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Visual Tactile Attributes in Online Product Presentations for Improving Purchase Intention

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ABSTRACT

Online shopping is increasing worldwide. Providing customers actual feeling of the product is essential in online shopping. Various technological aids can be used to support visual feeling. When delivering visual tangibility, it is important to study which attributes are significant in product presentations that best portray the actual tactileness. In this perspective, we suggest 'visual tactility' (VT) as a parameter for delivering tangibility in visual presentation. By measuring visual tactility in different product types, latent factors of visual tactility were identified and their influence on purchase intention was determined in this study. We defined material properties of touch such as surface texture, hardness, temperature, and weight as Visual Tactility (VT), the influential factor of tactility. We investigated the influence of VT on product purchase intention and analyzed tactileness within four online product presentations: single static picture, multi static pictures, zoom, and video. Our purpose was to investigate underlying effects of visual tactile attributes on touch and determine their influences according to online product presentation formats. Our results showed that visual tactility positively affected purchase intention and that each attribute differed in importance according to product type. Moreover, this study revealed a strong relation between online product presentation and VT attributes. These results provide a guide when selecting which presentation is optimal for delivering a product's tactility in online shopping situation.

Key words*: Visual Tactility, Online Product Presentation, Touch, Sensory Marketing, E-commerce.*

1. INTRODUCTION

E-commerce sale worldwide was expected to reach $2.290 trillion in year 2017, keeping its steady double-digit growth pace in the market [1]. With total of retail sales expecting to reach $22.737 trillion, it can be estimated that ecommerce covers around 10% of total retail sales now.

Despite the popularity of ecommerce, however, consumers do not regard it as the most trustable method of purchase. One of the biggest disadvantages in ecommerce, especially on online shopping, is due to products' nonexistence; customers cannot experience and feel the actual product.

In overcoming its physical limits, aside from developing high technology products, researchers have started to look for more foundational drivers. Senses, amongst all, are found to be the most instinctive and intrinsic drivers of all. It is known to affect our emotions, memories, perceptions, preferences, choices, and consumption of these products [2].

In particular, touch, amongst these senses, plays a significant role in consumer behavior. Evaluation of a product is processed through in substantial amount of weight depending on tactile input [3]. It has been shown that having the chance to touch a product influence consumer to have more persuasive attitudes and behaviors towards the product [4]. In current online environment where physical limitation is certain, products information is given through via visual media which substitutes the 'touch' in sensory realm.

Peck and Wiggins [4] showed an actual touch of the product increases the product credibility and likability which in

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all, influence purchase intention. Peck and Shu [5] have also stated that the feelings of touch increase people's willingness to pay as well as feelings of ownership. Increased tactility also affects consumer's judgement [6]. Another study has shown that the increased tactility can encourage customers to impulsively purchase products [4]. Therefore, a need for study in more specific aspects in tactility, not only in broad stimulus of touch, is needed.

Delivering the sense of touch; tactility to online customer has become essential for which sellers of the e-commerce whom cannot physically present products. Previous research has investigated tactility in broader spectrum. It considered tangibility as that of which influences purchase intention by the levels of interactivity [7], vividness [8] and local presence [6].

More specifically, the most analytical study on tactility was Klatzky's two dimensions of tactility; geometric attribute and material attribute. Various researches have been done to increase feelings of touch. However, existing research have explored the geometric aspects of tactility – shape and size [9], although some studies [10], [11] have shown material properties as the key element of touch. Therefore, in this paper, we propose four material property attributes – texture, hardness, temperature, and weight – as visual tactility (VT), which affect purchase intention of online customers.

We also assume that we can analyze the tactileness of four online product presentations with visual tactility; single static picture, multi static pictures, zoom, and video. With these four online product presentations, after measuring visual tactileness, we find out the correlation between customer's behavior with visual tactileness and online product presentation formats. Our purpose is to investigate underlying effects of visual tactile attributes as a part of significant role in touch and to find the influences in accordance with online product presentation formats.

2. LITERATURE REVIEW AND RESEARCH QUESTIONS

2.1 Sense of touch as purchase intention

When visual media offers information that fills the physical representation of an actual product, consumers have more positive feedback towards the object [12]. Providing salient cues to object's identity enable us to extract more information about the product [13]. A research has shown that increased tactility has positive effect on not only judgements' accuracy but also on information credibility, feelings of ownership, and consumer confidence [14]. However, surprisingly little is known about whether surface texture is represented similarly in vision and touch [15].

Nevertheless, the importance of feeling of touch in product purchase situation is increasing. Given a situation, a study showed that when consumers can touch the product, act of touch is always preferred in most of situation and in most of products [16]. However, the limitation of actual presence makes products to be shown via visual presentations only. To visually present the product, Schwarz [17] stated that consumer judgements are not only impacted by the showing of the products' content but also by the fluency of generating and processing products' information.

2.2 NFT Factor

To understand tactile factors affecting consumer behavior better, assessing the differences of tactile information became necessary. For this need, researchers have developed "Need for Touch" (NFT) scale in order to measure individual differences in preference for touch information. NFT is extracting a preferences and utilization gained by tactile input- haptic system which is measuring motivational factors of individuals [12]. Followings are the NFT survey that are used to measure individuals' preference [12]. In below, (A) stands for autotelic, which is a consumer that have high tendency to touch and have relatively more tendency on impulsive purchase and (I) stands for instrumental which consumer has tendency for more information driven purchase.

1. When walking through stores, I can't help touching all kinds of products. (A)
2. Touching products can be fun. (A)
3. I place more trust in products that can be touched before purchase. (I)
4. I feel more comfortable purchasing a product after physically examining it. (I)
5. When browsing in stores, it is important for me to handle all kinds of products. (A)
6. If I can't touch a product in the store, I am reluctant to purchase the product. (I)
7. I like to touch products even if I have no intention of buying them. (A)
8. I feel more confident making a purchase after touching a product. (I)
9. When browsing in stores, I like to touch lots of products. (A)
10. The only way to make sure a product is worth buying is to actually touch it. (I)
11. There are many products that I would only buy if I could handle them before purchase. (I)
12. I find myself touching all kinds of products in stores. (A)

Childers et al. [18] defines NFT factor in to two levels; instrumental and autotelic factors. The instrumental factor reflects customer's goal-oriented touch. The autotelic factor narrates where its reflection is more related to hedonic, arousal, and enjoyment aspect of touch. The study also finds people with high NFT measures, in which they are label as autotelic, has more tendency to be frustrated when they are not able to touch whereas low NFT people tends to be indifferent. This displays a need for not only depicting the product in tangible way is necessary but also individual's innate tendency is also an important factor when it comes to tactility.

2.3 Properties of touch

The sense of touch enables consumers to evaluate the structural attributes of objects. For last decade, importance of studying the sense of touch in marketing area has been emphasized. To investigate the sense of touch, Klatzky and

Lederman [19] addressed properties that associated with object and sense of touch. In their studies, they divided object's property into two dimensions; material and geometrical properties. Material properties included properties that involved gestures to investigate objects' tangible property; surface texture, hardness, temperature and weight. On the other hand, geometrical property included properties that did not involve movement but only seeing; size and shape.

2.4 Material attributes as visual tactility

In efforts to deliver tangibility, previous studies have been focusing on bigger frame such as interactivity, vividness, and local presence. At the same time, vibrant studies were progressing in haptic (touch) explanatory systems. Klatzky [11] has found two dimensions of touch; material and geometrical aspects of tactility. From searching hand movements to enclosure movements, the exploratory hand movements are done to decide object's tactile properties. Searching movements involved repetitive movements to find roughness, hardness, temperature, and weight. Enclosure movements dealt with visual information which is associated with shape and size [20]. Lederman and Klatzky [19] defined these movements to two dimensions – material property and geometrical property.

A study showed that increasing material property lead to increased tactility information [16]. Then, Loomis, Klatzky and Lederman [10] underlined determining material properties; texture, hardness, temperature, and weight, are the valuable factors influencing the haptic perceptual system. Moreover, various studies have proven that consumers are much inclined to tactile attributes prior to purchase especially when a material property is offered [12]. Therefore, in this paper, we propose visual tactility as key attributes for the tactility and examine its influence on product purchase intentions. Specifically, we hope to find the differences of purchase intention in people's preference over certain visual tactile attributes especially within the different product categories (see. Fig. 1).

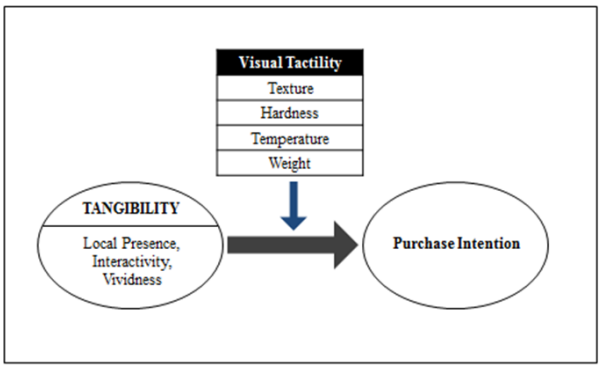


Fig. 1. Influence of visual tactility in purchase intention

Having visual tactility as key attributes for delivering tactility, we also assume ways of presenting products' images online that can also influence VT attributes. Tactility plays a significant role in consumer decision making [12]. Visually delivering tactility has become heavily influential on role of online product presentation especially when the product type is highly related to sensory experience [21]. There have been various studies of online product presentation elements which enhance the sensory aspects of product images (see. Table 1). The formats of product presentation include static product pictures shown in online situation as well as additional viewpoints (i.e., front and back views), enlargement (i.e., zoom in and zoom out), and videos.

Table 1. Tactile object properties

Sensory Attributes		Vision	Tactile
Geometrical Attribute	size	O	O
	shape	O	O
Material Attribute	texture	O	O
	hardness	△	O
	temperature	△	O
	weight	X	O

2.5 Various online research for improving tactility of products

To provide convincing product images in online shopping situation, different elements of product presentations are studied. In attempts to show non-physical product images in more tangible way, researchers have found interactivity and vividness as important underlying factors that influence the presentations [22].

Nevertheless, of rigorous studies of the tangibility in online product presentations, as Jiang and Benbasat [22] pointed out in their research, the influences of various product presentation formats have not been empirically examined. Therefore, we investigate material properties of touch as visual tactility as influential factor of tactility; surface texture, hardness, temperature, and weight. Based on our assumption which visual tactility has influence on purchase intention, we analyze the tactileness of four online product presentations; single static picture, multi static pictures, zoom, and video.

Visual tactileness is measured within four product presentations. We found the correlation between customer's behavior with visual tactileness and online product presentation formats. In this context, we investigate underlying effects of visual tactile attributes as a part of significant role in touch and to find the influences in accordance with online product presentation formats.

2.6 Online Product Presentation Formats

The prior researches have stated that various online presentation formats that increased either interactivity, local presence or vividness had positive influence on customer's purchase behavior [14]. However, in this paper, we try to approach the tangibility in more analytical perspective. We experiment attributes of tactility and its influence over online product presentation formats and product types. Existing researches [11], [4], have focused on mainly geometric attributes of online product presentation, size and shapes. However, as noted above, recent researches have proven material property as best at showing products' utility as well as

property [12]. Thus, we assume material properties will best portray the tactility of a product and that in more detail; each of the attributes can be weighed in their importance to purchase intention that fits specific product categories.

In this study, we proposed material attributes as visual tactility (VT) as influential factor of tactility; surface texture, hardness, temperature, and weight. We also investigated visual tactility's influence of tactileness in four online product presentations; single static picture, multi static pictures, zoom, and video. With four online product presentations, after measuring visual tactileness, we found out the correlation between customer's behavior with visual tactileness and online product presentation formats had positively strengthening effects on both sides.

2.7 Product Categories and Research Questions

In addition, the sense of touch and its purchase decisions varies in two distinct product categories [23]. Consumer decision making in hedonic products and utilitarian product differ in both sensory and cognitive way [23]. Hedonic product such as apparel, is one of the most characterized categories for its high consumer awareness in sense of touch [18]. Similarly, utilitarian goods such as electronics are known to be more 'seeing things', regarding less consumer sensitivity in tactileness [24]. However, there is a gap between recognizing the actual consumer perception of tactileness between these product categories.

Accordingly, it can be inferred that product presentation format will also influence the visual tactility when using different online product presentation to sell different product types. To positively strengthen the VT to increase purchase intention, understanding the importance in attributes of VT in chosen product will be necessary. Understanding VT in online shopping environment could benefit both consumers and for sellers to know more about the objects essential properties and to feel more tactility in given sight-only circumstances.

Therefore, in this study we propose material attributes as visual tactility as influential factor of tactility; surface texture, hardness, temperature, and weight. We investigate each attributes' influence on purchase intention with different product categories. We also examine the influence VT in four online product presentations- single static picture, multi static pictures, zoom, and video.

First, we explore visual tactility -which is composed of material property attributes –that will have influence on purchase intention. Then, the weights of each attributes are investigated for their impacts on purchase intention. Last, we examine the influence of online product presentation formats for relation between VT.

The main research questions are following.

RQ 1: Will Visual Tactility have positive influence on purchase intention?

RQ 2: Which visual tactility attributes will have higher influence on purchase intention?

RQ 3: Will online product presentations have positive influence on visual tactility which strengthens purchase intention?

3. RESEARCH DESIGN

3.1 Participants

A total of 202 participants were gathered from collected in survey questionnaire completed at KAIST (Korea Advanced Institute of Science Technology), which the most of respondents were students. The sample is consisted of 125 women (62%) and 77 men (38%) with an average age of 20 years (SD= 1.84). The study collected student of this age to reflect the segment that have high tendency for search the internet to purchase products [25].

3.2 Procedure

To investigate the influence of visual tactility, the survey was conducted with random distribution across students at KAIST. The each of the correspondent received survey on apparel with randomly chosen items. The subjects were informed that they would be evaluating online product for shopping. Then, they were asked general information such as gender and frequency of previous online shopping use. After, they were shown randomly chosen item to select their feelings of touch according to thumbnail pictures. Lastly, purchase intentions were measure for dependent variable.

3.3 Variables

To test the hypothesis, an experiment was conducted in an online setting in which each participant was given a link to access the survey. Each survey represented one of the four online presentation formats. A (single picture), B (multi-pictures), C (zoom), and D (video) presentation types were randomly distributed (see. Fig. 2). The study employed a 4 x 2 x 4 mixed design, with visual tactile attributes (surface texture, hardness, temperature, weight) serving as a main effect with products (apparel, electronics). Then, we observed influence of online product presentation formats (static picture, multi pictures, zoom, and video) within VT's existence.

In specify, we investigate the influence of four types of online product presentation formats within VT which were applied widely in current e-commerce websites: the single picture format, multi pictures format, zoom, and the video format. The single, static picture format presents product information on a website with stereotypical one-shot perspective of a product. The multi-picture formats present product information on different perspectives of a product. Zoom format enables viewer to actively participate in gathering tactile information. Video, which conveys largest amount of visual information, is most informative on viewing in perspectives of a product.

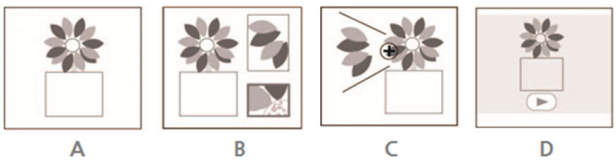


Fig. 2. Online product presentation formats

3.3.1 Control variables

In our study we controlled seven variables including age, gender, shopping experience, NFT, product knowledge, and VT. As seen in Table 1A, correlations between the factors are shown. Following measures were constructed with items adopted and modified from scales previously studied in the extant literature. All items used a 7-point Likert scale in which a rating of 1 corresponded with 'strongly disagree' and 7 with 'strongly agree'. The subjects answered Need for Touch (NFT) measures prior to main questionnaire. The NFT questionnaire were adopted from Peck's [12] study. It is twelve item scales consist of autotelic and instrumental dimension. It was to measure the participants' individual differences in preferences for haptic information. Then the subjects were shown one item of each product category, apparel and electronics (see. Fig. 3).

Fig. 3. Experiment product types

3.3.2 Independent variable

From the questionnaire Principal Components Analysis was used to measure the material attributes; surface, hardness, temperature, and weight factors. The four attributes were measured in PCA using weighted average to create VT variable. Evaluating weight of the visual tactility attributes were adopted from Laroche [26].

3.3.3 Dependent variable

Purchase intention was asked for dependent variable. Total of three questions constructed to measure purchase intention. 7-point Likert scale was used in which a rating of 1 corresponded with 'strongly disagree' and 7 with 'strongly agree'. Each of the results represented consumer's purchase as dependent variable.

4. RESULTS

4.1 Descriptive analysis

We proposed four attributes of material property as visual tactility (VT); surface texture, hardness, temperature, and weight. We then calculated a weighted score for VT using the factor weights (λ) from principal component analysis (PCA) was used. As in result, weight of apparel in VT was λ_hardness = 0.79, followed by λ_(surface texture)= 0.76, λ_weight= 0.73 and λ_temperature= 0.72. From this analysis, we can assume customers' importance rate on apparel in which weight of VT attribute is measured as hardness to temperature.

In contrast to apparel, weight of electronics in VT was λ_hardness = 0.83, followed by λ_temperature= 0.78, λ_weight= 0.75, and λ_(surface texture)= 0.56, and. From this analysis, we can assume customers' importance rate on electronics in which weight of VT attribute is measured as hardness to surface texture.

Table 2 shows correlation for apparels and Table 3 for electronics. Our main segments of participants' age had both significances in shopping experience, NFT, and product knowledge due to this age group best represents online shopping [23] (Fiore et al., 2005a).

Table 2. Descriptive statistics and correlations in apparel (n=201)

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Purchase Intention	2.74	1.29	1						
(2) Age	1.98	0.5	-0.06	1					
(3) Gender	1.62	0.49	-0.05	-0.14*	1				
(4) Shopping Experience	2.34	0.96	0.18*	-0.26**	0.27**	1			
(5) NFT	10.06	10.95	-0.09	0.19**	-0.12	-0.1	1		
(6) Product knowledge	4.16	1.61	0.12	0.19**	-0.12	-0.01	0.02	1	
(7) VT	3.33	0.67	0.16*	0	0.08	0.07	0	0.05	1

p~ 0.1
* p_.05
** p_.01
*** p_.001

Table 3. Descriptive statistics and correlations in electronics (n=201)

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Purchase Intention	3.46	1.53	1						
(2) Age	1.98	0.5	-0.12	1					
(3) Gender	1.62	0.49	-0.03	-0.14*	1				
(4) Shopping Experience	2.34	0.96	0.14	-0.26**	0.27**	1			
(5) NFT	10.06	10.95	0.06	0.19**	-0.12	-0.1	1		
(6) Product knowledge	4.67	1.57	0.34**	-0.02	0.09	0.09	0.18*	1	
(7) VT	3.32	0.71	0.34**	0	0	0.08	0.02	0.20**	1

p~ 0.1
* p_.05
** p_.01
*** p_.001

4.2 Visual tactility variables using the weight

Age, gender, shopping experiences, NFT, product knowledge and clothes dummies were controlled. Model 1 is the baseline model with only control variables. Models 2, 3 introduce VT, four product presentations – single picture, multi picture, zoom, video and the interaction between them, respectively.

Table 4 shows the correlation between purchase intention and visual tactility in apparel. We also controlled online product presentations to examine relation between purchase intentions and VT. In Model 1, we found in presentation dummies, zoom and video has significance to purchase intention. However, it is not shown in Model 1 whether the VT information plays a valuable effect or not. Then in Model 2, we investigated only the VT without presentation dummies. In this model, we found strong positive significance in VT to consumer's purchase intention. This supports Hypothesis 1, which we predicted that VT will have a positively significant effect on purchase intention.

Model 3 presents the results of both VT and online product presentation formats together. In this model, we showed that presentation formats are important element in delivering VT especially in zooming condition. Compared with Model 1 with Model 3 which includes VT, we found slight increase in purchase intention which is positively strengthened in zoom condition when VT is present (P value of zoom in Model 1 is

0.031 when in Model 3, the value is 0.029). With no significant effects in other conditions, we assume that consumer's feel more confident [12] (Peck, 2003) when engaged actively on searching the material attributes by zooming in purchasing apparel product type.

Table 4. Linear regression (DV=purchase intention in apparel)

Variables		Model 1	Model 2	Model 3
Control Variables				
Constant		2.29**	2.06**	1.65*
Age		-0.03	-0.17	-0.07
Gender		-0.11	-0.2	-0.14
Shopping Experience		0.27**	0.27**	0.26**
NFT		-0.0061549	-0.0063064	-0.0064339
Product knowledge		0.07	0.09	0.07
Clothes Dummies		*Included*	*Included*	*Included*
Presentation Dummies		*Included*		
	Zoom	0.51*		
	Video	0.56†		
Independent Variable				
VT			0.26*	0.24†
Controlled Presentation Dummies				
	Single Picture			-
	Multi Picture			0.22
	Zoom			0.52*
	Video			0.48

†p<0.1
*p<.05
**p<.01
***p<.001

Table 5 shows the result of electronic product type. Model 1 is consisted of controlled variables. In this model, we found that presentation dummies, especially in video, the relation with purchase intention's coefficient was high at 0.62 ($p<.05$). However, zoom conditions compared with Table 4; in apparel product type, did not show any significance. We also found that surface of electronic products is already known to majority and that there is little variance to different types of material surfaces led to lack of motivation for consumers to engage in active investigation of surfaces. Therefore, zooming condition in electronics did not have same effect as in apparels; consumer in electronics were not willing to engage in search actively as they did in apparel. This shows the differences in preference for VT attributes when there are different product types (e.g. Apparel, Electronics). Video, on the other hand, showed hardness and weights by presenting in most various perspectives of a product. In accordance with weight factors of electronics, it is possible to assume that video presentation format best suited in ways of showing hardness, temperature, and weight.

In Model 2, purchase intention showed strong positively significant relation to VT. This answers our RQ 1. However, to prove significant result in video condition were not due to increase in geometric information (shapes and size) but the influence of VT, we conducted Model 3. In the model, we found slight drop of video's effect at when there is VT's presence. Zooming in Model 1's coefficient was 0.62 (p-value 0.042) when in Model 3, the coefficient was at 0.51 (p-value 0.084). This provides us that even though geometrical information can be more included in video presentation, material properties; VT, plays an equivalent significance in increasing purchase intention.

Table 5. Linear regression (DV=purchase intention in electronics)

Variables		Model 1	Model 2	Model 3
Control Variables				
Constant		1.75*	0.72	0.21
Age		-0.09	-0.31	-0.16
Gender		-0.31	-0.31	-0.28
Shopping Experience		0.16	0.14	0.14
NFT		0.0000665	0.0009389	0.0009081
Product knowledge		0.37***	0.31***	0.07
Electronic Dummies		*Included*	*Included*	*Included*
Presentation Dummies		*Included*		
	Zoom	0.22		
	Video	0.62*		
Independent Variable				
VT			0.61***	0.58***
Controlled Presentation Dummies				
	Single Picture			-
	Multi Picture			0.13
	Zoom			0.23†
	Video			0.51

†p<0.1
*p<.05
**p<.01
***p<.001

4.3 Visual tactility and the online product presentations

To examine the research questions addressed, a series of OLS analyses was conducted to examine influence of VT in online presentations. The attributes of VT; surface texture, hardness, temperature, weight's and online presentation formats' (single picture, multi picture, zoom, video) relation to purchase intention was measured.

In terms of apparel, VT with zoom and video presentation format had positively significant effect on customers' purchase intention. With electronics, all of four product presentation format had interaction effect with VT and purchase intention. Similar with apparel, electronics had the most positive significance in zoom and video presentation format.

Table 6 and Table 7 shows the four presentation methods influencing VT in gradation of colors. Darker colors show more stronger relation to the attributes of VT. In apparel (see. Table 6), surface texture, hardness, and weight were shown to have slight significance (p value < 0.05) to zoom and video presentation. Hardness factor was not shown any significance to any of the product presentations.

In electronic products (see. Table 7), different levels of VT intensity were shown in product presentations. The strongest tactile information carried out was hardness via multi pictures, zoom, and video (p value < 0.000). This can be a foreseen result due to electronics' relatively small range of hardness compared to apparel. However, the attribute which has its diversity, such as surface texture was significantly increased with video presentation.

The results showed that product presentation formats positively strengthen surface texture, hardness, and weight attributes in zoom and video. In apparel, there was no significant difference of VT factors between when single or multi picture were offered. However, giving additional information such as zoom or video increased VT elements. On the contrary, electronics had each different levels of VT in every product presentations.

Table 6. Relation of product presentation and VT attributes in apparel

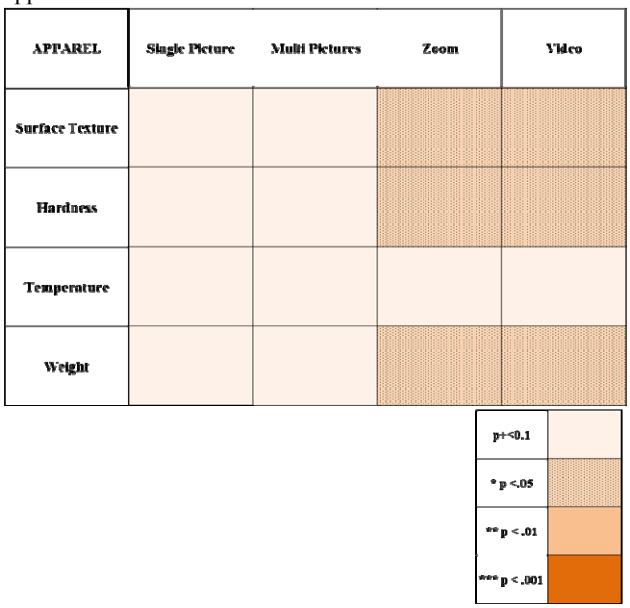
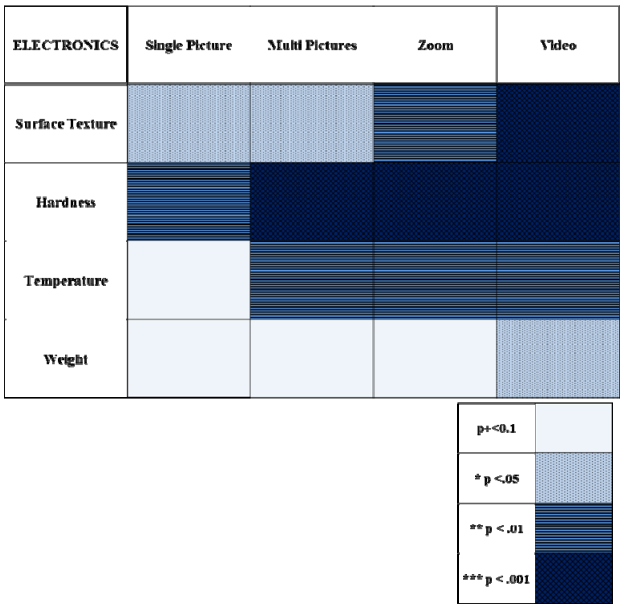


Table 7. Relation of product presentation and VT attributes in electronics



5. DISCUSSION AND CONCLUSION

5.1 Discussion

The main goal of this study was to articulate the material properties as visual tactility which influences sense of touch and to find whether the online product presentation format influence in consumer's purchase intention extent to which they exert significance under conditions of VT presence. We theorized material attributes as visual tactility as influential factor of tactility; surface texture, hardness, temperature, and weight. We also assumed that with visual tactility, we can observe the different influences of the tactileness on four online product presentations; single static picture, multi static pictures, zoom, and video.

We examined attributes of visual tactility and its weights on apparel which the result showed hardness as the strongest weight. This could enlighten future product categories for understanding which attributes are important when there is need to show strong tactility. From the findings of our paper, it will be necessary to emphasize specific attributes; hardness- to increase visual tactility which will likely to increase purchase intention. In electronics, similar to apparel, hardness was found to be the most weighted factor of all.

On product presentation formats, video showed the strongest VT influence. However, the orders of the weights were different from apparel product type. While surface texture was listed as second in apparel, in electronics, temperature and weight was second and third factors of VT weights. This implies the need for different approaches in emphasizing VT attributes according to product types.

Comparing the result of Model 1 and Model 3, it was shown that the increase of purchase intention was not only due to increase in information in electronic product category. In accordance with the weights on electronic VT, we found that video was the best format that best showed the features. This implies that low material diversity can influence preferences of VT attributes in which they prefer to be informed more on hardness and weights when surface texture is not stimulating.

Our findings scrutinized the characteristics of touch property in terms of consumer purchase behavior. While prior researches considered online presentation formats; interactivity, local presence or vividness [14] or on material property [12], we investigated both material property in online presentations which have significant impact on consumers' purchase intention. The difference of visual tactile attributes was found to weigh differently on both presentation and products, lending an insight for optimal level of online presentation for visual tactileness.

5.2 Implications

The findings from our study can utilize companies and marketers to provide most effective visual presentation for their own products with measuring VT weights of the product. Sellers will understand and more efficiently focus on which attribute to emphasize in order to increase purchase intentions. Second, then the ways of presenting product online can be chosen considering product type and their VT attributes. For instance, a product that has hardness as the highest weights in VT would be best shown in video presentation formats.

Also, from this study we could assume the complexity of materials and perceived knowledge could affect the consumer choices of presentation formats. Specifically, apparels, for their diversity in materials and broad amount of surface textures, it is hard to guess for consumers to guess their tactileness. Therefore, they tend to select the most active tactility searching method; zooming. However, electronic goods, on the other hand, have little variety of surfaces and materials. Which that the consumer tends to select presentation method that best shows product's hardness or weight; video. Being able to select the most effective presentation could save costs of excessive exposure.

5.3 Limitations and Avenues for Further Research

As for the limitation, our studies focused at two product categories, which lead us to investigation of other product categories for future research. Firstly, although the experiments were carefully designed, two types of product categories limit itself for generalization. Also, within a product, due to high range of consisting material, a coherent result might not be possible in some product categories. Limitation of excluding experiential value- for instance, services such as navigating etc. For future work, creating strengthening visual mechanism for visual tactility can be studied.

This study could also enlighten future product categories for understanding which attributes are important when there is need to show strong tactility. From the findings of our paper, it will be necessary to emphasize specific attributes of hedonic or utilitarian product to increase visual tactility which will likely to increase purchase intention.

Future work could extend the beneficial relationship of VT and product presentation formats together. Although the positively strengthening effect has been proven between VT and online product presentations, the way of visualizing that could emphasize the attribute of VT should be studied. For instance, when hardness is the strongest factor in showing electronics, our study has examined up to finding video will best play the role in delivering tangibility of a product. However, how to manipulate video or images in other cases, to emphasize the four different attributes- surface texture, hardness, temperature and weight- are to be studied in future work.

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REFERENCES

[1] E-marketer, “Worldwide Retail and Ecommerce Sales: eMarketer's Estimates for 2016–2021,” 2017. https://www.emarketer.com/Report/Worldwide-Retail-Ecommerce-Sales-eMarketers-Estimates-20162021/2002090

[2] A. Krishna, “Interaction of senses: The effect of vision versus touch on the elongation bias,” Journal of Consumer Research, vol. 32, no. 4, 2006, pp. 557-566.

[3] M. B. Holbrook, “On the importance of using real products in research on merchandising strategy,” Journal of Retailing, vol. 59, no. 1, 1983, pp. 4-23.

[4] J. Peck and J. Wiggins, “It just feels good: Consumers’ affective response to touch and its influence on persuasion,” Journal of Marketing, vol. 70, 2006, pp. 56-69.

[5] J. Peck and S.B. Shu, “The effect of mere touch on perceived ownership,” The Journal of Consumer Research, vol. 36, no. 3, 2009, pp. 434-447.

[6] T. Verhagen, C. Vonkeman, F. Feldberg, and P. Verhagen, “Present it like it is here: Creating local presence to improve online product experiences,” Computers in Human Behavior, vol. 39, 2014, pp. 270-280.

[7] A. M. Fiore and H. J. Jin, “Influence of image interactivity on approach responses towards an online retailer,” Internet Research: Electronic Networking Applications and Policy, vol. 13, no. 1, 2003, pp. 38-48.

[8] Y. K. Choi and C. R. Taylor, “How do 3-dimensional images promote products on the Internet?,” Journal of Business Research, vol. 67, no. 10, 2014, pp. 2164-2170.

[9] R. L. Klatzky and Joann Peck, “Please touch: Object properties that invite touch,” IEEE Transactions on Haptics, vol. 5, no. 2, 2012, pp. 139-147.

[10] J. M. Loomis, R. L. Klatzky, and S. J. Lederman, “Similarity of tactual and visual picture recognition with limited field of view,” Perception, vol. 20, no. 2, 1991, pp. 167-177.

[11] S. J. Lederman and R. L. Klatzky, “Extracting object properties through haptic exploration,” Acta Psychologica, vol. 84, no. 1, 1993, pp. 29-40.

[12] J. Peck and T. L. Childers. “Individual differences in haptic information processing: The “need for touch” scale,” The Journal of Consumer Research, vol. 30, no. 3, 2003, pp. 430-442.

[13] S. K. Podrebarac, M. A. Goodale, and J. C. Snow, “Are visual texture-selective areas recruited during haptic texture discrimination?,” NeuroImage, vol. 94, no. 4, 2014, pp. 129-137.

[14] T. Verhagen, C. C. Vonkeman, J. F. M. Feldberg, and P. Verhagen, *Making online products more tangible and likeable: The role of local presence as product presentation mechanism*, Research Memorandum, 2013.

[15] T. A. Whitaker, C. Simões-Franklin, and F. N. Newell, “Vision and touch: Independent or integrated systems for the perception of texture?,” Brain Research, vol. 1242, no. 25, 2008, pp. 59-72.

[16] B. Grohmann, E. R. Spangenberg, and D. E. Sprott, “The Influence of Tactile Input on the Evaluation of Retail Product Offerings,” Journal of Retailing, vol. 83, no. 2, 2007, pp. 237-246.

[17] N. Schwarz, “Metacognitive experiences in consumer judgment and decision making,” Journal of Consumer Psychology, vol. 14, no. 4, 2004, pp. 332-348.

[18] T. L. Childers, C. L. Carr, J. Peck, and S. Carson, “Hedonic and utilitarian motivations for online retail shopping behavior,” Journal of retailing, vol. 77, no. 4, 2001, pp. 511-535.

[19] S. J. Lederman and R. L. Klatzky, “Hand movements: A window into haptic object recognition,” Cognitive Psychology, vol. 19, no. 3, 1987, pp. 342-368.

[20] R. L. Klatzky, S. J. Lederman, and D. E. Matula, “Imagined haptic exploration in judgments of object properties,” Journal of Experimental Psychology: Learning, Memory, and Cognition, vol. 17, no. 2, 1991, pp. 314-322.

[21] C. V. Jansson-Boyd, “Touch matters: exploring the relationship between consumption and tactile interaction,” Social Semiotics, vol. 21, no. 4, 2011, pp. 531-546.

[22] Z. Jiang and I. Benbasat, "The effects of presentation formats and task complexity on online consumers' product understanding," MIS Quarterly, vol. 31, no. 3, 2007, pp. 475-500.
[23] X. Chen, F. Shao, C. Barnes, T. Childs, and B. Henson, "Exploring relationships between touch perception and surface physical properties," International Journal of Design, vol. 3, no.2, 2009, pp. 67-76.
[24] N. Crilly, J. Moultrie, and P. J. Clarkson, "Seeing things: consumer response to the visual domain in product design," Design studies, vol. 25, no. 6, 2004, pp. 547-577.
[25] K. Song, A. M. Fiore, and P. Jihye, "Telepresence and fantasy in online apparel shopping experience," Journal of Fashion Marketing and Management: An International Journal, vol. 11, no. 4, 2007, pp. 553-570.
[26] M. Laroche, M. V. Nepomuceno, and M. O. Richard, "How do involvement and product knowledge affect the relationship between intangibility and perceived risk for brands and product categories?," Journal of Consumer Marketing, vol. 27, no. 3, 2010, pp. 197-210.

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