Template for Website Browsing

Fong-Ling Fu[1] and Chiu Hung Su[2]

[1] Department of Management Information Systems National Chengchi University, No. 64, Sec. 2., ZhiNan Rd., Wenshan District, Taipei City 11605, Taiwan (R.O.C.)
flfu@nccu.edu.tw
[2] Department of Management Information Systems Hwa Hsia Institute of Technology
ritasu@cc.hwh.edu.tw

Abstract. Websites on e-commerce often display large amounts of multi-media and information, creating problems for viewers when locating specific information. This research uses the concepts of template and selective attention to understand the cognitive simplification in finding information and browsing websites. Utilizing content analysis with 240 university students as subjects, we conducted an experiment on information retention with browsing a shopping website. Although the amount of information displayed by the website was staggering, the result of the experiment showed that participants applied a template built up through past experiences of what's important and where things belong. This internal map containing three mechanisms: segmentation, grouping and attention, is then used to create an efficient task strategy, to segment the page, and to categorize the information. This research tried to understand the attributes of template for users who are browsing Websites. The "findability" of online information would be improved if the arrangement of information of a web site were the same as what viewers expected.

Keywords: Information search ability, selective attention, interface design of websites, template matching.

1 Introduction

How to improve searching ability is a hot issue in website design now, because the continuous trend in websites to display ever increasing amounts of textual information and multimedia content is resulting in information overload that is not only visually confusing, but complicates information searching [9, 8]. The reason why information is considered complicated is because sometimes there is too much of it to be processed by the brain. When the information is first read in by the human eye, hundreds of thousands of optical neurons are in place to register vast amounts of data. In fact, as understood by the mental perceptual model, the impressive processing capability of the optical nerves is able to handle virtually any volume of information elements [17].

The brain however, has only seven chunks in its short term memory, and this limited capacity is unable to fully process everything relayed from the eyes into meaningful and useful information [12]. To cope with this mismatch in processing ability and input volume, the mind uses a filter mechanism to sort the input, by only

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selectively processing information understood to be interesting or important, and ignoring information irrelevant to the user's task at hand; this is commonly referred to as "selective attention". Therefore when a viewer looks at complex information, his or her eyes will register all the objects, but his or her mind will not "see" and use all the details; the ignored messages will not be mentally processed any further [12, 1].

For more understanding the human being's mechanism of information filter, we hypothesize that when viewers see a webpage, they use what cognitive theory calls "template matching", to apply a template of what's important and where things belong, built out of past experiences. This internal map is then used to create an efficient task strategy, to segment the page, and to categorize the information [12, 13]. This experiment sets out to find what the template probably is, with the hopes that the findings may lead to identifying what types of attribute variety is needed for clear distinction of information and which ways of grouping information are the most suitable to particular kinds of tasks. Ultimately we hope to improve the way websites are designed and making them more accessible and useable for viewers.

2 Template-Matching: The Mechanism to Reduce Complexity

Template-matching Technique was proposed by Ben and Funder [2] which provided a language of description for both persons and situations. Applied to prediction of human being's behavior, the technique consists of two basic steps. First, each conceptually distinct behavior in the laboratory setting under investigation is characterized by a *template,* a personality description *of* the hypothetical idea person who is most likely to display the design behavior in that situation. These templates serve to characterize the potential behavior of subjects inside the laboratory. Second, personality descriptions of subjects are obtained from close acquaintances; these descriptions characterize the subjects' behaviors outside the laboratory. A particular individual behavior was predicted through the match between these two sets of data. It has been used in explaining peoples behaviors in social psychology [3]. Lots of applications of template-matching technique in image recognition or pattern match which involved template matching processes, assumed that various internal representations (templates) of objects were stored in memory, and new stimuli were processed by comparing them with the templates until a match was found. As a webpage can be considered as a complex image containing lots of information [5], the authors thus try to use template matching technique in predict (explain) behavior of web page browsing.

The way our brain runs the selective attention process is it uses the attributes of what we see, to distinguish the interesting from the unimportant. So the important question is, out of all the attributes to choose from, how does the mind decide which to use? The template states that people just grab a similar template to use because they impossible have enough experiences with all objects and the mental processing time for matching is very fast. Therefore, instead of information contents, information structures are usually used in looking for the pattern of template-matching [14]. Two preprocesses occur before the matching, one is a local operation to eliminate unnecessary noise, and the other is a normalizing process to translate the pictures which over large, over small, lean, or wrapping to be standard or normalized stimulus [10].

3 The Experiment

3.1 Procedures

The experiment was a laboratory experiment using two famous commercial websites in Taiwan: Yahoo Shopping center (http://buy.yahoo.com.tw) and PChome Online (http://shopping.pchome.com.tw). The subject was given one of the websites and assigned a task to identify the most optimal Panasonic digital camera and to find important information about it.

The procedures of the experiment are: first, before browsing the target Website, participants were asked to draw what their ideal start page of an e-commerce Website meant to handle the task. Then, browsing time was limited to only ten seconds per webpage, before users were required to make a mouse click to navigate to the next page, in order to force users to filter out irrelative information and get to key information quickly. The screen was then turned off and subjects would draw a mental image of the webpage just viewed before continuing on. This allowed us to figure out subjects' mental templates and their searching and browsing strategy for each web site. All browsing steps were repeated until the final target was reached.

Fig. 1. (a) Yahoo Shopping Center (b) Front page structure model

How can we discover the template used by a viewer during information seeking? Previous studies point to the fact that a viewer can use the structure of information presented to find a pattern [14], and that viewers' cognitive structure for a web site during information seeking thus can be analyzed to find their templates. The method used in the study for drawing structure of a web page was proposed by Ngo et al. [11], to analyze graphical patterns, called structure models. The actual content of the graphics is replaced by squares. For example, Figure 1(a) is a screenshot of the starting page of Yahoo Shopping Center. Removing the actual content turns the page into a structure model, which is illustrated in Figure 1(b).

The actual website is more complex than Figure 1(b), but the structure model is still able to fully capture important details regarding content grouping, location and alignment. When a subject draws out the web pages by memory, they may draw out something far less detailed, as in Figure 2(a), which consists of a frame containing

general groupings and rough comments noting why certain chunks were distinguished from others. The subjects' hand-drawings (Figure 2(a)) were then transformed into digital webpage modeling structures, such as the one shown in Figure 2(b). The number of chunks and the information inside the chunks were organized, sorted, and coded through content analyses for further investigation into the subjects' choice of template attributes used and remembered.

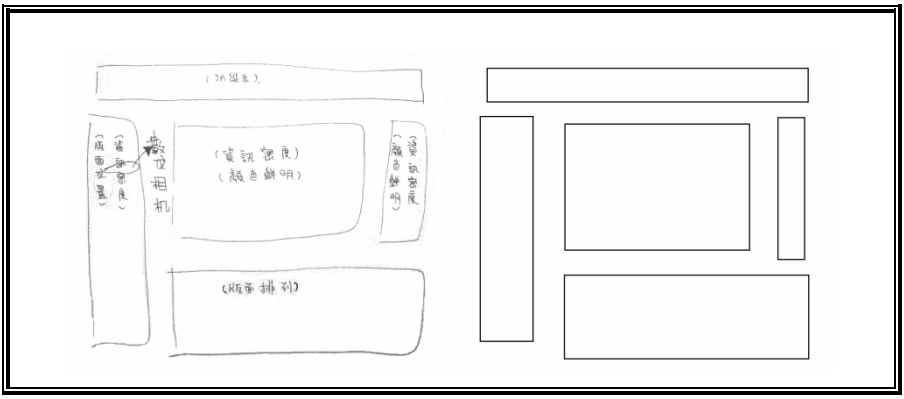

Fig. 2. (a) Subject drawing of webpage (b) Modeling structure of drawing

3.2 Subjects

The subjects were 240 undergraduate volunteers. They all had enough web searching and browsing experience to be adept at using the web. 75% had spent more than 25 hours per week on the Internet, but half of them lacked any online shopping experience. The subjects generally were not familiar with digital cameras. We assume experience with similar digital products would have been adequate for establishing a suitable mental template for information searching even if they were short of actual product knowledge.

To account for differences in subjects' attention capacities and cognition styles, the study utilized an "Embedded Figure Test" to check whether the subjects' cognitive styles were field dependent or field independent [19]. Field independent learners are better at construction, organization, and analysis of information in a multi-media open learning environment than learners who are field dependent [15]. 80% subjects were field independent and 20% were field dependent, but there were no significant differences in results between the two groups in our final analyses.

3.3 Content Analysis

The participants' structure models drawn from short term memory were content analyzed. Content analysis is a method that codes and classifies the qualitative data through frequency distributions. Categories were formed through a systematical,

quantitative and objective process. The first step of content analysis was to define the recording unit. Recording unit is the minimal and basic calculation unit used to summarize distribution statistics [18]. Seven recording units were defined in the study to help analyze the amount, varieties, and relations of chunks. These recording units were identified from common themes in participants' notes [6]. The second step of content analyses was to define the categories in each recording unit. Content could only be classified effectively when the categories were defined specifically. Effective categories should be exclusive, exhaustive, and reliable [4, 6].

The subjects have viewed three to four Webpages before ultimately identifying an optimal digital camera. To reduce the amount of content that needs to be analyzed in the process, the study only analyzed the first and last Webpages drawn by the participants. This study argues that the first and last pages were the most critical in understanding an information seeker's mental template. The retained image of the first page hints at a viewer's strategy for information seeking; the chunks remembered illustrate how the individual narrows down available information. The retention picture of the last page visualizes how a viewer's perceives the optimal product.

Our analysis, based on Kalbach's research [7], identified a total of 32 categories that could be utilized to define mental templates. All seven basic units and their respective categories are listed as follows:

1. Use of Hierarchical Searching: whether information searching used the index or relied on browsing the entire page.
2. Number of Chunks Remembered: Further classified into two categories: number of target and non-target (advertisement) chunks retained in short term memory.
3. Number of information Noticed: either 3, 4-7, or more than 7.
4. Reasons for Noticing Target Chunk : included 10 categories: 1) location in familiar position and consistent with experience, 2) key words provided relating to task, 3) significant contrast in colors, 4) distinguishable lines (frame) around the chunk, 5) significant visible alignment among chunks, 6) distinguishable space among chunks, 7) size variety of chunks, 8) located in the noticeable area of screen, 9) font contrast between sections, and 10) distinguishable graph icons. One retention chunk might include multiple above factors.
5. Reasons for Noticing Detail: classified according to the ten categories above.
6. Attention Paid to Target Chunk: included two categories, either Very Concentrated on Target or Viewed Other Information Also.
7. Reason for Action (click): included three categories: attention caught either by graph, by index, or by both.

Because the coded categories were based on the coders' subjective interpretations, reliability became an issue. Three individuals coded the templates independently. Inter-coder reliability was calculated through Hoslti's [6] inter-judge agreement method. Inter-judge agreement scores for the seven basic units of the first Webpage were 0.99, 0.96, 0.95, 0.97, 0.98 and 0.96 respectively, and 0.97, 0.96, 0.95, 0.94, 0.96, and0.93 respectively for last Webpage. The higher liability scores indicate that the assessment process is highly reliable.

Table 1. Comparisons of structure models before and after browsing

Recording Unit	Category	before browsing		After browsing		χ2	P
		No	%	No	%		
Segment	two areas [1]	102	64	101	63	2.44	0.660
	index only	18	11	18	11		
	two areas[2]	16	10	10	6		
	N/A	20	13	23	14		
	other	4	3	7	4		
Grouping factor	frame	152	95	160	100	9.92	0.042
	font variety	81	51	71	44		
	presence of picture	71	44	99	62		
	contrast in color	38	24	65	41		

Notes: [1] indicated as two areas of index and advertisement.
[2] indicated as two areas of advertisement and other s.

4 Results

No significant difference on p values at Chi-square analyses between the structure models of starting page before and after browsing the Webpage showed that participants had a preconceived expectation of how the start page of a Website is supposed to be structured according the task at hand (Table 1). Based on the task of finding a good digital camera, most participants (64% vs. 63%) noted two segmentations of a web page: one was index area and the other was advertisement area. And the methods which participants grouped chunks included distinguished frame, font variety, presence of picture, and contrast in color.

Table 2 shows the comparisons of frequency with which participants segmented a web page: Most participants segmented a web page as two areas of index and advertisement. But in the initial stage, five percents participants only noted one area of index and in the final page eight percents participants only noted one area of advertisement.

Table 2. Segmentation by location

Category	Starting page		Final page		χ2	p
	No	%	No	%		
index area only	12	5	0	0		
two areas	226	94	218	91	30.1	0.000**
Adver. Area only	0	0	18	8		

Location seemed to be the most important reason they segment a web page. The segmentation mechanism separated the location of target information in both the index and advertisement area. Participants took almost 3 to 4 “clicks” from the starting page before they found an acceptable product. All participants focused on the index area of the starting page, but their focus changed to the product advertisement area in the final page. The participants’ structure models indicates that their searching strategy involved using the Webpage index to reach the target gradually, first by clicking “digital camera” or “3C” section in the start page and then "Panasonic” on the second page. On the final page, participants ignored the entire index area, and instead paid attention to the product advertisement area.

Table 3. Grouping factors

Category	Starting page		Final page		$\chi 2$	p
	No	%	No	%		
distinguished frame	232	97	220	92	16.61	0.02
presence of picture	150	63	175	73		
font variety	114	48	96	40		
containing keywords	107	45	88	37		
contrast in color	89	37	47	20		
size variety	19	8	17	7		

The grouping mechanism breaks down a Webpage into basic units. Participants processed chunks of Web page information according to grouping mechanisms rather than reading everything line by line. Within the area viewed, users would try to distinguish chunks that correspond to their current purpose. As Table 3, the important factors for distinguishing chunks on a web page included the presence of a distinguishable frame and/or margin (97% on structure models of start page and 92% of final page), presence of pictures, (63% of start page and 73% of final page), variety in font (48% on start page and 40% of final page), containing keywords (45% on start page and 37% of final page),color contrast of the chunk from its neighbors (37% of start page and 20% of final page), and variety in chunk size(8% of start page and 7% of final page).

The attraction mechanism that draws viewer’s attention through key words or pictures related to the current task (Table 4, 87% of start page and 98% of final page). Viewers searched for icons with keywords such as “3C” or “digital camera” on the starting page. On the final page containing many different Panasonic camera choices, subjects were attracted to the keyword or image of the product, with particular attention paid to the product’s appearance, function, and price. In both the starting page and the target page, the viewers largely ignored information irrelevant to their current purpose.

Table 4. Attraction with click

Category	Starting page		Final page		χ2	p
	No	%	No	%		
containing keywords	209	87	234	98	79.5	0.000**
contrast in color	2	1	3	1		
distinguished frame	20	8	1	0		
font variety	0	0	1	0		
In first screen	0	0	3	1		
presence of picture	0	0	5	2		

Note: ** indicated as significant at .001.

5 Conclusions

Webpages contain massive, complex information. Understanding how users find their target product can help practitioners create more effective Webpage designs. This study utilized the lens of template and selective attention to assess how viewers would behave when presented with the complex information on a Webpage.

This study conducted a content analysis to verify whether users utilized their cognitive templates formed from past experience to filter information irrelevant to the given task. The result indicated a pattern in their browsing behavior. Through the content analyses of the structure models of information retention, it was then found that three attributes are critical to the viewer template model for information searching behavior: (1) the segmentation mechanism separating the location of target information in both the index and content area. (2) The grouping mechanism breaks down a Webpage into basic units. Participants processed chunks of Web page information according to grouping mechanisms rather than reading everything line by line. (3) The attraction mechanism that draws viewer's attention through key words or pictures related to the current task.

In terms of practical implications, we suggest that Website designers match the layout with users' possible cognitive templates. User templates determine the customers' searching strategies, their preferred location for valuable information, and distinguishable factors of target chunks and icons. We found that location plays a critical role in finding the index in the starting page. Meaningful words and phrases become the most critical factor when users search for target chunks and icons. Advertising chunks in the starting page are ignored by viewers whose searching strategy was to reduce the scope of potentially relevant information. However, once viewers find the target Webpage, they become more willing to browse through the adverting chunks. On the target page, pictures or texts with large fonts serve as the key to attract viewer attention.

This study provided an example of how template can be useful in Webpage design when searching for a specific product. Future research should continue to utilize template in the other kinds of searching tasks. For example, how do people without a clear searching target the browse the Web? How do they look for extended information, or search for "all" types of available product?

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