

Experimental Study on Effect of Information Behavior by Media Representation Patterns of E-Commerce System

Jiangyu Li

School of Economic & Business Administration, Beijing Normal University, Beijing 100875, China

ABSTRACT

The article made study on effect of different media representation pattern of the hierarchy in shopping-on-line system. The result shows that the effect of virtual reality representation pattern is better than that of Text in higher levels of the hierarchy, but more levels in virtual reality pattern increases the errors of user's activity. It also shows that the media representation pattern of first level have greatest impact on improving performance efficiency.

Keywords: shopping-on-line, virtual reality, hierarchy, media representation pattern

1. INTRODUCTION

In recent years, the development of Internet was growing enormously. While changing working pattern of humans, it also brings in another business model, say online shopping, its unique charming made itself a huge commercial future and even will change current existing traditional way of business model^[6]. The study^[2] found that visual reality pattern of commodity information involved in online shopping system can make buyers to give positive comments to commodity information and effectively arouse the buying desire of consumers. Therefore, that, factors in visual reality of commercial websites affect information behavior and shopping behavior of humans, gains a lot of attention from academic professionals. Those attentions can be interpreted as the following: the proceeding structure of consumers' visual experiences, and the relation between direct experiences of consumers and indirect experiences of consumers in visual reality system^[9]; the applicability of design rules of shops in visual reality system compared to that of real life shops, and the study on the advantages of shops' individuation in visual reality system to consumers^[10]. On the respect of media representative pattern, a primary finding is that representative pattern of shopping system in visual reality is in the better position for consumers to feel familiar in shopping process and have high frequency rate to complete buying tasks compared to that in Text pattern, while on the aspect of representative in systematical structure^[11], how does representative in visual reality affect consumers' information behavior still remains unclear.

As for the study on hypertext model, it was found that the overview was very important for the development of task strategy and working efficiency of the users because it constructed the mental map of users for the system^[3,8]. Representative pattern will greatly affect the development of the overview, even affect the interactive way with the system. One effective method was to fully use established experience and inherent cognitive ability of users, using their familiar objects and activity model to metaphorically demonstrate interface information and

interactive model, which is called metaphor Model^[1]. This understanding and practices had become the major pattern of representative and interaction of current information system. Visualization theory concerned perceived that users' inherent capability of understanding space and space's relationship should be utilized efficiently to allocate information. Therefore, different visualization utilization models are formulated [5,7].

The hypothesis is that hierarchies of shopping system in VR pattern will be easier for users to set up an overview of the system and formulate an effective interactive model, and it will be easier for users to formulate information cognition, but its efficiency of information activities (moves or actions in information space) maybe low due to its high frequency of going around to search objects compared to that in Text pattern, in this sense I suppose to draw a conclusion that VR pattern is better than that in Text pattern in higher level of hierarchy structure; VR pattern with more levels is easier for users to complete the task, but performance efficiency in Text pattern is higher than that in VR pattern, the understanding on the previous conclusion in online shopping environment needs to further test and examine.

2 METHODS

2.1 Subjects

30 subjects are from Beijing Forest University, they are all inexperienced computer and web users with average age of 20.5 years old, 22 of them are male subjects.

2.2 Experimental Devices

PC (Pentium 166), 14' Monitor, two-key Mouse.

2.3 Experimental Materials

To set up three on-line shopping centers The shopping centers use same 4+4+3+1 structures with four levels referring to shopping streets, shops, shopping berth and

commodities respectively and each level consists of four, four, three and one object respectively, say shopping streets have four shops with four shopping berths and each berth consists three items of commodities, and commodities has a list to describe its characteristics and indicate its name. The structure and objects of three shops are all the same. The first level at first shopping center will be presented with visual reality, and other levels will be presented with Text representative (hereinafter referred to as VR100); the first and second level at second shopping center is presented with visual reality, and other levels are presented with Text representative (hereinafter referred to as VR11); second level at third shopping center is presented with visual reality, and other level is presented with Text representative (hereinafter referred to as VR010). Entering the first three levels of the shopping center hierarchy will be proceeded by moving rolling bar at the bottom of the screen (for text pattern) or walking (for VR pattern), and then view all objects or the whole shopping site. Shoppers can enter next level of shopping site by clicking object-text, also they can back up the previous level by clicking Exit or Back button. The last levels of three patterns are all the same with text representative. All materials and the facilitation of the experiment are based on the web, VRML, HTML technology.

2.4 Experimental Task

One target object will appear randomly from 48 objects, subjects should go round and view objects in shopping centers by moving mouse. Subjects choose "determine to buy" when they find target object in the fourth hierarchy, which indicates the completion of one object-searching task. Subjects will execute 20 searching tasks as fast and accurate as possible. Reaction time, objects selected and accuracy in different levels made by subjects will be recorded by computer in the whole process.

2.5 Experimental Design

One factor between-subject design was adopted.

Independent variable is referred to different representative patterns of shops, or each level of shops in visual reality, that is to say, which level is presented by visual reality. Independent variable has three levels with three representatives mentioned in experimental materials, each level is matching three treatments respectively. Thirty subjects are grouped into three teams (each team consists of 10 persons) randomly and allocated into three treatments.

Dependent variables are the following

1. Reaction time (RT) : Time subjects spent to complete one object-searching task, totally 20 object-searching tasks in the experiment.

2. Times of mouse movement (TMS) : Actual number of clicking when subjects process the task.

3. Mouse movement error (MME) : It means that the difference between actual times of mouse movement and necessary times of mouse movement for one task. The shopping center was divided into four hierarchies, and subjects must take at least four times of choices to find the object, in this sense, the actual times of one task would be four. Mouse movement error would be the difference between times of mouse movement and four.

Controlled variables: Time delay during changes of different hierarchy level of the shopping center, and it takes 9 seconds to appear next level in each representative.

2.6 Experimental Procedures

30 subjects are grouped randomly into three teams with 10 numbers for each team and each team will conduct three treatments respectively (shopping center with three representative patterns). Under each treatment of Text, TCG or VR shopping system, subjects will read wording instruction first, and will perform for an exercise after understanding the instruction perceived by themselves in order to understand the whole tasks and requirement. The content of practices is irrelevant with that of the experimental tasks. Subjects should fulfill ten object-searching tasks during the practices and enter the actual performance of the experiment: as soon as target objects appeared, subjects will begin performing by clicking "Start", then the first level of shop system, say shopping street, will be showing. The subjects will perform tasks until he or she find the target object and determine to purchase by clicking "determine to buy", then the primary task is fulfilled, the next target objects appeared, and the second task begun. This process of objects-searching task will be performed twenty times by each subject. The computer will monitor the whole process and record all activities of the subjects.

3 RESULTS

The results are shown in table 1, effective subjects in three treatments are 11 persons, 8 persons and 8 persons respectively.

Review all data first (explore, SPSS 8.0 for Windows) and test the normality of the data, then conduct ANOVA analysis (GLM General Factorial in SPSS for Windows 8.0). Reaction time doesn't include time delay of 9 seconds, unless it marked clearly.

3.1 Reaction time under different three media representative patterns (RT)

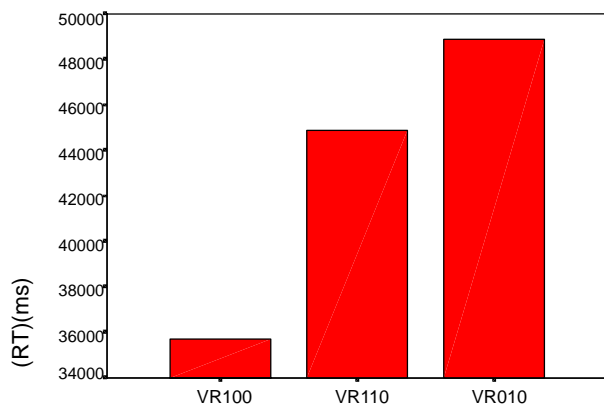


Figure 1. RT under different representative patterns

Table 1: Reaction time under different representative patterns

	Subject	Mean (ms)	Deviation	Deviation
VR100	11	35685	12367	3530
VR110	8	44896	11141	10565
VR010	8	48905	18944	6313
Total	27	42331	14929	3741

Table1 showed that subjects completed task fastest in VR100, second fastest in VR110 and slowest in VR010.

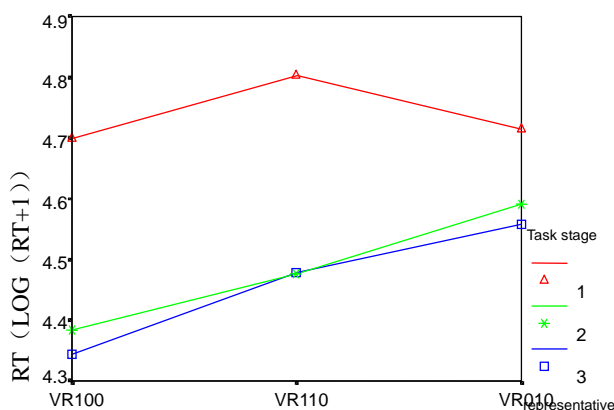


Figure2: RT of task stages under different representative patterns

ANOVA revealed that there was no significantly difference on task performance among three media representative patterns [$F(2,24)=2.161$, $p=0.137$], Post Hoc (LSD) Test found no significant differences among them as well(see figure1).

3.2 Reaction time of each task stage in media representative pattern.

In order to further understand the effect of three media representative patterns on information activity, a deeper research has been made to study the activity of subjects in different stage of tasks in three representative patterns. In this situation, we considered different task stages as additional factor, and divided it into three stages (or levels), first stage with first 7 tasks, second stage with 7

tasks in the middle, and third stage with last 6 tasks.

In considering of the requirement of data normality, we conducted changes ($RT \rightarrow \log(RT+1)$). Figure 5 showed that the speed of development under each representative pattern was getting faster as task stages (levels) are developing, which indicated the strong effect caused by practicing. VR110 was the slowest in first stage, and the other two are very close in merit; VR100 was fastest both in second and third stage, VR110 in the middle and VR010 the slowest.

ANOVA indicated that there are significantly differences among three treatments ($F(8,72)=5.785$, $p<0.01$), and the main effect of representative pattern ($F(2,78)=4.199$, $p<0.05$) and the main effect of task stages ($F(2,78)=0.629$, $p<0.01$) are all significantly different. But there are no significantly differences in interactive function between the two ($F(4,76)=0.897$, $p=0.470$). Post Hoc(LSD) Test found that there are significantly difference between the two of VR110, VR010 and VR100; and significantly difference between the last two stages and the first stage (see figure 2).

3.3 Times of mouse movement (TMS)、Mouse movement error (MME) under different representative patterns

TMS and MME in VR110 are the highest. ANOVA

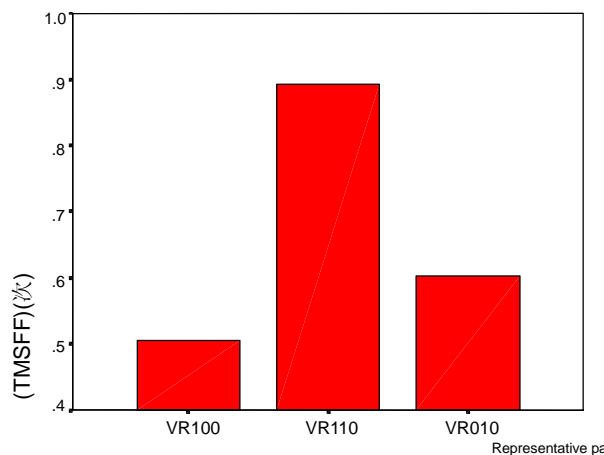


Figure 3. MME under different representative patterns

showed that there was no significantly difference on TMS ($F(2,27)=2.828$, $p=0.077$), and there was significantly difference on MME among the three ($F(2,27)=3.914$, $p<0.05$). Post Hoc(LSD) Test found significant differences between TMS and MME in VR100 VR 110 (see figure 3).

4 ANALYSIS AND DISCUSSION

This study showed that using VR in higher level under different media representative patterns results in better performance and higher behavior efficiency of consumers. At the first level, it reaches best performance in VR and worst in Text pattern. This leads a conclusion

that the position of VR appeared is very important under hierarchy structure of three representative patterns. The appearing of VR at first level and second level shows the opposite effect. Using VR at higher levels of hierarchy structure is helpful to lead performance efficiency, but using more VRs at more levels can't lead better performance, but increasing MMS that decreases the speed of the whole task. According to analysis mentioned before, VR at the first level help subjects set up an overview of the system, or setting up a relation between the existing experiences of the subjects and information target and behavior model of the subjects, that is better than that under Text pattern.

Conclusion can be made that VR has a better position to help subjects set up a systematic overview of media representative pattern; the first level in hierarchy structure is more powerful than others to set up a systematic overview of hierarchy levels.

REFERENCES

- [1] Alan Dix, Janet F., Gregory Abowd, Russel Bele, 1993, Human-computer interaction, Prentice Hall, Inc
- [2] Alice Richmond 1996, Enticing online shoppers to buy——A human behavior study. Fifth international World Wide Web conference, May 6-10, 1996, Paris, France. http://www.w3.org/confrences/www5/fich_html/papers_sessions.html
- [3] Ben Shneiderman 1997, Designing Information-Abundant Websites: Issues and Recommendations, International Journal of Human-Computer Studies, Int. J. Human-Computer Studies, 47, (1)
- [4] Donna L. Hoffman, Thomas P. Novak, and Patrali Chatterjee, (1995), Commercial Scenarios for the Web: Opportunities and Challenges, <http://209.130.1.169/jcmc/vol1/issue3/hoffman.html>.
- [5] Gary Marchionini 1995, Information Seeking in Electronic Environments, Cambridge University Press, UK.
- [6] GVU, 1997, GVU's WWW User Survey, http://www.guv.gatech.edu/user_surveys/servey-1997-04
- [7] Lisa Tweedie, 1997, Characterizing Interactive Externalizations, <http://www.acm.org/sigchi/chi97/>
- [8] P.A. SMITH, 1997, Virtual hierarchies and virtual networks: some lessons from hypermedia usability research applied to the World Wide Web, International Journal of Human-Computer Studies, Int. J. Human-Computer Studies, 47, (1)
- [9] Hairong Li, Terry Daugherty, Frank Biocca, Characteristics of Virtual Experience in Electronic Commerce: A Protocol Analysis, <http://elab.vanderbilt.edu/research/papers/pdf/manuscripts/jim.pdf>, 2001
- [10] Luca Chittaro, Roberto Ranon, New Directions for the Design of Virtual Reality Interfaces to E-Commerce Sites, <http://hclab.uniud.it/publications/5.pdf>, 2002
- [11] Selected Proceedings, the Second China and U.S. Advanced Workshop in Electronic Commerce 2004, South-west University of Financial & Economic Press