EMOTIONAL WEB-BASED DESIGN: THE CONCEPTS OF EMOTIONAL EXPERIENCE AND EMOTIONAL EXPRESSION

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ABSTRACT

For many years people have been trying to measure differences between individuals. Over the course of time, a combination of developments in statistical know-how and the evolution of thought within psychology enabled the refinement of measures, and subsequently the assessment of more specific factors in the field of individual differences like different kinds of ability, affect and emotion. This knowledge has been used in many areas within psychology and at the same time the advancement of technology has enabled the development of web-based systems that measure specific factors relevant to specific situations. Our research focuses on the emotional mechanisms that drive human behaviour in general and how we can implement a set of rules to web design so that we can promote system adaptability on the very important field of human emotions which is at the same time extremely difficult to describe and define. In this paper we introduce our model of emotion regulation and we present our first experimental results that concern the concepts of emotional experience and emotional expression and their effect on decision making and problem solving styles. Furthermore, we present the implications that these theoretical and empirical representations can have in web applications and design.

KEYWORDS

Emotion regulation, emotional experience, emotional expression, decision making, problem solving

1. INTRODUCTION

Since 1994, the Internet has emerged as a fundamental information and communication medium that has generated extensive enthusiasm. The Internet has been adopted by the mass market much quicker than any other technology over the past century and is currently providing an electronic connection between progressive businesses and millions of customers and potential customers whose age, education, occupation, interest, and income demographics are excellent for sales. The explosive growth in the size and use of the WWW as well as the complicated nature of most Web structures result in orientation difficulties, as users often lose sight of the goal of their inquiry, look for stimulating rather than informative material, or even use the navigational features unwisely. As the e-Services sector is rapidly evolving, the need for such Web structures that satisfy the heterogeneous needs of its users is becoming more and more evident.

To alleviate such navigational difficulties, researchers have put huge amounts of effort to identify the peculiarities of each user group. Their goal is to analyze and design methodologies and systems that could

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deliver up-to-date adaptive and personalized information, with regards to products or services (Mulvenna et al, 2002). Further consideration and analysis of parameters and contexts such as users' cognitive and mental capabilities, socio-psychological factors, emotional states and attention grabbing strategies should be extensively investigated. All these characteristics could affect the apt collection of users' customization requirements and along with the 'traditional' user characteristics (i.e. name, age, education, experience, profession etc.) constitute a comprehensive user profile that serves as the ground element of most of these systems offering in return the best adaptive environments to their preferences and demands.

Adaptivity is a particular functionality that alleviates navigational difficulties by distinguishing between interactions of different users within the information space (Eklund & Sinclair, 2000). The user population is not homogeneous, nor should be treated as such. To be able to deliver quality knowledge, systems should be tailored to the needs of individual users providing them personalized and adapted information based on their perceptions, reactions, and demands.

Web-based information systems are increasingly being used for learning and training applications. Computers are becoming better and more sophisticated every day. They can already perceive information related to user needs, preferences and characteristics (Cingil et al, 2000; Kim, 2002). One possible implementation of a Web-based system's interface that can appraise human characteristics is through the use of a series of online tests and questionnaires that can assess the psychological abilities and properties of the user (Picard, 1997).

The concepts of emotion and affect underpin psychology's attempt to identify the unique character of individuals. The terms describe properties of behavior which concern the individual's typical ways of coping with life events (Lewis & Haviland-Jones, 2004). Norman (2004) argued that in order for media to communicate better with people they need to be able to understand our emotion and in order to do that they need to have emotions as well. An in-depth model that grasps the complexity of these underlying concepts is the first purpose of our research. Instead of selecting one area of implementation we are trying to combine various levels of analyses and form a typology that will help us circle effectively the cognitive and affective mechanisms of the brain. In order to apply a purely psychological construct to a digital platform we adjust the various theories concerning cognition and emotion having in mind to make our model flexible and applicable to users' profiles, needs and preferences. In order to manipulate the emotional parameters according to user characteristics, our research has to go through the stage of extracting quantified elements that represent deeper psychological and affective abilities. The latter cannot be directly used in a web environment, but a numerical equivalent can define a user characteristic. We developed a theory and a corresponding battery of questionnaires for the concept of Emotion Regulation. Our psychological model has two base elements: The experiential level which is the actual emotional experience and emotional expression of the individual (the capacity of a human being to sense, experience and express specific emotional situations) and the rational level which is the multiple ways with which the individual recognizes and manages emotions. An effort to construct a model that predicts the role of specific emotions is beyond the scope of our research, due to the complexity and the numerous confounding variables that would make such an attempt rather impossible. We focus on emotion regulation as an emotional mechanism and not on a number of basic emotions because experiential emotion regulation can provide some indirect measurement of general emotional mechanisms since it manages a number of emotional factors like anxiety, boredom effects and frustration. Our model would be problematic without a regulatory mechanism of emotion. For this reason we included also the rational level of Emotion Regulation that is comprised from terms like emotion recognition, emotional management and emotional motivation. Emotion regulation is the way in which an individual perceives and controls his emotions. Individuals attempt to influence which emotions they have, when they have them and how they experience and express them (Bechara et al, 2000). By combining the affective state of the individual with his regulatory mechanism we can reach into a conclusion of how emotions influence his performance and the outcome of his behavior.

2. THE MODEL OF EMOTION REGULATION

Theorists from a variety of orientations tend to agree in two emotional processing systems. There is considerable conceptual overlap in their formulations:

- A schematic, associative and implicit system that has connections with bodily response systems. This mode involves fast and automatic processes such as priming and spreading activation. It often involves large numbers of memories in parallel. It is not wholly dependent on verbal information – visual, kinaesthetic or other cues could provide the basis for priming or activating an emotional memory.
- An abstract propositional 'rational' system that is analytical, reflective, logical and relies on high level executive functions. It is primarily based on verbally accessible semantic information.

Individuals can utilize these two systems to process information. The first system relies on experience and intuition. In particular, individuals consider issues intuitively and effortlessly. Rather than reflect upon the various considerations in sequence, individuals form a global impression of issues. In addition, rather than apply logical rules or symbolic codes, such as words or numbers, individuals consider vivid representations of objects or events. These representations are filled with the emotions, details, features, and sensations that correspond to the objects or events. Finally, learning is equated to ascertain associations from direct experiences.

The second system, in contrast, relies on logic and rationality. In particular, individuals analyze issues with effort, logic, and deliberation rather than rely on intuition. To decide upon issues, they rely on logical rules and symbolic codes. The context (details, features, and emotions) that correspond to objects or events are disregarded. To facilitate learning in this system, individuals learn the rules of reasoning that are promulgated in society.

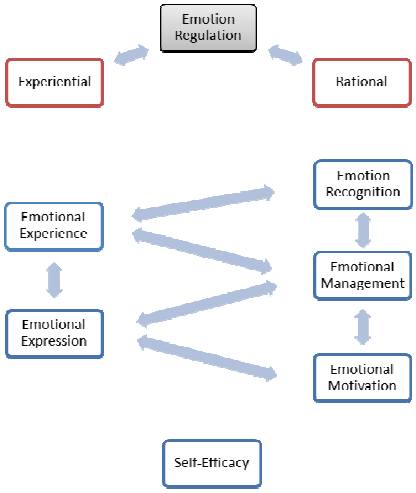

Figure 1. The Emotion Regulation Model

Recent neuroscientific findings are consistent with these multi-level conceptualisations. Le Doux (1998) has reviewed evidence suggesting that emotion networks have direct anatomical connections to both the neocortex and the amygdala. Events that are highly emotional are likely to be registered at both subcortical and cortical levels. The subcortical route is shorter and rapid whereas the cortical route is longer and slower. In the subcortical route sensory information goes from the thalamus directly to the amygdala. In the cortical route information is sent from the thalamus to both the cortex and hippocampus and is then projected to the amygdala. As noted by Samilov & Goldfried, (2000) these recent findings support a qualitative distinction between cortically based and subcortical levels of information processing. They imply that not all emotional responses are mediated cortically; rather, some may by initiated without any cognitive participation: "Emotional responses can occur without the involvement of the higher processing systems of the brain, systems believed to be involved in thinking, reasoning, and consciousness" (LeDoux, 1998, pp. 161)

Our Model of Emotion Regulation includes as well two levels of processing in relation to the aforementioned concept of processing but we consider that these two levels are connected closely with each

other and that information is processed not only in a serial way but also concurrently. The experiential level includes the notions of emotional experience and emotional expression. Emotional experience is the covert emotional condition that a human is experiencing as a result of a stimulus or information of such kind. Emotional expression is the overt reaction of such a stimulus, the behavior that follows the experience. On the other hand, the rational level is comprised of the notions of emotion recognition, emotional management and emotional motivation. Emotion recognition is the ability to realize the true nature of an emotion as it is and to feel it in the appropriate degree. Emotional management is the ability to manipulate and to control an emotion while emotional motivation is the ability to transform an emotional experience into a motivational urge. A visual representation of our model can be seen in figure 1. We believe that these two systems can interact. If someone during the stage of emotion recognition realizes intuitively that the emotion that is about to be triggered will have a negative and unpleasant emotional experience as an outcome, then it will be implicitly transformed to a different emotion so that it will be easily manageable in the next stage. The human brain prioritizes based on the principles of self-regulation and not on the search of objectivity and truthfulness.

3. THE CONCEPTS OF EMOTIONAL EXPERIENCE AND EMOTIONAL EXPRESSION

The study of emotional experience and emotional expression has a long history, which dates back to the 1870s with scientific investigations undergone by Charles Darwin (Darwin, 1872). Darwin's work emphasized the biological utility of emotional expression. Thus, it contributed to the development of an evolutionary-expressive approach to emotion, which suggests that emotion exists because it contributes to survival (Oatley, 1992). Emotional experience, emotional expression and emotional arousal have been conceptualized as three primary components of emotion (Kennedy-Moore & Watson, 1999), with emotional reflection as a secondary component, involving thoughts about the three primary components.

Our model of emotion regulation distinguishes mechanisms surrounding the experience of emotions, from those surrounding the expression of emotions. Whilst in practical terms this is probably a seamless process, we believe it is conceptually useful to distinguish experience from expression. We hypothesize that it is more fundamental and harmful to control emotional experience, than to control emotional expression. The expression of emotions is behavioral. Thus the mechanisms surrounding it, involve the real and imagined consequences of expression, cultural and family rules for acceptable expression. These mechanisms may be different from those involved in emotional experience, which is of course experiential, rather than overtly behavioral. Such emotional experience may involve feeling too much intensive emotion, feeling inappropriate emotion, or feeling numb. Also important, is how the initial negative stimulus is registered, whether emotions are experienced as a gestalt, rather than separate somatic constituents and understanding the causes and meaning of the emotional experience. In short, it could be said that emotional experience points more towards a stimulus event, and expression more towards the behavioral response.

In summary, emotion regulation is not so much concerned about whether emotional expression is right or wrong but more with what mechanisms underlie successful and unsuccessful processing. Failure to express emotions may be integrally related to failure to properly process an emotional event. However, this is only one important part within a more complex process, as emotion regulation is regarded as the overall concept within which, emotional expression simply constitutes the final stage.

4. EXPERIMENTAL EVALUATION

In this first experimental stage we wanted to investigate the implications behind the first level of emotion regulation and see how emotional experience and emotional expression interact with decision making and problem solving styles. Decision making and problem solving are two processes that circle almost every aspect of human activity. This way we can find some implications that connect emotion and its reactive responses with behavior in other areas that can be implemented in web design in various fields like e-learning, e-assessment and e-commerce. We hypothesized that highly emotional human beings will have a

tendency towards emotional styles and not rational ones. Respectively this information can be used in web design to personalize content and navigation to their likings. For example a user that as a decision maker is dependent (does not like to decide on his own, values the advice of others) will enjoy a more solid, concrete and "closed" navigational system and not a web interface with many links and freedom of navigation or will opt for help and guidance more often than someone who is not dependent and likes to decide always on his own.

5.1 Sampling and Procedure

The study was carried out within one week and the participants were all Greek citizens that live in Greece. All participants were of relatively young age studying or working at the time of administration. They could either participate in the experimental sessions that were held in the New Technologies laboratory in University of Athens or fill in the questionnaires that could also be found online in the web page designed specifically for that purpose. They were all given a battery of questionnaires. A total of 247 questionnaires were completed and returned. 55 of them were half completed or had double answers and were omitted from the sample. Our final sample included 192 participants giving a completion rate of almost 80%.

Participants varied from the age of 18 to the age of 40, with a mean age of 27 and a standard deviation of 5. 73 respondents were male and 119 were female. Among other demographic characteristics that were examined were the profession and the computer experience level of each participant.

5.2. Questionnaires

The study used questionnaires to collect quantitative data. It included five measures, one each for personality, emotional arousal, emotion regulation, decision making styles and problem solving styles. Our first treatment involved the close examination of the experiential level of the emotion regulation questionnaire (emotional experience and emotional expression) and its correlation with decision making and problem solving styles. To evaluate Decision Making we used the General Decision-Making Style Inventory (DMSI) by Scott and Bruce (1995) which includes 25 items and 5 scales (Spontaneous, Dependent, Rational, Avoidant, Intuitive) and for Problem Solving the Problem Solving Styles Questionnaire (PSSQ) by Parker with 20 items and four scales (Sensing, Intuitive, Feeling, Thinking).

5.3 Design

Internal consistency was assessed by computing Cronbach alphas for the three measures. Although there are no standard guidelines available on appropriate magnitude for the coefficient, in practice, an alpha greater than 0.60 is considered reasonable in psychological research (Kline, 2000). After the inspection of the alpha coefficients, we performed descriptive statistics for the study sample as a whole and for the particular scales under investigation to examine the sample's suitability. Since our sample was normally distributed with variance of suitable proportions we continued our statistical analysis with the use of the statistical package SPSS. The statistical analysis used to perform this study was mainly one-way Analysis of Variance (ANOVA). Our research hypothesis stated that the experiential emotion regulation factors will have an effect on the participant's style of action. More specifically, participants that score high in emotional experience and emotional expression scales will have a tendency towards more emotional and less rational styles.

5. RESULTS

For the purposes of the experiment, Analyses of Variance (ANOVA) were performed in order to indicate the relationships between the variables of the study. Table 1 presents the main findings between the scale of emotional experience and the scales of the DMSI and PSSQ. The analyses indicated that emotional experience correlated highly with the spontaneous, rational and avoidant styles of the decision making questionnaire and the feeling and thinking styles of the problem solving questionnaire.

Table 1. Statistical Significance between the Emotional Experience scale and Decision-Making and Problem-Solving Styles

Constuct	F	Sig.
DM-Spontaneous	18.160	.000**
DM-Rational	7.907	.005*
DM-Avoidant	10.116	.002*
DM-Intuitive	14.469	.000**
PS-Feeling	33.562	.000**
PS-Thinking	11.025	.001**

*p<0.005
**p<0.001

A person that experiences emotions vividly is typically afraid that he might feel anxious, tense and moody. He can get emotional easily and therefore is reasonable to react in a spontaneous and not thoughtful way in occasions or with an inhibition of action in others. His pattern of behavior is tense as his character and is subjective to strong feelings. On the other hand a less emotional individual is more rational and more methodical in his behavior.

The exact same pattern is repeated with the emotional expression scale as it can be seen in table 2. This is consistent with the idea that since expression is the consequence of experience it will follow the same set of rules that govern experience. In the general population a person that experiences an emotion of a specific magnitude will have a reaction of equivalent proportions.

Table 2. Statistical Significance between the Emotional Expression scale and Decision-Making and Problem-Solving Styles

Constuct	F	Sig.
DM-Spontaneous	18.033	.000**
DM-Rational	18.090	.000**
DM-Avoidant	12.155	.001**
DM-Intuitive	7.077	.008*
PS-Feeling	19.469	.000**
PS-Thinking	19.189	.000**

*p<0.005
**p<0.001

In figure 2 we can see the means of both measures in all decision making and problem solving styles. The logical assumption is that the two notions of emotional experience and emotional expression will be highly correlated which indeed is the case. Pearson's r has shown a significance at the 0.01 level (two-tailed) of .626.

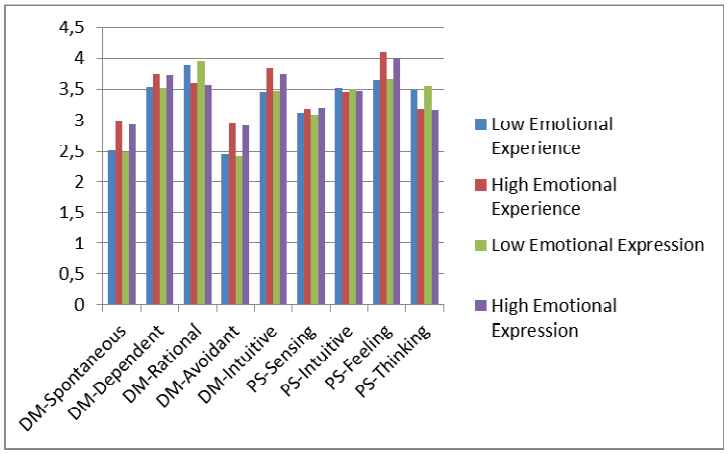

Figure 2. Means of High and Low Participant Groups in Emotional Experience and Emotional Expression. Emotional participants have higher means in the more "emotional" styles of spontaneous, avoidant, intutive and feeling while less emotional participants score higher in the "logical" ones such us rational and thinking.

6. DISCUSSION

It may come as no surprise that emotional factors are important in the decision and problem solving process. The emotion regulation factors comprise characteristics that people often exhibit in their decision making. Apart from the standard emotion regulation questionnaire we developed a theory and a corresponding battery of questionnaires for the concept of Affect (Lekkas et al, 2009). The next step of our research is to combine these findings with the purely affective elements of our model. It has been argued that positive affect increases motivation, attention, pleasantness, participation and engagement, while negative affect is highly involved with boredom, fear, anger, displeasure and distraction.

By combining the personality style and the affective state of the individual with his regulatory mechanism (experiential and rational emotion regulation) we can reach into a conclusion of how affect influences his performance and the outcome of his behavior. At the same time our level of implementation after analysing our findings in decision making and problem solving preferences, will concentrate directly on the user learning process. We have already developed a web system based on learning performance evaluation for the testing of the various instruments that we have incorporated in our model (Germanakos et al, 2007). The cognitive elements are more straightforward since they are easier to measure and easier to quantify and we have already reached a level in which we can make inferences about how users with different cognitive abilities and preferences can be aided or guided through a personalized web interface (Tsianos et al, 2008). The final step to complete the implementation of our model is to add the affective elements and to investigate the inner and deeper relations that exist between them. Personality type is also a fundamental construct since personality research is already established and developed to a great extent. Our next task is to examine our findings in combination with the constructs of task-specific anxiety and personality.

Emotional and decision factors can be proven significant in defining user behavior in web applications and interfaces, taking into consideration psychometric challenges, as well as the complicated matter of quantifying and subsequently mapping emotions on a digital environment. Most theories of choice assume that decisions derive from an assessment of the future outcomes of various options and alternatives through some type of cost-benefit analyses. The influence of emotions on decision-making is largely ignored. The studies of decision-making in neurological patients who can no longer process emotional information normally suggest that people make judgments not only by evaluating the consequences and their probability of occurring, but also and even sometimes primarily at a gut or emotional level (Damasio, 1994).

Decision-making and problem solving are cognitive processes where the outcome is a choice between alternatives. We often have different preferences as to our approach, varying between thinking and feeling. When we use reason to make decisions, we seek to exclude emotions, using only rational methods, and perhaps even mathematical tools although emotions exist in the first stage of our decision making procedure and are followed by reasoning. The foundation of such decisions is the principle of utility, whereby the value of each option is assessed by assigning criteria (often weighted). Web systems until recently tried to integrate tools that aid user in a purely rational process (e-learning and decision-support systems). There is a whole range of decision-making that uses emotion, depending on the degree of reason that is included in the process. A totally emotional decision is typically very fast. This is because it takes time (at least 0.1 seconds) for the rational cortex to get going. This is the reactive (and largely subconscious) decision-making that you encounter in heated arguments or when faced with immediate danger. User Behavior is in its final analysis a decision making process. The nature of its activity is strongly correlated with emotions, that is why the role of emotions is extremely important is a setting like this. The mediating role of technology can help the designers to understand the emotional mechanisms of the users and adjust more efficiently to their needs.

One possible implementation of a Web-based system's interface that can appraise human emotion is through the use of a set of parameters that can adapt according to the emotional condition of the user and his preferred style of action. An emotionally tense or unstable individual will be able to adjust the contents of a webpage based to what he considers easier to control and manipulate. A certain emotional condition demands

a personalization of equivalent proportions. The user will have the capability to respond emotionally either after being asked at a specific moment or after an initial profile construction.

Such a system should be designed in a way that it can create a detailed profile for every user and can provide two basic services. One application-based that will have to do with the interface, the navigation and its usability and aesthetical appearance and one content-based that will have to do with the database, the allocation of content, the depth and the dissemination of information. Using these, the interface will take the form that the user wishes so that he can work there more efficiently and less anxiously. Researching on decision making and problem solving is only the first step to map and model user patterns of behavior. The research results can be further used as more specific design guidelines.

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