

Designing Pleasurable Website Interfaces with the Consideration of Users' Metacognitive Strategies

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Abstract: Metacognitive strategies refer to one's knowledge of his/her own cognitive process and the strategies adopted for self-controlling of these processes. Recently, interaction designers have begun to realize the importance of incorporating pleasure into their user interface design process. However, most of the current studies are mainly focused on product pleasure. Very few research studies on interface pleasure are available. The purpose of this research study is to investigate users' metacognitive strategies pertinent to their perceptions of interface pleasure when interacting with a Website user interface, such as their browsing strategies, the way to recover from disorientation, and the way to solve potential interaction problems. Two experiments were conducted for this research. The first experiment was to investigate 10 participants' metacognitive strategies regarding their perceptions of interface pleasure when interacting with 10 pre-selected Websites. Both observation and think-aloud techniques were used to collect qualitative data. In the second experiment, three different design factors generated from the first experiment pertaining to users' perceptions of interface pleasure were used to help create five different Websites. Another 15 participants were recruited to interact with these five Websites and fill out a questionnaire. The results generated from one-way ANOVA revealed: (1) Most users felt that a simple and clean Website designed together with fresh colors can give them better perceptions of interface pleasure; (2) A Website designed by adopting a large, dynamic, and interesting image on the introduction page will also provide pleasurable perceptions; (3) A dynamic button on the Website may increase users' perceptions of interface pleasure as well, though the size of the dynamic button can be very small. It is hoped that by investigating users' metacognitive strategies regarding their perceptions of interface pleasure, interaction designers are able to create better Website user interfaces that are more fun to interact with.

Keywords: *Interface Pleasure, Metacognitive Strategy, Website, Interaction Design*

1. Introduction

As the progress of Internet technology, we are able to browse through the World Wide Web (WWW) to acquire up-to-date information to increase our life quality. As a result, the time we spend in interacting with the Internet is also increasing steadily. Kraut, Lundmark, Kiesler, Mukhopadhyay, and Scherlis (2003) investigated 100 households in the Pittsburgh area trying to understand people's use of the Internet at home. Their results demonstrated that people's foremost use of the Internet was for pleasure (see Figure 1). Therefore, to an interaction designer, in order to fulfill a user's interaction requirements, the functional aspect of a Website design is no longer the primary concern. Instead, a user's psychological needs should be taken into serious account. That is, modern Internet users prefer to obtain fun or enjoyment while navigating through the Internet. Bailey (1996) also argues that in addition to achieving the task goal, a computer user will also like to have fun while

using the computer. Therefore, to an interaction designer, designing a pleasurable Website user interface is one of the design challenges that s/he faces in the 21st century. To meet this challenge, the researchers started to investigate Internet users' metacognitive strategies pertinent to their perceptions of interface pleasure while interacting with the WWW. Metacognitive strategies refer to one's knowledge of his/her own cognitive process and the strategies adopted for self-controlling of these processes. Recently, interaction designers have begun to realize the importance of incorporating pleasure into their user interface design process. However, most of the current research studies are primarily focused on product pleasure (Jordan, 1998, 2000, 2001; Jorden and Green, 2002; Jorden and Jorden, 2000; Norman, 2002) with emphasis on going beyond interface usability. More specifically, to design a pleasurable product, this product should be equipped with design factors like useful functions, easy-to-operate tasks, and easy-to-understand user interfaces. Nonetheless, very few research studies on interface pleasure are available. For instance, Malone (1981) argues that challenge, fantasy, and curiosity are the important factors in the design of computer games, which may affect a user's internal motivation and enjoyment. Marcus (2002) contends that if an interaction designer is able to create a "cute" user interface, it may be fun to interact with. The purpose of this research study is to investigate users' metacognitive strategies pertaining to their perceptions of interface pleasure when interacting with a Website user interface, such as the browsing strategies, the way to recover from disorientation, and the way to solve potential interaction problems. It is hoped that by conducting this type of research, an interaction designer can create a Website user interface which not only possesses enhanced interface usability to meet the users' functional requirements but also provides better interface pleasure to satisfy their psychological needs.



Figure 1. Frequency of Using the Internet for Different Purposes
 (Adopted from Kraut, Lundmark, Kiesler, Mukhopadhyay, and Scherlis, 2003)

2. Research Methods

This research study consisted of two experiments. The first experiment adopted both observation and think-aloud methods. Participants were invited to interact with 10 pre-selected Websites and, at the same time,

spoke out their perceptions of interface pleasure occurring during the interacting processes. Both note-taking and voice-recording techniques were used to help collect the data. By so doing, the researchers could investigate the participants' metacognitive strategies used to help browse through the Websites. In the second experiment, three important Website design factors that might affect a user's perceptions of a Website's interface pleasure were adopted. Based on these factors, five Websites were created and used for the experiment including one from the previous experiment for the control purpose. The aim of this experiment is to validate if these design factors can actually affect a user's perceptions of a Website's interface pleasure.

3. The Experiments

Before the experiments, participants were asked to interact with several pre-selected Websites. The Website design guidelines regarding interface pleasure were then generated and summarized based on this process. A total of seven important Website design factors were found, such as introduction animation, overall perceptions of the introduction page, the relationship between the introduction page and the content pages, music, button design, overall structure, additional functions, and others.

3.1 The First Experiment

The purpose of the first experiment was to generate potential Website design factors that may influence a user's perceptions of interface pleasure. A total of 10 student volunteers were recruited from the Graduate School of Design in National Taiwan University of Science and Technology. None was paid for taking part in this experiment. They all have at least five years computer experience. They were asked to interact with 10 pre-selected Websites (see Table 1). These Websites were chosen because of their unique structures and they were all design-related. While interacting with the Websites, participants were required to think out loud their perceptions of interface pleasure and the metacognitive strategies they used to help them browse through the Websites. The participant's think-aloud protocols were further analyzed and a list of twelve pairs of polar adjectives was generated for the second experiment. These polar adjectives were displeasure vs. pleasure, dirty vs. clean, blurred vs. clear, colorless vs. colorful, formal vs. lively, static vs. dynamic, unlovely vs. lovely, uncomfortable vs. comfortable, dislike vs. like, ordinary vs. extraordinary, dull vs. vivid, and dark vs. bright.

3.2 The Second Experiment

From the first experiment, three important Website design factors affecting the user's perceptions of interface pleasure were generated. These factors: (1) There should exist large and interesting dynamic images on the introduction page of the Website; (2) The Website should be designed with simple and clean feels, and with fresh colors; (3) The Website should be equipped with dynamic icons. In order to know if the above-mentioned Website design factors do affect the user's perceptions of interface pleasure, the Website, 03-Content page, from the first experiment was chosen as the control group in the second stage for comparison purpose. This is because this Website is designed with one image and some description texts that are easy to be modified for further experiment. Furthermore, in order to know how large the dynamic image should be used on the Website introduction page, two smaller scales, 70% and 40% reduction from the original image of the control group, were adopted for the experiment. By reducing the image into smaller scales, the researchers would be able to verify if they might result in negative effects.

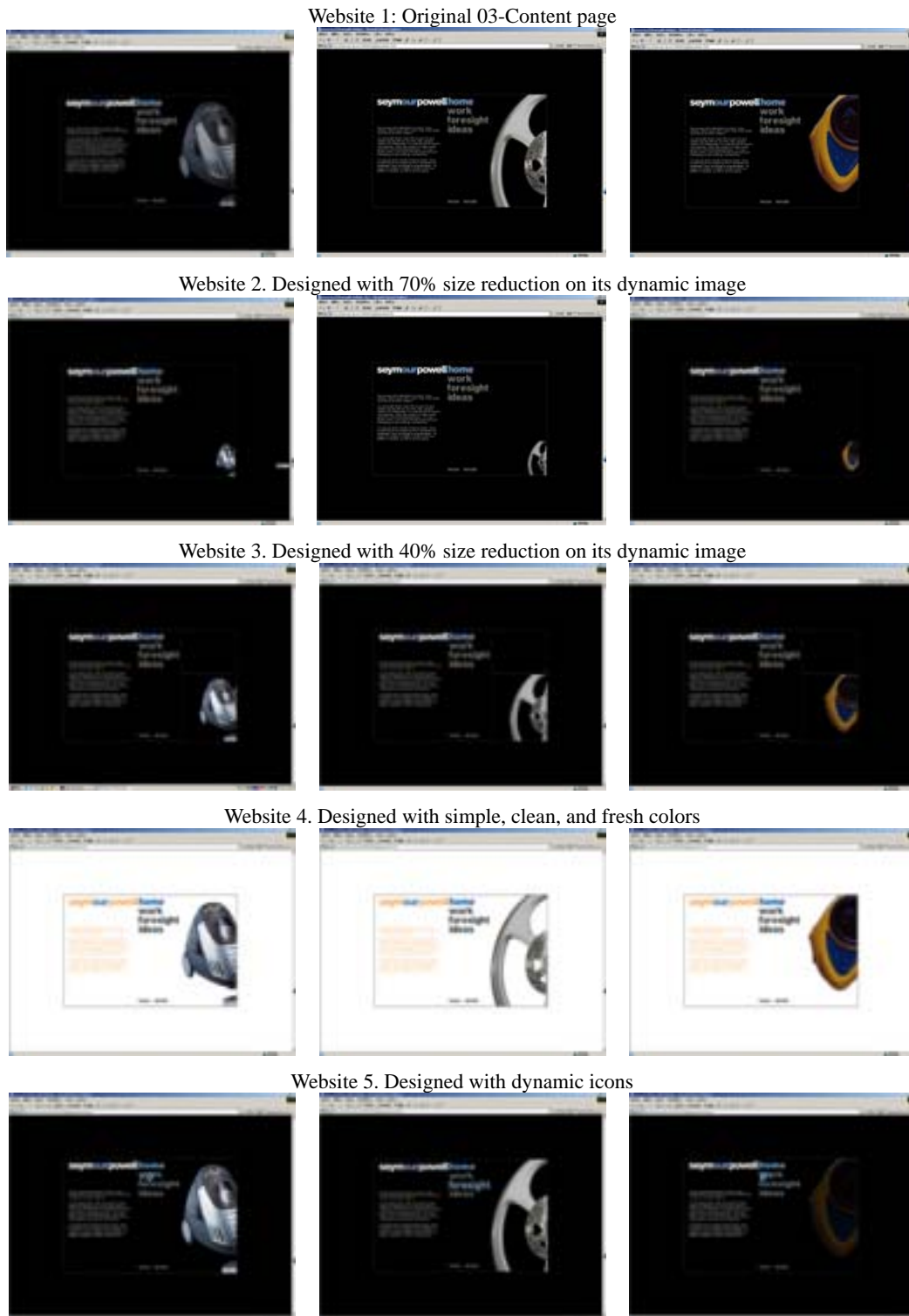
Table 1. The Websites Adopted for the First Experiment

01-First page	01-Content page	06-First page	06-Content page
			
02-First page	02-Content page	07-First page	07-Content page
			
03-First page	03-Content page	08-First page	08-Content page
			
04-First page	04-Content page	09-First page	09-Content page
			
05-First page	05-Content page	10-First page	10-Content page
			

In the end, a total of five different websites was used in the second experiment (see Figure 2). Website 1 was the 03-Content page without any modifications for control purpose. Website 2 was designed with 70% size reduction on its dynamic image from the control group. Website 3 was designed with 40% size reduction on its dynamic image from the control group. Website 4 was designed with simple, clean, and fresh colors. Website 5 was designed with dynamic icons. In this experiment, fifteen student volunteers were recruited from the Graduate School of Design in National Taiwan University of Science and Technology. None was paid for taking part in this experiment, and they did not participate in the first experiment. They all have at least five years computer experience. The participants were asked to interact with these five different Websites in a random order to prevent possible sequential effects. After that, they were required to fill out a questionnaire and accepted a brief interview. The questionnaire was designed based on a 7-interval Likert Scale. By so doing, the

researchers could investigate their perceptions of interface pleasure among these five Websites.

Figure 2. Five Website Designs for the Second Experiment



4. Results and Discussions

4.1 Results Generated from the First Experiment

The results generated from the first experiment were mainly from the observation and think-aloud techniques. That is, the participant's metacognitive strategies used for interacting with testing Website were observed and recorded for further analysis. In addition, the participant's think-aloud protocols were first transcribed into

written texts. After that, the contents of the protocols were analyzed and summarized. The important design factors regarding the participant's perceptions of interface pleasure were pointed out and the frequency of mentioning pertaining to interface pleasure or displeasure was also calculated. These Website design factors that affect a user's perceptions of interface pleasure were summarized as design guidelines to help create pleasurable Website user interfaces. Participants' detailed descriptions are provided as follows:

A. Introduction animation

a.1 Require introduction animation

Need loading feedback (9)

Animation should be simple (6)

Need "Skip" button (4)

B. The overall image of the introduction page

b.1 The perception of the introduction page

Should be simple, clear and understandable (18)

Users can read the whole page at one time (14)

Should provide eye focus (9)

b.2 The color of the introduction page

Need to have appropriate vivid colors (11)

Need to adopt fresh colors (7)

b.3 The perception of the primary image

The size of the image should be large (10)

The image should be consistent with the theme of the Website (7)

b.4 The figure and ground perception

The text visibility should be clear (42)

The description text should be of appropriate size (30)

The figure and ground should be simple, clean, and clear (10)

b.5 The frame and layout of the introduction page

The frame should be design with consistency (19)

The frame should be clearly presented (14)

C. The overall perception of content pages

c.1 The design of content pages

Should be consistent with the introduction page (82)

Should be designed with clear visibility (6)

c.2 The color of content pages

Should be simple and clear (14)

c.3 The images and texts of the content pages

The images and texts should be in similar proportions (10)

c.4 The size of the texts

Should adopt an appropriate text size (30)

c.5 The dynamics of background

Should adopt a simple dynamic background, but should not affect users' text-reading activity (19)

c.6 Pleasurable animations

Better to have pleasurable animations (9)

c.7 The frame of the content pages

Users should be located in the same frame while browsing through pages (8)

c.8 The layout of the content pages

The content pages should be designed with consistency (18)

Avoid slow loading time (9)

D. Screen buttons

d.1 The overall perceptions of screen buttons

The screen buttons should be sensed easily (31)

Provide clear functional indications (26)

Buttons should be designed with appropriate icons (23)

Need to provide interactivity and feedback (22)

The visibility of the button text should be clear (20)

4.2 Results Generated from the Second Experiment

The results generated from the questionnaire of 7-interval Likert Scale were first analyzed. The mean and standard deviation of each pair of polar adjectives among these five Websites were summarized in Table 2. After that, the one-way Analysis of Variance (ANOVA) was used to test if there existed statistically significant differences (under $\alpha=0.05$) among these five Websites. A subsequent Least Significant Difference (LSD) post-hoc test was conducted if the significant difference did exist. The results were described as follows:

1. Displeasure vs. pleasure

Based on the results from one-way ANOVA, there existed a statistically significant difference among these five Websites ($F=7.244$, $p=0.000<0.05$). The subsequent LSD test results suggested: (1) Website 1 is different from Website 4 and 5; (2) Website 2 is also different from Website 4 and 5; (3) Website 3 is different from Website 4. We may infer that if a Website is designed with simple, clean, and fresh feels, it may provide participants with pleasurable perceptions. Similarly, if a Website is designed with dynamic buttons, it may also increase its interface pleasure.

2. Dirty vs. clean

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=3.137$, $p=0.020<0.05$). The subsequent LSD test results indicated: (1) Website 1 is different from Website 5; (2) Website 2 is different from Website 4; (3) Website 3 is different from Website 5; (4) Website 4 is different from Website 5. The post-hoc test results indicated that a large, dynamic, and interesting image will provide users with clean and clear feels, which will lead to their perceptions of interface pleasure. A small image will cause negative perceptions.

3. Blurred vs. clear

The ANOVA results indicated that there existed no statistically significant difference among these five Websites ($F=2.478$, $p=0.052>0.05$). Therefore, participants' interface perceptions regarding blurred vs. clear

towards these five Websites were the same. This may be due to the fact that all the Website samples were recreated based on the control group, so the difference was not significant.

Table 2. The Mean and Standard Deviation of the 12 Polar Adjectives Among Five Websites

Polar adjectives		Displeasure vs. pleasure	Dirty vs. clean	Blurred vs. clear	Colorless vs. colorful	Formal vs. lively	Static vs. dynamic
Website 1	Mean	4.200	5.667	5.533	3.867	4.067	4.600
	SD	1.207	0.816	1.246	1.302	1.280	1.595
Website 2	Mean	3.933	5.067	4.800	3.267	3.267	3.733
	SD	1.033	1.033	1.265	1.223	1.163	1.335
Website 3	Mean	4.400	5.667	5.467	4.2	4.467	4.733
	SD	1.352	0.724	0.743	1.146	1.246	0.961
Website 4	Mean	5.800	5.933	6.000	5.267	5.467	4.929
	SD	0.775	0.704	0.875	0.884	0.990	1.439
Website 5	Mean	5.067	5.000	5.600	4.333	5.333	5.400
	SD	0.961	1.134	1.121	1.447	1.047	1.056
Polar adjectives		Unlovely vs. lovely	Uncomfortable vs. comfortable	Dislike vs. like	Ordinary vs. extraordinary	Dull vs. vivid	Dark vs. bright
Website 1	Mean	3.533	5.2	5.467	4.733	4.000	4.400
	SD	1.407	1.014	1.302	0.961	1.069	1.454
Website 2	Mean	2.867	4.533	4.667	3.667	2.800	3.467
	SD	0.834	0.915	0.976	1.345	1.207	1.302
Website 3	Mean	3.667	4.867	5.067	4.333	3.933	4.067
	SD	1.175	1.407	1.223	1.291	1.335	1.280
Website 4	Mean	4.933	5.800	5.467	5.400	5.533	6.067
	SD	1.335	1.014	1.125	1.121	0.834	1.387
Website 5	Mean	4.200	5.067	5.400	5.133	4.467	4.467
	SD	1.320	1.223	1.056	0.990	1.187	1.125

4. Colorless vs. colorful

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=5.428$, $p=0.001<0.05$). The subsequent LSD test results revealed: (1) Website 1 is different from Website 4; (2) Website 2 is different from Website 3, 4, and 5; (3) Website 3 is different from Website 4; (4) Website 4 is different from Website 5. The post-hoc test results showed that using simple and clean design strategies and providing the Website user interface with fresh colors will result in users' colorful perceptions, which will lead to their perceptions of interface pleasure.

5. Formal vs. lively

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=9.453$, $p=0.000<0.05$). The subsequent LSD test results showed: (1) Website 1 is different from Website 4 and 5; (2) Website 2 is different from Website 3, 4, and 5; (3) Website 3 is different from Website 4 and 5. The post-hoc test results revealed that using simple and clean design strategies and adopting fresh colors and dynamic

buttons will provide users with vivid interface feels, which will lead to their perceptions of interface pleasure. A large, dynamic, and interesting image will also offer users with the same perceptions.

6. Static vs. dynamic

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=3.305$, $p=0.015<0.05$). The subsequent LSD test results suggested that Website 2 is different from Website 3, 4, and 5. The post-hoc test result showed that dynamic buttons would provide users with more dynamic feels, which will lead to their perceptions of interface pleasure. A large, dynamic, and interesting image will also allow users to have more dynamic interface perceptions.

7. Unlovely vs. lovely

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=5.927$, $p=0.000<0.05$). The subsequent LSD test results indicated: (1) Website 1 is different from Website 3; (2) Website 2 is different from Website 4 and 5; (3) Website 3 is different from Website 4. The post-hoc test results revealed that Websites designed with simple and clean strategies and with fresh colors may make users have feelings of loveliness, which will lead to their perceptions of interface pleasure.

8. Uncomfortable vs. comfortable

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=2.579$, $p=0.045<0.05$). The subsequent LSD test results showed: (1) Website 2 is different from Website 4; (2) Website 3 is different from Website 4. The post-hoc test results showed that Websites created with simple and clean strategies and with fresh colors may give users feelings of comfort, which will lead to their perceptions of interface pleasure.

9. Dislike vs. like

The ANOVA results indicated that there existed no statistically significant difference among these five Websites ($F=1.390$, $p=0.246>0.05$). Therefore, participants' interface perceptions regarding dislike vs. like towards these five Websites were the same.

10. Ordinary vs. extraordinary

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=5.283$, $p=0.001<0.05$). The subsequent LSD test results revealed: (1) Website 1 is different from Website 2; (2) Website 2 is different from Website 4 and 5; (3) Website 3 is different from Website 4. The post-hoc test results revealed that Websites designed by using simple and clean strategies and adopting fresh colors may give users extraordinary feelings, which will lead to their perceptions of interface pleasure. A Website designed with a large, dynamic, and interesting image will also cause users to have similar perceptions.

11. Dull vs. vivid

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=11.291$, $p=0.000<0.05$). The subsequent LSD test results indicated: (1) Website 1 is different from Website 2

and 4; (2) Website 2 is different from Website 3, 4, and 5; (3) Website 3 is different from Website 4; (4) Website 4 is different from Website 5. Based on the post-hoc test results, we may infer that Websites created with simple and clean strategies and with fresh colors may give users feelings of vividness, which will lead to their perceptions of interface pleasure. A Website designed by using a large, dynamic, and interesting image will also cause users to have similar perceptions.

12. Dark vs. bright

The ANOVA results indicated that there existed a statistically significant difference among these five Websites ($F=8.077$, $p=0.000<0.05$). The subsequent LSD test results showed: (1) Website 1 is different from Website 4; (2) Website 2 is different from Website 4 and 5; (3) Website 3 is different from Website 4; (4) Website 4 is different from Website 5. The post-hoc test results revealed that Websites designed with simple and clean strategies and with fresh colors may give users feelings of brightness, which will lead to their perceptions of interface pleasure. A Website designed by using a large, dynamic, and interesting image will also cause users to have similar perceptions.

In summary, based on the statistical results, most of the participants felt that Website 4 was equipped with simple and clean feels, and with fresh colors, which offered them better perceptions of interface pleasure than the control group, i.e., Website 1. In addition, Website 2 was created based on 70% size reduction and Website 3 was designed with 40% size reduction on the dynamic image of the control group. Because Website 2 had more size reduction, it might cause greater impact on users' perceptions of interface displeasure than Website 3. After comparing the average ratings of twelve pairs of polar adjectives, the means of Website 3 were all higher than those of Website 2. This means that most of the participants agree that adopting a large, dynamic, and interesting image on the Website can result in better perceptions of interface pleasure. Finally, though the size of the dynamic button only takes up a small interface portion, participants still can feel its existence. In fact, a dynamic button on the Website may increase users' perceptions of interface pleasure as well.

5. Conclusions

This paper is intended to investigate users' metacognitive strategies pertaining to their perceptions of interface pleasure when interacting with the Internet, such as the browsing of various Websites, the way to recover from disorientation, and the way to solve potential interaction problems. This research study was conducted by two experiments. The first experiment adopted both observation and think-aloud methods. Participants were invited to interact with the pre-selected Websites and think out their perceptions of interface pleasure occurring during the interacting processes. Both note-taking and voice-recording techniques were used to help collect the data. Based on the results, the important design factors regarding the participant's perceptions of interface pleasure were identified and summarized as design guidelines to help create pleasurable Website user interfaces. In the second experiment, three important Website design factors that might affect a user's perceptions of a Website's interface pleasure were adopted to help create new Websites. Based on these factors, a total of five different websites were used for the second experiment. A 7-interval Likert Scale questionnaire was created to investigate participants' interface perceptions of twelve pairs of polar adjectives among these five different Websites. The results generated from the ANOVA indicated that most users felt that a simple and clean Website

designed together with fresh colors can give them better perceptions of interface pleasure. Furthermore, a Website designed by adopting a large, dynamic, and interesting image on the introduction page will also have the same effects. Finally, though the size of the dynamic button only takes up a small interface portion, participants still can feel its existence. A dynamic button on the Website may increase users' perceptions of interface pleasure as well. It is hoped that by investigating users' metacognitive strategies regarding users' perceptions of Website interface pleasure, interaction designers will be able to create better Website user interfaces that are more fun to interact with.

Acknowledgment

Financial support of this research by National Science Council under the grant NSC 91-2213-E-011-067 is gratefully acknowledged.

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