Electronic Commerce Inter-*face lift*

- Applying Emotive Interface Engineering to Cyber Banking Systems-

Jae Yun Moon **Jinwoo Kim**

Cognitive Information Engineering Laboratory

Yonsei University

Seodaemun-ku Shinchon-dong 134, Seoul 120-749, Korea

Email : jymoon@bubble.yonsei.ac.kr, jinwoo@bubble.yonsei.ac.kr

ABSTRACT

Researchers of emotion have long since established the principle that emotions are indispensable for rational decision making. In this article, we propose an Emotive Interface Engineering methodology that addresses the possibility of applying this to the design of human computer interfaces. EIE establishes the interrelation between the design factors and the emotions elicited by a computer interface from the user's perspective. The methodology was employed to evaluate existing cyber banking interfaces. The results support the proposition that certain design factors are more relevant than others for the elicitation of certain emotions. Results also indicate that computer interfaces elicit universally common feelings in a majority of users.

KEYWORDS

emotive interface design, electronic commerce, informative emotion, cyber banking.

INTRODUCTION

In the near future, electronic commerce systems may replace the shopping malls of today as the preferred medium of consumer purchases [7]. Electronic commerce has numerous advantages over traditional physical mediums. Lower costs for product and information delivery, customer service enhancement and reduced time to market are only some of the benefits of electronic commerce [2]. Many firms have already implemented some form of home shopping system in order to reap some of these benefits. However, the key to the success of electronic commerce systems lies in a wide adoption of such technologies by the consumer [2].

A major obstacle to the widespread diffusion of the electronic medium lies in the discrepancy between the electronic commerce system interface and the traditional shopping experience. Having satisfied their basic wants, consumers now seek products and services that are pleasing to their senses. This trend is reflected in the recent development of kansei engineering, the application of sensibility ergonomics to physical product development [11,13]. Nowadays, shopping is a process of emotional engagement and interaction with people, of looking at people, meeting people as well as performing the actual purchase [9]. A cyber shopping mall by this definition refers to a store where one can emotionally interact with the interface. In order to lure customers, electronic commerce system interfaces must be able to create a cyber shopping experience by eliciting the emotions felt in actual shopping. Electronic commerce systems of today focus mostly on reducing the cognitive burden placed on the user. However, in order to create a cyber shopping experience for the consumer, the interface to electronic commerce systems must engage the user both emotionally and cognitively [10].

This paper proposes a new design methodology of human computer interfaces, Emotive Interface Engineering, in order to achieve this end. Emotive Interface Engineering (EIE), based largely on the kansei engineering approach [11,13] is a design methodology that scientifically determines the emotive effects of certain design factors in order to incorporate this in the design of user interfaces. Until recently, study of human computer interfaces has focused on designing artifacts intended to help users overcome their cognitive limitations to reach rational decisions, with little regard for the emotive aspect of the interface [6,17]. EIE adopts a balanced view of emotion and cognition. Its basic assumption is that emotions can aid the user to make rational judgments and choices [1, 18].

The purpose of this paper is to pave the way for the design of emotion generating interfaces, that will enable the user to engage in a truly cyber experience. After laying the theoretical foundations for the emotive interface engineering methodology, the proposed methodology will be used to evaluate existing cyber banking interfaces.

The research was supported by the 1996 Korea Sanhak Foundation fund. We thank Hajin Jeon of Pixel System for aiding in the preparation of the cyber banking interfaces used in this study. Special thanks also to Dr. Kwang Hee Han for his valuable comments regarding statistical analysis.

EMOTIONS

The emotive interface engineering methodology was formulated based on the following concepts of emotions, their functions and emotion elicitation procedures.

Definition of Emotion

Emotion is a multifaceted phenomenon which encompasses a diversity of processes, such as appraisal, facial expressions, bodily responses, feeling states, action tendencies, and coping strategies [16]. There are two views of emotion —the basic category view which maintains that emotions are constituted of a fixed set of discrete categories [8,16]; and the multidimensional view which proposes that emotions are differentiated along no more than two to four bipolar dimensions.

The Emotive Interface Engineering methodology is based on the latter approach to the study of emotion. We extend this approach further in postulating the existence of an emotion space, based on the theory of the semantic space [15]. The emotion space is defined to be a region of some unknown dimensionality. Each emotional scale, defined by a pair of polar (opposite in meaning) adjectives, is assumed to represent a straight line function that passes through the origin of this space, and a sample of such scales then represents a multidimensional space. To define the emotion space with maximum efficiency, the minimum number of orthogonal dimensions or axes which exhausts the dimensionality of the space needs to be determined. The emotions that are identified as the orthogonal dimensions may not be the basic emotions of joy, sadness, amusement, interest, relief, sensory pleasure or anger [5], but domain specific emotions that are especially important with relation to the type of task, such as the feelings of trustworthiness or sophistication when performing financial transactions.

Function of Emotion

Although rational thought and emotion are often depicted as locked in an eternal battle, there is typically more cooperation than strife [11]. Recent research into the nature of emotion shows ample evidence with regard to this proposition. Neurobiological studies of frontal lobe patients show that practical and social decision making is closely related to the region of the brain connecting the emotional and cognitive centers [4]. Relying solely on cognition results in a never-ending cost-benefit analysis of numerous and conflicting options. Emotions provide information as to the emotional desirability of the options available, and thereby reduce and limit reasoning to those that induce positive feelings [1,18]. Thus, whether or not the emotion is functional or dysfunctional depends on the information that it provides to the accompanying affective experience [18].

The informative function of emotions is especially relevant in the design of human computer interfaces. The emotions elicited by an interface encompass bodily feelings and other non-affective sentiments. Studies indicate that such affects can also influence judgment and decision making in a similar manner [18].

In conclusion, the induction of emotions via user interfaces to electronic commerce systems is not intended to manipulate consumer behavior. On the contrary, emotive interfaces can produce the double benefit of enhancing the quality of the cyber shopping experience and triggering informative emotions that can aid in decision making.

Emotion Elicitation Procedures

The scientific research of emotion depends on the reliability of the emotion elicitation procedures used in the laboratory. Research on the elicitation of emotions under laboratory conditions indicate that stimuli can be constructed to elicit certain target emotions [8]. A large variety of emotion eliciting procedures have been used in these experiments, not the least of which are the use of films [8, 16] and slides [16].

Of the diverse methods available for elicitation of emotion in the laboratory, films were found to be the most effective in eliciting universally common target emotions among different subjects [8]. This was attributed to the fact that films have a relatively high degree of ecological validity, in so far as emotions are often evoked by dynamic visual and auditory stimuli that are external to the individual [8]. Slides also have similar attributes. Computer interfaces can basically be considered as a collection of slides that are composed of diverse visual and auditory stimuli. Accordingly, human computer interfaces also have the potential to elicit universally common emotions in all users. The Emotive Interface Engineering approach purports to design a user interface that elicits certain emotions that will aid the user in making rationally adept decisions.

Emotion Measurement Techniques

Study about the nature of emotions is not possible without the means to measure the elicited emotions. Emotions are displayed in a person's facial expression and voice tone, and cause certain motor behaviors and physiologic responses. However the most convenient measure of emotion is the self report given by the person experiencing the emotion. Facial expressions and self reports are more commonly used as the measures of emotion under laboratory conditions [8,12,18].

There are three types of self report measures of emotions, the Differential Emotions Scale (DES), the Semantic Differential (SD) scale [15], and the free labeling method [16]. The DES measures the intensity of an elicited emotion, whereas the SD scale pairs polar emotion terms and measures the intensity and direction of an emotion. Free labeling methods require that subjects simply jot down what they are feeling at the time of the experiment.

The Emotive Interface Engineering methodology proposed in this paper employs the SD scale because it is based upon a multidimensional approach to emotions. The SD scale is most suitable for determining the main polar dimensions of

which the emotion space is composed. The following section examines the Emotive Interface Engineering methodology in more detail.

EMOTIVE INTERFACE ENGINEERING

The aim of Emotive Interface Engineering (EIE) is to develop human computer interfaces that will enhance the quality of the decisions made by the user, via elicitation of those emotions that provide the information needed to interact effectively with the system. This methodology is based on the theory of emotional decisions [1,18], and the emotion elicitation and measurement procedures of prior laboratory research [8,16]. The concept of applying emotional other than cognitive criteria to the design of man made artifacts was derived from kansei engineering [11,13]. The design of emotive interfaces is made possible by determining the design factors that elicit the target emotions.

EIE is conducted in three separate phases. The objective of the first phase is to determine the primary dimensions of the emotion space and develop a self report questionnaire consisting of the emotive scales that best measure those dimensions. The purpose of the second phase is to determine the design factors of an interface from the user's perspective. The goal of the final phase of Emotive Interface Engineering is to establish the interrelation between the emotional dimensions and the physical design factors of the user interface.

Emotional Dimensions

Developing a set of emotive scales that can accurately measure all the feelings that have especial meaning in the design of a particular interface is the core of EIE. Emotive scales are pairs of polar adjectives that describe feelings relevant to the interface being evaluated [15]. The initial sampling should include multiple terms for the same emotion or feeling.

The compact set of emotive scales that will be used as a measurement tool of the emotions elicited by the interfaces needs to be determined through a pretest. The interfaces to be used in this pretest should include at least one type of all the existent interfaces. Results of the pretest are used to determine the rough structure of the emotion space. These results are developed into the reduced self-report questionnaire used to determine the structure of the emotion space, i.e. the number of relevant dimensions. The revised scales are used to evaluate a second, more exhaustive sample of interfaces, after which multivariate analyses are performed to determine the dimensions of the emotion space.

Design Factors

The design factors of the interface are determined from a user's perspective. A user's perspective is important because the user's perception of the interface will consciously or unconsciously influence the emotions evoked by that particular interface. The design factors from the user's perspective can be determined through an open question and answer session or a free recall test. The design factors that are important from a designer's perspective is also taken into account in the final selection of the design factors of a particular interface.

Interrelation between Emotional and Design Factors

Multivariate analyses are performed to determine the relationship between the design factors and the primary dimensions of the emotion space. The ultimate purpose of computing the interrelation is to design an interface that can elicit certain target emotions.

EXPERIMENTS

In this study, the method of EIE outlined above was applied to the evaluation of cyber banking interfaces. The study focuses on cyber banking system interfaces due to the relative universality of the emotions that can be elicited while interacting with a system of its kind.

The goals of the experiments were threefold : First, to determine the emotional factors that influence a user's overall impression of a visual interface. Second, to determine the design factors of a visual interface from the user's perspective. Third, to establish the interrelation between the emotional factors and design factors. Three experiments were conducted to clarify the structure of the emotion space and the effect of specific design factors upon it.

Experiment 1

The purpose of the first experiment was to develop the self report questionnaire to be used in measuring the emotions elicited by cyber banking interfaces. The resulting questionnaire should consist of the differential scales that best represent the dimensions of the emotion space for cyber banking interfaces.

Materials and Procedure

Questionnaire. The self report scale used in this study was that of semantic differentiation, based on the multidimensional approach to emotion upon which the EIE methodology is rooted [15]. Since the purpose of this first experiment was to select the best differential scales for emotion measurement, an exhaustive search was made of all relevant pools of emotion terms for the initial sampling of scales. Emotion terms were gathered from a variety of sources varying from pamphlets of cyber banking services, surveys of users and designers, dictionaries, and research papers about electronic commerce and cyber banking systems. Of these a total of 318 bipolar 7-point scales were selected. The scales were selected to overlap as to the emotion they measured.

Slide Material. The interfaces of eight different cyber banking systems were selected as the experiment material for this first experiment. The interfaces were selected to ensure that all the different kinds of interfaces were represented in this sample. They ranged from simple text based interfaces to three dimensional virtual reality interfaces. The most representative screen of each interface

was prepared to be shown as static slides, with the exception of those interfaces in which the animation effects constituted a major component of the interface. The final set comprised of one text interface, five videotex interfaces and two internet home pages. Figure 1 shows a sample of the cyber banking interfaces used in the first experiment.

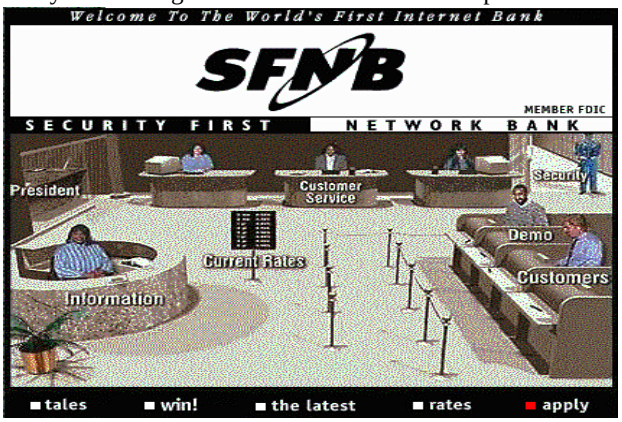

Figure 1. Example Cyber Banking Interface

Procedure. The experiment was conducted in group sessions of five to ten subjects. Three separate sessions were conducted with a total of 25 subjects. The subject pool consisted of cyber banking system developers, bank personnel, and cyber banking system users. Each session lasted approximately 3 hours. The subjects were shown one cyber banking interface at a time and asked to describe the intensity and direction of the feelings elicited by that interface on 7 point Likert scales. The subjects were especially cautioned to mark :

> *your first impressions, the immediate 'feelings' about the interfaces shown...*

on the 7 point scales as shown in figure 2.

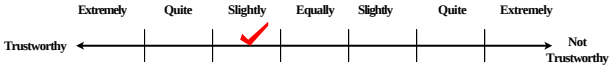

Figure 2. Emotive Differential Scale

The interfaces were shown on a 43 inch color monitor. The subjects were required to mark 318 scales for 8 slides, amounting to a total of 2544 judgments that needed to be made. The subjects were given five minutes after each slide to relax and empty their minds of the previous slide so as to avoid carrying over the feelings from the previous interface to the evaluation of the next slide. The order of the interfaces was counter-balanced for each of the three group sessions so as to prevent an ordering effect.

Results and Discussion

Each slot on the 7 point scale was assigned a number from 1 to 7 starting from the left. A total of 200 observations (8 interfaces $\times$25 subjects) were coded according to the assigned numbers. The variables in this data set were the 318 emotive differential scales. The variables were clustered in order to group the closely related scales. Cluster analysis was used because the important emotional factors related to the evaluation of the interfaces of cyber banking systems is not known a priori.

The two methods of cluster analysis employed in this study were complete cluster analysis and Ward's cluster analysis. The results of the cluster analysis procedures were used to weed out the unnecessary emotive scales. A total of fifteen clusters were determined through complete cluster analysis of which five were discarded due to significant discrepancies with the results of Ward's cluster analysis. A group of experts in cyber banking systems selected the emotive differential scales that were most appropriate for measuring the feelings elicited by interaction with cyber banking interfaces from the remaining 10 clusters. Forty bipolar emotive differential scales were selected to be included in the final self report questionnaire. The final set of emotive differential scales are shown in table 2. Although the initial set consisted of various basic emotion terms, most of these were filtered out as a result of the first experiment. The remaining terms shown in table 2 are representative of the non-basic, domain specific terms of the emotions that are most important in interacting with cyber banking systems.

Experiment 2

The second experiment was conducted to ascertain the physical design factors of a cyber banking system interface from a user's perspective.

Materials and Procedure

Slide Material. Twenty six cyber banking interfaces were selected for the second experiment. An extensive search was made of the existing cyber banking interfaces to ensure that all the different designs were accounted for in the final slide samples. The final set of cyber banking interface stimuli consisted of 2 text interfaces, 13 videotex and 10 internet interfaces.

Procedure. The experiment was conducted in two phases in order to determine the important design factors from the user's perspective. The first phase consisted of a free recall test in which the subjects were asked to describe the feelings elicited by the twenty six cyber banking interfaces on the differential scales. The instructions for this task were the same as in the first experiment. The free recall test was conducted at random intervals for a selected few interfaces. After the subjects had finished marking the self reported questionnaires, the interfaces were hidden from view, and the subjects were asked to draw what they could remember of the interface. The experiment was conducted in two group sessions of thirty subjects in total. The subjects consisted of users, designers and managers of various age groups.

The second phase of the experiment was conducted at the end of the first phase. The subjects were given the 26 interfaces in random order and asked to group them based on similar aspects. After the subjects finished grouping the

interfaces, the experimenter asked the subjects to explain the criteria employed in grouping the interfaces [3]. These criteria were translated into the corresponding design factors.

Results and Discussion

Figure 3 shows a sample of the subject's drawing in the free recall test. The drawing is that of the cyber banking interface shown in figure 1.

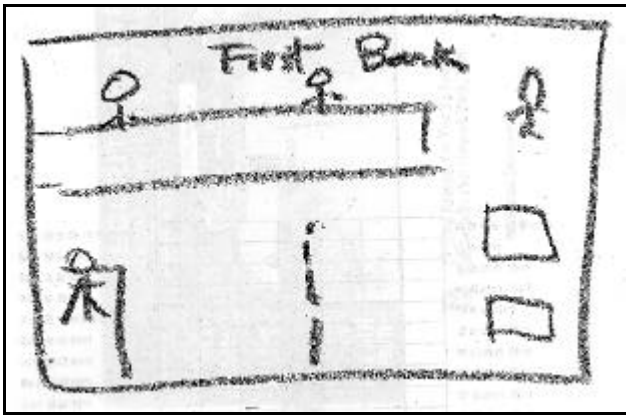

Figure 3. Extracting the Design Factors

The drawings indicate that the subjects tended to relate more easily to figures that represented the interior of an actual bank building. They also tended to remember familiar figures of people, animals and other artifacts of everyday life with more ease.

Results of the second phase of the experiment were used to supplement the results of the first phase. The subjects grouped cyber banking interfaces based on similar physical design traits. The explanations provided by the subjects, together with the drawings from the first phase made it possible to extract the following design factors from a user's perspective.

Table 1. Design Factors of Cyber Banking Interfaces - A User's Perspective

Design Factor		Category
Title	Format	Bar, Clipart ...
	Graphics	Included, Not Included
	Position	Top, ...
Main Clipart	Format	3 Dimensional,...
	Size	Over ½total screen size,...
	Motion	None, Simple animation...
Menu	Content	Numbers & text in a box,...
	Form Size	Square,... Over 1/16
Color	Color Tone	Cool shades...
	Main color	Pastel Colors...
	Background	White covering over ½....
	Brightness	High.....
	Symmetry	Stability of color tones....

Experiment 3

The purpose of the final experiment was to determine the dimensionality of the emotion space, and the interrelation between the emotive dimensions and design factors of a cyber banking interface.

Materials and Procedure

Questionnaire. The self report questionnaire used was identical in format to that of the first experiment. The questionnaire consisted of the forty representative emotive differential scales selected from the results of the first experiment.

Slide Material. Twelve cyber banking interfaces were selected from the twenty six stimuli used in the second experiment. The criteria applied in selecting the interfaces was that of the fourteen design factors obtained from the results of the second experiment. The minimum number of interfaces covering all possible combinations of the design factors was selected. The final set of stimuli consisted of two text based interfaces, four videotex based interfaces and six internet based interfaces.

Procedure. The procedure employed was identical to that of the first experiment. Three separate sessions of 123 subjects was conducted. The subjects consisted of thirty four designers and other cyber banking system experts, sixty one undergraduate students and twenty eight MBA students. The ages of the subjects ranged from the late teens into the early forties, comprising all potential users of cyber banking systems. The interfaces were projected onto a 43 inch screen using a color beam projector. The subjects were given approximately five minutes to mark the intensity and direction of the feelings evoked by each interface. The order of the interfaces was randomly generated for each session in order to eliminate ordering effects. Each subject had to provide judgments for each of the 480 items (40 emotive differential scales $\times$12 cyber banking interfaces) on the self report questionnaire.

Results and Discussion

Structure of the Emotion Space. A maximum likelihood factor analysis, using promax rotation, was performed across all subjects and cyber banking interfaces. The factor analyses were thus computed on 1417 observations (12 interfaces $\times$123 respondents, with 59 observations eliminated due to missing values). The seven factor solution accounting for 80.6% of the variance was retained (other factors accounted for less than 10% of the variance). The emotive differential scales have been reordered in descending order of factor loadings for each consecutive factor. The highest loading scales for the first factor were those that measured the attractiveness - unattractiveness of the cyber banking interfaces. The second factor reflects the symmetry - asymmetry of the interfaces, whereas the third factor is a dimension for the sophistication - or lack thereof of the interfaces. The forth factor reflects an emotion that can be crucial for effective user interaction with cyber banking interfaces — trustworthiness - untrustworthiness. Factors 5, 6 and 7 each reflect awkwardness, elegance and simplicity respectively. Each of

these factors reflects one of the emotions that can influence the effective interaction with cyber banking system interfaces. The emotive scales that pertain to each factor group were selected based on the factor loadings.

Interrelation between Emotive and Design Factors. In order to determine the interrelation between the emotions and the design factors of the cyber banking interfaces, the factor scores were computed for each of the 1417 observations. The redundancy of the emotive differential scales thus being reduced, the analysis was performed to determine the relationship between the main emotional responses represented by the seven factors and the fourteen design factors. Analysis of variance (ANOVA) was conducted with the factor scores as dependent variables, and the design factors as independent variables. The purpose of these analyses was to determine which design factors are responsible for causing a particular emotion. Regression analysis would have been more appropriate for this purpose. However, the independent variables all being nominal variables, interpreting the regression analysis proved to be complex, even with the use of dummy variables.

The first test of ANOVA was conducted to determine whether or not the elicitation of emotions was influenced by differences in the design factors. The results in Table 2 indicate that the main effect of the design factors on each of the seven emotive dimensions are statistically significant. In other words, the intensity and direction of the emotions elicited by a particular interface is differentiated by the value of each of the design factors.

Further ANOVA tests were conducted to determine exactly which design factor was most significant in the elicitation of particular emotions. Due to space limitations, in this paper we will present the detailed analysis for only one of the seven factors — factor 4, which reflects the trustworthiness - untrustworthiness of cyber banking interfaces. This is due to the importance of this particular emotion in the design of cyber banking interfaces.

Table 2. ANOVA - Design Factor Main Effect

	Attractiveness	Symmetry	Sophis-tication	Trustworthy	Awk-ward	Ele-gance	Simpli-city
F Value	99999	124.5	99999	189.9	99.9	2098	99999
P >F	.0001	.0001	.0001	.0001	.0001	.0001	.0001

Factor 4 - Trustworthiness. The design factors that were most important in deciding the trustworthiness - untrustworthiness of cyber banking interfaces was identified to be those related to the main clipart inserted in the interface, and the color layout of the overall background. This was determined based on the amount of variance explained of the dependent variable in the first ANOVA test. The following table displays the main effect of each of the eight design factors on the extent of trustworthiness experienced from a particular cyber banking interface.

Table 3. ANOVA - Main Effect of Clipart and Background Color Layout on Trustworthiness

Design Factor	Main Clipart			Color				
	Form	Size	Mo-tion	Tone	Main	Backg round	Brigh tness	Symm etry
F	213.0	148.2	17.0	401.7	214.1	190.5	78.7	277.6
P	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Design Factor (mean)	3D (-.41)	½ screen size (-.26)	many anima-tions (-.17)	Cool Tone (-.28)	Pastel (-.15)	None (-.21)	Low (-.19)	Homo-gene-ous Color (-.15)

The results indicate that each of the eight design factors has a significant effect on the elicitation of the feeling of trustworthiness. The last row in the table indicates the value of the design factor that is most effective in eliciting the feeling of security. The values in parentheses are the mean factor scores for the respective design. The results indicate that a cyber banking interface that will enhance the user's feeling of trust in the security of the transaction must be designed using three dimensional, dynamic clipart. Its background should be a moderate pastel tone color, without using a vast number of colors in the background.

The effective use of colors and the selection of the appropriate clipart will influence the feelings that are aroused in the user, thus influencing the effectiveness of, or the very desire to conduct financial transactions through the cyber banking system. The results of this ANOVA test reveal that each of the design factors relating to the use of clipart and color have a separate effect upon the trustworthiness of an interface. However, they provide little insight as to the optimal combination of design factors for maximum elicitation of trustworthiness.

GENERAL DISCUSSION

The central question addressed by this paper was that of the possibility of designing emotive interfaces which can involve the users emotionally and thus enhance the quality of the decisions made while interacting with that computer system. A new design methodology for human computer interfaces was proposed. Emotive Interface Engineering applies the theory of emotions and the role of emotions in problem solving to the development of interfaces that can aid the user by eliciting emotions or other non affective feelings that aid decision making through the information provided.

The results indicate that it is possible to design user interfaces that will appeal to universally common emotions in all human beings. The high values of the ANOVA effects relating to the interface manipulation indicate that there was little individual variation in the quality of emotion brought forth by the cyber banking interfaces. Prior research in emotion elicitation using films have determined that there

are no inter cultural differences in the particular type of emotions elicited [8]. This makes it possible to extend the findings of this paper to other cultures.

The results of the present study have interesting implications for the future of human computer interaction. They demonstrate that it is possible to elicit target emotions in a majority of individuals, thus making it possible to design emotive interfaces for widespread use. This makes it possible to establish connections between the physical design factors and emotions elicited by the interface, thereby enabling an explicit method of dealing with the emotional aspect of user interfaces. Interfaces thus designed will be sure to appeal to the individual user's emotions and make the experience of interacting with the computer system, whether it be to shop, to perform a task or to play a game, a true virtual experience, a mimesis of the actual world.

Further research is currently under way along this line to develop a standard of cyber banking interfaces. The present study merely applied the Emotive Interface Engineering methodology to the evaluation of existing cyber banking interfaces. In future studies, the design factors identified in this study will be actually incorporated into the design of a standard emotive interface for cyber banking systems.

REFERENCES

1. Barnes, A., and Thagard, P. Emotional Decisions, *Proceedings of the Eighteenth Annual Conference of the Cognitive Science Society* (1996), 426-429.
2. Bloch, M., Pigneur, Y., and Segev, A. On the Road of Electronic Commerce - a Business Value Framework, Gaining Competitive Advantage and some Research Issues, at *http://haas.berkeley.edu/~bloch/docs/roadtoec/ ec.htm*, 1996.
3. Chi, M.T.H., Feltovich, P.J., and Glaser, R. Categorization and Representation of Physics Problems by Experts and Novices, *Cognitive Science*, 5, 121-152.
4. Damasio, A.R., Tranel, D., and Damasio, H. Individuals with sociopathic behavior caused by frontal damage fail to respond autonomically to social stimuli. *Behavioural Brain Research*, 41, 1990, 81-94.
5. Ekman, P. An argument for basic emotions, *Cognition and Emotion*, 6, 1992, 169-200.
6. Gardiner, M.M., and Christie, B. *Applying Cognitive Psychology to User-interface Design*, 1993.
7. Gasmori, M. *CALS Strategy and Electronic Commerce*, Research Institute of Modern Econo-Society, 1995.
8. Gross, J. J., and Levenson, R. W. Emotion Elicitation Using Films, *Cognition and Emotion*, 9(1) (1995), 87-108.
9. Institute of Korea Science and Technology, Electronic Commerce Laboratory, The Components of Electronic Commerce, *Internet Monthly*, 1996 No. 5, 216-219.
10. Laurel, B.K. Interface as Mimesis, Chapter 4. in *User Centered System Design, New Perspectives on Human-Computer Interaction*, eds. Donald A. Norman and Stephen W. Draper, Lawrence Erlbaum Associates, 1986, 67 - 85.
11. Lee, S. Y., and Nagamachi, M. *Kansei Human Engineering*, Yangyonggak, Seoul, 1996.
12. Levenson, R.W. Human Emotion : A Functional View, in *The Nature of Emotion*, eds. P. Ekman and R. J. Davidson, Oxford University Press, 1994, 123-126.
13. Nagamachi, M. Kansei Engineering : A new ergonomic consumer-oriented technology for product development, *International Journal of Industrial Ergonomics*, 15 (1) (1995), 311-346.
14. Norman, D. A. *Things that Make us Smart*, Addison Wesley Publishing Company, 1993.
15. Osgood, C.E, Suci, G.J., and Tannenbaum, P.H. *The Measurement of Meaning*, University of Illinois Press, 1957.
16. Philippot, P. Inducing and Assessing Differentiated Emotion-Feeling States in the Laboratory, *Cognition and Emotion*, 7(2), 1993, 171-193.
17. Rasmussen, J., Pejtersen, A.M, and Goodstein, L.P. *Cognitive Systems Engineering*, 1993.
18. Schwarz, N., and Clore, G. L. Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states, *Journal of Personality and Social Psychology*, 45, 513 - 523.
19. Wagner, H.L., The spontaneous facial expression of differential positive and negative emotions, *Motivation and Emotion*, 14, 1990, 27-43.