Employ Consistent Interface to Various Ticket Vending Systems for Diverse User Experiences

Jisook Han*, T. K. Philip Hwang**, Li-Chiao,Chu***, Yun-Hei Lai****

** hanjisook@gmail.com*
*** phwang@ntut.edu.tw*
**** joycechu605@gmail.com*
***** tigerfat37@gmail.com*

Abstract: Interface design transaction kiosks should be optimized for first-time use and provide consistent interface and operation sequence among functionally similar systems, such as the Taiwan High Speed Rail(TSHA) and the Taiwan Railway(TRA)'s ticket vending machines. This study is intended to employ concept of consistent interface, overview plus detail (OPD) and metaphoric interfaces to ticket vending machine for TSHA and TRA. The operation sequence, screens layout and option buttons in ticket vending machine are mainly redesigned for various mass transportation systems. The assessment revealed that experienced users of any one of the two ticket vending system performed less error and better efficiency when using the other ticket vending systems. Furthermore, the study remarked that users were able to easily identify the location of information, process of operation, and progress through interactively, intensely and deliberately designed page layout.

Key words: interface consistency; overview plus detail (OPD); metaphoric interfaces

1. Introduction

The effectiveness of ticket vending machine is to integrate transportation systems in ticket window, which allows passengers to avoid long queues and provide lower operating cost. The Department of Taipei City Transportation has set up ticket vending machines at the Taiwan High Speed Rail (TSHA) and Taiwan Railway's (TRA) stations that allow passengers to purchase the ticket from one machine efficiently for many years. However, TSHA Corporation research shows low capacity utilization of ticket vending machine (Figure 1).

The TSHA and The TRA's ticket vending machines are computer-based information system with an intuitive interface for user input and output, located in a public area, used by an anonymous user who is standing, and required a relatively short time to use. However, those have different or unnecessary operation sequence (Figure 2), screens layout and option buttons that confuse the passengers with no consistency and cause low capacity utilization. In addition layout fundamentals such as shape, size and position of option buttons and especially location of navigation on existing TSHA and TRA’s ticket vending systems, do not perfectly match to user's mental model and also frequently confuse the passengers(Figure 3).

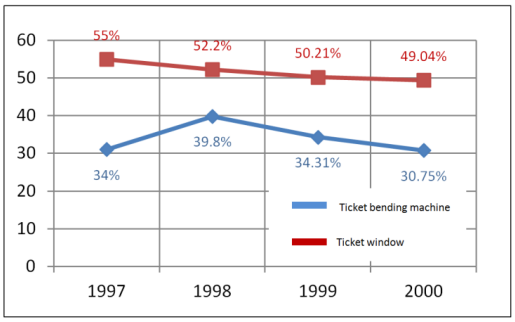

Figure.1 Buying ticket between ticket window and vending machine percentage of TSHA from 1997~2000

Source: TSHA report

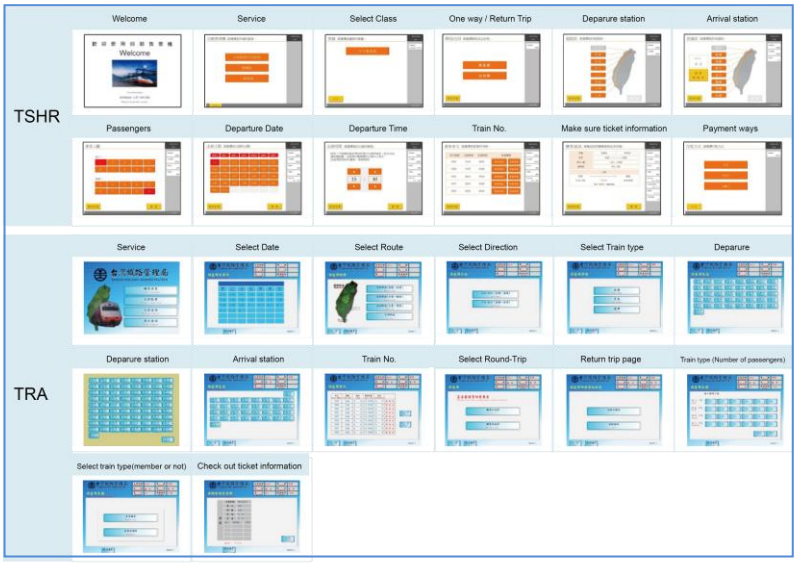

Figure.2 The various operation sequence of existing ticket vending machine systems frequently confused the passengers (upper: TSHA and lower: TRA).

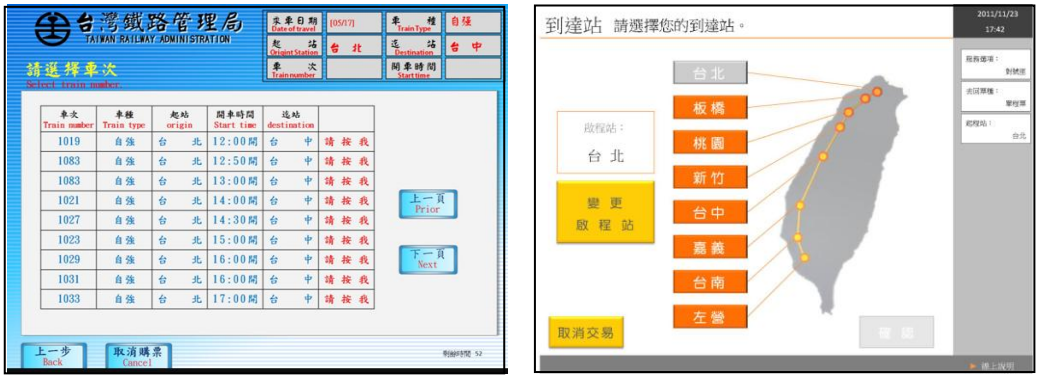

Figure.3 Existing ticket vending machine systems in layout fundamentals such as shape, size and position of option buttons in TRA and TSHA need to be redesign employing the principle of interface consistency, overview plus detail (OPD) and metaphoric interfaces

(left: TRA and right: TSHA).

2. Conceptual Frameworks

Although all existing ticket vending machines have used consistent interface in this study, the interface consistencies still need to be improved for better usability. In addition, the concept of Overview Plus Detail (OPD) needs to be emphasized for effective awareness of location of information, process of operation and progress more intensely for the users.

2.1 Consistent Interface

Consistent interface and Overview Plus Detail were also frequently used to help users prevent error operation. The internal consistency (e.g., layout, terminology, color, etc.) is a crucial issue in the usability of highly interactive computer programs (Shneiderman 1992; Reisner 1990; Nielsen 1989). Nielsen referred that consistency leads to "improved user productivity by leading to higher throughput and fewer errors because the user can predict what the system will do in any given situation and can rely on a few rules to govern use of the system." He also pointed out "it is desired to have the system be consistent with users' expectations whether formed by other applications or by non-computer systems."

Consistent interface allows users to quickly understand the system, and help them build accurate mental models. Based on the existing system and user interface design theory, this study defined the page layout of ticket vending machine that contained main page, option buttons, cancel option, feedback and efficient operation sequence. Consistent shape and graphic details of buttons were defined, while proper locations of buttons, options and text instructions were given.

2.2 Over View Plus Detail

The concept of Overview Plus Detail (OPD) was employed in the new design of ticket vending machine UI in transport system. OPD is a way of dealing with complexity: present a high-level view of what's going on, and let the user 'drill down' from that view into the details as they need to, keeping both levels visible for quick iteration. In addition meeting the criteria for each of these ticketing machine interfaces in a group of systems requires overview plus detail (OPD). It should not only help users understand where they are in the system, but help them understand where they are in the overall process as well. Edward Tufte (2001) used the terms 'micro and macro readings' to describe a similar concept for maps, diagrams, and other static information graphics. The users have the large structure in front of them at all times, while being able to peer into the small details at will: 'the pace of visualization is condensed, slowed, and personalized'. Similarly, users of 'Overview Plus Detail' can page methodically through the content, jump around, compare, contrast, move quickly, move slowly, or even rearrange it.

According to our survey, overview location on the upper left corner in existing interface of ticket vending machine that most people not realized its location and had difficulties while operating the system. After our design with the theory, overview on the left and bigger portion that everyone recognized its location and indicated better efficiency.

2.3 Metaphoric interfaces

Metaphoric interfaces rely on intuitive connections that users makes between the visual cues in an interface and its function. There is no need to understand the mechanics of the software, so it is a step forward from implementation-centric interfaces.

Metaphors in the context of user interface and interaction design, we really mean visual metaphors: a picture used to represent the purpose or attributes of a thing. Users recognize the imagery of the metaphor and, by extension, can presumably understand the purpose of the thing. Metaphors can range from the tiny images on toolbar buttons to the entire screen on some programs and in interface can grasp the meaning intensely.

Intuition works by inference, where we see connections between disparate subjects and learn from these similarities, while not being distracted by their differences. We grasp the meaning of the metaphoric controls in an interface because we mentally connect them with other things we have already learned. This is an efficient way to take advantage of the awesome power of the human mind to make inferences.

3. Analysis and Results

In order to find the cause of reducing utilization and ineffective usability in existing ticket vending machine systems, there was experiment to general audience for the discussion.

3.1 Existing Ticket Vending Machine Systems Status

We divided two groups into A and B, each group has 10 general users that addressed the casual interview and questions through a study. The study is structured as follows (Figure 4). This study purposed to understand users using existing status and get analysis and comparison between operating on TSHA and TRA's vending machine systems. Initially, an overview of the results is provided (Tab.1, Tab.2).

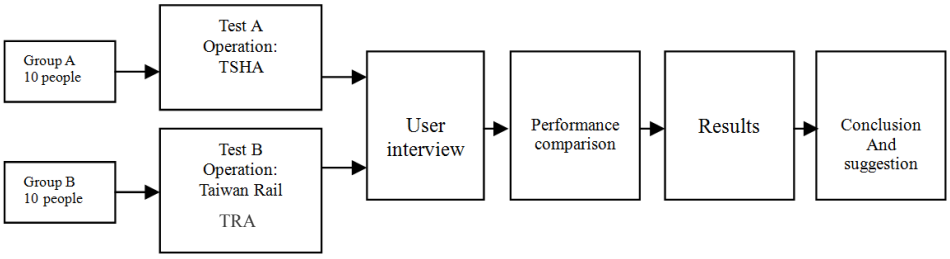

Figure.4 Flowchart of steps for the pilot study

Table.1 Verification of experiment for analyzing error rate

Interface	Group	Average	Standard deviation	p value
Test A	A	0.2	0.442	0.556
	B	0.1	0.316	
Test B	A	0.3	0.483	1
	B	0.3	0.483	

*P<0.05, Statistical significance

Table.2 Verification of experiment for analyzing operate time

Interface	Group	Average	Standard deviation	p value
Test A	A	81.600	15.785	0.635
	B	78.400	13.794	
Test B	A	111.900	23.835	0.813
	B	112.400	22.790	

*P<0.05，Statistical significance

The results reflected on the study as a whole that no consistency in operation sequence and screen layout between TSHA and TRA's vending machine system is the major reason that users can not establish the same mental model.

4. Discussion

Based on the pilot study, which indicated that operating sequence, page layout and button types need to improve in employing consistent interface to various ticket vending systems. Consistent shape and graphic details of buttons were defined, while proper sizes and locations of buttons and text instructions were given. After first developing, some of subjects were not still satisfied and not desired the direction and users' mental model in consistent interface.

4.1 Operation Sequence in Consistency

According to Pei-Rong Lee's (2010) study " Exploring the Cognitive Model of Ticket Buying - Case Study of Ticket Vending Machines of Taiwan High Speed Rail" demonstrated that passengers have five basic demands in their mind while operating ticket vending machine system that are (1) Date, (2)Time (departure, arrive, duration), (3) Tickets Category, (4)Passengers, (5)Destination. According to his demonstration, the passenger can get a goal within 5 steps (Figure 5).

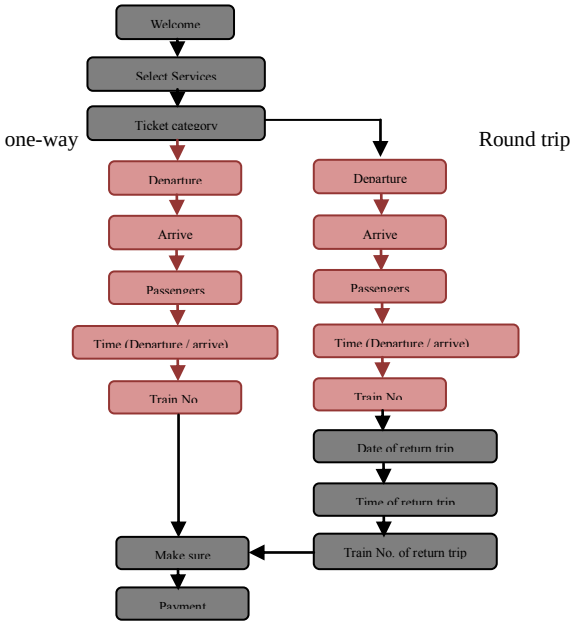

Figure5. Consistent operation sequence for TSHA and TRA's vending machine systems

4.2 Page Layout and Button Types in Consistency

The first prototype page layout designed based on eye movement and consistent interface. Analysis Eye Movement across an interface should form a logical path that enables users to efficiently and effectively accomplish goals and tasks. In addition to precisely following a grid, the layout must also properly structure an efficient logical path for users to follow through the interface, taking into account the fact that the eye will move from top to bottom and left to right (Figure6). Consistent interface allows users to quickly understand the system, and help them build accurate mental models. This study defined the page layout that should contained main page, option buttons, cancel option, feedback and efficient operation sequence.

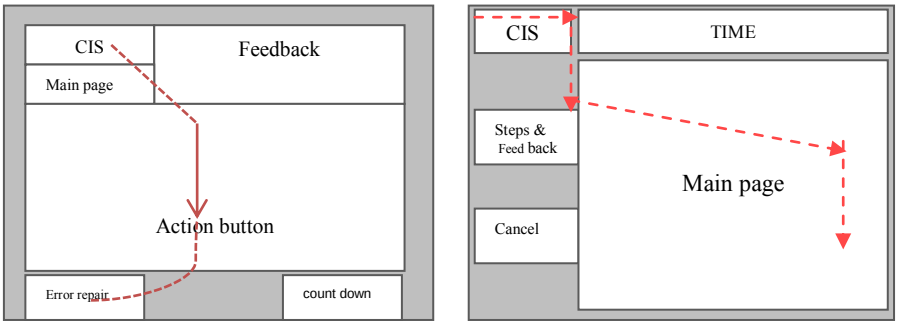

Figure6. Analysis eye movement in existing page layout (left) and the first prototype page layout (right)

Graphic details were also defined, including color, button shape and size. Buttons are most often identified by their simulated-3D raised aspect and were adapted from its traditional analog shape that expanded significantly in function, role, and visual aspect. Part of the affordance of a button is its visual pliancy, which indicates its "press-ability." When a user points to it, the button onscreen visually changes from raised to indented, indicating that it is activated (Table.3).

Table.3 Consistent Buttons for THSR and TRA

Button Category	THSR	TRA	Description
Option button			Vivid Colors Traditional analog shape Embossed width:5pt / Hight:2pt
Back & Cancel option			Easy to distinguish from other buttons

4.3 Experiment and Verification

Second experimental subjects were divided into two groups and thirty participants of each group to verify first prototype usability. The overall aim of the study was to further investigate the users' descriptions of their first prototype of consistent interface to ticket vending systems' experiences, fault times and operate times.

Table.4 Verification of experiment for analyzing error rate

Interface	Experience	People	Average error time	Standard deviation	p value
Taiwan High Speed Rail	no(Group A)	30	0.40	0.563	0.031891*
	yes(Group B)		0.133	0.346	
Taiwan Railway	no(Group B)	30	0.567	0.568	0.000266*
	yes(Group A)		0.10	0.305	

*P<0.05, Statistical significance

Table.5 Verification of experiment for analyzing operate time

Interface	Experience	people	Average operate time	Standard deviation	p value
Taiwan High Speed Rail	no(Group A)	30	90.475	38.310	$6.6416x10^{-7}$*
	yes(Group B)		45.627	15.498	
Taiwan Railway	no(Group B)	30	99.236	41.784	$6.43362x10^{-7}$*
	yes(Group A)		47.507	26.807	

*P<0.05, Statistical significance

Participants explored the first prototype of page layout and the result showing that 68% of experienced users satisfied (Figure7). However, numerous of users still lost their goal that they couldn't aware where they are in the system and where they are in the overall process as well. The most appropriate alternative for this problem is that requires overview plus detail (OPD) to meeting the criteria for each of these ticketing machine interfaces in a group of systems

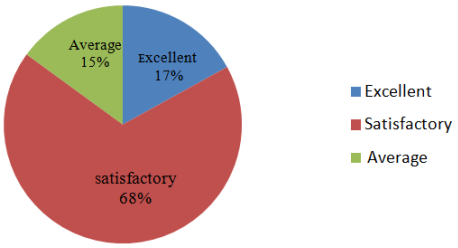

Figure7.The result of user evaluation for first prototype usability

5. Final Design

The final prototypes of TSHA and TRA's vending machines interface emphasized the concept of overview plus detail and Metaphoric interface design for better usability from verification of previous study.

Overview plus detail pattern is optimal for full-screen applications that require user access to many different kinds of objects, manipulation of those objects in groups, and display of detailed content or attributes of individual objects or documents. Also OPD is apparent in Microsoft Outlook with its navigational pane on the left, overview pane on the upper right, and detail pane on the lower right (Figure 8).

Figure8. Owing to consistently designed interface system, the user who experienced using one of those systems, will be able to use another without any difficulty and user knows the step of operating process any time because the transportation systems were integrated with OPD

(left: TSHA and right: TRA).

Metaphoric interfaces rely on intuitive connections that users make between the visual cues in an interface and its function. There is no need to understand the mechanics of the software, so it is a step forward from implementation-centric interfaces. Therefore the buttons based on graphical rendering to select an item, the Taiwan map graphic to choose the location, clock graphic to choose the time and user can get the goal faster and more intuitive (Figure 9).

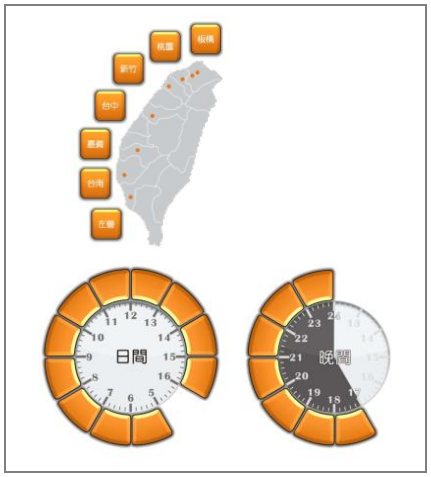

Figure9. Option button graphic in Metaphoric interfaces

6. Conclusions

This study proposes analysis and suggestions on consistent interface to various ticket vending systems for diverse experience users. The prototypes of TSHA and TRA's vending machines were tested by thirty passengers. The result showed that the prototypes improved obviously, but several passengers didn't notice the existence of overview ribbon. The overview ribbon was then rearranged for visually noticeable display and size according to the user's experience. Color and graphic emphases for better operation sequence indication were also designed to implement the usability rule of Overview Plus Detail. The user knows the location of information, process of

operation, and progress any time because the prototypes of TSHA and TRA's vending machines systems were integrated with consistent interface, overview plus detail (OPD) and metaphoric interfaces.

7. References

[1] Cooper, Alan; Robert Reimann; Dave Cronin (2007) *About Face 3 The Essentials of Interaction Design* ([3rd ed.). Indianapolis, IN: Wiley Pub.

[2] Nielsen, J. (1989) *Executive Summary: Coordinating User Interfaces for Consistency*, in Nielsen, Jakob (editor), Coordinating User Interfaces for Consistency, Academic Press, San Diego, 1-7

[3] Sieh, Jei-Chen; Peng-Hsiang Lai; Jin-Yen Khau (2010) *Interface Study on Automatic Selling System for Taiwan High-Speed Train with Eye-Tracking Camera and Subjective feeling*, Taiwan Institute of Kansei conference, C-12, Taichung.

[4] Lee, Pei-Rong. (2010) *Exploring the Cognitive Model of Ticket Buying - Case Study of Ticket Vending Machines of Taiwan High Speed Rail*, National Taipei University of Technology, Taipei

[5] Schlosser, A. E. (2003) *Experiencing Products in the Virtual World: The Role of Goal and Imager in Influencing Attitudes versus Purchase Intentions, Journal of Consumer Research*, vol. 30, no. 2, pp 184-198.

[6] Wang, Tsung-Hsiang (2011) *Employ Consistent User Interface and Mental Model in Common Use Self Service (CUSS)*, National Taipei University of Technology, Taipei

[7] Cheng, Yu-Ru (no date) *A Study on the Layout of Graphic User Interface —Using the Electronic Sleep Diary as an Example*, National Taiwan University of Technology, Taipei

[8] Wickham, D.; Mayhew, D.; Stoll, T.; Toley, K. & Rouiller, S. (2002). *Designing effective wizards: Amultidisciplinary approach*, Upper Saddle River, NJ: Prentice-Hall.