# Smart TV as a Social Platform

**Dong-Hee Shin** dshin@skku.edu
**Taeyang Kim** sunneverstop@hanmail.net

**Department of Interaction Science, Sungkyunkwan University**

## Abstract

With the conceptual model of interactivity, this study empirically investigates the effects of perceived interactivity on the motivations and attitudes toward Smart TV in Korea. A model is created to validate the relationship of perceived interactivity to performance, attitude, and intention. Further, the model examines the mediating roles of perceived interactivity in the effect of performance on attitude toward Smart TV. Empirical evidence supports the mediating role of perceived interactivity. Implications of the findings are discussed in terms of building a theory of interactivity and providing practical insights into developing a user-centered Smart TV interface.

*Keywords:* Smart TV, social interaction, moderating effects, TAM, TRA

## Introduction

Smart TV (STV), a television set with integrated interactive Internet capabilities, is being rapidly developed around the world. The rapid growth of high-speed broadband connections is enabling the creation of a smarter TV by delivering content directly to consumer devices in the living room. STVs have adapted the popularity of app stores for smartphones and brought them to living rooms. STVs enable viewers to not only navigate programs live, but also check online content such as news, weather forecasts, stock market information, maps and games. It will be capable of television-commerce, Internet browsing, twitting, online social networking, chat, and other things. STVs present new opportunities to consumer electronics manufacturers for product differentiation and value creation through user-driven product innovation. Media companies will be afforded a direct path to consumers, delivering more choices and new types of content in an on-demand, personalized service.

With all the progressive movement, it is expected that the era of STVs will come at a much faster rate than had been expected, following the success of the smartphone era. STVs will be at the heart of all electronics goods and communications devices used in homes. Others even predict that the time for STVs will come within one or two years. These positive predictions argue that STVs will become a so-called hub at home by connecting computers and telephones in homes and automating electricity, tap water, home security and other home entertainment systems. For example, people will check their doorbell security cameras through smart TVs while seeing doctors offering a ubiquitous health system. Along with STVs, smartphones will keep evolving, serving complementary functions in those smart homes. Because smartphones will be connected with STVs, users will be able to be check what is going on in their houses even when they are out.

However, with all of the hype over STVs, a question is whether marketers really know how consumers truly feel about STVs. As with many rollouts, a key problem is that STV is still primitive. STVs in the average household are probably years away. One factor slowing the adoption of STVs is the fact that content is scarce and service is limited. This is consonant with Cesar and Chorianopoulos' study [1], which examined interactive TV and gave explanation on why the full potential of interactive TV has not yet been realized. They examined how viewers interact with TV content and argued that three factors (content editing, content sharing and content control) are important in the success of interactive TV. The current problem of STV is lack of content and thus customers have rare opportunity to edit, share, and control contents. Because of the low interactive features, customer apathy seems to be increased.

Shin, D.-H., & Kim, T. (2013). Smart TV as a social platform. *iConference 2013 Proceedings* (pp. 673-681). doi:10.9776/13314

Consumers are not so exciting about another form of technology that will come and go within a few years. Consumers have seen so many technologies and so many rosy promises come and go over a decade. They still clearly remember the advent of similar technologies which ended up a total failure such as Web TV, TiVo, and television commerce (t-commerce). More recent technological innovations related to TVs include IPTV and 3DTV, which have yet to become widespread. Some consumers object to upgrading again to STV sets after recently upgrading to costly multimedia technology such as digital TV and 3DTV. Although pricing has not yet been revealed, incoming STVs are generally expected to be costly, partly due to various applications. While there is widespread enthusiasm for STVs, skeptics consider STVs to be a gimmick or, at best, an immature technology.

Despite rising concerns over user acceptance and marketability, STV viability issues have been addressed in only a few industry reports. While it is expected that STVs will likely succeed due to their interactive services, it is still unsure how the interactivity will play out in the diffusion of STVs. This study examines consumers' perceptions of STVs by proposing a research model that incorporates perceived interactivity (PI), perceived hedonic performance, and perceived utilitarian performance as enhancing constructs. For the methodology, the structural equation modeling approach, supported by AMOS software version 18, was applied to assess the empirical strength of the relationships in the integrated model. The findings should be of interest to both academics and industry. From a theoretical perspective, this study suggests a model to identify antecedents of user intention to accept STVs. The new model represents an improvement over previous technology acceptance research (like the Theory of Planned Behavior and the Technology Acceptance Model), because it integrates cognitive and behavioral attitudes as the primary factors of influence. These attitudes are driven by underlying beliefs and assessing the beliefs will improve STV forecasting. From a practical standpoint, the findings may be used to guide industry in selecting more effective strategies to attract STV consumers. The STV industry is facing the challenge of how to design STV services that are useful, valuable, enjoyable and most importantly, user-centered. However, interface designs and related elements are rarely examined in-depth in the specific context of *in-situ* user evaluations. By better understanding how motivational factors will impact adoption and consumer behavior, manufacturers, content providers, and programmers can obtain the insights they need to plan their STV strategies. The results of this study represent a set of guidelines to help STV industry and developers better understand how users develop their perceptions of STVs and how users contribute to ongoing adoption and usage. inception. So far, Samsung, the current leader in the 3DTV field, has sold 90 percent of all 3DTV sets in the market and is expected to sell 600,000 of them in the first six months of 2011.

## Definition and Current Trends

### The Evolution of Smart TV

STVs aim to focus on being easy, fun, and useful. The first products out of the gate will be equipped with a graphical user interface that will allow users quick and easy access to a variety of content and applications, many of the moves enabled just by a single click. STV manufacturers also focus on developing personalized applications in entertainment, games, lifestyles, education, news and information, which could be easily downloaded to television sets.

So far, STV has been rapidly developed by Korean technology giants like Samsung and LG Electronics. The two are vowing to take a leadership role in the STV market, which is the buzzword in consumer electronics. Both companies introduced their first model STVs equipped with network access for Web-connected televisions at the IFA trade fair in Berlin. STVs will provide an all-in-one device for data-handling television. However, the television makers lack in areas such as software capabilities and content delivery. As such, STV manufacturers are seeking partnerships with movie studios, entertainment companies and other content providers to reduce the gap, while also seeking to use their manufacturing prowess as an edge.

Although STV has made great strides technologically, it has still many obstacles to overcome, particularly usability. For example, user interfaces and form factors will face major changes — instead of being fixed in the center of the living room, they will be incorporated into mirrors, walls and ceilings to embody a layout-free concept. Since STV is in its infancy, it is difficult to predict just what the STV landscape will look like in the near future. One thing is clear though, STVs should focus on user-centered design to become a mainstream phenomenon. In this regard, this study focuses on user attitudes and

behaviors related to STVs with a focus on the role of PI and its relation to other factors of STV adoption and usage.

### User's Experience With STV

TAM was inspired by the TRA, which argued that both the attitude towards an action and the subjective norm have an impact on behavioral intention that, in turn, affects people's performance and action. TAM assumed that perceived usefulness (PU) and perceived ease of use (PEoU) were major influences on an individual's attitude toward using technology [2]. This study proposes an adaptation of the TAM that consists of social presence, perceived enjoyment (PE), perceived quality, and flow, along with the traditional components of TAM. Figure 1 presents the proposed Smart TV acceptance and use model. The utility of considering the TAM stems from the fact that 3DTV is technology-driven, as well as user-oriented. This model, based on the TRA, is well-suited to reflect the nature of Smart TV, because the model embodies the evolutionary progression of technology to become more agile, interactive, and easy-to-use. All the key drivers are defined and explained, and their relationships to acceptance of Smart TV are examined. Given the wide applicability of the TAM in emerging technologies, it is expected that the general causalities found in TAM are also applicable to Smart TV. In particular, the relationship between attitude and intention in IPTV (Internet Protocol TV) has been confirmed [3]. Thus, it is hypothesized that:

H1: Attitude toward STVs is positively related to the intention to use STVs.
H2: PI positively influences intention to use STVs.
H3: PI positively influences attitude toward STVs.
H4: PI positively influences perceived hedonic performance of STVs.
H5: PI positively influences perceived utilitarian performance of STVs.
H6: The higher utilitarian performance a user perceives of an STV, the more positive an attitude the user has about STVs.
H7: The higher hedonic performance a user perceives of an STV, the more positive an attitude the user has about STVs.

## Study Design

The survey method consisted of four phases. First, individual in-depth interviews were conducted with potential customers. Ten respondents were asked to explain their attitude and the experience of advanced TV such as 3DTV, HDTV and IPTV. Second, with the help of the STV manufacturers in Korea (Samsung), five focus groups of current and prospective users were organized, and group interviews were conducted in which groups of four to six individuals discussed how they currently use TV services and what factors would influence their use of STV services in the future. The goal of the individual interviews and focus group sessions was to test and validate the research model, to identify items missing from the model, and to gain a preliminary understanding of the factors that have an impact on usage behaviors.

Third, based on the focus group sessions, a final survey questionnaire was developed through several comment rounds of an expert panel consisting of professors, researchers, and STV experts. Prior to its use, the questionnaire was tested by administering a pilot survey among possible users who, in turn, provided a comprehensive review of individual responses to the pretest survey. Twenty undergraduate students participated, with tests given at three-week intervals. Prior to answering the questionnaire, they were strictly instructed to ask the experimenter any questions about questionnaire items that they did not understand. With these precautions, the possibility of participants filling out some questions without exactly understanding the content of those questions was eliminated. The wording of items was reviewed and modified by three marketing professors knowledgeable in quantitative research based on the pilot test outcomes.

The finalized survey was administered online. From July to October 2010, a web-based survey questionnaire was posted in the communities of several professional associations, and on blogs and forums devoted to smartphones, advanced TV services, HDTV, digital TV, interactive TV, and 3DTV. The survey included preliminary questions to ensure the respondents had a certain level of understanding of STV. Such questions, for example, include "Do you know about STV?" and "Have you used STV before?" A cover letter was attached to explain its purpose and to ensure confidentiality. By the time the survey ended, 1208 visitors had viewed it, and 342 questionnaires were submitted. Of the submitted

questionnaires, 13 were excluded because of incomplete answers, leaving 329 usable responses. Table 3 presents the sample demographics. The final sample reflects the general population interested in STVs. For the analysis of statistics, AMOS, a maximum likelihood-based SEM software, was used.

## Measurement Development

The variables in the model are well established in the HCI, Information System and Communications literature. Prior to further study, a pilot test for measures was conducted. The participants indicated their agreement with a set of statements using a 7-point Likert-type scale (ranging from “strongly disagree” to “strongly agree”) drawn from previously validated instruments. The final scales used in this study consisted of 24 items, all of which included three items for each variable.

## Pretests

A pretest was undertaken to examine the test-retest reliability and to construct reliability indices before conducting fieldwork. Thirty current and prospective users, who have interests and/or had had experiences with 3DTV and other similar services (e.g. HDTV, augmented reality TV, interactive TV, IPTV) participated in the two pretests at an interval of three weeks. After eliminating the measure items that failed in either the retest or the alpha test, Cronbach’s alpha was applied to identify poor item-to-total-correlation items. The alpha values ranged between 0.84 and 0.91, suggesting acceptable construct reliability. When theoretical models do not exist, these pretests are useful in the early stages of empirical analysis in cases for which the basic purpose is exploration.

## Data Analysis

**Measurement instrument.** The reliability and validity of the measurement instrument were evaluated with AMOS 18 using the reliability and convergent validity criteria. The reliability of the survey instrument was established by calculating Cronbach’s alpha to measure internal consistency. All values were above the recommended level of 0.7 [4]. The convergent and discriminant validity of the model were examined using the procedure suggested by Fornell and Larcker (1981), who recommend measuring the reliability of each measure and each construct, as well as the average variance extracted (AVE) for each construct. The reliability of each item was examined according to a principle components factor analysis. It shows the results of this analysis, with varimax rotation on the original 24 items (four items were eliminated due to low loading). According to Hair et al. (1995), measurement of items loads highly if the loading coefficient is above 0.6. This analysis showed that most items had factor loadings higher than 0.7, which Fornell and Larcker (1981) considered to be very significant. Each item loaded significantly on its underlying construct ($p<0.01$ in all cases). Therefore, all constructs in the model had adequate reliability and convergent validity.

To examine the discriminant validity, this study compared the shared variance between constructs with the average variance extracted from the individual constructs. The shared variance between constructs was lower than the average variance extracted from the individual constructs, confirming discriminant validity. In short, the measurement model demonstrated adequate reliability, convergent and discriminant validity. Content validity is a characteristic of items that are representative and drawn from established literature [4]. The variables in this study that were derived from the existing literature exhibited strong content validity. The wording used in the questionnaire appears similar, so that the responses can be highly inter-correlated. In addition, a correlation analysis of Pearson’s R (correlation coefficient) shows an acceptable level of correlation among variables.

**Structural model.** A test of the structural model was performed using the AMOS procedure, and a maximum likelihood-based SEM software was used. Table 2 shows the estimates from the structural modeling. The overall fit of the model is satisfactory, with all of the relevant goodness of fit indices greater than 0.90. The GFI is 0.95, the AGFI 0.91, and the TLI 0.91. Similarly, there is no evidence of misfit, with the RMSEA showing a very satisfactory level of 0.067, which favorably compares to the benchmarks by [5], who suggest that values of 0.06 or more reflect a close fit. The standardized RMR was also very good, at 0.027, well below the threshold for a good overall fit. Another positive test statistic was the normed chi-square value (a chi-square divided by degrees of freedom) of 1.98, a value that is appropriately below the benchmark of three, to indicate good overall model performance. Given a

satisfactory measurement of the model's fit to the data, the path coefficients of the structural model were assessed.

## Results

### Structural Paths and Hypothesis Tests

A test of the structural model was performed using AMOS software. Table 4 shows the estimates from structural modeling. The overall fit of the model is satisfactory, with all of the relevant goodness of fit indices greater than 0.90. Chi-square statistics show non-significance in the models, indicating that the two models fit the data adequately. The GFI is 0.95, the AGFI 0.91, and the TLI 0.91. Similarly, there is no evidence of misfit, with the RMSEA showing a very satisfactory level of 0.067, which favorably compares to the benchmarks by [6] who suggest that values of 0.06 or more reflect a close fit. The standardized RMR was also very good, at 0.027, well below the threshold for a good overall fit. Another positive test statistic was the normed chi-square value of 1.98, a value that is appropriately well below the benchmark of 3, indicating good overall model performance. Given a satisfactory measurement of the model's fit to the data, the path coefficients of the structural model were assessed.

To test the structural relationships, the hypothesized causal paths were estimated, and all seven hypotheses were supported. The results are reported and depicted in Table 5 and in Figure 3, respectively. The results support the proposed model well, confirming the key roles played by PI. All of the paths in the model are statistically significant. The results highlight the significant roles of PI in determining user attitudes toward STVs (β=0. 41, t=3.420, $p < 0.01$), supporting H3. PI also has a significant direct effect both on PUP and PHP, which influence attitude significantly (H6 & H7). Whereas PUP and PHP had strong effects on attitude (β=0.49, t=2.021, $p<0.01$; b =0.43, t=2.001), the effect of attitude on intention was moderate or weak at the most in this model (H1, β=0.24, t=3.120); probably because the users want to confirm their intention with other factors, probably PI. Consistent with this inference, PI showed the highest impact, supporting H2 (β=0. 65, t=4.981, $p < 0.001$). Approximately 58% of the variance in the intention of STVs was explained by the variables in the model ($R^2$=0.581). The $R^2$ of all endogenous constructs in the model exceeded 20%.

Overall, the model shows a pattern that highlights the importance of utility and hedonicity along with their antecedent, PI. However, the model also underplays the role of attitude, as compared with previous studies employing attitude. This implies that while the STV consumers might have a good attitude influenced by PUP and PHP, this does not automatically lead to intention. While consumers might cognitively perceive the excellent features of STVs well, they may not really intend to adopt or use it. They may want to personally ensure that the STV experience is a positive one and that programming is available. It may be inferred that there is a gap between attitude and intention in STVs. Psychological factors like interactivity can play a facilitating role between attitude and intention. This role has important implications in terms of theory and practice. Thus, further tests are necessary to uncover possible underlying effects.

Table 1
*Summary of the hypothesis tests*

| Hypothesis | Path coefficient (β) | t-value | Support |
|---|---|---|---|
| H1: Attitude →Intention | 0.23* | 3.120 | Yes |
| H2: PI → Intention | 0.65*** | 4.981 | Yes |
| H3: PI → Attitude | 0.41** | 3.420 | Yes |
| H4: PI →PHP | 0.40** | 2.001 | Yes |
| H5: PI→ PUP | 0.34* | 2.459 | Yes |
| H6: PUP → Attitude | 0.49** | 2.021 | Yes |
| H7: PHP→ Attitude | 0.43** | 2.001 | Yes |

* $p<0.05$; ** $p<0.01$

# Discussion

## Findings from the Research Model

The goal of the study was to empirically test the STV interaction model in order to explain the development of individual behavioral intentions to interact with STVs. The results add to our understanding of user attitudes and intentions in a new HCI paradigm to clarify the implications for the development of effective STV services. Overall, the findings represent an extension to previous work on design characteristics and interactivity by showing interactivity leading to utility and enjoyment as an antecedent and a mediator of positive attitude and intention. Thus, interactivity has a hedonic component, supporting work by Cyr et al. [7] and Van der Heijden [8].

Among the constructs, the effect of PI shows a much stronger impact on intention than previous studies have indicated. While this may be partly because this study emphasized the effect of PI, the unusually high impact of PI suggests that STV users are more influenced by the interactive features in their decision to accept STVs than conventional TV or other advanced TV services (e.g., augmented reality TV, HDTV, IPTV). This finding implies that STV is not only perceived as a TV device for entertainment, but as a multi-tasking social, educational, informational and commercial tool. STVs will be likely to evolve as a social platform that unifies all functions and features and enables users to connect with online communities through STVs. That is, it redefines how people engage and interact across any application on STVs.

This inference is well suited to the performance value in the model. Along with the highly significant result of PI, the effects of PHP and PUP also show a much stronger impact on attitude than previous studies have shown [9]. It may be inferred that there was some kind of effects between PI and PHP/PUP. Together with interactivity and performance, it might very well be that interactivity with the TV increases user perception of utility and hedonicity.

Just as previous studies have consistently shown the importance of usability in technology adoption, this study confirms the importance of usability and further clarifies that usability can be greatly influenced by utility and hedonicity. These findings pinpoint a need for STVs to provide viewers with quality content, as well as interactive services. Although the issue of quality has emerged as a major factor in STV development, to date the research on this issue is quite sparse, especially from the perspective of user perception on interactivity. The perception of technology quality by user is a major factor for achieving market breakthrough. While many studies indicate the important role of quality in user adoption, not many indicate to what the specific nature of quality refers. In other words, quality can vary depending on different technologies. The specific nature of quality should be clarified according to technology. This study finds that the quality in the STV context refers to interactivity and further clarifies the components of interactivity. Most importantly, this study shows how such interactivity is related to other factors with different roles.

It has been argued that the most significant potential of STVs is high quality and versatility. As people turn increasingly to STVs for various services they formerly got from other sources, their expectations for those services will change. Those changing expectations will undoubtedly have an impact on the development of future STVs as multimedia tools for games, commerce and entertainment. In this study, the user perception of performance shows a much stronger impact on intention than previous studies have indicated [10].

Interesting findings can be derived from the insignificant relation between attitude and intention. This weak link is consonant with the insignificant role by attitude. All of the paths regarding attitude--the path of PUP to attitude (H6), the path of PHP to attitude (H7), and the path of PI to attitude (H3)--show weaker effects, as compared to other paths particularly regarding performance. As such, further tests are necessary to uncover possible underlying effects.

This study modified and extended the proposed model to test possible hidden effects. Previous studies have shown the moderating effects of variables in various IT contexts [10][11]. While recent technology acceptance research has revealed the importance of interactivity, research has failed to further investigate the matter of meaningful interaction beyond the single effect of controllability, responsiveness or personalization [12][13]. Thus, given the importance of interactivity in STVs, it is worthwhile to examine new roles played by PI because user perception of interactivity may greatly vary depending on different technologies. This study tested the mediating role of PI in the effect of PUP/PHP on attitude.

### An Extended Model with Moderating Effects

To test mediating effects, this study used Baron and Kenny (1986)'s procedure, which has discussed four steps in investigating mediation:

Process (1): Show the correlations of the initial variables;
Process (2): Show the correlations of the initial variables with the mediator;
Process (3): Show how the mediator influences the outcome variable; and
Process (4): Establish that the mediator mediates the relationship of the initial variables.

With this procedure in mind, regression analyses were conducted specifically to examine (1) whether independent variables (PUP & PHP) significantly accounted for variance in the hypothesized mediator (PI), (2) whether variance in the mediator (PI) accounted for variance in attitude toward STVs, and (3) whether the relationship between independent variables (PUP & PHP) and the dependent variable (attitude) would no longer be significant once the variance in the dependent variable accounted for by the mediator was partialled out.

First, a model was fitted in which PUP/PHP was regressed on PI. The effect of the independent variable (PUP/PHP) significantly explained the variance in the hypothesized mediator PI ($t = 4.42$, $F = 15.42$, $p < 0.001$, $r2 = 0.10$). This result suggested that the mediator PI was related to the independent variables PUP/PHP whose effects are supposedly mediated. Another regression model was run with attitude toward STVs as the dependent variable and the mediator PI as the independent variable. PI significantly accounted for variance in the dependent variable attitude ($t = 5.56$, $F = 29.75$, $p < 0.001$, $r2 = 0.24$). A third regression model was fitted with attitude as the dependent variable and PUP/PHP as independent variables. A significant result was obtained ($t = 3.23$, $F = 9.76$, $p < 0.001$, $r2 = 0.15$). Finally, a fourth model was conducted with attitude as the dependent variable and PUP/PHP and PI as independent variables. The effects of PUP/PHP were not significant ($t = 1.00$, $p = 0.39$) after the significant effect of the hypothesized mediator PI ($t = 4.98$, $p < 0.001$) was partialled out. Thus, PI is proven to be a full mediator between PUP/PHP and attitude

## Implications For Theory And Practice

The contribution of this study is both theoretical and practical. With regard to theoretical advancement, the empirical findings demonstrate that employing interactivity and performance would be a worthwhile extension of TRA/TPB or TAM in STVs, as they were found to be influential in predicting the attitude and behavioral intention to adopt STVs. As an antecedent variable to performance, the role of interactivity is of importance in the STV context, because one of the limitations of technology acceptance literature is that it does not help us explain acceptance in ways that guide development, besides suggesting that system characteristics have an impact on perceptions of enjoyment and usefulness. Therefore, as many researchers argue [14], it is essential to understand the antecedents and the underlying effects of the key factors in order to explain eventual user acceptance and continuous use. With regard to TPB, behavioral intention can be viewed as an individual's underlying attitude, which ultimately determines behavioral intentions via attitude [15]. TPB has some limitations including a significant risk of confounding between attitudes and norms, since attitudes can often be reframed as norms and vice versa. Another limitation is the assumption that when someone forms an intention to act, they will be free to act without limitations. In practice, constraints such as limited ability, time, social or organizational limits, and unconscious habits will limit the freedom to act. The model in this study attempts to resolve these limitations. This study contributes to the literature on the TRA/TPB research by confirming that perceived usability can influence behavioral intentions through attitude. This study focuses on the user-centered perspective: how users perceive and use STVs and how STV factors play a role in the development of user attitudes. This can be a modest but heuristic contribution to research on STV acceptance, because previous research has studied them separately, leaving the relationship unclear.

Related to this implication, an intriguing and heuristic contribution of this study is the recognition of a directional relationship between PI, performance, and attitude. While interactivity is an embedded concept in multimedia technologies, the concept has apparently been under-researched. Aside from the relationship between PI and intention, it seems that the relationship is not apparent in the STV context. Given the unique nature of STV interaction, the relationship with PI and other factors should be clarified. Based on the findings of PI, this study reconceptualizes and redefines PI in the STV context. Previously,

PI has been measured with the capability to interact with system/technologies. In the STV context, the current notion of interactivity should be expanded to include new features provided by STVs. For example, one of the motivations of smartphone users is to be connected by constantly communicating with other users. With the advancement of ubiquitous technologies, the social expectation is that one is nearly always connected and reachable almost instantly via smartphones. It is considered that smartphones are the instrument of that connectedness. Assuming smartphone features apply to STVs, STVs will have similar functions, features, and user interfaces. Given these, the PI of STVs should be understood not only via responses and feedback, but also the feeling of connectedness enabled by such continuous interaction.

Applying this new notion of interactivity into STVs may render a real-time interaction system unnecessary. Rather, it is more effective to increase the user's sense of connectedness or belonging. From this understanding, specific design features and characteristics of STV services can be utilized to achieve meaningful interactivity. For example, STV viewers might want to post comments on social networking sites when they are watching TV programs. This kind of continuous interaction loop may increase users' sense of connectedness. Future studies should further investigate the complex interrelationships among interactivity, connectedness, presence, performance, and usability to clarify these intricate relationships. In particular, given its key roles, PI should be further extensively investigated in reference to the presence and flow in the STV context. For example, two people in geographically disparate regions could watch the same Internet-based show at the same time, and chat with each other about the program. For the two people, interactivity may mean a social presence. Interactivity can occur at many different levels and degrees of engagement, and it is important to differentiate between these levels.

Practical implications for the STV industry can be drawn in terms of strategies and new models for STVs. As STVs converge with other multimedia technologies, the concepts of interaction will be highlighted anew. The industry should focus on enhancing social presence through PI and increasing interactivity, user participation and involvement. The findings suggest that vendors should ensure that their device works and plays in accordance with user expectations and emotions. In addition, the findings imply that interactive content/services will be vitally important to the sales of STVs.

Although this study only employed STVs as the target technology, the research model captures the general characteristics of ongoing smart IT and hence the findings of this study can enhance our understanding of the factors leading to future intention of smart IT in general, which provides both utilitarian and hedonic functions with services such as communication, information, entertainment, and commerce. The focus on the experience of interactivity allows us to take a step closer to the design features of future smart IT. The results suggest the high relevance and great importance for smart IT to be designed with the capability of inducing an experience of interactivity in users. The more users feel interactivity in using the technology, the more they will perceive it to be of high utilitarian and hedonic performance and expectation exceeding, and the more they will feel satisfied with the technology and intent to continue its usage.

In conclusion, considering the ever-changing nature of smart technologies, this study elucidates motivations associated with STV acceptance and the implications for developing effective STV services. As users accept STVs as a new tool to communicate, collaborate, and entertain, industries should provide usable tools and platforms for users. STVs will be likely become an exciting and popular application in the near future. For STVs to become popular, developers need to understand individual perceptions and experiences concerning truly smart services.

## References

[1] Cesar, P., & Chorianopoulos, K. (2009). The evolution of TV systems, content, and users toward interactivity. *Foundations and Trends in Human-Computer Interaction, 2* (4), 373-395.

[2] Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13* (3), 319-340.

[3] Cho, E. J. (2010). Presence in 3DTV: A study on the perceptive characteristics of the presence in 3D imaging programs. *International Communication Association*, June 18-22, 2010 Singapore.

[4] Cronbach, L.J. (1971). Test validation. In: Thorndike, R.L. (Ed.), *American Council on Education*, second ed., Washington, pp. 443-507.

[5] Fornell, C., & Larcker, D. (1981). Structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.
[6] Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate Data Analysis (5th ed.)*, Prentice Hall, New Jersey.
[7] Cyr, D., Head, M., & Ivanov, A. (2007). Perceived interactivity leading to e-loyalty. *Proceedings of the Sixth Annual Workshop on HCI Research in MIS*. Montreal,
[8] Hassenzahlm, M. (2003). The thing and I: understanding the relationship between user and product. In *Funology: From Usability to Enjoyment* (Blythe, M.A., Monk, A.F., Overbeeke, K., & Wright, P.C., Eds), pp 31-42. Kluwer Academic Publisher, Dordrecht, the Netherlands. December 8, 2007 p. 46-51.
[9] Deng, L., Turner, D., Gehling, R., & Prince, B. (2010). User experience, satisfaction, and continual usage intention of IT. *European Journal of Information Systems, 19*, 60-75.
[10] Shin, D. (2009). An empirical investigation of a modified technology acceptance model of IPTV. *Behaviour and Information Technology, 28* (4), 361-372.
[11] Koufaris, M. (2002). Applying the technology acceptance model and flow theory to online consumer behavior. *Information Systems Research, 13* (2), 205-223.
[12] Kreijns, K., Kirschner, P., Jochems, W., & Burren, H. (2007). Measuring perceived sociability of computer-supported collaborative learning environments. *Computers & Education, 49*(2), 176-192.
[13] Lin, J., & Lu, H. (2000). Towards an understanding of the behavioral intention to use a web site. *International Journal of Information Management, 20*, 197-208.
[14] Rogers, R., & Lea, M. (2005). Social presence in distributed group environments. *Behaviour and Information Technology, 24* (2), 151-158.
[15] Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50* (2), 179-211.