The Effects of Perceived Interactivity on Intention of Continuous Use of Smartwatches

A New Perspective on the Mediating Roles of Cognitive and Affective Trusts

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The Effects of Perceived Interactivity on Intention of Continuous Use of Smartwatches : A New Perspective on the Mediating Roles of Cognitive and Affective Trusts

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… Abstract …

The study aims to offer empirically tested findings of users' trust in smartwatches in the context of IoT. The study (1) analyzes the causal relationship between perceived interactivity of a smartwatch and intention of continuous use, (2) examines cognitive and affective trust perceptions as the underlying mechanisms for mediating this relationship, (3) investigates affective trust as a resulting variable of cognitive trust. The result of analysis implies that not only direct effects but also indirect effects are significant in a series of causal relationships from perceived interactivity to intention of continuous use through cognitive and affective trusts. The analysis result also indicates that cognitive and affective trusts play key roles as mediators between perceived interactivity and intention of continuous use. In addition, the analysis result shows that cognitive trust affects affective trust.

Key words: Internet of Things, Smartwatch, Interactivity, Cognitive Trust, Affective Trust, Intention of Continuous Use

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Ⅰ. Introduction

The Fourth Industrial Revolution is one of the most popular terms in recent years. Like the previous revolutions, the Fourth Industrial Revolution has been introducing breathtaking technologies. It is characterized by a fusion of emerging technologies including artificial intelligence(AI), robotics, Internet of Things (IoT), and autonomous vehicles. We stand at the forefront of the technological revolution that will fundamentally change our lives, our works, and our relationships with others (Schwab, 2015). The change is unlike anything we have experienced before in its scale and scope. The speed of the revolution has also no historical precedent, compared with previous industrial revolutions(Schwab, 2016).

With the rising popularity of IoT, more customers are enjoying personalized, autonomous, and optimized services provided by smart and connected devices(Hwang et al., 2017; Wu et al., 2017). Compared to the traditional devices, smart devices are more proactive, responsive, interactive, user-friendly, and professional, and are easier to be perceived as being humanlike rather than a cold machine(Aggarwal and McGill, 2012; Wu et al., 2017). Especially, the consumer IoT such as smartwatches is permeated into our lives and enables us to communicate with other people and devices.

This study aims to offer empirically tested findings of users' trust in smartwatches in the context of IoT. The contribution of the study is twofold. First, it offers empirically tested understanding of the relationship of cognitive and affective trust dimensions. Second, the findings may help smartwatch producers understand how users' cognitive trust affects their affective trust in smartwatches and reflect the understanding on developing more appealing features of smartwatches. The model tested in this research integrates knowledge gained from studying perceived interactivity, cognitive trust, affective trust and intention of continuous use of smartwatches. The study examines the mediating roles of cognitive and affective trusts within the context of IoT.

This study conducted research on a smartwatch, which is one of the most typical IoT device. A smartwatch has various functions such as fitness tracking, healthcare monitoring, paying without a credit card, checking the weather conditions, receiving and sending messages, controlling home appliances, listening to music and many other functions. This study focuses on the fact that smartwatch users are now increasingly recognizing smartwatches as companions, rather than as tools, when the users continue to use them. Such a change in recognizing objects has already been described by Actor Network Theory(ANT). ANT has become one of the widely used theories as an increasing number of IS researchers have been interested in AI in recent years. With the advent of ANT, researchers began to theorize nonhuman agency to understand human capacities and human-nonhuman dependencies. From the perspective of ANT, human agency is not the collection of specific qualities and characteristics, but a diversified profile defined by its relationship with the environment (Latour, 2005; Neff and Nagy, 2016). In ANT, the actor is described as an active entity. The actor can be a human being, nonhuman systems like smartwatches and even an intangible element such as an idea or a situation. This study focuses on the role of affective trust in addition to cognitive trust(Chua et al., 2008) when using IoT devices such as smartwatches from the ANT point of view(Latour, 2005). Affective trust is expected to show its importance in recognizing IoT devices and to guide the designers to consider the affective aspects of the devices.

This study will be focusing on an IoT environment and use smartwatches as a representative of IoT devices. The purposes of the study are (1) to analyze the causal relationship between perceived interactivity of a smartwatch and intention of continuous use, (2) to examine cognitive and affective trusts as the underlying mechanisms for mediating this relationship, and (3) to investigate the relationship between cognitive trust and affective trust in smartwatch. Through the studies, the mediating roles of cognitive and affective trusts will be reinforced, contributing both theoretically and practically. The remainder of the paper proceeds as follows. The next section describes theoretical background and drives hypotheses for the study. The third section presents the research model and methodology used to empirically test the research hypotheses and examines the results of data analyses. The fourth section discusses research implications for the major findings, contributions and limitations.

II. Theoretical Background and Hypotheses

2.1 Perceived Interactivity

Interactivity is the quality or condition of interaction in a given environment. Interactivity can occur with several different types of communications; human to human, human to machine, and machine to machine. Interactivity is an important concept that has been actively studied for a long time in the field of advertising, marketing, and communication. Interactivity is a complex concept consisting of various dimensionalities (Javornik, 2016). The meaning of perceived interactivity varies depending on the situation and the subject, so the conceptual definition varies and each study has different sub-concepts(Hoffman and Novak, 1996; McMillan and Hwang, 2002; Johnson et al., 2006; Yi, 2015).

A variety of definitions of perceived interactivity exist in the literature. These definitions focus on mainly three aspects of perceived interactivity: two-way communication, responsiveness, and control (Liu, 2003). Liu and Shrum(2002) defined perceived interactivity as “the degree to which two or more communication parties can act on each other, on the communication medium, and on the messages and the degree to which such influences are synchronized.” They proposed three dimensions of interactivity: active control, two-way communication, and synchronicity. Song and Zinkhan(2008) figured out the determinants that enhance user perceptions of interactivity under a situation in which users chatted with an e-store. They used three dimensions accepted by McMillan and Hwang(2002) and Liu(2003): (1) control (internally based efficacy), (2) responsiveness, and (3) two-way communication.

Johnson et al.(2006) suggested four different aspects of interactivity: reciprocity, responsiveness, speed of response, and nonverbal information. Reciprocity is the most basic concept of perceived interactivity, which means how much interaction is possible with the system from the user's point of view. In other words, bidirectional communication is the basic condition of interactivity(Kim, 2012). The interactivity should be two-way interaction of information and the exchange of information should closely relate to one another(Liu, 2003). Liu and Shrum(2002) included two-way communication which is specified as the bi-directional flow of information. Speed of responsiveness is another basic concept of perceived interactivity. When communicating party sends information, the receiver should be able to get it fast enough(Liu, 2003). Liu and Shrum(2002) included synchronicity which means the speed of interaction. Speed of response is determined by the speed of delivery and the concurrency of delivery, meaning that multiple interactions can occur simultaneously (Kim, 2012). For example, The speed of response of smartwatch depends on how efficiently smartwatch performs user requests.

Many of the interactivity researchers include control as the core component of the construct. Liu and Shrum(2002) included active control as core dimension of interactivity. They described active control as a user’s ability to voluntarily participate in and instrumentally influence communication. In an interactive communication, participants should be able to exercise control over the information exchanged. In the case of a mediated communication, participants should be able to exert control on the communication medium (Liu, 2003). In IoT environment, the mediated devices can be smartphones, smartwatches, AI speakers, or AI robots.

Interactivity was inherently suggested as a natural attribute of face-to-face communication (Rafaeli, 1988; Fan et al., 2017). However, in ubiquitous era, IoT devices mediate interactivity between people and devices. In the context of IoT, users are able to communicate with not only their partners but also IoT devices such as smartwatches. In this research, main focus is on the interactivity between users and smartwatches. Smartwatches as IoT devices are important media which enable interactive communication. Smartwatch users may have a new perspective on smartwatches by breaking away from human-centered thinking. In other words, it is natural for users to recognize smartwatches as actors like people rather than as simple tools, and to communicate with them emotionally. So, it is expected that as users perceive better interactivity, they form not only positive cognitive trust but also positive affective trust in smartwatches which in turn, leads to more intention of continuous use. Therefore, the following hypotheses were set.

H1: Perceived interactivity has a positive impact on cognitive trust.
H2: Perceived interactivity has a positive impact on affective trust.
H3: Perceived interactivity has a positive impact on intention of continuous use.

2.2 Trust

Trust has been the most important factor in social science. According to the definition of Hon and Grunig(1999), trust means the level of confidence that one has in the other and the level in which he is willing to disclose himself. Trust also means integrity, profession, dependency, and competence. Trust is a belief formed through long-term interactions among trading partners. Trust is not a mere input to form a transactional relationship between partners, but rather a leading factor for relationship formation, as well as a productive outcome of relationship formation(Johnston et al., 2004). According to Fukuyama(1995), trust is related not only to organizational cooperation, but also to traditional virtues, such as honesty, commitment, and reciprocity. Trust can be strengthened through frequent face-to-face contact and sharing of critical information(Bensaou, 1999). Trust can be categorized into cognitive and affective dimensions, according to whether the attribute of trust is either rational or emotional in nature(Hansen et al., 2002; Scott, 2000).

2.2.1 Cognitive trust

Many trust researchers defined cognitive trust as a rational view of trust and included some of the subconcepts of competence, integrity, ability, responsibility, credibility, reliability, and dependability(Scott, 2000; Chua et al., 2008; Hon and Lu, 2010). Cognitive trust is more objective than affective trust in nature and is grounded on a rational process that results in a judgment that an individual or group is trustworthy(Hansen et al., 2002). Cognitive trust involves a calculative and instrumental assessment(Chua et al., 2008). In interpersonal relationships, cognitive trust in competence and functionality means trust in the ability to achieve an outcome. Komiak and Benbasat(2004) distinguish cognitive trust in competence from cognitive trust in integrity and cognitive trust in benevolence because there are significant differences in meanings among competence, integrity, and benevolence. In the context of IoT, cognitive trust in competence refers to the ability of smart devices to conduct tasks successfully. Cognitive trust in reliability means whether smart device can be reliable on conducting tasks. Cognitive trust in integrity means procedural fairness which refers to the notion of information integrity and users' perception that information will not be changed without notice(Harwood and Garry, 2017).

2.2.2 Affective trust

Many trust researchers defined affective trust as an emotional view of trust and included some of the subconcepts of care, concern, benevolence, altruism, a sense of personal obligation, commitment, mutual respect, empathy, rapport, and self-disclosure(Scott, 2000; Chua et al., 2008; Hon and Lu, 2010). Affective trust is more subjective than cognitive trust in nature and is grounded on the feelings, emotions or moods that one has concerning perceived trustworthiness of its partner(Hansen et al., 2002). Affective trust comes from the feeling of having trust in another person and is associated with mutual interpersonal relations of care(Hon and Lu, 2010). Affective trust is based on emotion and is characterized by the sense of security felt in the relationship(McAllister, 1995). Komiak and Benbasat(2004) acknowledged that emotional trust is not the synonym of affective trust. They defined emotional trust as the extent to which one feels secure and comfortable about relying on the other.

2.2.3 The relationship between cognitive trust and affective trust

In general, there is a bidirectional causal relationship between cognition and emotion. Cognitive and affective trusts are interchangeable in their relationships(Kujala et al., 2016). Komiak and Benbasat(2004) conceptualize trust as a combination of cognitive and emotional trusts which are related to reasoning and feeling, respectively. The cognitive dimension of human mind captures how people evaluate and judge things based on facts and evidence(Chua et al, 2008). The mutual causal relationship applies to the relationship between cognitive and affective trusts. Cognitive dimension connotes the direct and conscious process based on reason and evidence, which is called referring to head. Affective dimension captures how people feel about a thing based on emotion and feeling, which is called referring to heart(Chua et al., 2008; Lee et al., 2015). Some of previous studies did not specify the relationship between cognitive and affective trusts(Zhao et al., 2013; Miao et al., 2014). However, most of the previous studies indicated that cognitive trust is a precursor of affective trust(Johnson and Grayson, 2005; Schaubroeck et al., 2011; Huang, 2015; Wang et al., 2016; Jiang et al., 2017). This study analyzes the role of cognitive trust as a precursor of affective trust. This study also analyzes cognitive and affective trusts as the underlying mechanisms for mediating the relationship between perceived interactivity and intention of continuous use. Therefore, the following hypotheses were set.

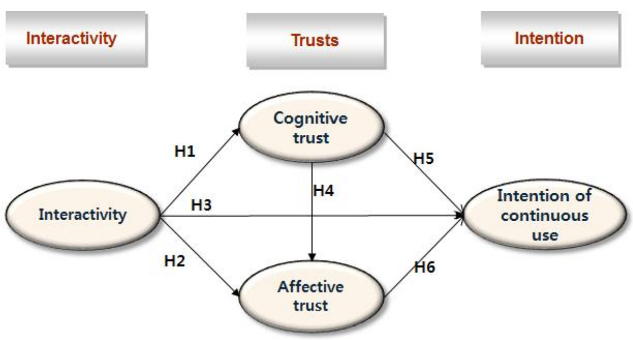
H4: Cognitive trust has a positive impact on affective trust.
H5: Cognitive trust has a positive impact on intention of continuous use.
H6: Affective trust has a positive impact on intention of continuous use.

III. Research Model and Hypothesis Testing

3.1 Research Model

Research questions addressed in this paper are: (1) how will users' perceived interactivity with smartwatches influence intention of continuous use? (2) is it appropriate to take into account any emotional feeling like users' affective trust in smartwatch? (3) what is the relationship between cognitive trust and affective trust in smartwatch? (4) how do cognitive and affective trusts work as the underlying mechanisms for mediating the relationship?

A structured questionnaire was designed to empirically analyze the relationship among perceived interactivity, cognitive and affective trusts, and intention of continuous use. Amazon's Mechanical turk(MTurk) was used to collect a total of 303 responses in 2018. Among them, 270 responses were used in the subsequent analyses after removing 33 invalid responses. Respondents' residential area was confined to the United States. Recently, MTurk has been gaining popularity in experimental and survey-based social science research(Huff and Tingley, 2015). MTurk is one of the largest micro-crowdsourcing markets, which is widely used in both industrial and academic research. In the online survey, a short introduction of the study, explanation of IoT and some functions of smartwatch are provided first in order for the respondents to engage in the survey. This method is also intended to overcome the greatest disadvantages of the retrospective type survey. In the survey, the respondents are asked to rate how they think about their smartwatches regarding two-way interaction with it, how they believe in them cognitively



<Figure 1> Proposed Model

<Table 1> Characteristics of Respondents

Characteristics		Responses	%
Gender	Male	181	67.0
	Female	89	33.0
Age	10s	1	.4
	20s	116	43.0
	30s	98	36.3
	40s	32	11.9
	50s	14	5.2
	60s or more	9	3.3
Educational level	high school or low	10	3.7
	some college	59	21.9
	4 year college graduates	151	55.9
	postgraduates	50	18.5
Period of use	6 months or less	31	11.5
	6– less than 12 months	99	36.7
	1 - less than 2 years	87	32.2
	2 years or more	53	19.6
Total		270	100

and affectively and their intention of continuous use. Seven point Likert scales anchored at 1(strongly disagree) and 7(strongly agree). The demographic characteristics of the respondents are summarized in <Table 1>.

3.2 Scale Development and Item Generation

A multi-step approach was used to specify the domains of the constructs of the research model and generate an initial pool of questionnaire items designed to measure them. The constructs include users' perceived interactivity, cognitive trust, and affective trust in smartwatches and users' intention of continuous use. First, the operational concepts of the constructs were defined based on the extensive literature review. Second, in-depth interviews with 9 people were conducted to identify, evaluate, and purify the operational definitions and potential questionnaire items. Four constructs were measured in this study: perceived interactivity, cognitive trust, affective trust, and intention of continuous use. Constructs were measured using multiple-item scales drawn from validated measures in previous research. <Table 2> provides operational definitions for these constructs.

<Table 2> Operational Definitions of Constructs

Constructs	Operational definitions
Perceived interactivity	The extent to which a user believes that a smartwatch facilitates two-way communication
Cognitive trust	The extent to which a user believes his/her smartwatch in terms of competence, ability, and reliability of the smartwatch
Affective trust	The extent to which a user has positive feelings or emotions about his/her smartwatch for decision making
Intention of continuous use	A user's intention to continuously use the smartwatch and service currently being used

As shown in <Table 3>, perceived interactivity was measured using the five-item instrument. Cognitive and affective trusts were measured three and four items, respectively. The six measures of intention of continuous use were used with minor adaptations of the previous studies. Intention of continuous use was measured using 6 items adapted from the scales by Hong et al.(2017), Choi et al.(2018), and Dehghani et al.(2018). The items, Intn 1 and 5, measured how frequently respondents are willing to use smartwatch. The second and

<Table 3> Questionnaire Items and References

Factors	Name	Items	References
Perceived interactivity	Inter1	The smartwatch facilitates concurrent communication.	McMillan and Hwang, 2002 Song and Zinkhan, 2008 Jiang et al., 2010 Fan et al., 2017
	Inter2	The smartwatch facilitates interactive conversation.	
	Inter3	The smartwatch is effective in communicating with others.	
	Inter4	The smartwatch is efficient in communicating with others.	
	Inter5	The smartwatch is efficient in sharing information with others.	
Cognitive trust	Cog1	I believe the smartwatch would correctly use the information I would provide to it.	McAllister, 1995 Zur et al., 2012 Harwood and Garry, 2017
	Cog2	I believe the smartwatch is competent in providing information.	
	Cog3	I believe the smartwatch is proficient in providing information.	
Affective trust	Aff1	I feel secure about relying on the smartwatch for my decision.	McAllister, 1995 Komiak and Benbasat, 2006 Zur et al., 2012 Zhao et al., 2013
	Aff2	I feel content about relying on the smartwatch for my decision.	
	Aff3	I find the smartwatch suitable to my style of decision making.	
	Aff4	I like using the smartwatch for decision making.	
Intention of continuous use	Intn1	I will frequently use a smartwatch in the future.	Shin et al., 2013 Kim and Shin, 2015 Hong et al., 2017 Oh et al., 2017 Dehghani et al., 2018
	Intn2	I would like to continue using new generation of a smartwatch.	
	Intn3	I intend to continue using a smartwatch rather than discontinue its use.	
	Intn4	I will take advantage of the many features of a smartwatch.	
	Intn5	I will try to use a smartwatch in my daily life.	
	Intn6	I intend to buy it again if I lose my smartwatch.	

<Table 4> Convergent and Discriminant Validities of Measurement Model

Factors	Variables	Factor Loadings	Response		Composite Reliability	AVE	Reliability
			Mean	STD			
Perceived interactivity	Inter1	.739	5.72	1.071	.815	.471	.837
	Inter2	.838	5.76	1.155			
	Inter3	.757	5.73	1.153			
	Inter4	.611	5.74	1.081			
	Inter5	.614	5.83	1.040			
Cognitive trust	Cog1	.689	5.53	1.040	.753	.504	.745
	Cog2	.732	5.66	.950			
	Cog3	.692	5.73	.960			
Affective trust	Aff1	.775	5.23	1.252	.828	.546	.871
	Aff2	.765	5.48	1.172			
	Aff3	.779	5.56	1.118			
	Aff4	.858	5.43	1.258			
Intention of continuous use	Intn1	.728	5.82	.953	.875	.540	.875
	Intn2	.707	5.79	1.006			
	Intn3	.665	5.87	1.009			
	Intn4	.753	5.82	1.091			
	Intn5	.788	5.99	.952			
	Intn6	.776	5.91	1.047			

fourth items, Intn 2 and 4, measured respondents' intention to continue to use the new generation and features of smartwatch. The third item, Intn 3, measured respondents' intention as opposed to discontinuing their use. The last item, Intn 6, measured their intention to buy it when they lose it.

This study is one of the earliest to examine a theoretical model of causal relationship between user interactivity with a smartwatch and intention of continuous use, that takes into account mediating roles of cognitive and affective trusts. The proposed model is based on expectation-confirmation theory(ECT). ECT is widely used in various literatures to study users' intention of continuous use and repeated purchase decisions(Bhattacherjee, 2001).

3.3 Measurement Model

SPSS V20 and AMOS V20 were used to analyze the response data obtained from the survey through the two-step approach to the structural equation modeling. In order to secure the single dimensionality of the factors,

<Table 5> Fit Indices for Measurement Model

χ^2	df	p	CMIN/DF	GFI	AGFI	RMR	RMSEA	NFI	CFI	IFI
263.571	129	.000	2.043	.906	.875	.050	.062	.895	.943	.944

<Table 6> Correlations for Factors in Measurement Model(* $\sqrt{AVE}$)

Factors	Correlations			
	Interactivity	Cognitive trust	Affective trust	Intention of continuous use
Perceived interactivity	.687*			
Cognitive trust	.618	.710*		
Affective trust	.580	.640	.739*	
Intention of continuous use	.636	.639	.599	.735*

confirmatory factor analysis was performed to remove some questionnaire items to obtain appropriate model fit. Then, all the factors with single dimensionality were connected to analyze the measurement model. <Table 4> summarizes the factor loadings, response mean and standard deviation, composite reliability (CR), average variance extracted(AVE) value, and reliability for each factor. In the initial model, 26 questionnaires items were included and eight items with low squared multiple correlations or high covariance with other items were eliminated. The items that were removed were 2 items of perceived interactivity, 3 items of cognitive trust, 2 items of affective trust, 1 item of intention of continuous use. As shown in <Table 5>, the $\chi 2$ value is not adequate, but the absolute fit indices such as GFI=.906, AGFI=.875, RMR=.050, and RMSEA=.062, and incremental fit indices values such as NFI=.895, CFI=.943, and IFI=.944 are satisfactory.

Convergent validity and discriminant validity were examined. Factor loadings and composite reliability values of the questionnaire items were used to analyze the convergent validity. As shown in <Table 4>, all factor loadings, which are standardized regression coefficient values, exceed .6, and most of the composite reliability values exceed .8. In addition, most of the Cronbach alpha values are above .8, indicating that they have excellent internal consistency. To examine discriminant validity, the correlations between factors are compared with the AVE of the individual factors. <Table 6> presents the inter-construct correlations (below the diagonal) and the square roots of the AVE(on the diagonal) of the constructs. It shows that the shared variance among variables was less than the variances extracted by the constructs (Fornell and Larcker, 1981). The analysis result shows that discriminant validity is secured. On the other hand, the means of the responses to the questionnaire items are distributed between 5.2 and 6.0 on the 7 point Likert scale, which are pretty high and consistent. The standard deviations are distributed between .95 and 1.26. The response means of intention of continuous use show the highest level and the response means of affective trust show the lowest level. But there

<Table 7> Comparisons of Proposed and Alternative Research Models

Paths	Proposed Model			Alternative Model 1			Alternative Model 2			Hypothesis Testing
	계수	CR	P	계수	CR	P	계수	CR	P	
H1 : Perceived interactivity→Cognitive trust	.508	7.339	.000	.538	7.853	.000	.566	8.032	.000	Supported
H2 : Perceived interactivity→Affective trust	.307	3.495	.000	.289	3.050	.002	.632	8.279	.000	Supported
H3 : Perceived interactivity→Int. of con. use	.257	3.892	.000	removed			removed			Supported
H4 : Cognitive trust→Affective trust	.569	4.730	.000	.574	4.337	.000	removed			Supported
H5 : Cognitive trust →Int. of con. use	.288	3.043	.002	.493	5.040	.000	.472	5.923	.000	Supported
H6 : Affective trust →Int. of con. use	.171	2.676	.007	.220	3.272	.001	.268	4.971	.000	Supported

were no significant differences in terms of responses means and standard deviations.

3.4 Hypothesis Testing of Proposed Model

<Table 7> presents the standardized path coefficients, CR, and p values for each of the proposed and two alternative models and the test results for the hypotheses set for the proposed model. For the proposed model, all of the path coefficients were statistically significant and all the hypotheses were supported. As shown in <Table 8>, the fit indices for the proposed model are satisfactory. The absolute fit indices are GFI=.906, AGFI=.875, RMR=.050, and RMSEA=.062, and the incremental fit indices are NFI=.895, CFI=.943, and IFI=.944. In the measurement model and the proposal model, the questionnaire items Inter 4 and 5 show relatively low SMC(Squared Multiple Correlations) values, but these items were retained and included in the subsequent analyses to ensure the content validity of perceived interactivity.

It is found that all of the path coefficients connecting factors are significant. The path coefficient linking cognitive trust and affective trust was found to be strongest among the path coefficients of the research model. This implies that the result of the analysis supports the main focuses of the study. One of the main focuses of the study is the importance of users' cognitive and affective trusts in smartwatches. The analysis result implies that cognitive and affective trusts play key roles as mediators between perceived interactivity and intention

<Table 8> Fit Indices for Structural Models

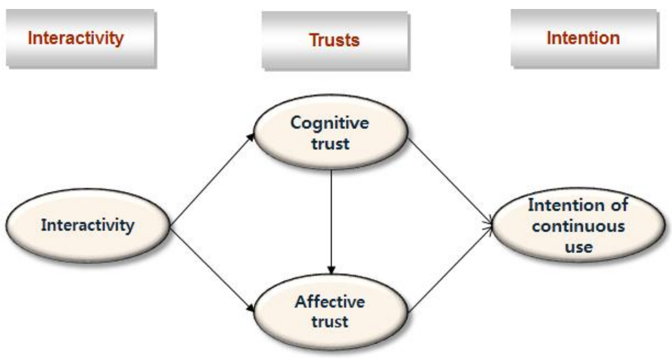
	χ^2	df	p	CMIN/DF	GFI	AGFI	RMR	RMSEA	NFI	CFI	IFI
Proposed	263.571	129	.000	2.043	.906	.875	.050	.062	.895	.943	.944
Alternative 1	278.777	130	.000	2.144	.901	.870	.061	.065	.889	.937	.938
Alternative 2	300.444	131	.000	2.293	.893	.860	.069	.069	.881	.928	.929

of continuous use. The other main focus is the causal relationships between cognitive trust and affective trust. The result of the analysis shows cognitive trust influences affective trust, which matches with the results of the previous researches.

3.5 Comparisons of Research Models

Two alternative models were examined to compare them with the proposed model. The first alternative model is similar to the proposed model except that the path connecting perceived interactivity to intention of continuous use is removed. As shown in <Table 7>, all the path coefficients are very significant and not much different from those in the proposed model except that the coefficient linking cognitive trust and intention of continuous use became stronger. As shown in <Table 8>, most of the fit indices are satisfactory. The absolute fit indices are GFI=.901, AGFI=.870, RMR=.061, RMSEA=.065, and the incremental fit indices are NFI=.889, CFI =.937, and IFI=.938.

The proposed model(Figure 1) and the first alternative model(Figure 2) consist of the same latent factors and measurement items, and the first alternative model is nested in the proposed model with one path removed. The proposed model has a χ^2 value of 263.571 with df=129, and the first alternative model has a χ^2 value of 278.777 with df=130. The difference between χ^2 values of the two models is 15.206 with df=1. This difference of χ^2 value is larger than the χ^2 value with df=1 of 3.84 at α=.05. This means that the proposed model is superior to the first alternative model in terms of fit. Another benefit of the proposed model is that the direct path from perceived interactivity to intention of continuous use is examined to be statistically significant, indicating that perceived interactivity influences on intention of continuous use not only directly but also through the mediators, cognitive and affective trusts. The SMC values for intention of continuous use, which is the final dependent factor, are 52.8% for the proposed model and



<Figure 2> Alternative Model 1

51.6% for the first alternative model.

In the second alternative model, the path connecting cognitive trust and affective trust was eliminated in addition to the elimination of the path in the alternative model 1 for comparison purposes. As a result of eliminating the two paths, all the paths became much stronger as shown in <Table 7>. However, the main focus of the study, the causal relationship between cognitive and affective trusts could not be examined. Most of the fit indices of the second alternative model are satisfactory, but the values became a little bit more weakened. The absolute fit indices are GFI=.893, AGFI=.860, RMR=.069, RMSEA=.069, and the incremental fit indices are NFI=.881, CFI=.928, and IFI=.929.

The second alternative model is nested in the proposed model with two paths removed. The second alternative model has a χ^2 value of 300.444 with df=131. The difference between χ^2 values of the two models is 36.873 with df=2. This difference of χ^2 value is much larger than the χ^2 value with df=2 of 5.99 at α =.05. This means that the proposed model is superior to the second alternative model in terms of fit. In addition, the SMC value for intention of continuous use, which is the final result factor, is 50.7% for the second alternative model which is the smallest among the three models. As a result, the proposed model turns out to be superior to the two alternative models in terms of fit and richer relationships among the constructs.

3.6 Indirect Effects of Proposed Model

The following indirect effects among the constructs were analyzed. : (1) The indirect effect of perceived interactivity on affective trust through cognitive trust, (2) The indirect effect of perceived interactivity on intention of continuous use through cognitive and affective trusts, (3) indirect effect of cognitive trust on intention of continuous use through affective trust. <Table 9> shows the path coefficients indicating the magnitudes of the indirect effects for the paths and their p values. The significance levels of the indirect effect were calculated using the bootstrapping technique. All the indirect effects in the proposed model are significant. The result implies that not only direct effects but also indirect effects are significant in a series of causal relationships from perceived interactivity to intention of continuous use through cognitive and affective trusts. In addition, it is important to note that the mediating roles of cognitive and affective

<Table 9> Indirect Effects for Proposed Model

Factors	Affective trust		Intention of continuous use	
	Coefficients	p value	Coefficients	p value
Perceived interactivity	.281	.001	.312	.004
Cognitive trust	–	–	.101	.014

trusts are both important.

IV. Conclusion

The Fourth Industrial Revolution not only changes the environment of human society, but also changes the perception and feelings about things. The Fourth Industrial Revolution is quite different from the three Industrial Revolutions that preceded it in that it challenges our ideas about what things mean to human beings(Schwab, 2016). It changes not only the format of communication, but also our concepts of things. This study is based on the fact that human beings will have affective trust as well as cognitive trust in IoT devices when interacting with them. Representative technologies of the Fourth Industrial Revolution era include AI and IoT. Among them, IoT is being rapidly commercialized and permeated into our lives. IoT has become the core of ubiquitous technology that has been popular for a long time, and the use of IoT equipped with AI is gradually becoming a part of our daily lives.

The most important characteristic of IoT is hyperconnectivity among people, among people and objects, and among objects and objects. Hyperconnectivity enhances human convenience through effective and efficient sharing of information and ultimately plays a major role in human pursuit of happiness. Human beings must have a new perspective on the hyper-connected society by breaking away from human-centered thinking. In other words, it is natural for users to recognize IoT devices as actors like people rather than as simple tools, and to communicate with them emotionally.

The study aims to offer empirically tested findings of users' trust in smartwatches in the context of IoT. First, The study analyzed the causal relationship between perceived interactivity of smartwatches and intention of continuous use. Second, the study examined cognitive and affective trust perceptions as the underlying mechanisms for mediating this relationship. Third, the study investigated affective trust as a resulting variable of cognitive trust. The result of analysis implied that as users' perceived interactivity improves, their intention of continuous use increases. The analysis result also indicated that cognitive and affective trusts play key roles as mediators between perceived interactivity and intention of continuous use. In addition, the analysis result showed that cognitive trust affects on affective trust.

The contribution of this study is twofold. First, and from a theoretical perspective, it offers a conceptual foundation between cognitive trust and affective trust in the context of using smartwatches. This study shows the empirical evidence that smartwatch users are now increasingly recognizing smartwatches as companions and tend to have emotional interactions with them. Second, and from a pragmatic perspective, it is expected that the result of the study guides the producers to consider the design of IoT devices so that users can feel affective trust in addition to cognitive trust. There will be increasing need in the future where people may want diversity and high sense of emotion to increase their attachment to the IoT devices.

The limitations of this study and future research directions are as follows. First, the simplicity of research model was secured by using perceived interactivity as an integrative construct. In future studies, however, it will be necessary to examine the impact of the detailed dimensions of perceived interactivity such as responsiveness, control, and communication modes. Especially, in the context of IoT, It is important to analyze the effects of perceived interactivity through various communication modes. Communication modes are channels in which information is exchanged and include visual, auditory, and tactile senses. In the past, text-based information was mainly exchanged in communication, but information in various modes can be exchanged by the recent development of information communication technology(Kim, 2012). Second, it is necessary to try to obtain more sophisticated research results by analyzing the moderating effects of user characteristics for a series of causal relationships of the research model. Some limitations regarding the study result from the sample used in the analysis. As with other types of survey, there is always the question whether the respondents pay attention. Another limitation of using the Mturk is its voluntary labor pools who are motivated mainly by financial benefits.

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