First-Time User Experience with Smart Phone New Gesture Control Features

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Abstract. This study aims to investigate experience of users who use new gesture control features of smart phones and tablets for the first time. To achieve this goal, two laboratory-controlled experiments were conducted. The first experiment focused on new finger gesture features (i.e., pinch), and the second experiment focused on new hand gesture features (i.e., turn over to mute, tap to top, direct call, palm swipe to capture, and palm touch to mute). A total of 19 younger adults and older adults participated in two experiments. They used both new gesture control features and traditional features (e.g., touch) to complete tasks. Their errors and subjective feedback were recorded. Results revealed the relative advantages and disadvantages of new gesture control features over traditional features. Based on the results, design suggestions were provided.

Keywords: Finger gestures, Hand gestures, Smart phones, User experience.

1 Introduction

With rapid development of interaction technologies and mobile infrastructure, smart phones and tablets are integrating more and more features. Under this circumstance, many people prefer to buy a smart phones/tablets with more features rather than another one with fewer features at the same price.

Traditional features (e.g. pinch zooming) are so widely used that they become the necessity of smart phones and tablets, and new features (e.g., hand gestures, fingerprint detecting features, gaze features) are revealed to wow users during the launching of a new smart phone/tablet.

However, little is known about users' first-time experience with new features. Some users are not aware of certain features. Suppose they are aware of certain features and they briefly try to use these features. They may still refuse to use them again if their first-time experience using new features is bad, then they would turn to other choices. First-time user experience is so important that it may influence people's purchase intention, continuous use of smart phones and tablets, and their brand loyalty.

This study aims to investigate first-time user experience with new features of smart phones and tablets. Specifically, younger adults and older adults would use finger gesture features and hand gesture features for the first time in two

P.L.P. Rau (Ed.): CCD/HCII 2014, LNCS 8528, pp. 262–271, 2014.

laboratory-controlled experiments. The results would not only reveal usability problems, but also help practitioners improve intuitiveness of new features.

2 Related Work

The direct input on smart phones and tablets could help solve older adults' problems with feature phones (e.g. hierarchical menu and multi-tap). However, older adults' mental models with feature phones are not applicable to smart phones and tablets anymore, and the lack of computer experience hinders them from developing correct mental models [1]. Thus, older adults still encountered difficulties with smart phones and tablets. This is reflected in their errors during pointing tasks [2] and text input tasks [1]. In our previous study [3], we investigated older adults' use of pinch zooming and reported quantitative results derived from the survey. We would report qualitative results of errors associated with pinch zooming in the first experiment.

Compared with older adults, younger adults had different needs of smart phone features. Young adults generally used more features and were more willing to accept new features than older adults, but younger adults did not use features consistently and they even quickly abandoned many features [4]. Younger adults' quick judgment with new features is of reference value for practitioners, so this study also investigated younger adults' use of new features in the second experiment.

3 Methodology

Two laboratory-controlled experiments were conducted. The first experiment examined new finger features for certain older adults: pinch and touch. The second experiment examined new hand features for certain younger adults and certain older adults: turn over to mute, tap to top, direct call, palm swipe to capture, and palm touch to mute.

3.1 Finger Gesture Experiment

There were 12 older adults (Mean age=66.4; SD=5.6; Range=59-77) participated in this experiment. They were mainly retired faculty recruited from the Senior College of Tsinghua University. They were well educated and had 13-year experience with desktop computers, but they had little experience with smart phones and tablets.

Participants used both pinch and touch in zooming tasks to view photos, PDF documents, map, and web pages. They used smart phones and tablets, including Apple iPod Touch (3.5″, iOS), Dell Streak (5″, Android), Samsung Galaxy Tab (7″, Android), and Apple iPad (9.7″, iOS), and they used four applications on each device including the photo album (the default application in iOS/Android), the document reader (the default application in iOS, and Office Suite in Android), Google map (the default application in iOS/Android), and the web browser (Internet Explorer in Android, and Safari in iOS). Each application supported pinch zooming or touching buttons labeled with "+"/"-".

Participants first signed consent forms and filled in the questionnaire about demographic information and experience with computers and mobile phones. Then, they watched the demonstration from the instructor. Next, they completed the following four tasks:

- Task 1: Brow the album which contains six photos. Zoom in to view the predefined digit on each photo and write it down.
- Task 2: Read the three-page PDF document. Zoom in each page to read the predefined contact and write down answers to the cloze test.
- Task 3: View the map and get walking directions. Zoom in the map to view the predefined route and write down walking directions to the destination.
- Task 4: Browse web pages. Zoom in to read text on predefined web pages and write down answers to the cloze test.

Afterward, they filled in the questionnaire about their attitude toward the experience and had a brief interview. This study was conducted in a standard usability-testing laboratory. Two camcorders were set up to record this experiment: one on the top of the display and the other one on the upper right.

3.2 Hand Gesture Experiment

There were five younger adults (three at age 21 and two at age 20; four males, one female) and two older adults (one at age 68 and the other at age 69; two females) participated in this experiment. People who had never used hand gestures used in the experiment were eligible for this study. Recruiting flyers were distributed in Chongqing University. Younger participants were undergraduate students and older participants were typical older adults who did exercise on campus.

Within-subjects design was used. Each participant used both new hand gesture features and traditional features to complete tasks on Samsung Galaxy S III (4.8″, Android). There are two reasons for choosing this device. First, Samsung is one of the brands that dominate smart phone market, and it is keen on adding innovative gesture-control features. Second, 4.8″ is still one of mainstream sizes for smart phones.

The procedure of this study is similar to the first experiment except the following differences: participants' innovativeness was measured through the questionnaire which had five items adapted from [5]; there was one additional instructor who interviewed participants after each task; there was no demonstration. Instead, the instructor introduced each feature and showed the physical manual and the interactive manual in the phone setting if necessary; this experiment was recorded through five cameras around the ceiling of the laboratory through Guard 4000. Participants completed four tasks:

- Task 1: Mute incoming call ringtones through three methods: touch & drag the reject button, turning over, and palm touch (shown in Figure 1).
- Task 2: Make a phone call through two methods: touch the call button and direct call (i.e., lift the phone to the ear [6]).

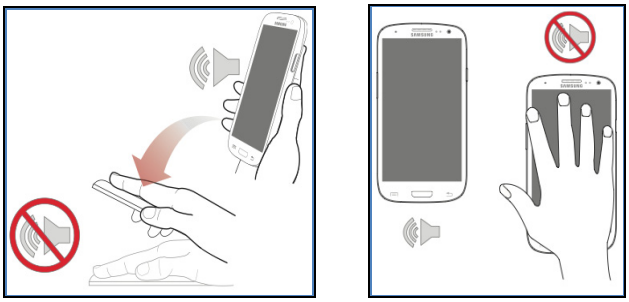

Fig. 1. Turning over to mute (left) and palm touch to mute (right). (Source: Samsung Galaxy S III User Manual, p. 23 and p. 25)

- Task 3: Go to the top of the contact list through two methods: touch & drag and tap to top (shown in Figure 2).
- Task 4: Capture a screen shot through two methods: press the home button & the power button simultaneously and palm swipe (shown in Figure 2).

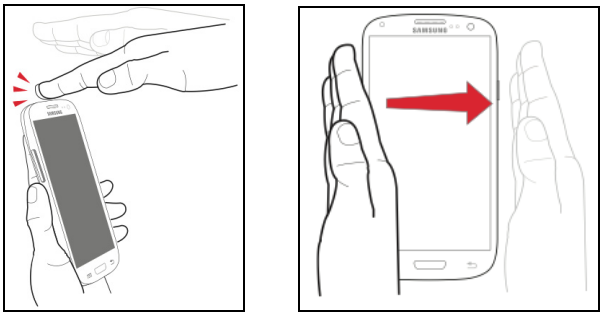

Fig. 2. Tap to top (left) and palm swipe for screen shots (right). (Source: Samsung Galaxy S III User Manual, p.24 and p. 25)

After using each feature, participants filled in the questionnaire with the following seven questions. The first six questions measured perceived ease of use, which were adapted from Post Study System Usability Questionnaire (PSSUQ) [7]. Q7 is the overall question to measure intention to use the feature [8]. The questionnaire was first translated into Chinese and then back translated into English. The wording was slightly adopted and five-point Likert scale was used.

- Q1: Overall, I am satisfied with how easy it is to use this feature.
- Q2: It was simple to use this feature.
- Q3: I was able to complete the tasks and scenarios quickly using this feature.
- Q4: I felt comfortable using this feature.
- Q5: It was easy to learn to use this feature.
- Q6: I believe I could become productive quickly using this feature.
- Q7: I intend to use this feature in the future.

4 Results and Discussion

Data were collected through questionnaire, interview, and videos. We first went through all the videos to develop a framework of errors. Then, we analyzed video through Noldus Observer XT 8.0 (shown in Figure 3). The results included the number of errors, outcomes of each error (i.e., work out independently, ask for help, and give up), and task completion time.

Fig. 3. The interface of data analysis using Noldus Observer XT 8.0

4.1 Finger Gesture Features

Pinch zooming is one of the most popular features of smart phones. Although it is intuitive and easy to learn, older adults may still make a lot of errors during their first-time usage.

As shown in Figure 4, participants who used pinch zooming accidently touched unrelated buttons (e.g., Home Button). They understood physical buttons relatively well, but they seemed to have difficulty in distinguishing on-screen buttons and dim buttons (e.g., Return Button and Setting Button). When participants accidently touched on-screen/dim buttons, they would complain that devices were too sensitive.

Another two frequently happened errors were zooming in and zooming out a photo too much. Participants tended to repeatedly pinch but failed to realize that the photo did not actually change. This is because there was no explicit hint showing that a photo was already at its largest/smallest size, and participants had to tell the differences in the photo before and after zooming. However, their attention was easily

distracted by animations of zooming, and they seemed to perceive that animations of zooming indicated the differences in the photo, which in turn implied that the photo did not reach its smallest/largest size.

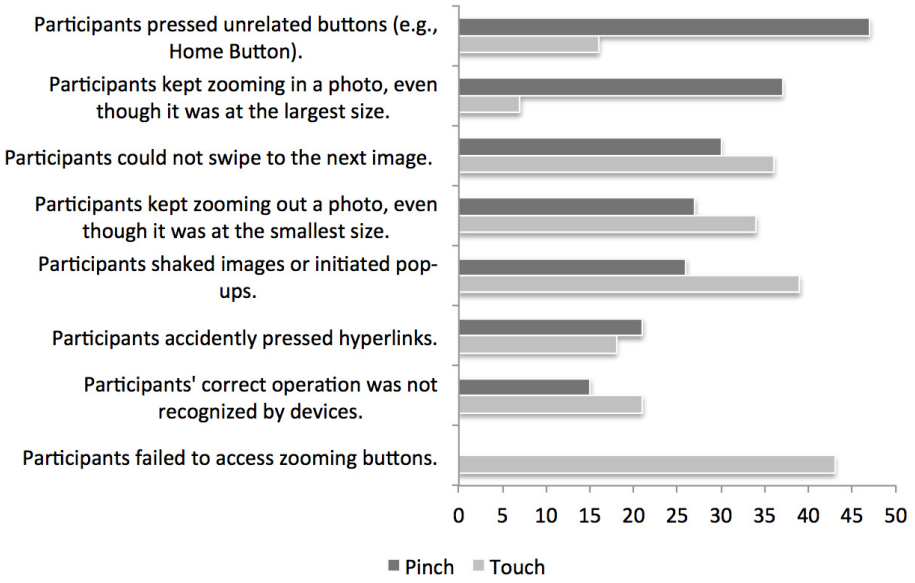

Fig. 4. Top six errors of pinch and touch in zooming tasks

Apart from this, participants had difficulties with swiping. Some participants did not zoom out the enlarged photo but directly swiped. They usually moved the photo around and got disoriented in the partial view within the enlarged photo. What made the disorientation even worse were the small movements of photos and pop-ups caused by participants' unstable hands.

Different from pinch, which does not require a specific input area, touch has the specific input area: zooming buttons. The smaller input area of touch reduces the possibility of pressing unrelated buttons. Despite of this advantage, touching a smaller input area also sets higher requirement for motor ability and thus resulted in more errors caused by unstable hands.

Regardless of touch or pinch, the third most frequent error was that certain participants could not swiped to the next page. The above-mentioned reasons for errors associated with pinch are also applicable to touch, and there is one more reason: pinch enables zooming based on any desired point of an image, while touch uses the central point of an image as the default base for zooming. This implies that participants who touched zooming buttons generally needed more movement of the image to view details.

Touch also caused a new problem: zooming buttons are usually hidden, and participants first needed to touch/drag the screen to access zooming buttons. Even if zooming buttons are accessed, they will quickly disappear again. This repeated process of

accessing hidden zooming buttons was prone to errors, so it became the most frequently happened error associated with touch.

4.2 Hand Gesture Features

Participants took 58 minutes to complete this experiment on average. They made seven errors per minute. Although they were encouraged to independently figure out ways to overcome errors, they asked the instructor for help 15 times.

The number of success and failure for each trail was recorded, and task effectiveness was the percentage of successful trails out of all trails. As shown in Figure 5, gesture features resulted in lower task effectiveness than traditional features in task 3 (tap to top) and task 4 (screen shots).

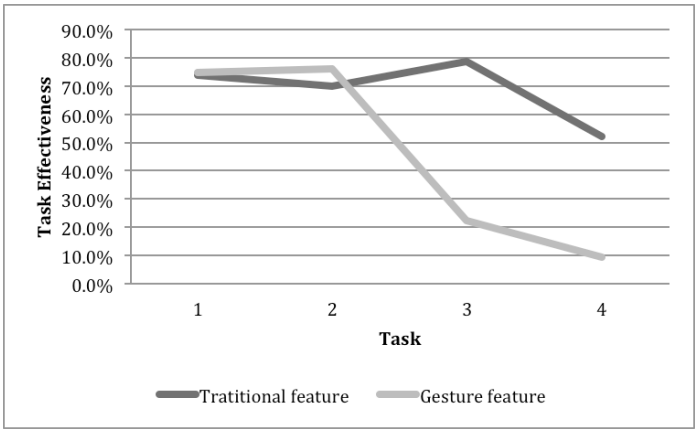

Fig. 5. Task effectiveness of tradtional features and gesture features

Consistent with results about task effectiveness, gesture features also resulted in more errors and longer task completion time in task 3 and task 4 (shown in Figure 6). In task 3, one error took up 78.9% of errors associated with the tap to top feature: participants' correct operation was not recognized. They tapped on the top of the phone twice, but the phone did not respond. Four participants made this error, and in the interview, three of them indicated that they may not use the tap to top feature in future but would stick to the traditional feature.

In task 4, one error took up 61.9% of errors associated with palm swipe: participants' palm did not touch the display during swiping. However, participants should not be blamed because both the physical manual and the interactive manual did not indicate the need to touch the display. Six participants made this error, but all of them indicated that they would like to use the palm swipe feature in the future. Another error took up 27.9% of errors associated with palm swipe: participants' entire palm covered the display.

In task 1 and task 2, errors were fewer than but similar to those in task 3 and task 4. Again, participants' correct operation was not recognized (turning over to mute: five

times; palm touch to mute: 11 times; direct call: two times) and participants' palm did not touch the display (palm touch to mute: 25 times). Major errors associated with traditional features included touching unrelated buttons (six times) and combined operation of the home button and the power button (17 times).

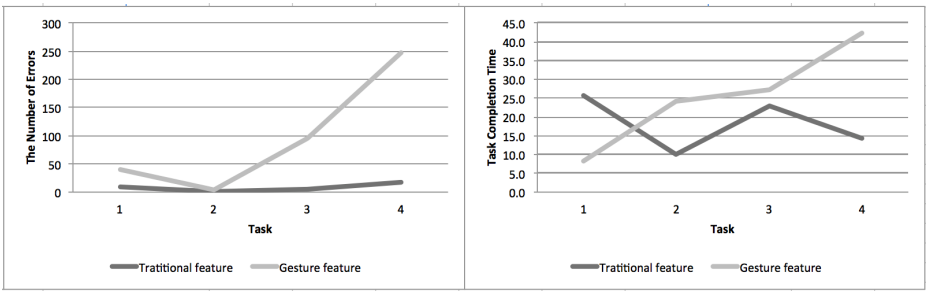

Fig. 6. The number of errors and task completion time

Despite of the above-mentioned errors, participants were generally positive towards both traditional features and gesture features of smart phones (shown in Figure 7). Their rating on intention to use features and perceived ease of use was not always consistent with their performance. Particularly, participants perceived the palm swipe feature easier to use and had higher usage intention compared with simultaneously pressing the home button and the power button.

To further unveil participants' real feeling behind the tendency of giving high ratings, the results of interview were analyzed. The most popular gesture features for participants were palm swipe for screen shots, followed by turning over to mute and palm touch to mute. Although they made errors when they used these gesture features, they preferred gesture features to traditional features in task 1 and task 4 as long as they learned how to use them. In contrast, they preferred traditional features to gesture features in task 2 and task 3. They indicated that the differences between traditional features and gesture features were not obvious and they would stick to their habit.

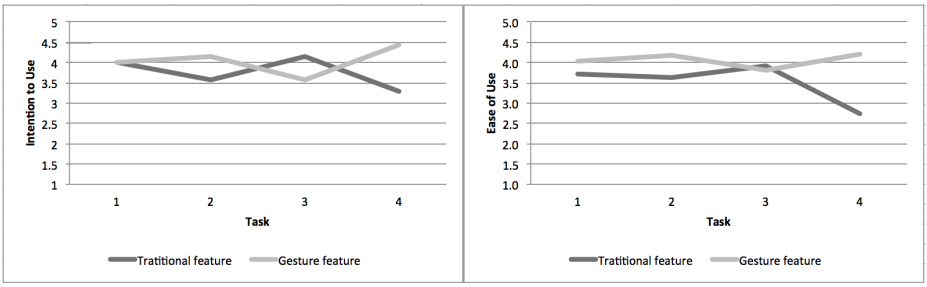

Fig. 7. Intention to use features and ease of using features

We also compared younger participants and older participants. Older participants' performance was slightly better than younger participants, and they had slightly more positive attitude towards new features. One possible reason is that two older

participants' innovativeness (2.80 on the five-point Likert scale) was higher than that of younger participants (1.68).

5 Conclusion

This study investigated first-time user experience with new gesture control features in two experiments. The first experiment focused on new finger features for certain older adults and the second experiment focused on new hand features for certain younger adults and certain older adults. To examine the advantages/disadvantages of these gesture features, they were compared to traditional features. Based on the results, four main findings were derived:

First, older participants who used pinch zooming for the first time were prone to errors associated with touching unrelated buttons, in particular, on-screen buttons and dim buttons. Besides, they kept zooming in/out a photo even though it already reached its largest/smallest size. Practitioners may provide explicit feedback of the largest/smallest size of an image in a way that does not distract older adults' attention.

Second, participants who used palm gestures (i.e., palm swipe for screen shots and palm touch to mute) for the first time were prone to errors associated with floating swipe and entire palm touch. Manuals should specify the inappropriate distance from palm to the display and the inappropriate size of touch area.

Third, participants who used other three hand gestures (i.e., tap to top, turn over to mute, direct call) were prone to errors that participants' correct operation was not recognized. This error could easily result in the lost of users. Practitioners should take the variety of gestures into account to make the devices responsive and provide immediate feedback for wrong gestures.

Fourth, participants perceived their operation was correct as long as they followed instructions in the manuals. Instructions in physical and interactive manuals should provide detailed instruction to ensure initial success.

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