



Design Requirements for Web Applications to Affect the End User Emotional State

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Abstract. We report on work aiming to identify Web design requirements to stimulate specific emotions. The results are based on a user test analysis with 50 participants evaluating the emotional impact of six different Web design criteria eliciting respectively hate, anxiety, boredom, fun, serenity, love. The design criteria applied come from a previous survey with 57 participants suggesting the main typical emotions during Web interaction and associating them with some specific Web characteristics. An additional user test with 40 users investigated deeper which design features are most important to elicit a particular emotional state. A formalization of such criteria can be important to support Web designers developing Web applications taking into account the user's emotional state.

1 Introduction

The role of emotions has acquired more and more importance in HCI [1, 2]. Emotions are complex and depend on individual preferences, attitudes, moods, affect dispositions, and interpersonal stances; “there is no single standard gold-method for their measurement” [3]. Unfortunately, even if in HCI there is a general agreement about the importance of the user emotional state during the interaction, no concrete formalization of the relevant design criteria has been proposed in order to support designers aiming to obtain applications able to stimulate the user emotional state. There are examples of emotions classifications, such as Geneva [4], or contributions comparing different versions of Web pages [5] to investigate the impact of their attractiveness [6] or aesthetics, but no work has focused on typical emotions during Web interaction. Our goal is to investigate the impact of some Web design criteria to elicit a particular emotional state on the user and if some specific Web design features are more effective than others. To accomplish this goal, we conducted one survey and two user studies. The preliminary survey aimed to collect some basic indications from a sample of 57 users. In particular the survey intended to understand the most recurring emotions during the Web interaction and the associated Web design features for each proposed emotion.

The final data produced a scale of six emotions (ordered from the perceived most negative to the most positive) typical of Web interaction: hate, anxiety, boredom, fun, serenity, love. After the survey, we designed and implemented six interfaces to which we applied the collected criteria, and we asked 50 users to test the emotional effectiveness of the Web design criteria applied. Finally, in order to understand if some Web aspects of design can be more relevant than others to stimulate a specific emotional state, we performed another user test with 40 users. Section 2 analyses in details the survey and the two user tests, and provides an overview about the future evolution of this research, and then the conclusions are drawn.

2 Web Design Criteria able to Stimulate Emotions

The process for identifying some Web design criteria able to stimulate an emotional reaction on the user, has been defined through many steps.

2.1 A Survey: Collecting Opinions about Emotional Web Design

The 57 participants (25 females and 32 males) had an average age of 38,21 years (ranging from 26 to 59). The sample considered users with heterogeneous educational level and Web development experience. We asked each participant to suggest the typical emotions (maximum 8) involved during Web interaction. The only constrain for each proposed emotion was to indicate also the opposite one (depending on the negative or positive emotional valence, in their perception). The average number of proposed emotions was 3.84 per user. On the base of their perception, users had to order each proposed emotion, and to associate each one with specific characteristics in terms of main Web design aspects (such as colours, page structures, contents distribution, type of media, navigation & interaction elements, etc.). We collected 219 emotions perceived as negative and 219 perceived as positive.

2.1.1 Results

Analysing the proposed emotions, we discarded synonyms, emotions with a low number of preferences or having the same Web characteristics suggested by different users. The resulting six emotions may not be exhaustive. However, the goal of this work is not to provide a further emotion classification, but rather if possible, to identify some clearly distinguishable design characteristics that could elicit a specific emotion. As a final result, we obtained a filtered scale of six emotions: hate, anxiety, boredom, fun, serenity,

love. Hate and love express the sense of disliking/liking for something (e.g. typical of Web social networks). Anxiety and serenity express the emotional state during critical/safe actions (i.e.: the user is booking/buying something on Web inserting personal or credit card data). Boredom or fun depend on the way the contents are presented attractively. For each emotion, the users suggested us some Web design features as potentially able to stimulate the considered emotional state [7]. Even if the proposed Web design features are distinguishable, emotions close in the scale have some common features. This indicates the complexity of the emotions and the fact that there is not a well definite distinction between similar (but not equal) emotional states.

2.2 A User Study: Testing the Emotional Impact of the Criteria

After having performed the preliminary survey, we wanted to check concretely if the collected data were effectively efficient to elicit each considered emotion. To accomplish this goal, we implemented six Web interfaces applying the Web design criteria suggested in the survey. Each Web interface presented the same content (except very minimal additions suggested by the users) in a different design style. The goal of each interface was to stimulate one of the six emotions. Fifty new users (21 females and 29 males) evaluated the emotional impact of the six interfaces through a user test. The average age was 38,28 years (ranging from 26 to 77). The sample considered users with heterogeneous educational level and Web development experience. We chose the Beatles' musical history as topic for the six interfaces. The interfaces contained a short textual biography, a player where the user could listen to five famous songs, a video, a form to buy virtual tickets for revival events and six clickable graphic covers of famous albums. The 50 users evaluated in random order each one of the six interfaces giving a judgement in a scale from 1 to 5 scale (where the value 1 indicated that the page was very ineffective to elicit the target emotion, while value 5 indicated that the page was very effective, and the value 3 represented the neutrality). Before giving their judgments, users had to perform three tasks for each interface: a) find the answer to a question in the biography (so the user could test the reading) b) clicking one of the six albums (so the user could test the navigation elements) c) filling in the form (so the user could test the interactive elements). The six Web interfaces had been designed as follow: a) the interface eliciting hate had the content distributed in one single page, a confused layout, and blurred text and elements; b) the interface eliciting anxiety presented the contents distributed in multiple pages, showed intermittent light effects and jerky

transformations, with a countdown as a pressure factor to fill in the form; c) the interface eliciting boredom was one single page with long text, without images or videos, requiring more fields to fill in the form; d) the interface eliciting fun had the contents distributed in multiple pages, and showed unpredictable animations and dynamic effects; e) the interface eliciting serenity was very simple to minimize the user's effort, allowing easy navigation through TABS elements; f) the interface eliciting love was a long page with an appealing graphics and was usable [7, 8].

2.2.1 Results

The user appreciated positively the emotional impact of the interfaces. In particular, the average judgment and the deviation standard (SD) related to the six designs were: 4.48 (SD 0.64) for hate, 4.52 (SD 0.61) for anxiety, 4.16 (SD 0.88) for boredom, 3.32 (SD 1.21) for fun, 4.22 (SD 0.72) for serenity and 3.64 (SD 1.06) for love. Fun and love were considered the more critical Web design criteria, even if the judgment was on the positive side. In particular, the presence of animations/dynamics effects applied for fun was considered excessive, and the red and pink colours applied for love were considered too shocking.

2.3 A User Study: Looking for Relevant Emotional Features

Encouraged by the positive results of the previous user test, we wanted to understand if some Web design features were more relevant to stimulate an emotional reaction. For this goal, we designed and implemented a Web application able to adapt its design to the emotional state selected by the user. For each emotion we designed two versions (implemented with different Cascading Style Sheets): the first version applied the criteria of the previous user test but improved by the users' suggestions; the second version presented small differences for those elements deemed controversial in the previous user test (such as colours, visual characteristics, blurred or clear text and dimension of images/videos). We recruited other 40 users and we divided them in two groups A e B of 20 users each. Group A (11 females and 9 males) evaluated first version for each emotion and Group B (14 females and 6 males) the second one. Both groups were heterogeneous in terms of education and developing experience. Each user evaluated one version of each design in random order. For each emotion, every user had to perform three similar tasks of the previous user test, and had to give a judgement (in a scale from 1 to 5) about the emotional impact, choosing also the main three aspects of Web

design (from a proposed list) considered fundamental to stimulate the target emotional state.

2.3.1 Results

The results of the two groups appeared consistent [8]. The judgments on the emotional impact improved with respect to the results of the previous user test. Only the boredom evaluation decreased due to the fact that even if the biography was long, the actual information to find was at the beginning. The main aspects for the six Web designs resulted as follow: a) *hate*: **confused layout, difficult interaction and navigation**; b) *anxiety*: **stress factors, blurred text/images/videos, and dynamic effects**; c) *boredom*: **excessive information, absence of dynamic effects and absence of images/videos**; d) *fun*: **appealing graphics/aesthetics, dynamic effects and colour images/videos**; e) *serenity*: **ordered layout, reassuring elements and easy interaction & navigation**; f) *love*: **appealing graphics/aesthetics and the reassuring elements**.

2.4 Discussion

Our user tests have showed that usability, even if it is an important factor, it is not the unique aspect responsible to elicit an emotional reaction on the user (e.g. different interfaces with poor usability, can produce different emotional reaction, as different interfaces with good usability can produce others). Users considered positive emotions important to improve the user experience, but in some specific application domain also negative emotions have been considered useful (e.g. in educational, learning or psychological tools where it is necessary to increase the awareness of children about the difference between good and bad behaviours).

2.5 Possible Approaches to Emotion Changes

The final goal of this research aims to obtain solutions able to adapt the design of Web applications to stimulate more positive emotions. Thus, we need to understand the best approach to support a transformation of design criteria for this purpose. The idea of a transformation from a design to another has been suggested by the users in the preliminary survey as a gradual process. Choices of strategies (which elements of the interface can be transformed before others and the evaluation of the times of the transformation) are important to avoid the perception of a too traumatic change of Web design. Depending on the original and target emotional design, the common elements between two different designs can facilitate a smooth perception of transformation on the

user, otherwise an intermediate design could be necessary. We plan new user tests to understand more concrete indications about more effective strategies to guide the user towards a different emotional state.

3 Conclusions and Future Work

The process for identifying some Web design criteria able to stimulate emotional reactions during the interaction has produced encouraging results, showing that different Web design requirements are able to stimulate different emotions. However, further investigation is necessary. The ultimate goal of this research is the formalization of a set of design criteria for Web interfaces able to stimulate effectively emotional states. In addition, we plan to monitor the emotional state of the user and the level of attention (with some physiological sensors, an eye tracker and log analysis) to design Web applications able to adapt the design in order to guide the user towards a more positive emotional state and a pleasant user experience.

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