of familiarity of the motion itself since certain swiping direction can influence the way we organize information and analytically process them.

Interestingly, there was no interaction in WTP but only a main effect of swiping direction. Because WTP

is rather an objective measure than preference which asks for subjective judgement, its result might have been more related to swiping direction rather than need for touch which reflects individual differences. Choi & Taylor (2014) demonstrated that products presented in 2D or 3D environment showed difference in purchase intention, mediated by vividness of mental imagery (VMI). Although in our research we manipulated the motion to see the product not the visual dimension of presentation, we assume that difference in motion direction can also create a difference in vividness of mental imagery and further influence WTP. Further research is needed to confirm these hypothetic explanations.

Traditional desktop websites are designed in a vertically way that users scroll up and down via computer mouse to explore and access information. With the prevalence of mobile devices, especially those with touch interface, users can directly interact with websites using their fingers. Users may get used to the scroll wheel of computer mouse which allows them to conveniently scroll up and down. Without mouse, however, do mobile websites have to follow the vertical tradition in design? The main effect of swiping orientation in our study may provided an answer: participants report higher preference for products when they swipe horizontally. The finding is coherent with empirical practice in mobile UI design as well as previous studies (Kim et al., 2016; Quinn, 2012). Is not hard to understand: we turn pages horizontally when reading books and in the same way we can swipe horizontally to access more contents via touch interface.

Touch screen devices make mobile websites distinguished from desktop websites mainly because users interact with device differently: via computer mouse or finger gestures. Brasel & Gips (2014) found that in online shopping scenarios, compared with computers or laptops, touch screen interfaces could create stronger perceived psychological ownership over products. In this sense, the device and the interaction between users and interface matter. When users directly touch the screen and swipe, besides the design of websites, other factors can also influence user experience such as individual NFT. Peck & Childers (2003b) distinguish individuals regarding their preference for haptic information. For those with high NFT, direct touch brings higher confidence in their judgment while a lack of direct haptic information makes them suffer more. Individuals with low NFT are much less sensitive in haptic information, which seems not essential at all. We compared individuals with different level of NFT and found the similar pattern: only those with high NFT showed higher preference for products under horizontal swiping condition. In other words, the influence of swiping orientation differs according to individual differences in NFT.

One thing to think about here is what is the origin of the horizontal swiping that influenced the preference of the high-NFT group. From the perspective of information processing (Yazdanparast & Spears, 2012), horizontal swiping can lead to analytical processing and this may compensate the frustration felt by the high-NFT group. We can interpret it in other ways, horizontal swiping can help people better deal with the haptic infomation of the product. This leads to better tactile imagery and compensates for the frustration of the high-NFT group. Of course, this is a problem to be discussed in future research.

Interestingly, when we analyze WTP, we do not get the same results as those from preferences. Naturally, even if preference and WTP are both related to purchase intention, they are essentially different. Subjective judgment is more important in preference, and WTP tries to judge objectively because it includes the process of measuring the price of product. In the result of WTP, the main effect according to direction may be due to the effect of information processing in swiping direction with some degree of preference excluded.

The current study have some limitations. First, the participants are limited to university students. Considering the fact that in real purchasing situation consumers

should cover all ages, it will be necessary to revalidate the various age groups in order to obtain more reasonable results. In addition, it is necessary to confirm whether there is a difference between the age and the unfamiliar age. For future studies, we need to gather the sufficient number of participants and increase the ages groups to secure the validity of the research. Another limitation is that the type of product is limited. Previous research has shown that haptic information is different for different types of products and that the high-NFT group compensates for their frustration(Peck & Childers, 2003a). If the result of this study is a problem of degree of tactile imagination, we can test the results by using various kinds of products.

The major significance of this study can be summarized into two points. First, there is a lot of research on swiping in touch screen, but it is rare to find any difference in value judgments. This study showed that the direction of swiping can affect not only the physical demand and the simple stimulus-response situation but also the value judgment by reflecting individual differences. Second, The current study provides a new perspective of design principles especially for online shopping websites: it may means nothing to those with low NFT, but to those with high NFT, horizontally swiping may somehow bring more profits. Although it is difficult to generalize quickly through this experiment, presenting products in the horizontal direction at the online shopping mall may be helpful for at least the high-NFT group.

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원고접수: 2017.05.08
수정접수: 2017.11.23
게재확정: 2017.11.26