

The changing view of home

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Abstract

In recent years, digital home appliances have been springing up in ordinary households. Nevertheless, the user experience study of those advanced gadgets has somewhat been overlooked. In this paper, I present a review of several empirical studies and try to combine their conclusions in a new way. Finally, the users' changing view of home is classified into five categories: connectivity and sociability, privacy, mobility, complexity as well as criteria of users' evaluation.

KEYWORDS: user experience, digital home, home networks, social issues

1 Introduction

The infiltration of information technology and network into daily lives of ordinary households is becoming increasingly notable nowadays. For example, in the US, home broadband adoption grew by 40 percents from March 2005 to March 2006, twice the growth rate of the year before [18]. However, little attention has been paid to the consequences and influences brought about to those families. This paper presents users' changing perception of home thanks to domestic information technology usage.

The family market is essential for the home appliances and electronics industry. At the same time, the trend of wide adoption of high-tech devices enlarges the cake. On the other hand, the research and investigation based on corporate users can not be applied to family oriented products on account of significant distinction between those two categories.

As mentioned, the principles and theories of designing enterprise products can not be used on family ones without any modification; neither can the methodologies of studying enterprise users. Summing up from others' research, there are several issues that need to be taken into account, such as the place where the trials proceed, the informed consent due to involvement of children, etc.

2 Related work

In home network research, there have been multiple approaches to this complex problem area. To start with, the methodologies to undertake home-related studies are already described by Hindus, D. in 1990s [1]. The new phenomena to take into account in research in the homes include, e.g., "co-experience" [2], "broken experience" [4], the household tension resulted from contention for digital resources and challenges of administration and trouble shooting [3] and so

forth. In addition, Hsieh, A. specializes in influences wireless technology imposes upon family life [8]. What's more, Terrenghi, L. has carried out a trial testing user experience within a so-called digital kitchen then draw a conclusion and deduct user experience in whole household [5]. Moreover, there was a cross-cultural study among European countries by a scenario-driven approach to demonstrate user requirements [6]. Among others, organizations like UPA, CSCW, etc. have done a lot of research in field of home related research as well.

3 Digital home

Digital home is a concept under the spotlight of the media during recent years. Sometimes it is an ideology that manufactures are eager to convey to consumers for promotion and marketing purposes. In some other cases, it is a category to systemize diverse academic researches and developments targeting improving hearth and home. In the usability point of view, the various technologies of digital network are the sources where the user experience come from, in other words an indirect research object. So before digging into users' attitude toward home technologies, it is worth taking some time to systematize and get familiar with different approaches and applications.

From a technical perspective, the digital home applications can be put into three categories: wireless technology, home automation technology and multimedia technology. I simply merge the broadband internet access into the category of wireless technology since the band of wireless access is getting growingly wider and the fixed connection has nothing better than its wireless counterpart except the band.

Wireless technology is far more than 802.11 series or so called WiFi. Following are also considered as members of wireless family: domestic 2.4GHz devices working on unregulated radio frequencies (e.g. cordless phones, cordless mice and keyboards); UltraWideBand (UWB) with which the theoretic connection speed can reach 1Gb/s; Bluetooth and infrared both transferring data in short distance and low speed which are mostly used to connect cell phones and PDAs; as well as HomePlug, HomePNA, CEBus, Neverwire, Readywire and so forth.

Perhaps most computer practitioners are not acquainted with *automation technology*. It encompasses X10 and Z-Wave which are often drawn upon to automate lighting, air conditioner and other home appliances; Universal Plug and Play (UPnP) revealing Microsoft's ambition of unifying home appliances; Jini that connects devices integrated with Java virtual machines; as well as operating system and pro-

gramming language independent protocol xAP.

It is not difficult to be aware of the *multimedia technology* with the emergence of IPTV, VoIP and devices like flat-panel displays, home theaters, MP3 players, etc.

On the other hand, the variant applications can be classified into a couple of groups from the usage viewpoint. The first one is *entertainment application* which involves digital music, digital photos, digital movies, customized TV program and computer games. The second class is *communication application* that enables individuals keep in touch with their friends, coworkers, clients and others using whatever devices. The third category is *practical application* that comprises both the online shopping and keeping control of home automation system. The last one can be called *educational or intellectual application* that helps users access information they need or gain on-line educations.

4 Users' changing view

4.1 Connectivity and sociability

For home users, while the technology itself is important, it is not as crucial as social relationships are negotiated in many cases. In spite of its interface is not so fancy and attractive, Napster succeeds in catching on because the social desire of human beings to share niceness overwhelm the technology. In "Content is not King" by Odlyzko, A. M. [20], a persuasive argument is made that the connectivity of internet is more important than the content on it. Media efforts based around the dominance of content, he assumes, will ultimately give way to those based around the dominance of connectivity.

According to the taxonomy mentioned above, the factors that have strong influences on connectivity and sociability are the wireless technology and communication applications. Some results and original answers from the respondents of Hsieh's wireless technology usage survey are borrowed here to illustrate users' changing view in terms of connectivity and sociability. Concluded from his survey, Hsieh claims that the foremost reason people are using wireless technology is to keep connected with family and friends. As explained in most social psychology books (e.g. [19]), it is human nature avoiding loneliness and isolation. There is some difference between having a feeling of loneliness and being indeed physically alone. The isolation from most intimate people can make one feel lonely easily, especially when he or she is in a bad mood. So they try to keep connection whenever and wherever they want. After the interview with one Japanese respondent, Hsieh mentioned that "people did not want to be connected less; they want to be connected more." [8]. It happens more often on the younger generation. Talking on their cell phones and instant massagers (IM) has already become an essential part of their social life for most teenagers and ones in their 20s. It makes possible for them to sustain a circle of good friends even when they physically far away from each other. The first thing some teenagers do nowadays when they get up is to turn on the computer, log on the IM and have a look at who is online in the contact list. As to the family relationship, it is quite common that family members are living in different cities or even different coun-

tries in modern society. The needs of maintaining kinship can also be meet by wireless technologies.

The other side of the coin is some people are turning to rely too much on the connectivity. Among the participants in Hsieh's survey, most of them feel uneasy or uncomfortable when they get disconnected. Besides the benefits wireless technologies bring about, "they expressed serious concern about how their constant connectivity was detrimental the other parts of life", "they felt they had to stay connected" [8]. In most cases, it relates to the third layer of Maslow's hierarchy of human needs, namely needs for loving and belonging. It is inner nature of human beings to have desire for belonging and acceptance. They need to love and be loved. In defect of those elements may result in susceptibility to loneliness, social anxiety and depression. Sometimes people feel they are lost, they don't know how to get back the touch with some one when they are unconnected. Probably they don't have any idea what they are supposed to be doing and begin daydreaming without their digital companions.

Sometimes I'll just consciously say, enough. If it's a Saturday or a Sunday, I'll turn off the computer and cell phone and deal with it on Monday. . .but then I'm anxious all day, like what am I missing. So it defeats the purpose (Louise, respondent from Hsieh's interview). [8]

In some other cases, it arises from the vocational stress. It may do harm to one's career life if he misses some important calls or emails from either his boss or his clients. Sometimes simply not seeing some email in time may let business opportunities slip past. You may have to keep connected if you want to keep your job.

Sometimes I'll take my wife out on the town and I'll sneak off to the washroom just to check my voicemail on my cell phone. I know I should probably turn it off, but I also know my clients will get pissed off if they can't get a hold of me (Jeremy, respondent from Hsieh's interview). [8]

Another aspect is the changing influence of digital home applications which may seems like a contradiction. It helps when some one is studying or working in another city and tries to keep in touch with his parents. Nevertheless, it could take place or it does often take place that kids stay in the living room with their parents yet without saying any word to them. Instead, they center their attention on their cell phones, sending and reading SMS with their friends. To some extent, the influence of latest technology resembles what televisions had in earlier years. When the first televisions were introduced into households, it brought family together in a theatre-like setting so that the whole family frequently spend time tied together. Whereas successive TV sets may separate family members and let them watch their own favorite programs if they have different preference. Isn't it ironic that a couple physically sit in the couch together with their own laptop, they are right next to their spouse but don't see each other?

One important reason why people can deeply immerse themselves in telephone calls or online chatting is they are staying in a *virtual context*. As we all know, human behavior and emotions can be strongly influenced by the environment and background they are staying in at the moment. Nevertheless, while the mediated communication is occurring, the real context, namely the actual environment is thrown out of

the window by the communicators more or less depending on the situation. Instead, an imaginary virtual context is taking place of the real context. The communicating parties unintentionally detach themselves from the current situation and plunge into a new one. For example, a guy falling in love online can easily forget about he is staying right in front of his computer in his messy bedroom, but supposes being deeply gratified in a romantic French candle dinner with the "charming girl" he is chatting with, no matter if that is a real girl or not. He is highly likely to isolate another person who is in the same room as there is a brick wall between them. The virtual context overwhelms the real context. Consequently, the communicating party adapts his behavior to the virtual environment.

Another concern regarding of sociability is for some people, new technology is for communicating and experience sharing purpose. Some of them keep themselves up to date with latest products so that they are able to join the daily talk with their friends and colleagues and understand what they are talking about. In MIT's smart kitchen project, named La Cantina, tester participated in an experiment called Living Cookbook [5]. They were asked to record their cooking process, both visually and literally, and then share the recorded experience with their friends and relatives. They were happy to do it because they felt it was fun and enjoyable.

The phenomena in smart kitchen can be explained by the concept of co-experience. "Co-experience is the user experience, which is created in social interaction" [2]. So it is not a simple accumulation of individual experience as it may sound like. According to Maslow's hierarchy of human needs, the causation to it is the desire of human being for emotionally-based relationship and being socialized.

4.2 Privacy

For householders, privacy means concealing their private affairs and lives from the public and keeping control of their personal information. Irwin Altman who is a social psychologist has founded a theory of privacy regulation. He defines privacy as a boundary regulation process where people optimize the reachability of personal lives and information along a spectrum of openness and closeness depending on the situation, instead of simply avoidance of leaking that information [15]. It is like a spring, which can be either tight or loose, depending on how much power it is imposed on, i.e. the expectation of human beings. Further, people are not always expecting more privacy. There is some problem with privacy regulation both while feeling crowded and lonely. The preference of privacy of one individual may differ from time to time. Less privacy is needed when he is pursuing more social approval and social identification whereas more is preferred when he needs some time alone. "The goal of privacy regulation is to modify and optimize behaviors for the situation to achieve the desired state along he spectrum of openness and closeness." [12]

Sometimes people actively participate in the networked world and expose some privacy. Social networking websites like MySpace can exemplify the active participation. Users simply make their personal profiles accessible to make more friends. The prevalence of blogs can be taken as another ex-

ample. Bloggers share their daily lives and feelings within a circle of their fellows while the articles are reachable for outsiders as well. However, some personal information is disclosed without intension or awareness of the owners. Merely a Google search of one's name can reveal a good deal of personal information.

Teenagers' usage of IM may demonstrate privacy regulation theory. Adolescents consider IM as a more favorable communication tool than telephones. Their parents are not aware of if they are chatting with their friends online or not. Yet while some friends are calling them, the telephone ring advertises to everyone at home. In the physical environment, namely their homes, they try to minimize others' awareness of their participation in IM; whereas in cyber environment, i.e. the contact list of their friends, they are willing to show their presence to their fellows.

4.3 Mobility

The concept of mobile domesticity proposed by Hsieh can be split into two types. One is someone can feel emotionally he is at home while he is spatially not. The other is mobility within household, in other words without being restricted by cable limit or other sorts of physical limit.

Firstly, we will discuss about the former type. In a legacy theory, furniture, visual art, photos, books and the stereo were considered the five most symbolic items of home. It is claimed that a mobile home can be perceived since three items out of the five can be taken along with (i.e. photos, books, music). However, there are a lot people disapprove of that. They advocate that it is just from a technical perspective while relaxation and other psychological needs, such as needs of safety, can not be achieved. The defense against those disagreements given can be found is the ones holding contradictory viewpoints are unaware of mobile domesticity and they are a bit conservative in this regard.

Secondly, the condition of being free of physical constraints is agreed by general consensus. The lives of householder at home are becoming increasingly enjoyable with wireless access. They may surf the internet while staying in couch, or play fitness video from Youtube using laptops for physical exercises. The examples of improved user experience gained from wireless internet connection are numerous. Following are some samples from a report about the influences of Wi-Fi on USA TODAY [17]:

Rajesh Vasireddy, a graduate student at the University of Illinois at Urbana-Champaign, hates using his remote to navigate program listings that come with cable TV. So he uses a Wi-Fi laptop to breeze through the listings online.

Anna-Marie Claassen, who works for a Wi-Fi company, likes to do crossword puzzles online from her couch

Tim Pozar, another co-founder of the San Francisco Wi-Fi group, uses it to check his e-mail from a personal digital assistant while following his 4-year-old son around the house. "It's handy," he says.

Myrtis Smith, who runs a career-coaching service from her Cincinnati home, worried that a new baby would make working tough. She installed a Wi-Fi network just before her son was born. Now, Smith, 30, can check e-mail while watching her 8-month-old son play. "I'm free from my desk,"

she says.

All in all, the mobility not only enhances the entertaining experiences, but also increases the professional opportunities. A funny joke going around is when you make a phone call to 800-JETBLUE, you are highly probably talking to a housewife in bunny slippers since the JETBLUE airlines has outsourced its call center to housewives.

4.4 Complexity

As a result of technology development, high-tech devices are becoming increasingly powerful yet at the same breath more complex. Non-expert consumers always end up with trouble to operate them. In the trial carried out by Booth, C. et al [7], the intended goal was to build a model to predict user experience with a Digital Media Adapter (DMA). The first phase of the experiment was end-user usability testing and analysis. Summing up from the test results, they declare "while technology's pervasiveness is at an all time high, so is its complexity. With increased complexity, the usefulness of each new and exciting product diminishes to end-users."

Bly, S. et al have undertaken an exploratory study labeled broken expectation study [4]. They focused on to what extent the user experience could not accord with their expectations that is more or less owing to complexity of the products. They had nine participants with different amount of technical background who were using their home network more than an internet access. The respondents were asked to describe the problems they had ever encountered with their home networks. Some troubles resulted from neither software problem nor hardware problem, but broken expectations, defined as "a mismatch between what a person expects to be able to do and specific device capabilities [4]". As far as I am concerned, it was the growing complexity which confused the consumers and led to the misunderstanding.

Part of the home network set-up study conducted by Grinter, R.E. [3] was about administration and trouble shooting. Typically, the one with most technical knowledge is responsible for the home network administration and trouble shooting in a household. The complexity made the participated administrators complaining the work was time consuming and let their leisure hours slip by. Also, the problems can not be solved in the absence of administrators. Sometimes they need to stay there for a couple of weeks until the administrator is back from a trip. In some scenarios, householders had to ask outsiders to help the trouble shooting, nevertheless the outsiders often made mistake because they could not comprehend the environment and network framework in which the device was working.

It is suggested that another influence of complexity is that it widens the generation gap. A report by Paypal, investigating the "technology quotient" of Britons, has declared generation gap which has a part to play when it comes to making sense of technology [21]. Whilst younger generation has less problems with complicated, fast-changing terminals as well as services like MMS, where users are supposed to figure out how to combine the text and multimedia contents together. Meanwhile, the elders are not as open-minded and competent to learn new ideas and technologies as their descendents do. It is more obvious in terms of Internet because of the

relatively higher threshold of operating computers. As a result, different generations find increasingly difficult to find common interests to each other.

4.5 Criteria of Users' evaluation

Normally people are not completely aware of their own criteria of making judgments and evaluating. Understanding the hidden emotion and the unconsciousness of the users may benefit both studying user experience and improving the design of products [9].

A scenario-driven approach was adopted in an empirical cross-culture study undertaken by Rucker, C et al to investigate user requirements [6]. During that experiment, the researching staff constructed an intelligent home with a number of innovative applications for the participants. Then the interviewees were asked to give feedback based on their experiences in intelligent home. A lot of discussion is aroused with respect to the feedback. The first one mentioned is respondents emphasized on fears instead of pleasure as what they had experienced. Fears are comprised of "lack of control, lack of security, increasing isolation, favoring laziness" [6]. A bit surprisingly, the lack of control is tagged as the most significant source of fear. The control theory (a.k.a. choice theory) from Glasser, W. [9] might be an explanation to this phenomenon. Glasser claims that the choices of behavior human beings make arise out of their aspiration to control their lives. In his theory, human behavior consists of three elements: what they do, what they think, and what they feel. According to Glasser, "all behavior is an attempt to satisfy powerful forces within ourselves" [9]. Hence, it makes sense that testers highlighted on the control issue. The other three types of fears can be explained by Maslow's hierarchy. They should be put into the category of *Safety*, *Love/Belonging* and *Esteem* respectively.

As a result, a couple of design guidelines are proposed for developing new applications. The criteria also represent the expectation of the consumers on intelligent devices. The items highlighted here include control, security, added value, avoidance of interference and continuous comfort. People are more or less conservative in terms of private possessions. Home is a place needs to be changeless where the metaphor of investing psychology may apply, i.e. it is always more painful to lose money than missing opportunities with equal amount of profit. People are willing to gradually get added value with presupposition of not losing anything.

5 Conclusion

The concept of digital home is undoubtedly a hot point in the consumer market. Many giants like Microsoft, Intel and Nokia have proposed their own solution for smart home. Those ambitious plans reveal their resolution to take a big slice of this promising market. Also, the infiltration of intelligent devices into households is inevitable. The number of smart gadgets in our daily lives is increasingly growing. This paper explores the implication of those technologies and the impact they have on our perspectives of home.

As every coin has two sides, digital and smart home technologies have resulted in both positive and negative affect-

tion. The benefits are made up of unlimited connectivity, freedom of moving around, chances of building up and maintaining social circle, amazing enhancement of audio-visual experience, etc. On the other hand, the problems arising from those technologies encompass users' estrangement with their family members, inadequate usability and widening generation gap and so forth.

The limitation of those empirical studies is they were all carried out in the occident. So the conclusion drawn from them may not apply to other cultures. Future work investigating changing perspective of users in other continents as well as with different background such as gender, education and financial status may help to dig out the underlying reason of the changes. In addition, further research in respect of the influence of automation technology is necessary to complement the study of users' changing view of home. Likewise, the combination of wireless technology, automation technology and multimedia technology could be taken into account in usability point of view. Moreover, how to use the theories concluded from those researches to help product design and resolve social problems should be taken into account as well.

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