Who Wants Stylus Pen? An Empirical Study about the Stylus Pen Affect through Product Attachment of Smartphone User

Young-Berm Kim[1], Sang-Ho Lee[2] and Jai-Beom Kim[3]

[1]*General Manager, Korea Telecom*
[2]*Corresponding Author, Professor, Kyungsung University, School of Digital Media*
[3]*Professor, Sungkyunkwan University, Global Business College*

ABSTRACT

Stylus pen (hereinafter, stylus) is an auxiliary tool for the direct input through display simulating human pencil activities over papers. In a vein of new product development strategy of IT industry, it is known that new product features don't just offer benefits to consumer but also inconveniences due to additional complexities. In order to evaluate the benefit and loss of the stylus, we researchers suggest a new causality model represented with the structural equation and test the model which the stylus effect to the device value with survey data from the Korean smartphone consumers. For the empirical test, we categorize their various consumer experience as three groups as icon, competence, and novelty. As the bounded rational factors and as a mediating variable, we introduce the consumer attachment, and we set the extent of stylus pen use as a discrete moderating variable. The active stylus users have stronger attachment and repurchase intent than the inactive users. They also have the higher score in experience, notably in icon and novelty than the others. For the active users, their attachment mediates in part positively the relation from icon and novelty to repurchase intent and mitigates the negative effect from novelty experience to repurchase intention. The researchers argue the new product strategy of equipment stylus pen into smartphone works properly in the Korean market. The embedded pen helps to induce current user to buy the same series again. The methods and research model suggested in the paper can be applied as a tool for new product evaluation.

Keywords: Product attachment, stylus pen, repurchase intention, product experience, product development strategy.

1. INTRODUCTION

Does the stylus pen (hereafter, stylus) equipped in the personal digital device such as smartphone or tablet PC increase the device value or at least the consumer perception for it? It has long been debated whether

the embedded pen gives actual benefit to the consumers of handheld devices and by many theoretical or empirical researches ever tried to get the optimal solution of the product feature bundle in new product development strategy (Thompson, Hamilton & Rust, 2005). Apple Inc. has been producing all their personal devices such like iPhone, iPad, and Mac book series without embedded pen since the comeback of Steve Jobs 1997, even though they first adopted it decades ago to their first PDA (personal digital assistant), Newton. Currently Samsung Electronics Inc., Microsoft Inc., and many other developers have adopted various type of embedded pen into their new devices and elaborated to increase the value of new devices. In a view of the product development strategy, new features into current product bring about positively added product value, and negatively the learning cost occurred by the use complexity (Boehner et. al., 2007; Hirschman & Holbrook, 1982). They should elaborate to balance the trade-offs and, as a result, to lead competitors in the market or maximize their revenue.

In this paper, the researchers propose an empirical model based on consumers' product experience and their intent. It assumes that consumer experiences for an artifact maybe different in the shoe of person because it originates from various personal subjectivity (Kenney & Bryan, 2011). To manage them meaningfully in the causality model, the researchers categorize them to several groups. Smartphone, the object of the study, is a digital device with composite functions and utilities. New apps working on it are daily emerging and give us innovating experiences (Thomson, MacInnis & Park, 2005). From the literature in consumer behavior, product use experiences affect directly consumers' next purchase behavior. The influences to behavior may be transferred indirectly such as satisfaction, attitudes, and any other perceptual process of evaluation. In the study, the researchers focus on the emotional attitude that indirectly affects the direct relationships between experiences and purchase intent. The rational perception of people is not enough in explaining people's digital product consumption and they are also considered along with the perceptions about human emotion such as product attachment, patina, and cherishment (Head & Ziolkowski, 2012; Holbrook & Hirschman, 2012). Of those not-rational human perceptions, the researchers pay attention to the attachment from consumer to product that explains both rational and not-rational human behaviors. Because a smartphone is a device that requires periodic purchase and a personalized technology goods, ever changing and daily upgraded from the old one (Nagengast et. al., 2014). Therefore, when consumers make decisions on this cyclical purchase, they have interests in the compatibility between the old and the new device to maintain personal data and memory (Hassenzahl, Diefenbach & Goritz, 2010). In the switching cost model, the attachment has been regarded as a main barrier that interrupts easy churn-out (Burnham, Frels & Mahajan, 2003), and in other view of consumer behavior, it is a bounded emotional attitude that gives consumers personal meaning and value (Odom et. al., 2009).

Note	Paper	Digital
Display		
Tool	Pen and paper book	Stylus pen and E-book pdf

Figure 22.1: Annotation on the physical and digital book

Left side of Figure 22.1 is the picture of paper page scribbled with red color pen. The right side of Figure 22.1, meanwhile, is a pdf file page annotated with red color stylus pen. They are in common the results that a reader represented his improvised idea with pen. Still now in the era of E-book (electronic book), a number of readers write their individual thoughts or personal memo over some margins while reading. If we don't have paper and pencil beside us at once, actually keypad input tackles them, or at least don't support if we are not veteran typist. The advanced stylus pen and its applications support direct drawings or writings on the device display. However, the new system asks consumers to learn and get accustomed to it with patience and resource. Because the experience concerned with the stylus pen system affects our memory and attitude, we reasonably presume that the stylus pen enthusiasts have a stronger tendency to buy pen-embedded tablet PC or smartphone than the others. This is a question about the extent of stylus pen use and the attachment of the users to their device (Hinckley et. al., 2010). To summarize our research questions, first, our main aim of the paper is about the stylus pen effect. Next, our study object, smartphone, is a multi-functioned, composite digital product with an operating system. Thus, the extent that each owner utilizes and acknowledges is different by person. New applications are daily emerging on the App store (on-line market) and are providing incessantly new experience and utility (Desmet & Hekkert, 2007; Kleine & Baker, 2004).

- **Research Question:** What and how does stylus pen equipped affect consumers to repurchase their smartphone?

The structure of the study is as follows. To begin with, we critically review the literatures in and around the digital attachment, repurchase intention, digital experiences, and stylus pen. Building on the theoretical analysis, we do research models and hypotheses for empirical tests. The models are gradually extended from basic model to elaborated model with the moderate variable as stylus pen and with a mediate variable as attachment. Next, with this model, we survey with sampling in South Korean smartphone consumer. With test results for hypotheses in each model, we will discuss the meanings of our test result and lastly summarize the test results and future research issues.

2. LITERATURE

Repurchase intention (RPI) refers to an individual decision to purchase the same line product of a company that consumers possess now or used once before. As a competition strategy the device developers try to raise the attractiveness of their product by adopting new features and functions. This corresponds to the product differentiation strategy leaning on human satisfaction maximizing needs. They say consumers' RPI's are influenced rationally and emotionally. Satisfaction is in a major rational side since long time ago (Hassenzahl et. al., 2000), and the emotional or bounded rational/emotional side concepts are invigorated to study recently (Belk, 2013; Schifferstein & Zwartkruis-Pelgrim, 2008; Tatikonda & Rosenthal, 2000; Thompson & Norton, 2011). In Korean market, personal digital device of smartphone changed periodically because of their technological obsoleteness, their average life for smartphone is about 2 years, 3 years for tablet PC, 4 years a PC. In addition, they are becoming shorter. Besides consumers switch the owned to the new because of their attractiveness, appeal based their curiosity including the performance/cost rate (Desmet & Hekkert, 2007; Hellier et. al., 2003). On the contrary, the switch tendency gets hampered by many types of switch cost, for example, the backward compatibility to the phone book, memo, photograph etc. interrupts the switching to new device or different operating system products. In the study, the repurchase

intention is observed by following three questions: Will you choose a same series with current product in future? Do you need to backward compatibility for extant all contents? And are you willing to pay additional price to continue using current applications?

Attachment for Digital Product

Attachment was originated in human psychology about the emotional ties between infant and its guardian. In consumer behavior studies, the attachment means consumers' the emotional attitude toward owned products or their brands (Park et. al., 2010). They have been defined in some different version like "the strength of the emotional bond a consumer experiences with a product (Bansal, Taylor & James, 2005)," "an arousal related to whether discard or continue to use the owned goods (Park et. al., 2010)," and "multi-faceted nature of the relationship caused by the individual or group owning a specific destination (Kleine & Baker, 2004)". To be integrated, attachment is the emotion that consumer feels for his/her belongings and its strength is various pertaining to the artifacts kind, personal difference, and ownerships.

The attachment strength of the tangible product such as jewelry, watches, and cookware scores high at the time after immediate purchasing and after the time it decreases steadily, and once more it bounces up after elapse of many years because of its antique value (Belk, 2013). People often adhere to owning of certain thing (s) privately or socially. We call the case "attached" and the reason is because they give some relevance and utilities. When the object is commercial artifacts we call the relationship as the consumer product attachment (Park et. al., 2010). The attachment for intangible product such as digital goods is weaker than the one for tangible product such as jewelry or furniture, etc. (Qi & Fu, 2011; Fallman & Waterworth, 2010). Because the latter are easy to copy, never changed over the time elapse, and reproducible at a minute cost at any time (Verbeek, 2011). In other view, digital artifacts can form the stronger emotional bonds than any other analog artifacts. They response because of the input-output interface system (Hellier et. al., 2003; Read, Robertson & McQuilken, 2011). In HCI (human computer interface) study, researchers say that consumers have the attachment also for the digital product, and just the degree and the kinds of determinants are different from analogue one (Mugge, Schiffersteine & Schoormans, 2010; Read, McQuilken & Robertson, 2010; Qi & Fu, 2011).

The researchers regard the whole product as one without the separation between hardware and software. The attachment for two are somewhat different in many case (Kim, Kim & Lee, 2015; Ball & Tasaki, 1992), the researchers name it the hybrid product as one product because hardware and software are formed and optimized under one complementarity, and mingled under one brand (Golsteijn et. al., 2012; Turner & Turner, 2012). In order to observe for this latent variable, we ask the question items for their cherishment, detachment, and special meaning (Cox, Saliagas & Locander, 1987).

Table 22.1
Dimension and categories of product experience

Dimension	*Category of Experiences*	*Researchers*
Durability of relationships between product and consumer	• Function • Symbolism • Material Qualities	Verbeek (2005), Odom et. al., (2009), Jung et. al., (2010)

Dimension	Category of Experiences	Researchers
Meanings experienced from products	• Aesthetic experience • Experience of meaning • Emotional experience	Desmet et. al., (2007)
Product meanings related with consumer self	• Enjoyment • Memories to persons, places, and events	Ballet al., (1992), Belk (2013), Schilferstein et. al., (2008)
Special or cherished meaning from private possession	• Self, • On-going occasion • Capability, • Enjoyment • Memento	Golsteijn et. al., (2012)
Common attributes which participants report from attached artefacts.	• Availability, • Proximity • Aesthetics	Turner et. al., (2012)

Digital Experiences

By the extant empirical studies standards, how to categorize various human experience into several groups is determined by the research purpose. As the deductive approach, the dimensions are usually about the human nature or product benefit and the experiences are classified like hedonic and practical, emotional and rational, or generic and expansion (Fallman & Waterworth, 2010). As the inductive method, there are usually the direct observation, interview, or indirect case study method without theoretical inferences (Golsteijn et. al., 2012; Turner & Turner, 2012). They interview the consumers directly or visit their home and interview about what is their cherished goods and what is the reason. According to them, consumers feel attachment irrespective of product forms as analogue, hybrid, or digital. The study divides total consumer experiences into three categories of icon, competence, and novelty. Icon and competence experience almost match for emotional and rational experience in human nature dimension studies (Fallman & Waterworth, 2010). Novelty is adopted new in the researches for innovation experience which characterizes digital products like smartphone (Tatikonda & Rosenthal, 2000). The industrial design research emphasizes material quality experience for the substantial characteristics of the product which is related to the existence (Verbeek, 2011). Three kinds of experiences are as following.

Icon experience (ICN): The greater the frequency in which consumers use the pen, the more accustomed to it with their self. This is because people tend to find significances from their owning consciously or unconsciously (Belk, 2013). Smartphone is the storage of electronic identifiers, passwords, photos, and the private contents which identify a specific person. Consumers carry it always so that the device can give the experience of proximity and appendage him or herself (Turner & Turner, 2012). Related to the concept, the symbolic experience has been treated as main determinant for purchase intent (Desmet & Hekkert, 2007) and the memory and enjoyment selected as the significant concepts (Schifferstein & Zwartkruis-Pelgrim, 2008). The study defines the icon experience as the latent variable including all constructs of memory, self, and proximity experience from the above literatures. Exactly it is observed by questions about the memory, personality, self.

*Competence experience (CMP)***:** Digital product functions are the reason of existence. Above all, the functions are perceived to consumers before they are evaluated rationally or emotionally. This means the actual use extent of the product is very important to the attitude of consumer in that it gives users the senses of accomplishment, capability, and mastery. On the contrary, with all their sacrificing personal time and endurance, if they feel incompetence and they refuse to buy the same model again (Zabramski, Gkouskos & Lind, 2011). As a contents creator or contents consumers, people's flow and achievement affect similarly their purchase intent. The competence experiences are observed by questions for functions, expert, and utilization in Table 22.2.

Novelty experience (NVL) is the cognitive and psychological arousal influenced by product consumption and articulated as unconventional, startling, and interesting etc (Cox, Saliagas & Locander, 1987). Usually consumers experience it indirectly through advertisement or from others and do it directly after purchasing. Archivists or librarians refer to the novelty as the experience in media containing text (Fallman & Waterworth, 2010), and design theorists mention it as the product experience in original reason to exist for consumers (Jung, Blevis & Stolterman, 2010). Some design theorists reveal that novelty is related to the material quality of products which means their raison d'etre or the important purpose of them (Csikszentmihalyi & Csikszentmihalyi, 1991). Digital products have been growing and replacing the reason of being physical goods. To such an extent that innovativeness for being digital, aesthetics and convenient functions are the novelty for digital product (Bansal, Taylor & James, 2005). Digital image, mp3 and e-books are replacing traditional printed photographs, music discs, and paper books respectively. The original tactile, olfactory experience disappears but just visual, auditory one remain. They disappear tangibly but exist unchangeable against aging. They are completely replicated, easily stored, and anywhere shared. The experiences for them give the user the materiality which determine novelty (Blevis, Lim & Stolterman, 2006; Park, Kim & del Pobil, 2012). The novelty experience is a relative and ever changing experience category. It means that the novelty is influenced sensitively by alternatives and change from positive to negative abruptly when some experiences are proved as outdated *cliche* now (Csikszentmihalyi & Csikszentmihalyi, 1991). Under some special conditions, the outdate innovation could be the real novelty but the case corresponds to icon experience. The study observes the visual, auditory aesthetics, and ease of possession and with them determines the latent novelty experience (Feinberg, 2013).

Stylus Pen

The input tool changing tiny dots status on the device display started as a pointer device at first time like a mouse of computer. Then gradually has been developed as the special input device which supports to write and draw on device screen (Zabramski, Gkouskos & Lind, 2011; Arif & Sylla, 2013). The merits of the input tools are the similarity with traditional pencil activity. With the last ameliorated product device users can draw and write the similar output with pencil-and-paper on screen. It can be possible with the data of pressure, moving speed, and the angle data etc. issued from pen and screen integrated circuits. It can also fix the parallax occurred by the sight angle gap between sight point and pen-contact point. Most of extant literature for stylus have treated the relation between functional performance and users' satisfaction in view of technical measurement. For example, the users' age and pen performance relation[41], tactile or haptic feedback function and the performance (Park, Kim & del Pobil, 2012), and stylus pen is good at

working for relatively creative task (Marshall & Scharff, 2009). Hinckley et. al., (2010) contend that stylus pen provides the write function, finger touch shall be responsible for function manipulation, and the bundle use of stylus and finger touch is the unprecedented handling. Kim et. al., (2015) argue that active smartphone consumers have more retention intent of current model than the uninterested-pen-users.

Table 22.2
Constructs questionnaire of research model

Construct	Measure item	Questionnaire	Literature
Icon (ICN)	• Memory • Personality • Self	• Remind me of place, people etc. • Represent my personal character • Express my self-image	Golsteijn et. al., (2012), Mugge et. al., (2010), Schifferstein et. al., (2008)
Competence (CMP)	• Function • Expert • Utilization	• Functions to do with this artifact • Challenging and mastering • Utilize this device to get new performance	Feinberg (2013), Hassenzahl et. al., (2010), Zabramski et. al., (2011)
Novelty (NVL)	• Visible aesthetic • Auditory aesthetic • App/contents possession	• Good appearance of my device, application, contents, etc. • Sound from my device for MP3, manipulation, etc. • Possession applications, contents in my device	Belk (2013), Blevis et. al., (2006), Jung et. al., (2010), Odom, Banks et. al., (2012)
Product Attachment (ATT)	• Cherishment • Detachment • Special meaning	• More valuable • Bad feeling without the device and contents • Special meaning to myself	Schifferstein, et. al., (2008), Mugge et. al., (2010), Odom et. al., (2009)
Repurchase Intention (RPI)	• Continue to use stylus pen • Need to backward compatibility • Continue to use current product series	• Intent to buy model to continue stylus • Intent to buy model to continue current contents • Intent to sacrifice cost to keep current applications	Golsteijn et. al., (2012), Qi and Fu (2011), Read et. al. (2010)

The study adopts the frequency of stylus pen usage as primal test stimuli and to treat it as discrete moderator for the experiences, attachment, repurchase intention, and all relationships between those constructs. In Table 22.4, we represent two groups as the high stylus pen (HSP) and the low stylus pen (LSP) and compare them.

3. RESEARCH METHODS

With the operational definitions for all constructs Table 22.2 in previous chapter, we suggest the research model and test the model by survey for Korean smartphone consumer. The statistical method is designed as the structural equation modeling approach and stylus is set to control the entire study model. To understand the mediate and moderate effects evidently, we expand path analysis by stepwise models and group analysis.

Research Models and Hypotheses

It is troublesome to measure precisely and divide from other relationship. To control other variables, we should repeat many hierarchical model calculating and fear to miss some. The researchers approach with stepwise expansion from base model to the moderated mediate model (Gross, 2012).
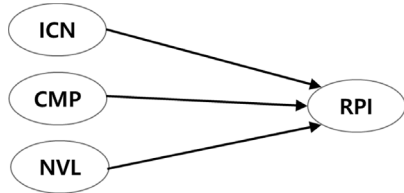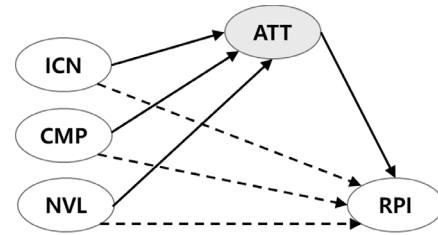

Figure 22.2: Model 1 (Base Model)

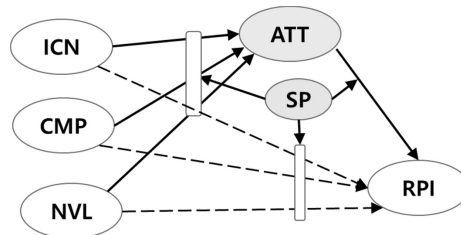**Figure 22.3: Model 2 (Mediate model)**

Figure 22.4: Model 3 (Moderated mediate model)

Model 1. Base model: In the base model three experiences influence directly the repurchase intention as above Figure 22.2.

> **H1.** Three experiences of smartphone users positively affect repurchase intention (RPI)**.**

> **H1.1.** Icon experience (ICN) positively affects RPI.

> **H1.2.** Competence experience (CMP) positively affects RPI.

> **H1.3.** Novelty experience (NVL) positively affects RPI.

Model 2. Mediate model: Model 2 is suggested by adding one more variable, the product attachment, into the model 1. As in previous chapter, though it is practically accepted for the traditional physical product that consumer experience influences their attachment and purchase behaviors (Holbrook & Hirschman, 1982; Kleine & Baker, 2004), but it is not yet for digital product like smartphone. Researches for digital are taken place comparatively only recently. We assume the records stored by users in the product memory, the contents like photos, idea, games, movies, music, and hardware accustomed for owner are the sources of their emotional attitude as independent which affects the purchase behavior (Kleine & Baker, 2004; Belk, 2013). The hypotheses H2 are as follows and the responded research model is represented as above Figure 22.3.

> **H2.** Product experience affects significantly their product attachment (ATT).

> **H2.1.** Icon experience (ICN) affects ATT.

> **H2.2.** Competence experience (CMP) affects ATT.

> **H2.3.** Novelty experience (NVL) affects ATT.

The attachment for current digital contents or the files affects he relationships from experience to the products re-purchase intention. This means the attachment can be a mediate that strengthens positively or negatively (Nagengast et. al., 2014). Hypotheses to test them are represented as follows H3.

H3. Product attachment (ATT) mediates the relation from each product experience to RPI.

H3.1. ATT mediates the relation from ICN to RPI.

H3.2. ATT mediates the relation from CMP to RPI.

H3.3. ATT mediates the relation from NVL to RPI.

Model 3. Moderated mediate model: By adding a moderator, the frequency of stylus usage, into Model 2, we made model 3. To look out the effect of stylus use extent over all constructs, and their relationships, we divide all users into the low stylus pen (hereinafter LSP) and the high stylus pen (hereinafter, HSP) and compare them with the t-test difference test. Stylus pen use is managed as the discrete variable and analyzed with the multiple group analysis.

H4. The mean of the same construct in each group (HSP, LSP) are significantly different.

H4.1. ATT of HSP and LSP user are significantly different.

H4.2. RPI of HSP and LSP user are significantly different.

H4.3. ICN of HSP and LSP user are significantly different.

H4.4. CMP of HSP and LSP user are significantly different.

H4.5. NVL of HSP and LSP user are significantly different.

The hypotheses for the comparing path coefficients in each group are as follows.

H5. The path coefficient in each groups (HSP, LSP) are significantly different.

H5.1. The path coefficients ICN-RPI of HSP and LSP are different.

H5.2. The path coefficients ICN-ATT of HSP and LSP are different.

H5.3. The path coefficients CMP-RPI of HSP and LSP are different.

H5.4. The path coefficients CMP-ATT of HSP and LSP are different.

H5.5. The path coefficients NVL-RPI of HSP and LSP are different.

H5.6. The path coefficients NVL-ATT of HSP and LSP are different.

H5.7. The path coefficients ATT-RPI of HSP and LSP are different.

As the additional analysis, we want to know what the stylus pen effect is. For the analysis Path analysis is necessary after we limit all users into only HSP group. This is the in-depth hypothesis as follows.

H6. In case of HSP user, ATT mediates the relationships from product experiences to repurchase intention (RPI).

H6.1. In HSP user, ATT mediates the relationships ICN to RPI.

H6.2. In HSP user, ATT mediates the relationships CMP to RPI.

H6.3. In HSP user, ATT mediates the relationships NVL to RPI.

Data Collection

To test model, we survey for Korean smartphone users. As of 2014, there are some smartphone models embedded stylus pen. Galaxy Note series of Samsung Electronics Inc. are the representative which is massively supplied worldwide to achieve enough sample size economically for the research model. In order to control other device features except of stylus pen such as brand image, partial performance, or price etc., we sample two groups of product users. One group is the Galaxy user and the other is the non-Galaxy user. We compare the HSP and LSP user within the Galaxy users and once more compare between the Galaxy group and the non-Galaxy group. As of March 2014 in the Korean market, the share of Galaxy Note series is about 17% (Sampling and Survey by IDINCU Inc., commercialized mobile research agent). Participants were randomly sampled with the 95% confidence level from the panel database registered to 80,000 voluntarily. For the survey they are paid somewhat through the internal compensation system. Questionnaires are transported to them through application in their smartphone which consisted of not more than 30 questions and each question is expressed as short sentence to respond quickly. It would take at most ten minutes to complete total answers at normal reading speed in Korean.

Table 22.3
Survey sample demography

Group Division		Model				Stylus Use			
		Gal-Note 1, 2, 3 (n=200)		Others (n = 100)		HSP (n = 161)		LSP (n = 139)	
Gender	Male	91	46%	56	56%	75	47%	72	52%
	Female	109	55%	44	44%	86	53%	67	48%
		X^2 test 2.941 (.086)				X^2 test 0.812 (.368)			
Age	-20s	65	33%	41	41%	46	29%	53	38%
	30s	69	35%	29	29%	49	30%	41	29%
	40s	52	26%	26	26%	58	36%	38	27%
	50s-	14	7%	4	4%	8	5%	7	5%
		X^2 test 2.707 (.258)				X^2 test 1.123 (.570)			
Holding Duration (Months)	0-5	40	20%	25	25%	37	23%	28	20%
	6-11	27	14%	10	10%	22	14%	15	11%
	12-17	51	26%	15	15%	39	24%	27	19%
	18-23	17	9%	15	15%	13	8%	16	12%
	24-29	17	9%	9	9%	13	8%	13	9%
	30-35	11	6%	6	6%	10	6%	10	7%
	36-40	19	10%	11	11%	21	13%	21	15%
	41-	18	9%	9	9%	9	6%	9	6%
		X^2 test .330 (.848)				X^2 test 1.391 (.499)			

4. RESULTS

Demography

Presumably survey participants are people who use smartphone relatively adroitly or at least beyond average well. First, 200 samples were selected from the Galaxy note series owners as the experimental group. 159 persons (around 80%) of them answered they use stylus very much (many times, beyond 1 time in a week), or much (average 1 time in a week). The other 41 (around 20%) responded as they don't use it not-much (under 1 time in a week), scarcely use, and don't have or lost it already. As the control group 100 people were gathered those owned the non-Galaxy smartphone models and ask the same questions. As expected, most of them (98%) rarely used the pen. Exceptionally small minority among them (2%) answered they use it much. We assume they use an external type stylus pen and add them also in Galaxy HSP group. Interestingly we found those who responded as "to have Galaxy Note products but not to use the pen" had the similar statistics with the non-Galaxy owner in that they are indifferent for the pen use. Descriptive statistics for them are summarized as above Table 22.3.

Table 22.4
Cross tabulation

Groups Count/Exp. Freq.	HSP		LSP		Total
	Count	*Exp. Freq.*	*Count*	*Exp. Freq.*	*Total*
Gal-Notes'	148	107	52	93	200
Others	13	54	87	46	100
Total	161	161	139	139	300

In total views, they are adult female and male under 60 over 20 years old residing over all country, 63% of them are locating in Seoul and Gyeonggi province in Korea. Their occupations are 34% of office technicians, followed by 18% of professional service or self-employed. Female has Galaxy Note series models and use stylus more than male. But those gaps are not significant by chi-square difference test with 95 confidence level as (Table 22.6). In ages, the 30s are the biggest in Galaxy Note group (35%), and so the 40s are in HSP group (36%). In the holding period of current device, 12 months to 17 months are the most common (26% of Galaxy Note, and 24% of HSP). The chi-square statistics for this case also do not exceed the threshold for 95% confidence level and so they are insignificantly different. Table 22.4 is the 2 by 2 cross tabulation in which row axis is stylus pen use frequency (HSP & LSP) and column axis is smartphone model (Galaxy Note & Not Galaxy Note model). With 99% confidence level Galaxy Note series owners use stylus pen more frequently and other model user don't use it so much. Then will those who have more tendency to use the pen have stronger attachment? Galaxy Note series are relatively the high-end models because those products adopt larger display, higher speed CPU, and also expensively priced than others. By comparing with the control group we separate the attachment of pen from those of other attributes like brand loyalty.

Test Results

Model 1 test: To verify the research model 1 is suitable and reasonable as a measurement tool, we compute the CR, AVE, and the standard factor loadings for all constructs of model 1 as follows Table 22.5.

Table 22.5
Reliability and validity for Model 1

	CR [a]	AVE [b]	ICN	CMP	NVL	RPI
ICN	.780	.542	.736			
CMP	.861	.674	.564	.821		
NVL	.751	.504	.804	.682	.710	
RPI	.664	.416	.650	.572	.552	.645

$$^a\text{CR(composite reliability)} = \frac{\left[\sum(\text{standardized factor loading})\right]^2}{\left\{\left[\sum(\text{standardized factor loading})\right]^2 + \sum(\text{error variance})\right\}}$$

$$^b\text{AVE(average variance extracted)} = \frac{\sum(\text{standardized factor loading})^2}{\left\{\left(\sum(\text{standardized factor loading})^2\right) + \sum(\text{error variance})\right\}}$$

CRs for all construct are more than 0.7, and AVEs have surpassed more than 0.5 (except of RPI which is approximately 0.5), so they secure construct reliability as good model. Standard regression weights between the constructs are higher than 0.5, so the construct validity is also assured. The square root of each of the construct AVE is larger than the standard regression weights (except ICN-NVL), and the discriminant validity has also been secured approximately. Model fit indices of the model are Cmin/df = 2.492, GFI = .939, AGFI = .901, TLI = .932, CFI = .951, RMSEA = .071, and PCLOSE = 0.017 (GFI, AGFI of a good model with explanation power have better be more than 0.9., TLI, CFI be 0.9 or more, RMSEA be lower than 0.08, and PCLOSE be lower than 0.05: Preacher, Rucker & Hayes, 2007). The results of path analysis from three experiences for the 300 respondents are following Table 22.6. SMC (squared multiple correlation), which means the explaining degree of the dependent RPI is 0.572 (bigger than 0.4), and the Hypotheses H1.1 ~ H1.3 are all accepted.

Table 22.6
Test result for Model 1

Path	Estimate	S.E.	C.R.	P	Test
ICN-RPI	.739	.060	12.348	***	H1.1 Accept
CMP-RPI	.323	.040	8.067	***	H1.2 Accept
NVL-RPI	-.504	.085	−5.898	***	H1.3 Accept

Notes: Hereinafter all [***] *p*-value < 0.001; [**] *p*-value < 0.05; [*] *p*-value < 0.10 for all following tables

Model 2 test: The confirmatory factor analysis result of Model 2 is as following Table 22.7.

All CR values including ATT are above 0.7 (only RPI almost it as .666), All AVE values are all above and at least 0.5 (only RPI slightly below it as .420). They can say the model reliability is secured. Since those standardized regression weights between constructs of them are higher than 0.5 (except CMP-ATT .499), constructs validity are also assured. Diagonal position values in the right side matrix of the Table 22.7 are the square root of the AVE value for each construct. Those values should have a greater value than the correlation coefficients with the other constructs except for ATT-ICN, and NVL-ICN. We can say almost all relationships are approximately secured the discriminant validity (Thaler, 1985). Model fitness indices

of Model 2 are Cmin/df = 2.44, GFI = .919, AGFI = .878, TLI = .927, CFI = .944, RMSEA = .069, and PCLOSE = .006, and they come to be almost good fit. There are no the absolute allowances for good model, the natural science research requires CFI, GFI both as more than 0.95, and in case of social science research if PCLOSE is less than the 0.05 value, CFI is more of 0.9, RMSEA is under 0.1, and Cmin/df as an absolute index (a kind of chi-square value) is less than 3.0, they are accepted as valuable. So we claim the model fitness index for model 2 is generally good (Baron & Kenny, 1986).

Table 22.7
Reliability and validity of Model 2

	CR ^{a}	AVE ^{b}	ICN	CMP	NVL	RPI	ATT
ICN	.774	.533	.730				
CMP	.861	.674	.570	.821			
NVL	.748	.501	.806	.678	.708		
RPI	.666	.420	.662	.562	.544	.648	
ATT	.831	.622	.852	.499	.762	.610	.789

Hypothesis test results in Model 2 are as Table 22.8. Except of ATT-RPI, all standardized regression coefficients are significant and they are accepted. In model 2, all experiences influence RPI similarly with model 1, but the signs of CMP and NVL influence to ATT are opposed to RPI. That is, while CMP-RPI is positive and NVL-RPI is strong negative, CMP-ATT is negative and NVL-ATT is positive. This expresses attachment and repurchase intention are antithetical consumer perception. ICN influences strong positively to RPI and ATT. In order to test the hypothesis, H3, as the first step, we check whether all paths via attachment as the mediate secure the significance or not (Baron & Kenny, 1986). As Table 22.8, ATT-RPI path is insignificant. So all mediating effects via ATT are insignificant. For total smartphone owner, hypothesis H2(H2.1~H2.3) are accepted but H3(H3.1~H3.30) are rejected. The SMC (squared multiple correlations) value for ATT is 0.876 and SMC for RPI in Model 2 is 0.652. By adding attachment, we ameliorate SMC for RPI in Model 1 (.469) but still can't find the mediation effect of attachment.

Table 22.8
Path coefficient and hypothesis test for Model 2

Path	Estimate	S.E.	C.R.	P	Test
ATT-RPI	.124	.081	1.524	.128	H3 Reject
ICN-ATT	.770	.042	18.117	kkk	H2.1 Accept
CMP-ATT	−.105	.028	−3.700	kkk	H2.2 Accept
NVL-ATT	.211	.061	3.484	kkk	H2.3 Accept
ICN-RPI	.644	.086	7.456	kkk	H3.1 Reject
CMP-RPI	.336	.041	8.238	kkk	H3.2 Reject
NVL-RPI	−.530	.087	−6.105	kkk	H3.3 Reject

Model 3 test: Model 3 is a moderated mediation model, stylus pen use extent is the moderator and attachment is the mediate. The discrete moderator has two types of status as HSP and LSP and we adopt bi-group structural equation modeling analysis in AMOS 16.0. As the pre-test of this group analysis, we test the cross validity by stepwise comparison between base model and constraint models of constraining factor loading (λ-constrained), structural covariance (Φ-constrained), and measurement residuals (θ-constrained). First, like

below Table 22.9, there are no significant differences between unconstrained model and three constrained models (5% significance level). Second, Model 3 as base models without any constraints (unconstrained model) has Model fitness indices as Cmin/df = 1.98, P = 0.00, TLI = .898, CFI = .922, RMSEA = .057, and PCLOSE = .095, and other constraints models have under 2.15 Cmin/df (chi square) and at least CFI = 0.877 mean that they are good as model fitness.

Test result of hypothesis H4 is shown in Table 22.10. Most of the men scores in HSP are larger significantly than those of LSP. So they are accepted only except of H4.4 for CMP. The score of CMP in LSP is unexpectedly bigger than one in HSP, but insignificantly (F value by Levene's test are all above 0.05: Preacher, Rucker, & Hayes, 2007). In Table 22.11, we compare the differences in the path coefficients between two consumer groups. Z-score, the standardized score for differences between path coefficients of two groups are accepted in the H 5.5, H 5.6 and H 5.7 (Benjamin & Gaskin, 2014). In HSP group, NVL affects negatively RPI and positively ATT stronger than LSP group. Also ATT influences RPI positively. In order to compare the ATT mediation effect between two groups, we execute the moderated mediate analysis. As result, though LSP group has the similar path coefficients pattern with Model 2, HSP group are different in several ways. First, while LSP group has the relationship ATT-RPI as insignificant, the HSP group has it as significantly positive. For the active user, all mediate effects via attachment are statistically significant and the explanatory power for RPI also gets better than Model 2.

Table 22.9
Cross validity test for Model 3

Model	Cmin(p)	df	CFI	RMSEA	A(cmin/df)	X^2 threshold	Invariance
Unconstrained	316.742***	160	.922	.057			
Measurement weights (λ constrained)	335.388***	170	.918	.057	18.646/10	320.58(0.045)	No
Structural covariances (λΦ constrained)	420.494***	200	.891	.061	85.106/30	339.23***	No
Measurement residuals (λΦθ constrained)	462.619***	215	.877	.062	42.125/15	466.46***	No

If Invariance is no. 2 Groups are different at the model level. Check path.   ***p-value < 0.001

Table 22.10
Constructs mean difference tests between groups for Model 3

	Mean		Levene's test		T-test			
	LSP	HSP	F	Sig	t	(two-liled)	Mean gap	Results
ATT	3.3732	4.0733	.408	.524	−8.194	.000	−.7001	H4.1 Accept
RPI	1.9971	3.2186	3.997	.046	−20.978	.000	−1.221	H4.2 Accept
ICN	3.1320	3.3696	4.022	.046	−3.436	.001	−.237	H4.3 Accept
CMP	3.8535	3.7941	23.525	.000	.724	.470	.059	H4.4 Reject
NVL	3.2735	3.7849	.178	.673	−7.129	.000	−.512	H4.5 Accept

df = 298, confidence level 95%

Additional analysis: the mediated effect of attachment in HSP group. In Table 22.12, we compute the direct, indirect, and total mediation effect size and summarize the hypothesis test results of H6. There

are two effective partial meditation paths. In ICN-ATT-RPI, the indirect path via ATT is significant (.316). Because total effect (.733) combining the direct and the indirect impact is bigger than that of base model (.723), ATT mediates ICN to RPI relationships positively. NVL-ATT-RPI also gets mediated positively by ATT. Though the direct effect through NVL-RPI is strong negative, the indirect effect via ATT is positive. We can say the negative direct influence is mitigated from (−.539) to (−.393) by the mediation effect of ATT in this path. That is, ATT magnifies the ICN to RPI and mitigates NVL to RPI relationships. The explanatory power (SMC) of RPI in HSP group increases from .439 to .522.

Table 22.11
Path coefficients difference tests between groups for Model 3

Path	HSP regression weights		LSP regression weights		z-score	Test result
	Estimate	P	Estimate	P		
ICN → RPI	.434	.002	.518	.000	.508	H5.1 Reject
ICN → ATT	.708	.000	.717	.000	.096	H5.2 Reject
CMP → RPI	.366	.000	.226	.000	−1.645	H5.3 Reject
CMP → ATT	−.061	.242	−.114	.000	−.850	H5.4 Reject
NVL → RPI	−.673	.000	−.255	.000	**2.402	H5.5 Accept
NVL → ATT	.393	.000	.178	.003	*−1.742	H5.6 Accept
ATT → RPI	.464	.000	−.094	.369	***−3.674	H5.7 Accept

Notes: **p*-value < 0.01; **p*-value < 0.05; *p*-value < 0.10

Table 22.12
HSP moderated ATT mediator effect for additional test

	HSP moderator-ATT mediator effect			Base	Mediate	Test
Path	Direct	Indirect	Total	Model	Effect	Result
ICN-ATT-RPI	.417(.002)	.316(.002)	733(***)	ICN-RPI 723***	Partial	H6.1 Accept
CMP-ATT-RPI	.397(***)	−.031 (.154)	.366	CMP-RPI .391***	No	H6.2 Reject
NVL-ATT-RPI	−.539(***)	.146(.002) -	.393(***)	NVL-RPI −.433***	Partial	H6.3 Accept

Model 1: SMC, RPI .439
Model 2: SMC, ATT .776, RPI .522

5. DISCUSSION

Result of Model 1 says that users' icon and competence experience positively influence the repurchase intention, but novelty experience does it negatively. This means that consumers get smartphone model unchanged because it retains their identity, and retains skill and knowledge for the current device. They are usually exposed to heavy advertisement or informational allures for new products. Their novelty experience thus makes them to explore new novelty from new attractive products. When it comes to product repurchase, Model 1 explains the fact that there are three categories in their minds and they are often conflicting (Bansal, Taylor, & James, 2005).

In Model 2, we introduce the attachment into Model 1 as the third independent variable and postulate that the attachment mediates the relationships from three experiences to repurchase intention. As a

result, path coefficient signs had changed such that competence affects negatively, and icon and novelty does positively to repurchase intention. It means that when we consider their attachment simultaneously, competence experience of currently owned device disturbs rather than other two experiences help to buy again it. But, the relationship from attachment to purchase again is not significant. So, there is not the mediation effect of attachment.

In model 3, we divide consumers into two groups in view of their stylus pen usage extent and compare the test results of the two groups. In this model, we define stylus pen use extent as a discreet moderate variable and test by group analysis method. The test results are as follows: First, for inactive pen use (LSP) group, the path coefficients are similar with those of Model 2. For active pen use group (HSP), all variable means except of competence are higher than those of LSP. Secondly, the factor scores of two dependent variables, attachment and repurchase intention in HSP, are also higher than those of LSP. Thirdly, in HSP group, except of path from competence to attachment, all paths are significant. Fourthly, the paths of the two groups, from novelty to attachment and repurchase and from attachment to repurchase, are significantly different. Taking all the above things into consideration, those HSP users are not the technology lover and they assume to be inactive for product change, they are more likely to repurchase the same product series. Lastly, but not least at all, in the analysis of HSP users, we identify the partial mediate effect of attachment. By this mediation, the effect from icon experience is strengthened positively and the effect of novelty negatively to repurchase.

6. CONCLUSION AND LIMITATIONS

In the paper, we show that consumers who use stylus pen actively have more tendency to choose again the same device series in their next purchase. The researchers claim that is because the consumers' attachment as the emotional tie to their devices resulted from stylus pen use role for it as the primary variables. As the structural equation model with the stylus pen as a moderate variable and the attachment as a mediation variable we represent the research model where those relationships exist effectively. Digital artifact developers have struggled in selecting new features to their new products. Therefore, the model in the paper can help them to evaluate whether a feature strengthen the repurchase intent or not. That is, the model would be applied to the model planning as a new product development strategy.

However, there are limitations in the paper. First of all, the survey samples were Koreans in Korea. All responses and effect to stylus pen are from Korean and Korean language. To generalize our findings, we need to do the cross-cultural survey and compare the results. For example, Chinese characters are closer to ideogram, so drawing character with pen is more valuable in comparison with the other language area. The experiences to stylus in this area must be different with other linguistic culture. Secondly, the researchers target at possessors of a smartphone model to observe the stylus pen effect. Actually, the loyalty for a smartphone is composed of various features including high resolution LCD, high performance CPU, beautiful user interface. The attachment for the model could be influenced by other factors aside from stylus pen. To evaluate the effect of stylus pen, we had better restrict the smartphone consumers as the one commercial series model. To generalize the research results to the material stylus pen, we should expand the participants of survey to various device models users. Now and different there will be more commodities equipped stylus pen. Lastly, some cases of consumer attachment to the belongings are formed over decades. People say a smartphone is just ten-year old, since it first appeared around 2007. Therefore,

if another attachment research is conducted with longer time gap, it may come out with different findings. It is also useful to repeat this study with four- or five-year interval.

References

Arif, A., & Sylla, C. (2013), A comparative evaluation of touch and pen gestures for adult and child users. In *Proceedings of the 12th International Conference on Interaction Design and Children* (New York, NY, USA, Jun 24-27), 392-395.

Ball, D. & Tasaki, L. (1992), The role and measurement of attachment in consumer behavior. *Journal of Consumer Psychology,* 1(2), 155-173.

Bansal, H., Taylor, S., & James, Y. (2005), Migrating to new service providers: Toward a unifying framework of consumers' switching behaviors. *Journal of the Academy of Marketing Science,* 33(1), 96-115.

Baron, R., & Kenny, D. (1986), The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, 51(6), 1173.

Belk, R. (2013), An extended self in a digital world. *Journal of Consumer Research,* 40(3), 477-500.

Benjamin, P., & Gaskin, J. (2014), Partial least squares structural equation modeling for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transaction on professional communication,* 57(2), 123-146.

Blevis, E., Lim, Y., & Stolterman, E. (2006), Regarding software as a material of design. In *Design Research Society International Conference.*

Boehner, K., DePaula, R., Dourish, P., & Sengers, P. (2007), How emotion is made and measured? *International Journal of Human-Computer Studies,* 65(4), 275-291.

Burnham, T., Frels, J., & Mahajan, V. (2003), Consumer switching costs: A typology, antecedents, and consequences. *Journal of the Academy of Marketing Science,* 31(2), 109-126.

Cox, D. Saliagas, & Locander, W. (1987), Product novelty: does it moderate the relationship between ad attitudes and brand attitudes? *Journal of Advertising,* 16(3), 39-44.

Csikszentmihalyi, M., & Csikszentmihalyi, M. (1991), Flow: The psychology of optimal experience. New York: HarperPerennial.

Desmet, P., & Hekkert, P. (2007), Framework of product experience. *International Journal of Design,* 1(1), 57-66.

Fallman, D., & Waterworth, J. (2010), Capturing user experiences of mobile information technology with the repertory grid technique. *Human Technology,* 6(2), 250-268.

Feinberg, M. (2013), Beyond digital and physical objects: The intellectual work as a concept of interest for HCI. *CHI'13(April 27-May 2)*, Paris, France.

Golsteijn, C., Van, den Hoven, Frohlich, D., & Sellen, A. (2012), Towards a more cherish-able digital object. In *Proceedings of the Designing Interactive Systems Conference*, ACM, 655-664.

Gross, M. (2012), The evolution of writing. *Current Biology,* 22(23), R981-R984.

Hassenzahl, M., Diefenbach, S., & Goritz, A. (2010), Needs, affect, and interactive products – Facets of user experience. *Interacting with Computers,* 22, 353-361.

Hassenzahl, M., Platz, A., Burmester, M., & Lehner, K. (2000), Hedonic and ergonomic quality aspects determine a software's appeal. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems,* 201-208.

Head, M., & Ziolkowski, N. (2012), Understanding student attitudes of mobile phone features: Rethinking adoption through conjoint, cluster and SEM analyses. *Computers in Human Behavior,* 28, 2331-2339.

Hellier, P., Geursen, G., Carr, R., & Richard, J. (2003), Customer repurchase intention: a general structural equation model. *European journal of marketing,* 37(11/12), 1762-1800.

Hinckley, K., Yatani, K., Pahud, M., Coddington, N., Rodenhouse, J., Wilson, A., Benko, H., & Buxton, B. (2010), Pen + touch = new tools. In *Proceedings of the 23nd annual ACM symposium on User interface software and technology,* ACM, 27-36.

Hirschman, E. C., & Holbrook, M. B. (1982), Hedonic consumption: Emerging concepts, methods and propositions. *Journal of Marketing,* 46, 92-101.

Holbrook, M. B., & Hirschman, E. C. (1982), The experiential aspects of consumption: Consumer fantasies and feelings and fun. *Journal of Consumer Research,* 9, 132-140.

Jung, H., Blevis, E., & Stolterman, E. (2010), Conceptualizations of the materiality of digital artifacts and their implications for sustainable interaction design. In *Proceedings of Design Research Society International Conference*, Montreal, Canada.

Kenney, M., & Bryan, P. (2011), Structuring the smartphone industry: is the mobile internet OS platform the key? *Journal of Industry, Competition and Trade***,** 11(3), 239-261.

Kim, Y-B., Kim, J-B., & Lee, S-H. (2015), Digital pen effects on the product attachment and retention intent for smartphone consumer. *Journal of Consumer Studies (Korean ed.),* 26(6), 1-23.

Kim, Y-B., Lee, S-H., & Kim, J-B. (2010), Market neutrality requiring for application marketplace openness based on two-sided market theory. *International Journal of Information Processing and Management,* 4(7), 155-162.

Kleine, S., & Baker, S. (2004), An integrative review of material possession attachment. *Academy of Marketing Science Review,* 1-39.

Marshall, M., & Scharff, L. (2009), Rewriting history: Historical research with the digital pen. *Institute for Information Technology Applications, TR-09-3*, US Air Force Academy, Colorado.

Mugge, R., Schifferstein, H., & Schoormans, J. (2010), Product attachment and satisfaction: understanding consumers' post-purchase behavior. *Journal of Consumer Marketing,* 27(3), 271-282.

Nagengast, L., Evanschitzky, H., Blut, M., & Rudolph, T. (2014), New insights in the moderating effect of switching costs on the satisfaction–repurchase behavior link. *Journal of Retailing,* 90(3), 408-427.

Odom, W., Pierce, J., Stolterman, E., & Blevis, E. (2009), Understanding why we preserve some things and discard others in the context of interaction design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 1053-1062.

Park, E., Kim, K., & del Pobil, A. (2012), The effects of multimodal feedback and gender on task performance of stylus pen users. *International Journal of Advanced Robotic Systems,* 9(1), 30.

Park, C., MacInnis, D., Priester, J., Eisingerich, A., & Iacobucci, D. (2010), Brand attachment and brand attitude strength: Conceptual and empirical differentiation of two critical brand equity drivers. *Journal of Marketing,* 74(6), 1-17.

Preacher, K., Rucker, D., & Hayes, A. (2007), Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate behavioral research,* 42(1), 185-227.

Qi, Y., & Fu, C. (2011), The effects of flow and attachment on the e-loyalty of SNS websites. *Management and Service Science International Conference,* 1-6.

Read, W., McQuilken, L., & Robertson, N. (2010), A novel romance: conceptualizing emotional attachment as a barrier to adoption. *Doing more with less: Proceedings of the 2010 Australian and New Zealand Marketing Academy Conference,* 2010

Read, W., Robertson, N., & McQuilken, L. (2011), A novel romance: The technology acceptance model with emotional attachment. *Australasian Marketing Journal,* 19, 223-229.

Schifferstein, H., & Zwartkruis-Pelgrim, E. (2008), Consumer-product attachment: Measurement and design implications. *International Journal of Design,* 2(3), 1-14.

Tatikonda, M., & Rosenthal, S. (2000), Technology novelty, project complexity, and product development project execution success: A deeper look at task uncertainty in product innovation. *IEEE Transactions on Engineering Management,* 47(1), 74-87.

Thaler, R. (1985), Mental accounting and consumer choice. *Marketing science,* 4(3), 199-214.

Thompson, D.V., Hamilton, R.W., & Rust, R.T. (2005), Feature fatigue: When product capabilities become too much of a good thing. *Journal of Marketing Research,* 42, 431-442.

Thompson, D.V., & Norton, M.I. (2011), The Social utility of feature creep. *Journal of Marketing Research,* 48, 555-565.

Thomson, M., MacInnis, D., & Park, C. (2005), The ties that bind: Measuring the strength of consumers' emotional attachments to brands. *Journal of Consumer Psychology,* 15(1), 77-91.

Turner, P., & Turner, S. (2012), Emotional and aesthetic attachment to digital artefacts. *Cognition, Technology & Work,* 15, 403-414.

Verbeek, P-P. (2011), Moralizing technology: Understanding and designing the morality of things. University of Chicago press.

Zabramski, S., Gkouskos, D., & Lind, M. (2011), A comparative evaluation of mouse, pen- and touch-input in computerized version of the Torrance tests of creative thinking. In *DESIRE'11 Conference-Creativity and Innovation in Design* (19-21 October, Eindhoven, Netherlands), ACM, 383-386.