Understanding Impacts of Hidden Interfaces on Mobile Phone User Experience

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ABSTRACT
This paper describes hidden interfaces as an important feature of touch screen based mobile phones and explores their impacts in user experience. Six sessions of focus group study were conducted to identify some patterns of how people explore and use hidden interfaces of mobile phones depending on their motivations—either passive or active. Then values of the hidden interfaces were further discussed from utilitarian (efficient control at cost of low cognitive load), emotional (engagement and attachment), and social perspectives (elatedness & sense of community). We expect these findings to contribute to understanding the impacts of hidden interfaces more systematically to be applied to design of interactive products.

Author Keywords
Hidden interface, mobile phone, focus groups.

ACM Classification Keywords
H5.2. Information interfaces and presentation (e.g., HCI): User interfaces.

INTRODUCTION

Recent mobile phone interface has become drastically dynamic with advanced touch screen technology that can afford more diverse interactions and functions. Unlike older generations of mobile phones whose screen interaction is largely revealed through a limited number of physical user interfaces (PUI), current mobile phones have far more features that cannot be represented as static graphic user interfaces or menus. In other words, some interfaces of recent mobile phones using touch screens are hidden under initial screens and only discovered by dynamic gestures or buttons in certain conditions of use to provide advanced functions or shortcuts. Designers have more and more applied such hidden interfaces to mobile phone interaction to manage the complex navigation of a number of functions (Refer to the video clip of hidden interface examples).

Figure 1 shows a representative example of a hidden interface. Though the interface looks typical, there is a hidden interface hardly recognized by novice users: users can adjust the scrub rate from high-speed, half-speed to fine scrubbing by sliding their fingers down as they drag the play-head along the scrubber bar. Although users do not recognize the existence of hidden interfaces at the first time of use, they become used to hidden interfaces through processes of encountering and learning. In most cases, several hidden interfaces already exist inside mobile phones and they are changing user experience, which is far from their experience with past devices.

Despite the increasing use of hidden interfaces and their potential values in user experience, we do not have much research to strategize how to analyze and design them in practice. Since the interface of a product plays an important role in constructing user experience [2], it is necessary to understand the effects and values of hidden interfaces especially from the perspective of user experience.

This study is motivated by the need for an analytic approach to the design of hidden interfaces (of touch screen mobile devices). We conducted focus group discussions with mobile phone users to investigate (i) how users discover and use hidden interfaces, (ii) what are perceived values of hidden interfaces to users, and (iii) what are limitations of current hidden interfaces. Based on the study results, we suggested implications for designing hidden interfaces.

BACKGROUND

As Norman pointed out usability problems of gestural interfaces including hidden interfaces [8], research on such dynamic and fluid interfaces are at an early stage and a great deal of studies are in demand. Although some researchers have investigated the use of hidden interfaces in the HCI field, their studies have limited application to mobile phones. For instance, Howes suggested a
mechanism that learns how to use menu structure by exploration and investigated how menu knowledge is acquired at desktop computer interfaces [4]. Later on, Grossman et al. evaluated menu designs that motivate using hotkeys and showed that speed of hotkey learning can be increased with little modifications to the standard interface paradigm [3]. Similarly, Scarr et al. explored a way to support the use of hidden interfaces by developing a system termed “Blur” [9].

Since these studies dealt with hidden interfaces of physical and/or graphic user interfaces in desktop computer environment, it is difficult to apply their approaches and implications to current mobile phones application design. Considering the need for improving hidden interface in recent (touch screen-based) mobile phones and limitation of earlier researches, our study focuses on how people use and evaluate hidden interfaces in mobile phones.

**USER STUDY SETUP: FOCUS GROUPS**

We conducted a qualitative user study to investigate people’s experiences and values created by the hidden interfaces of mobile phones. Focus group methodology was employed since it is a qualitative research tool frequently used to explore people's ways of understanding, or experiences of a complex phenomenon [6]. In this case, focus groups enable the researcher to get to know their target participants’ experiences with hidden interfaces in detail without the need for a priori assumptions. Besides, the moderator can probe to acquire relevant background information, such as motivations and contexts on their experiences. In two rounds of focus group discussions, we aimed to explore how people discover hidden interfaces and how they evaluate those values in use.

### Table 1. Topics of a focus group session

<table>
<thead>
<tr>
<th>Round</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1st</td>
<td>Ways of exploring and using hidden interfaces</td>
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<tr>
<td></td>
<td>Value of hidden interfaces for users</td>
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<tr>
<td></td>
<td>Difficulty of discovering hidden interfaces</td>
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<tr>
<td>2nd</td>
<td>Changes after finding more hidden interfaces</td>
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<tr>
<td></td>
<td>Difficulty of learning hidden interfaces</td>
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</tbody>
</table>

Six focus-group sessions were prepared. Three focus groups (FG1–3) included iPhone users, and another three (FG 4–6) were with Galaxy S users. Each focus group session consisted of two consecutive rounds with a time interval of three days (Table 1). We included the interval to give participants some time to explore devices more. Each round lasted about sixty minutes with three or four users.

Twenty two university students participated in the study with an average age of 23.5 years old ranging between 22 and 27 year (10 males and 22 females). A half of the participants were using iPhone by Apple (run on iOS platform) and another half Galaxy S by Samsung (run on Android platform). They have used the touch-screen mobile phones for 1.4 years in average.

During the first round, participants were given a basic explanation about the concept of ‘hidden interfaces’. The participants were then asked to talk about their experiences of finding hidden interfaces including any values or their difficulties in using them. Moreover, we asked them how they perceive hidden interfaces. At the end of the first round, we showed specific examples of hidden interfaces that general users rarely find (we gathered 22 examples of iPhone and 15 examples of Galaxy S from online resources). After showing these interfaces to the participants, we asked why these interfaces would be hard to be discovered by users.

The second round of the focus group session was held three days later. The purpose of this session was to further inquire how participants used the hidden interfaces that they had learned about during the first session including any difficulties they might have experienced in use.

All sessions were video-recorded with two cameras. One camera recorded the entire process of the focus group sessions while the other captured product interfaces that were mentioned during the discussion.

**RESULT**

In the user study, we could find common ways of exploring and using hidden interfaces. In addition, the values of the hidden interfaces that participants mentioned were classified. They encompassed not only utilitarian but also emotional and social values [1].

**Patterns of finding hidden interfaces**

It was observed that participants’ experience with hidden interfaces—especially their process of discovering these interfaces—varied depending on their intents to learn more about their devices. For example, if they are curious and active in learning new product interfaces, they have more chance to find hidden interfaces beyond the features that they frequently use. We refer this pattern of use as active exploration.

For active exploration, participants said they applied their conceptual models of previous product interfaces to their new mobile phones. Similarly participants also showed a tendency of applying their understanding of one function to discovering other hidden functions. Some mentioned that they tried every conceivable gesture such as swiping, pinching, or pressing certain point on their touch screen in an effort to discover hidden interfaces:

“*I tried gesture that I learned from iPod touch in Galaxy S. I could find some works in same ways.*” (Male, 23 years, 1st round of FG4)

“*After I found swiping was for deleting in e-mail application, I tried swiping in album, music list, and SMS lists.*” (Male, 26 years, 2nd round of FG1)

As another way of active exploration, participants sometimes referred to available complementary materials, from which they could find more information about their
product, such as video clips on online communities. In some cases, they participated in searching and sharing information on the hidden interfaces in online communities or blogs with other user groups.

Unlike active exploration, some hidden interfaces also were found by chance regardless of the user’s intention or need—we refer this pattern as accidental discovery. When users encountered hidden interfaces by chance, they considered them as an error for the first few times:

“One day I found screenshots were stored in album. Since I didn’t know why, I searched on the internet and many people mentioned similar experiences like me. That is how I learned the hidden interface for screenshot.”  
(Male, 22 years, 1st round of FG2)

Though they initially considered this an error, the interface was finally recognized as a hidden interface and as a function of a product after this occurred several times.

**Values of hidden interfaces in use (to users)**

Through the focus groups, several values of hidden interfaces were discovered. In this section, we described the classification of values with participants’ cases.

**Utilitarian value: Efficient control & Low cognitive load**

Many participants discussed the values of hidden interfaces in terms of a useful tool. For some users, hidden interfaces were helpful to increase work efficiency. Hidden interfaces in many cases served as a shortcut interface and as a command line type of input method to achieve a certain task in a prompt manner. As users became more knowledgeable about their mobile phones, they required more customized control over specific features of their mobile phone. We could observe that this need of advanced participants was satisfied by expert functions provided through hidden interfaces:

“The functions that hidden interfaces provide are not critical for using phones. But they are more comfortable and efficient after getting used to them.”  
(Male, 25 years, 1st round of FG1)

At the same time some participants reported that a hidden interface helped reduce cognitive burden that could result from a complex structure of many features of a mobile device by selectively presenting them on initial screens. Since a hidden interface is invisible to novice users, they are not overwhelmed with complicate features at the first time of use:

“Since I only use basic functions such as calling and messaging, I will not use most of these interfaces. If I knew their existence from my early stage, maybe I might be confused about how to control them.”  
(Female, 23 years, 1st round of FG5)

**Emotional value: Engagement and Attachment**

Participants described diverse types of emotional values that are associated with the use of hidden interfaces. Most of all, active exploration and uncovering hidden interfaces provided lucid engagement to participants. Many of participants pointed out that they enjoyed exploring and learning the new interfaces of the product. Furthermore, we heard from some participants that this feeling of ludic engagement led to a sense of achievement. Specifically the process of discovering hidden interfaces of their devices made them feel as if they were experts on that particular product:

“I enjoyed finding interfaces that were hidden in my phone. Now, I am satisfied with the fact that I’m using the product completely.”  
(Male, 25 years, 2nd round of FG3)

We could also see that the feeling of engagement could create more product attachment. As they could build up more secrets about their phone by discovering its hidden interfaces, they felt emotionally more connected to their phone:

“I like that still there are something to uncover even after using it a year ago. As I know about it one by one, I feel more attached to my phone.”  
(Male, 25 years, 2nd round of FG2)

**Social value: Elatedness & Sense of community**

Participants noted that feelings of elatedness arose when they shared their secrets regarding the product interface to other people, such as friends or family members. In relation to the feeling of achievement, they enjoyed boasting of a discovery that others were rarely aware of. A sense of community was also found among participants. For example, participants often shared their difficulties and know-how in use of hidden interfaces both offline and online. It was noted that users cooperated with others to find solutions to difficulties in discovering interfaces:

“I usually do not use calculator application. But after learning one hidden interface, rotating iPhone to landscape mode for a scientific calculator, I remember it just to boast to my boyfriend.”  
(Female, 25 years, 2nd round of FG2)

“It is kind of fun to share tips and tricks that I knew with other users.”  
(Female, 24 years, 1st round of FG2)

This type of value could lead people to share more information on hidden interfaces through online and offline communities as self-motivated activities independent from official mobile phone providers.

**Limitation of hidden interfaces for satisfying experience**

Regardless of some positive aspects of hidden interfaces discussed above, still several limits of hidden interfaces were noted in the focus groups. The most serious problem is the fact that sometimes the hidden interfaces are not easily discovered due to a lack of its proper affordance. For instance, the hidden interface for multi-tasking was considered as a useful tool feature available to iPhone users. Users had to double tap the home button in order to bring up the list of new apps from the bottom of the screen. However, a double tap of the home button appeared
would apply to video controller, which was not the case. If music function, they expected the same type of interface hidden interface for adjusting the scrubbing rate in the music function, they expected the same type of interface would apply to video controller, which was not the case.

Such inconsistency of interactive behavior of hidden interface often exists among different products as well. Swiping is a common gesture for hidden interfaces in mobile phones as shown in Figure 2. However, this same gesture is used both for deleting a selected list in iPhone and for making a phone call from the contact list of the Samsung Galaxy series. Users who are used to one of them may run into unexpected difficulty when using the other.

DISCUSSION AND DESIGN IMPLICATION
In this study we investigated patterns of discovering hidden interfaces and the values of using them. According to the results, we could discover the potential of hidden interfaces for motivating prolonged use of mobile devices from different perspectives [5]. However, hidden interfaces have not been applied strategically in mobile devices despite their values. Since hidden interfaces are not consistently designed among various applications within a mobile phone or across other devices, the disagreement makes it hard for users to learn from each other. Thus, it is important to keep design principles such as consistency, visibility, discoverability at the general level of design implication to improve current interfaces [7].

For more specific guidelines, designers can provide subtle visual signifiers about hidden interfaces depending on users’ choice. Since hidden interfaces serve useful features for advanced users, graphics guides could be provided to show what features are hidden and how they can be operated if users want to see indications of hidden interfaces. In addition, interface developers can provide an interactive manual inside mobile devices for introducing hidden interfaces to support users’ learning and exercising. Accordingly novice users may be able to create conceptual models about hidden interfaces and naturally apply the conceptual models to various interfaces and features of their devices.

CONCLUSION
It is inevitable that hidden interfaces are increasingly applied to the design of mobile devices that incorporate multifunctional and thus complex interface systems. As an early attempt to explore design and research issues in this domain, our study draws upon values of hidden interfaces in use based on the investigation of how people perceive and use hidden interfaces of their mobile devices. Through the analysis of study results we highlight general levels of design implications, which could serve as a foundation for developing more practical design guidelines.

ACKNOWLEDGMENTS
This research was supported by the SW Computing R&D Program of KEIT (2011-10041313, UX-oriented Mobile SW Platform) funded by the Ministry of Knowledge Economy, Convergent Design University Program in 2012 funded by the Ministry of Knowledge Economy (H1101-12-1001), and Korea Foundation for the Advancement of Science and Creativity (KOFAC) grant funded by the Korean government.

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