Cross-Platform Product Usability and Large Screen User Experience: A Teleconference System U&E Research

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Abstract. In this paper, researchers focus on product usability and user experience on a teleconference system that was in development, aiming at using a effective method to focus on the whole user experience, looking for product defects and improving the product usability and experience (U&E) in the mid stage of the product development. The main method applied in this study are Users Performance, User Experience Map and CSUQ. The most important finding is that the large screen is the key experience when user interact with the large screen system.

Keywords: Teleconference system; User Experience; Product Usability; Large Screen Experience.

1 Introduction

1.1 Large screen

With the development of information technology, the human-computer interaction (HCI) technology and network technology is developing rapidly. The application of large screen based human-computer interaction technology is applied more and more widely. Screen with big picture, color, high brightness, high resolution display rate in demand by such as network center building, command control center, temporary meetings etc. Large-screen wall displays are becoming a common fixture in command and control environments [12]. As with high resolution, high brightness and color, the size of screen has been a important parameter to describe the large screen device. There are many studies focus on the relationship between the size of screen and users experience, even though they come from different domains. As long as, researchers studied the impact on study performance of screen size. Subjects using a 15 inch screen need less learning time than subjects using a 12 inch screen, with no difference in learning performance [4]. Consumer demand for large screen television sets is on the rise, with sales of 27 inch and larger sets exceeding the most optimistic industry expectations. One reason for this demand may be that a large screen television delivers a different, more enjoyable, more intense viewing experience than a small screen model. This greater intensity may also indicate that large screen viewers experience a

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A. Marcus (Ed.): DUXU 2014, Part IV, LNCS 8520, pp. 469–479, 2014.

sense of presence, a feeling that they are in the environment portrayed on the screen [7]. In some study of Virtual Reality, researchers found that large, curved projection screens yielded better performance than HMDS (head-mounted display) [3]. Besides, some researchers used bio-measurement to proved similar theories. In a comparison experiment, largest screen produced greater heart rate deceleration than the medium and small screens. The large screen also produced greater skin conductance than the medium and small screens [10]. There are relevant study in military domain. Panoramic displays are intended to facilitate a common operational picture between multiple commanders or command centre operators, enabling personnel in the command centre to appreciate the 'big picture' of a tactical situation. Hence, the panoramic display may improve situation awareness and assessment of the situation, facilitate shared mental models, and improve team decision-making [1].

In this study the large screen is applied in a Teleconference system with Cross-Platform Product. The main goal is to prove whether the large screen has positive impact on users experience or not.

1.2 User Experience and Usability

The goal of user experience design in industry is to improve customers satisfaction and loyalty through the utility, ease of use, and pleasure provided in the interaction with a product [11]. High quality user experience (UX) has become a central competitive factor of product development in mature consumer markets [8]. There are so many studies on users experience, but a clear evaluation methods is not exist. So far, user experience studies have mostly focused on short-term evaluations and consequently on aspects relating to the initial adoption of new product designs [5]. The recent shift of emphasis to user experience (UX) has rendered it a central focus of product design and evaluation. A multitude of methods for UX design and evaluation exist, but a clear overview of the current state of the available UX evaluation methods is missing [2].

The study on usability is more complete relatively. Usability inspection is the generic name for a set of cost effective ways of evaluating user interfaces to find usability Problems [9].

1.3 The Present Research

The main goal of this study is to propose a new model for evaluating usability and experience of one new teleconference system. The model contains User Performance, Experience Map, CSUQ. Researchers selected CSUQ to analyze users satisfaction. At the beginning, researchers compared nine questionnaires as Table 1:

In consideration of the system type: a human –computer teleconference system, researchers chose CSUQ to evaluate users satisfaction.

Table 1. Nine questionnaires to evaluat usability

QUIS	Questionnaire for User Interface Satisfaction	Chin et al, 1988
PUEU	Perceived Usefulness and Ease of Use	Davis, 1989
NAU	Nielsen's Attributes of Usability	Nielsen, 1993
NHE	Nielsen's Heuristic Evaluation	Nielsen, 1993
CSUQ	Computer System Usability Questionnaire	Lewis, 1995
ASQ	After Scenario Questionnaire	Lewis, 1995
PHUE	Practical Heuristics for Usability Evaluation	Perlman, 1997
PUTQ	Purdue Usability Testing Questionnaire	Lin et al, 1997
USE	USE Questionnaire	Lund, 2001

2 Method

2.1 Participants

Sixteen participants took part in this study, and all of them were recruited from the general public. Eight were recruited from the person who have been working and eight were recruited from students. The male/female ratio is 5:3, that is ten men and six women. They were aged between 23 to 30 (M=25.87;SD=2.22). Male participants were aged between 23 to 28. Female participants were aged between 23 to 30. The study investigated employment statues and gender. The researchers established three criteria for recruitment: English level, iPad using experience, teleconference using experience .

2.2 Experimental Materials and Device

Experimental Hardware. The experimental site was in a main conference room. The room was decorated specifically for the system. There was an assistant meeting room beside the main one, which was with screen which could be connected with the large screen and act as the remote site. The main experimental hardware devices were a large screen teleconference system which could be touched (developer called it touch wall) and a iPad, the area of touch wall almost took up about two adjacent walls. Moreover, there were some other physical objects-mark pens with different colors and whiteboard eraser providing to participants to use.

Experimental Software. There was an Application on both large screen and iPad, participants could use it to do some interaction.

2.3 User Tasks

The main functions of the teleconference system were made both sides who participant the meeting communicate freely, also made them share their ideas to other people and understand others' ideas by the Cross-Platform Product.

According to these main functions researchers established 29 tasks which covered all the functions. The 29 tasks belonged to 4 section in sequence: (1) Tasks Conducted on Touch Wall, (2) Tasks Conducted on iPad, (3) Tasks Conducted back to Touch Wall and (4) Voice Command. The detail task name are presented in Table 2

Table 2. Tasks names and numbers

1.1	Join a scheduled meeting	2.16.2	Full-screen the document by iPad
1.2	View meeting information from meeting panel	2.17	Annotate on shared document
1.4	Display workspace	2.18	Navigate shared document
1.5	Access group space to open a document	2.19	Unshared the document
1.7	Annotate on the document	2.20	Create sticky notes and share to touch wall
1.8.1	Open active chart	2.22	View touch wall content on iPad
1.8.2	Play active chart	2.23	Download file/screenshot on touch wall
1.9.1	Launch Whiteboard	2.24	View downloaded file/screenshot
1.9.2	Full-screen the whiteboard	3.13.1	Stack sticky notes by color
1.10	Draw on whiteboard	3.13.2	Stack sticky notes by selection
1.11.1	Erase the whiteboard	3.13.3	Move sticky notes
1.11.2	Select something. on whiteboard	3.14.1	Un-stack sticky notes by "ungroup"
1.11.3	Scale selected object on whiteboard	3.14.2	Un-stack sticky notes by finger sliding
1.11.4	Move selected object on whiteboard	4	Voice command
1.12	Navigate whiteboard (zoom, pan,)	2.16.2	Full-screen the document by iPad

- Task 1.3, 1.6 and 1.15 was deleted during the experiment, because they were unimportant tasks that could be ignored and had no impact on UX.
- Tasks numbers was not in sequence but tasks was in actual order. Please ignore the numbers order and focus on the task itself.
- 4.Voice command was added tasks and didn't belong to the 29 tasks.

2.4 Experimental Design

Researchers invited a moderator to host the experiment. Moderator had been trained to use the teleconference system before so that moderator known the system very well could get hold of the condition. Participants was invited into the meeting room to do the test one by one. After moderator's introduction about the experiment, the participant was told the names of the tasks and prepared to complete them one by one. Once partic-

ipants were in trouble, they could try to (1) Conquer the problems all by themselves; (2) Call the moderator for help; (3) Call for a hint; (4)Task failed . During the test processes, the moderator would ask some presupposed questions about users' feeling and thinking (think aloud), the answers were recorded. After participant finish the whole tasks, they was asked to fill CSUQ. At the same time, two cameras were set up in the meeting room, one was set up the left side of the participant to record his or her facial expression and body gesture. The other was set up in the back of the room in order to record the screen of the touch wall so that researcher could judge the progress of tasks. One recorder controlled two cameras and the other recorder seat in the back of room and recorded participants' added details. 16 participants was separated into 6 days, that means there was 2 or 3 participants conducted this test everyday so that researchers could ensure the moderator's physical and mental condition was fine.

2.5 Analytical Method

Users Performance. Users Performance Analysis, researchers could get the data about product performance. On the basis of analyze result researchers could improved the product features accurately and reduce newcomers' learning cost.

User Experience Map. Experience Map was an objective way to analyze users subjective emotion changes according to the times. It helped researchers to get the users Pain Points, Gain Points and Wow Points.

Table 3. Computer System Usability Questionnaire. It is a 1-7 scale from disagree to agree

1. Overall, I am satisfied with how easy it is to use system
2. It was simple to use system
3. I can effectively complete my work using system
4. I am able to complete my work quickly using system
5. I am able to efficiently complete my work using system
6. I feel comfortable using system
7. It was easy to learn to use system
8. I believe I became productive quickly using system
9. System gives error messages that clearly tell me how to fix problems
10. Whenever I make a mistake using system, I recover easily and quickly
11. The information (such as online help, on-screen messages, and other documentation) provided with system is clear
12. It is easy to find the information I needed
13. The information provided for system is easy to understand
14. The information is effective in helping me complete the tasks and scenarios
15. The organization of information on system screens is clear
16. The interface of system is pleasant
17. I like using the interface of system
18. System has all the functions and capabilities I expect it to have
19. Overall, I am satisfied with system

CSUQ Analysis. CSUQ (Computer System Usability Questionnaire) was proposed in Psychometric Evaluation and Instructions for Use. International Journal of Human-Computer Interaction. It is a subjective usability measurement at IBM [6]. The 19 questions show in Table 3.

CSUQ showed users subjective satisfaction of every level of the teleconference system. CSUQ contains 19 questions and analyzed to the 19 questions would revealed whether users were satisfied with system interface, Efficient, Effective, Engaging , Easy to learn, Error Tolerant .

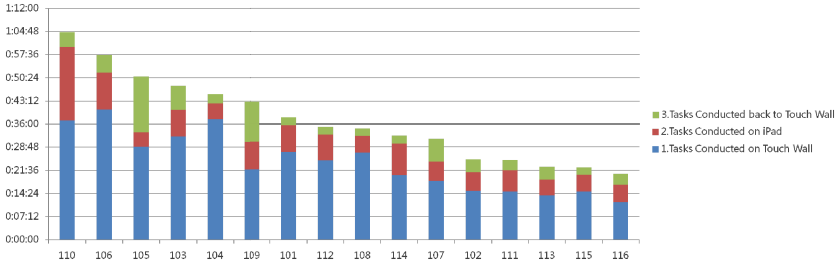
3 Result and Conclusion

3.1 Performance Result

Users Performance included the following aspects

Overall Performance. Sixteen participants were numbered 101 - 116. Researchers watched the recorded video and got statistical data about the total time comparison as Table 4. Table 4 indicated that participant NO.110 spent longest time (1 hour and 4 minutes) to fulfill 29 tasks and participant NO.116 spent shortest time (about 20minites).

Table 4. Measured in hours

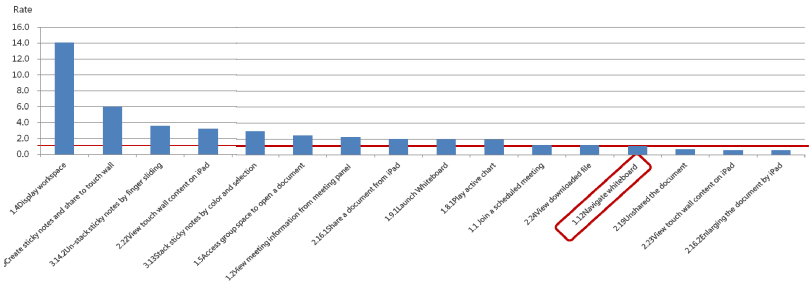


Before researchers started the experiment, they invited a developer of this teleconference system to do preliminary experiment on 16 tasks. The meaning of experiment result was that established the ideal duration (there is no cognition friction between human – computer) of 16 tasks. The ideal duration was a datum line. By means of the comparison with the datum line researchers got difficulty level of 16 tasks for newcomer. Researchers called it Magnification Comparison as **Table 5**.

β (Magnification Comparison)* is the ratio of T1 (mean time) and T2 (Estimated Time), namely

$$\beta = T1/T2$$

Table 5. 1.0 means the task is as difficult as Estimated



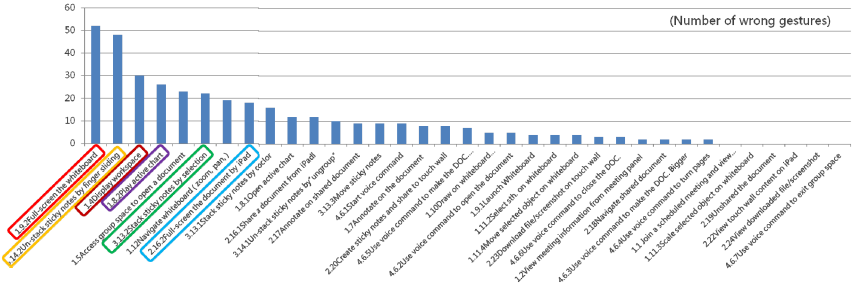
The table indicated that several tasks were harder than estimated some were easier and 3were almost as difficulty as estimated.

Comparison of Control Variables. Researchers classified 16 users into two categories according to their employment statues and gender: Employed group and Students group / Male group and Female group. The result revealed that there is no significant difference between employed group and Students group.

That means the difficulty level of this teleconference system was almost equivalent for all newcomer no matter what his / her gender and work or not, as long as they were proficiency in English and iPad operation and also known something about teleconference system.

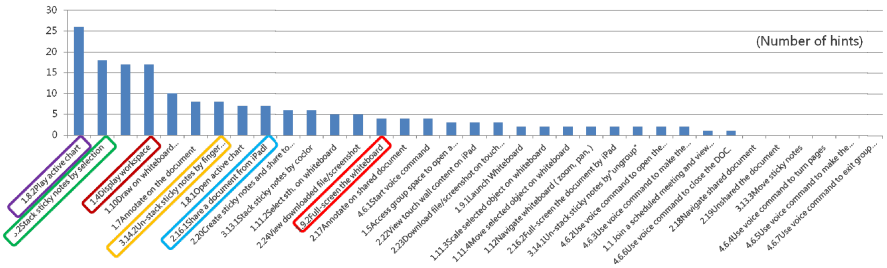
Number of Wrong Gestures and Calling for Help. In the process of test, users came up against so many kinds of problems. Researcher systemized the number of wrong gestures when they trying and believe that the number reflected which task was difficult, which interface made users feel confused, which part layout unreasonable as **Table 6.**

Table 6. Numbers of wrong gestures



They could call for a hint to moderator to be provided a simple hint. Researcher systemized the number of the hints. The number showed difficulty level of each task in a qualified sense as **Table 7**.

Table 7. Number of hints

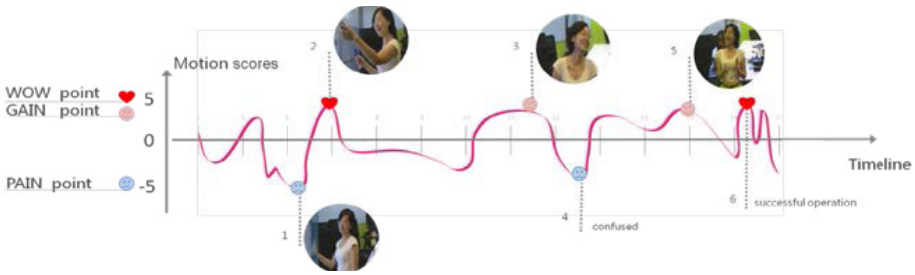


Both the **Table 6** and **Table 7** reflected six tasks were in a high difficulty level. Researchers believed that cognition friction exist in this six tasks: 1.9.2 Full-screen the whiteboard, 3.14.2 Un-stack sticky notes by finger sliding, 1.4 Display workspace, 1.8.2 Play active chart (Switch 2D to 3D), 3.13.2 Stack sticky notes by selection, 2.16.2 Full-screen the document by iPad .

3.2 User Experience Map Result

Researches took the employed group and the students group as an example to how to obtain the key factors of the whole UX. **Table 8** is emotion changes graphic coordinates of participant NO.115. X position represented the time he spent. Y position represented participant emotion changes. Numerical range was -5 to 5. Positive value stood for positive emotion of user such as happy / surprise / praise and so on. Negative values represented negative emotion, for example anxiety / upset / criticism and so on. Researcher recorded each point of emotion change in three ways: facial expression, body language, words. According to these method, researchers judged users' emotion (gave the emotion a score -5 to 5) at some time point and marked a position in coordinates. A Experience Map presented when every position was linked by smooth curve in sequence.

Table 8. Take NO.115 as an example



Pain Points, Gain Points and Wow Points were obtained by compare the 8 Experience Maps. All of Points were universal.

Participants revealed negative emotion when the Pain Points appeared usually:

- Meeting with difficult tasks.
- "Exit" button was ambiguous, that means exit menu rather than exit meeting.
- The screen was not sensitive enough.
- Inconsistent interfaces between touch wall and iPad.
- The screen was too big to conduct, the visual range on screen was relatively small.
- Voice commend gave no reaction.

They also gave some positive comments to the function they like.

- Whiteboard contained many functions, "smoothly" was attractive.
- Share a document from iPad was an interesting task.
- The app had clear hint message when sharing a document from iPad.
- Annotate on shared document by iPad.
- Annotate on the document when using marker pen.
- Interacting with the remote site on whiteboard.
- The dynamic effects of active chart.

Participants also gave a compliment to the functions which surprised them.

- Large screen meeting made users feel amazing surprise.
- The process of interacting with the remote site on whiteboard was interesting.
- "Smoothly" on whiteboard was a very useful function.
- The dynamic effects of active chart.
- Annotate on the document when using marker pen and eraser.
- Voice command was intelligent.

3.3 CSUQ Analysis Result

Researchers used SPSS to analyzed the Computer System Usability Questionnaire as **Table 9**. Descriptive Statistics revealed that participants gave weak score on question NO.9, NO. 10 and NO.11. And question NO.17, NO. 7, NO.16, NO.3 got good score.

Table 9. Descriptive statistics

CSUQ Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
9 System gives error messages that clearly tell me how to fix problems	16	1	6	2.81	1.377	1.896
10 Whenever I make a mistake using system , I recover easily and quickly	16	2	6	3.63	1.408	1.983
11 The information provided with system is clear	16	2	6	4.44	1.548	2.396
18 System has all the functions and capabilities I expect it to have	16	2	7	5.00	1.414	2.000
12 It is easy to find the information I needed	16	4	6	5.19	.750	.563
2 It was simple to use system	16	4	7	5.38	.957	.917
4 I am able to complete my work quickly using system	16	3	7	5.38	1.204	1.450
8 I believe I became productive quickly using system	16	2	7	5.38	1.204	1.450
5 I am able to efficiently complete my work using system	16	4	7	5.38	.806	.650
1 Overall, I am satisfied with how easy it is to use system	16	3	7	5.50	1.033	1.067
15 The organization of information on system screens is clear	16	3	7	5.69	1.138	1.296
19 Overall, I am satisfied with system	16	3	7	5.75	.931	.867
13 The information provided for system is easy to understand	16	5	7	5.81	.544	.296
6 I feel comfortable using system	16	4	7	5.88	.885	.783
14 The information is effective in helping me complete the tasks and scenarios	16	5	7	5.88	.619	.383
17 I like using the interface of system	16	3	7	6.00	1.033	1.067
7 It was easy to learn to use system	16	4	7	6.13	.885	.783
16 The interface of system is pleasant	16	3	7	6.19	1.047	1.096
3 I can effectively complete my work using system	16	4	7	6.25	.856	.733
Valid N (listwise)	16					

Table 10. Factor Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.575	29.341	29.341	5.575	29.341	29.341	4.096	21.557	21.557
2	3.488	18.360	47.702	3.488	18.360	47.702	3.117	16.403	37.960
3	2.677	14.091	61.793	2.677	14.091	61.793	2.388	12.567	50.527
4	2.083	10.962	72.755	2.083	10.962	72.755	2.380	12.529	63.056
5	1.333	7.015	79.770	1.333	7.015	79.770	2.230	11.739	74.795
6	1.048	5.514	85.284	1.048	5.514	85.284	1.993	10.489	85.284
7	.891	4.689	89.973						
8	.683	3.596	93.569						
9	.363	1.911	95.480						
10	.268	1.409	96.889						
11	.200	1.054	97.943						
12	.174	.917	98.860						
13	.144	.757	99.617						
14	.054	.282	99.899						
15	.019	.101	100.000						
16	.000	.000	100.000						
17	.000	.000	100.000						
18	.000	.000	100.000						
19	.000	.000	100.000						

Extraction Method: Principal Component Analysis.

Table 11. Factor Analysis

Principal factor	Variable	
Effective	It was simple to use system	.497
	I can effectively complete my work using system	.890
	I am able to complete my work quickly using system	.834
	I am able to efficiently complete my work using system	.871
	The information is effective in helping me complete the tasks and scenarios	.713
	Overall, I am satisfied with system	.712
Engaging	I believe I became productive quickly using system	.771
	The organization of information on system screens is clear	.670
	The interface of system is pleasant	.778
	I like using the interface of system	.842
Efficient	The information (such as online help, on-screen messages, and other documentation) provided with system is clear	.606
	It is easy to find the information I needed	.940
	System has all the functions and capabilities I expect it to have	.678
Easy to learn	I feel comfortable using system	.598
	It was easy to learn to use system	.870
	System gives error messages that clearly tell me how to fix problems	-.639
	The information provided for system is easy to understand	.927
Error Tolerant	Overall, I am satisfied with how easy it is to use system	.770
	Whenever I make a mistake using system , I recover easily and quickly	.713

There were five principal factors(5Es) of CSUQ: Effective, Engaging, Efficient, Easy to learn, Error Tolerant.

The result of CSUQ showed that users were satisfied with System Interface, Efficient and Easy to learn. And they gave bad score on Error Tolerant.

4 Discussion

The central goal of this study is to propose a novel model to evaluate usability and experience of this new teleconference system.

New technology triggered evolution in people's daily life. Take large screen as an example, it has been applied in many domains such as Military Command. Bigger is better? Interestingly, in this study researchers grasped the key factors that hade impact on large screen users experience. Even though most of the participants thought large screen was a amazing surprise to them, but there are still part of users considered that large screen was too large to conduce and the visual range on screen was relatively small when they operate this system. So it is not 'bigger means better', more appropriateness is better, better experience is better.

The technology of Large screen and Cross- Platform is applying in more and more domains such as education and medical. It is still need to study that how to make this resource plays the biggest role under limited conditions and brings users best experience.

Acknowledgments. This paper is sponsored by Shanghai Pujiang Program (13PJC072), Shanhai Philosopy and Social Science Program (2012BCK001), Shanghai Jiao Tong Universty Interdisciplinary among Hunmnity, Social Science and Natural Science Fund (13JCY02). We thank to the students of Shang-hai Jiao Tong University who contributed to this research. Moreover, we thank Cisco Systems (China) Research & Development Centre for their support.

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