Identifying Subtasks of m-Commerce Website through Scenario-Based Design

Completed Research Paper

Eugenia Y. Huang
National Chengchi University
huang.eugenia@gmail.com

Travis K. Huang
Ling Tung University
travisk.huang@gmail.com

Yu-Ju Lin
National Chengchi University
frank78525@gmail.com

Abstract

Due to the tremendous penetration speed of pocket-size mobile devices, surfing the internet on the go is rapidly becoming a preferred life style for people nowadays. Smooth transition from e-commerce to m-commerce requires that businesses recognize a major paradigm shift in web interface design. While many studies have focused on obtaining functionalities requirements and have identified many critical design factors, most of them have ignored the importance of non-functional requirements, which only can be elicited by a task-oriented methodology. Three rounds of focus groups were held in order to collect ideas and opinions from eleven participants, and several scenarios for m-commerce website were generated. This study intended not only to identify tasks and subtasks by following the concepts of the scenario-based design, but also to propose design guidelines for developing subtasks in activity layer, information layer, and interaction layer with an in-depth description of tasks proposed by the study.

Keywords

Scenario-based design, focus group, m-Commerce, human computer interface, system usability.

Introduction

With the great progress of information technology, the tremendous penetration speed of pocket-size mobile devices, such as smart phones and mini pads, has been revealed. For instance, 158.3 million smart phones were sold in the second quarter of 2012, and the growth rate of smart phones was 46.7% (Source: Canalys, 2012), whereas 998 million handsets shipped in full year 2013, a 44% increase on 2012 (Source: Canalys, 2013). IDC predicts that the population of surfing the internet through mobile device will be over a billion, and the global e-commerce transaction also will surpass over sixteen trillion US dollars. The population of using mobile Internet would grow by a compound annual growth rate of 16.6 percent between 2010 and 2015. Hence, the trend represents that surfing the internet through mobile devices are now changing our daily life because of obtaining information in anytime anywhere.

Nowadays, most of organizations and enterprises have established their websites to advertise goods to the people all over the world. In order to make a good impression on customers, the elements or information displayed on the web interface should be carefully considered and arranged. It has been a critical mission for a well-designed website to attract customers' attention and to keep them stay longer, if revenue growth is desired. However, as surfing the internet own the go is rapidly becoming a preferred life style and often a necessity of life for many people. Smooth transition from e-commerce to m-commerce requires that businesses recognize a major paradigm shift in web interface design.

It is quite obvious that pocket-size mobile devices have several characteristics that personal computers or laptops do not have, such as spatiality, temporality and contextuality. Spatiality represents that people can surf the internet with these devices at any places, whereas temporality refers to that people can

browse the website anytime. Contextuality is concerned with the nature of the dynamic circumstances where users employ mobile devices, such as the degree of their interaction with others (Lee and Benbasat 2004). Besides, as pocket-size mobile devices are equipped with relatively small screen, when displaying web pages which are designed for personal computers and laptops, viewing poses a great challenge. For example, the efficiency of navigation activity on traditional websites is found to be much worse when scrolling the web pages up/down and left/right on mobile devices (Chae, Kim, Kim, and Ryu 2002). Due to the limited space, items or components on the screen of pocket-size mobile devices should be much more intuitive so that users can interact with the interface more quickly. Consequently, it is necessary to create a mobile vision of web interface with better considering the characteristics of pocket-size mobile devices.

Traditional software design produces a main system structure which is decomposed into substructures with clearly defined functionalities. The well-known water-fall methodology, System Development Life Cycle (SDLC or Waterfall Model), maps well to this type of approach, which emphasizes the design of functionality, and each functionality aims to address some design factor. Therefore, SDLC proceeds from functional requirements analysis to software design, implementation, and testing, then cycle through maintenance.

Due to the influence of traditional methodology described above, prior research has made much effort to identify critical design factors in interface design (Liu and Arnett 2000; Bell and Tang 1998; Misic and Johnson 1999; Aladwani and Palvia 2002; Palmer and Griffith 1999). Designers were asked to focus on the fulfillment of functional requirements. There are four aspects of functional factors, namely product perception, shopping experience, customer service, and consumer risks (Jarvenpaa and Todd 1996). However, M-commerce adds the degree of complexity to user interface design. In mobile interface framework (Lee and Benbasat 2003), nine aspects were identified: mobile setting, mobile constraints, context, content, community, customization, communication, connection, and commerce.

Gaining the knowledge of possible factors that can influence user experience would provide valuable insights to effective interface design. However, unless users can navigate through the maze of functionalities and accomplish his/her tasks easily, the functionalities merely clog up a small screen of a pocket-size mobile device. Thus, we posit that m-commerce mandates a completely different approach to interface design which is task-oriented rather than functional-oriented.

Task-oriented approach focuses on what a user would like to accomplish, whereas functional-oriented approach focuses on the capabilities of a system. We believe guiding users through tasks is much more important than asking users to dig through functionalities on their own. The objective of the study was to identify critical tasks while designing web interface for pocket-size mobile devices based on a task-oriented methodology, namely scenario-based design. Scenario-based design has been used in various product designs and proved to be effective in delivering successful products. It is also adopted widely by software development projects. Its context and task-oriented emphases can enhance designers' and analysts' understanding and provide a broader view of the system being developed. Activity, information and interaction designs are framed by considering and perhaps acting out the scenario (Rosson and Carroll 2001). Often, temporary prototype is constructed to aid preliminary evaluation and documentation (Carroll 2000).

Due to the complexity of scenario-based design, all the design phases should be taken into consideration. Thus, three rounds of focus groups were held in order to collect ideas and opinions from eleven participants, and several scenarios for m-commerce website were generated. The result was summarized and demonstrated the feasibility of a scenario-based design for m-commerce user interface. Thus, this research intends to answer the following questions: What are the critical tasks while designing web interface for pocket-size mobile devices? How to implement the identified tasks?

Literature Review

In the field of interface design, many studies have focused on obtaining functionalities requirements and have identified many critical design factors. However, most of them have ignored the importance of non-functional requirements, which can be observed only by task-oriented approach such as scenario-based

design. In order to design appropriate m-commerce interfaces for pocket-size mobile devices, both functional and non-functional requirements for interface design should be explored in advance.

Functional Factors

Organizations should pay much more attention to consider those critical factors which lead to customer satisfaction, if websites with high usability (Flavián, Guinalíu, and Gurrea 2006) and quality (Chang and Chen 2009) are desired. Thus, prior studies have identified several functional factors in interface design. For instance, website navigation design, website visual design, and website information design had positive effects on website satisfaction (Cyr 2008). Four aspects of functional factors, including product perception (such as quality, price, etc.), shopping experience (such as effort, playfulness, etc.), customer service (such as responsiveness, reliability, etc.), and consumer risks (such as economic risk, privacy risk, etc.) were summarized (Jarvenpaa and Todd 1996). Besides, four categories of factors that affected website quality were proposed, namely information, friendliness, responsiveness, and reliability (Wan 2000).

Scenario-Based Design

As the interactive systems become more and more popular, designers return to pay their attention to users' real requirements and preference. However, in interactive systems, some requirements are not definite enough and it is difficult to acquire those requirements in the early stages. The focus is shifted to the system usability, which includes the concepts of ease of learning, ease of use, and user satisfaction (Rosson and Carroll 2001). Besides functional requirements, there are still some non-functional requirements such as portability, reliability, and maintainability that will finally influence system usability. Also, in order to solve the problem of traditional development methodology, designers must find a balance between waterfall and flexible prototyping approach. Consequently, to deal with the two main issues that are mentioned previously, some other intuitive methodologies such as usability lifecycle and scenario-based design should be utilized by designers. Although the overall flow of lifecycle and scenario-based design seems to be similar, the output of scenario-based design is more vividly to show detailed descriptions of the interaction and new ideas. Thus, according to the difference between two methodologies, scenario-based design is much more suitable for us to implement our research and understand what kind of tasks and subtasks are more appropriate to integrate into m-commerce websites.

Simply speaking, scenarios are just like stories, which describe what and how actors do in the specific story. A scenario emphasizes the coordination of information resources and data. According to the example described above, we can obtain lots of information about the actor's behavior, the reaction from the system, the procedures designed in the system, and the reasons why the actors in the system.

As shown in Figure 1, the framework of scenario-based design is consisted of five steps, including developing problem scenarios, designing activity scenarios, designing information scenarios, designing interaction scenarios, and evaluating prototype (Carroll 2000). First of all, by analyzing requirements appropriately, a problem scenario, which describes the practical activities that need to be revised and improved, would be proposed. Then, in the next steps, metaphors and complementary information technologies are identified to supplement specific scenarios, including activity scenario, information scenario, and interaction scenario. Finally, the eventual subtasks will be outlined and further evaluated.

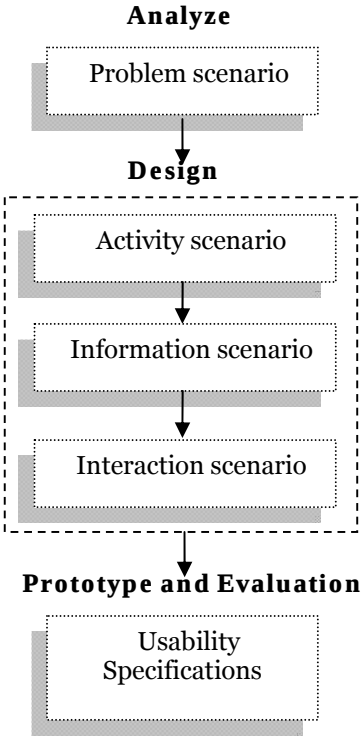

Figure 1. The Framework of Scenario-Based Design

Research Method

Experiment Design

The study intended to apply a task-oriented approach, namely scenario-based design, to identify critical subtasks while designing m-commerce interface for pocket-size mobile devices. To make sense of what issues matter the most in helping users accomplish tasks, this research employed three rounds of focus group studies (Krueger & Casey, 2000) to conduct each phase of design.

There were eleven members in the focus group. All participants were familiar with the use of pocket-size mobile device and had shopping experience on the e-commerce website. The members in focus group should be homogeneous, because experienced users could easily comprehend the problem and propose more ideas for the revision of the design in each step of scenario-based design. Besides, in order to let all participants feel relaxed, their homogeneous experiences may trigger and enhance their willingness to share ideas. To allow full discussion, two to three hours were allocated for each round of focus group study. Rich information was observed in problem scenario, activity scenario, information scenario, and information scenario.

The study focused on four steps of scenario-based design, including requirement analysis, activity design, information design, and interaction design. However, because presentation and execution frequently happen simultaneously, information design and interaction design were conducted in the same session. Therefore, as each step has its specific objective, our study conducted three rounds of focus group to obtain detailed information corresponding to four steps of scenario-based design.

In the first session of focus group, the focus was requirements analysis. In this phase, we first constructed the root concepts including high-level vision, basic rationale, stakeholders, and starting assumption. Our vision and rationale were to design a comfortable environment for surfing m-commerce websites and to

improve the current problems by using innovative solutions or information technologies. Stakeholders were our participants who were highly interested in and familiar with the project. Then, the study conducted the focus group to ask all participants questions, to observe their reactions and even to draw diagrams which can help to generate problem scenarios and claims. Problem scenarios refer to the detail descriptions of current activities, while claims are the advantages and disadvantages.

The following two sessions of focus groups started to focus on the design process, including activity, information and interaction design. The major objective of the whole design process was to emphasize the positive point, and minimize the negative consequences (Carroll and Rosson 1992). In the second round of focus group, the study intended to conduct activity design which included functional and non-functional features. The goal of activity was effective, comprehensible, and satisfying. By referencing problem scenarios and claims, participants could specify their design ideas deliberately with appropriate information technologies. Metaphors and useful information technologies were be identified in this step. The output of this session was activity scenarios, which were new ways to improve stakeholder's current activities and problems. Besides, while constructing activity scenarios, pros and cons claims were considered carefully and treated as another output in this session.

Because of the interdependency, information design and interaction design were combined and conducted in the third session of focus group. The purpose of information design was to arrange appropriate elements on the screen for enhancing user's perception, interpretation, and making sense of what they see. On the other hand, the goal of interaction design was to construct a list of user interaction and system response step by step. Interaction design focused on how to use and operate the system. In this session, metaphors and information technologies were used to generate design ideas regarding how to present the information and how to interact with the system interface. By using activity scenarios and claims, participants could combine these design ideas to construct both information scenarios and interaction scenarios, namely completed scenarios.

Results

After the first session of focus group, three problem scenarios were generated. Then, by discussing these problem scenarios in the second session of focus group, metaphors and information technologies, as summarized in Table 1 and Table 2, were illustrated to generate design ideas regarding how to present the information and how to interact with the system interface. Thus, after the second session of focus group two activity scenarios were composed.

Activity	Metaphors	Implications
Uwant wall	Fashion magazines	Providing up-to-date information recommended by celebrities
Demonstrating an item by a model and enabling pictures to be rotated to browse the item	Dummies in a store window.	Providing a real model for people to see.
Providing an additional discount while buying one item bundled with specific items	Promotion catalogs from a department store	Buy one, get one free. Special offers for buying bundled items.

Table 1. Metaphors

Activity	Information technology	Implications
Uwant wall	Yahoo Uwant wall beta version	Providing a brand new way for people to access product information
Sorting and filtering mechanism	Library searching system	Sorting by price or any preference, or filtering products according to the status of the stock
Arrangement of the interface objects	iGoogle	Freedom to pick up elements or objects on the interface
Automatic webpage adjustment according to the screen size of the mobile device	Media JS	Providing more interactive functions
Animation for adding an item to the shopping cart		
Allowing pictures of products to be rotated		

Table 2. Information Technology

By referencing activity scenarios, metaphors, and information technologies, two completed scenarios, which combined information scenarios with interaction scenarios, were developed after the last round of focus group. However, due to the limitation of paper length, it is not available to present any scenario here. Thus, we extracted tasks and subtasks from two completed scenarios instead, as shown in Table 3.

Tasks	Subtasks			Implementation
	Activity layer	Information layer	Interaction layer	
Find the site enticing	What products are interesting?	What are popular	Hot product	- Slide pictures left and right
		Who use what?	Uwant Wall	- The widget zoom out to show some products after clicking the picture
		- Time limiting - Information	- Today's deal - Weakly special	- Banners
Find product quickly	Know product taxonomy quickly	Simplified and structured	- Initial interaction - Stowed away when category is selected	- Implement a product category button - Place the button on the bottom of the screen - Window expands and collapses as needed (when button is clicked) - Categories arranged roughly according to likely popularity
	Browse	Product , Review , Stock, Delivery, discount, payment method	- Immediate response - Complete and concise	- Effective product category as the basis - Link clicking - Pull-down menu - 10 products in one webpage
	Search	Usual classifications are showed at the beginning	- Keyword - Keyword and category - Sorted result - search recommendation	- Pull-down menu - Separate widow for product categories selection
	Know where I am	Show my path	Breadcrumb	- Put in the detail information page - Put under the search bar and pull-down menu
Make sense of product information easily	Glance product introduction	- Concise information display(name, price, brief introduction) - Clear picture of product	- See picture before words - View from various angles	- Picture on the left-hand side - Words on the right-hand side - Picture rotates 360 degree

	View product information in detail	- Product information categorized - Clear spec and pictures	- Hide information if not selected - Default information is picture - Display the category of information when selected	- Implement a tab panel with three tabs: “Picture”, “Video”, and “Spec” - Slide to view pictures - Show clothing and apparel on model (with size and model’s height and weight)
Switch tasks quickly and easily	How can I go back to the top of webpage?	Where is the shortcut?	- Do not need to scroll up - Do not need to reload the page again - Jump to the top directly	- Implement a “↑” button at the bottom of the page - Click and jump directly to the top
	How can I stay on the original webpage?	- Don’t waste time loading a new webpage	- Floating window	- A small “X” button in the upper right of the window to close it quickly, and at anytime - Pull-down menu - Functional menu
	Not familiar with mobile website	See the same website browsed in PC or laptop	Link to traditional version	- Implement a button (PC pattern) in the upper right of the webpage - The button exist in every page - The button appears on the right side of the functional menu button
	Check buying list or browsing record anytime	- Log in - Shopping list - Tracking list - Browsing record - Transaction record - All these choices show in one time	- Hide the information if not selected - Do not need to click “Buy” or “Shopping cart” buttons - Can click in every webpage	- Implement a button in the upper right of the webpage - The button exist in every page - The button appears on the left side of the “PC” button

Complete transaction smoothly	Gaining product overview	- Brief summary - Clear picture	- Can purchase right away without further browsing - Tap "Buy Now" or " Add to shopping cart" buttons	- Implement "BUY" and "Add to shopping cart" button in product information page - Place the buttons right underneath the picture and summary information
	Confirm buying intention and know the transaction procedure	- Is it popular? - In stock? - How do I put in shopping cart - How do I pay?	- "Glue" the information with product (there is no need to click product information in order to see them) - Acknowledge whenever an item is put in shopping cart	- Combine wish list and shopping cart functions. - Pop up "+1" on the menu icon to show an item is inserted in the shopping cart. (A large and very visible "+1" pops up, shrinks to normal size, then disappears.)
	Check what products I have selected	- Selected items are clearly listed - Product name, picture, price, quantity, total amount	- Modify the quantity - Confirm the list - Remove specific items - Move specific items to tracking list	- Implement "Delete", "Tracking list", and "Pay" buttons - Use the picture which was shown with product summary information - Other product recommendations are put at the end of the page (under "Pay" button)
	- Select payment method - Pay conveniently and safely	- Provide most common methods - Safety features of each payment method	- Previously saved information, such as name, address, phone, and/or credit card, is brought in automatically - Users only need to double check the information which the system brought in, then tap OK to complete the transaction - Acknowledge the personal information is safe in the marketer's hand	- Currently, three payment methods are common: IBON, credit card, and Paypal - Other future possibilities, but may not be feasible at once - Statements of safety features is together with the relative payment method

Table 3. Tasks and Subtasks

Usability Test

In order to investigate system usability of the m-commerce website which was described with two completed scenarios, we applied system usability scale (Brooks, 1996), which is an easy and useful way for practitioners to assess the system usability. Questionnaires were administered to 31 subjects, who belonged to three groups. Ten subjects in group 1 were potential users, whereas another twelve subjects in group 2 had experience in designing apps by means of traditional system development methodology, such as SDLC. The other ten subjects in group 3 were the members in the three rounds of focus group, and they all provided valuable opinions and feedbacks to develop various scenarios.

First of all, the reliability of the scale was examined. Cronbach's α for the ten-item measure, namely system usability scale, was .890. Secondly, the study further compared the difference of system usability perceived by subjects among these three groups. Analysis of variance (ANOVA) was applied to analyze the differences between group means, and to test whether or not the means of three groups are equal statistically with Scheffe's method. As Levene's test was not significant (*p*-value=.460), there is no difference among the variances in the three groups. In other words, three groups were with of homogeneity of variance, which indicated the equality of variances.

		System usability scores		
	N	Mean	Std. Deviation	Std. Error Mean
group 1	10	77.40	14.73	4.66
group 2	12	78.16	10.56	3.05
group 3	10	82.40	9.17	2.90

Note: group 1: users (n=10); group 2: traditional system analysts (n=12); group 3: focus group (n=10).

Table 4. Group Descriptive Statistics

	Mean difference	*p*-value	Results
group 1 and group 2	-0.766	.988	Not Significant
group 1 and group 3	-5.000	.636	Not Significant
group 2 and group 3	-4.233	.701	Not Significant

Note: group 1: users (n=10); group 2: traditional system analysts (n=12); group 3: focus group (n=9).

Table 5. Results of Intergroup Comparisons

As shown in Table 4, in terms of system usability, group 3 (mean=82.40) outperformed that in group 1 (mean=77.40) and group 2 (mean=78.16) on average. However, based on Scheffe's method, the intergroup comparison was conducted, and the results are shown in Table 5. It is clear that there was no significant difference among three groups. However, due to the small samples of our measurement, we again utilize Kruskal-Wallis H test to verify the accuracy of ANOVA. Hence, after using K-W test, the p-value is 0.643 which is higher than 0.05. The result represents that there is no significant difference between three groups. That is to say, m-Commerce website designers are able to identify subtasks that satisfy potential users by applying scenario-based design approach in the system analysis phase.

Conclusion

In the field of interface design, many studies have focused on obtaining functionalities requirements and have identified many critical design factors. However, most of them have ignored the importance of non-functional requirements. The study applied the task-oriented approach, namely scenario-based design, to identify not only functional tasks but also non-functional tasks for m-commerce website. After conducting

three sessions of focus groups, two completed scenarios were presented for describing the preferred m-commerce website.

Describing the outcome of system analysis with scenarios, rather than with traditional standard documents, indeed provides all participants and potential users with better understanding of m-commerce website. In particular, the use of metaphors played an important role in inducing participants of focus group to create the occurrences of innovative tasks and subtasks, which were hardly offered by means of factor-based approaches. Furthermore, design guidelines for developing subtasks in activity layer, information layer, and interaction layer were summarized and demonstrated with an in-depth description of tasks proposed by the study.

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