Multi-component assessment of users' responses to web page designs.

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Introduction

There is growing recognition that the assessment of user responses to software designs should extend beyond 'traditional' usability concerns of 'effectiveness', 'efficiency', and 'satisfaction' (as described, e.g., in ISO 9241) and encompass a broader range of affective experiences (see e.g., Hoffmann and Kraus, 2004). Psychometric approaches have been used extensively in efforts to identify affective constructs that might prove useful in this respect. In part, such efforts seem to be motivated by the need to develop interface designs that are more engaging and that provide the user with a generally rewarding experience (e.g., Huang, 2003). However, work in this area is also driven by the need to develop designs that engender specific affective responses, such as feelings of trust in relation to e-commerce web site designs (e.g., Kim and Moon, 1998).

Much of the relevant empirical work can be described as being based on a 'bottom-up' approach, i.e., it is 'data-driven', in that data reduction techniques (e.g., cluster analysis or factor analysis) are used as the main method for identifying what are thought to be fundamental components of user response. Although some agreement between studies can be found with respect to the distinctions made, e.g., between utilitarian and hedonic interface properties, there is also much inconsistency. For example, some propose that hedonic qualities are multidimensional (Lavie and Tractinsky, 2004), while others describe apparently related constructs such as flow (Huang, 2003, 2005) or fun (Igbaria, Schiffman, and Wieckowski, 1994). We argue that some disparities arise because insufficient attention is given to the 'top-down', theory-driven construction of models. Although data reduction techniques are valuable, they can also lead to the misidentification of constructs, with similar factors not being recognised as such because they have been given different names (see e.g., Block, 1995) or qualitatively different components being amalgamated into single factors on the basis of context-specific data. For example, users' ratings of specific 'concrete' interface design properties (such as 'symmetry') are often included for factor analysis along with ratings of users' evaluative responses to interfaces (such as 'dependability'). Resulting factors (e.g., a factor with positive loadings of symmetry and dependability) may be interface-specific and consequently have limited explanatory value. We argue that such associations should be identified at the model level, where they can be moderated by other factors, and not at the factor level. In an attempt to demonstrate this, we have undertaken a programme of work that we hope will be informative with respect to the integration and extension of existing research findings. We are developing and testing a theoretically-driven model that can be applied in this context. In this workshop presentation we will describe this model and evaluate it in the context of empirical evidence.

A theoretically-driven model of user responses

As a starting point for the model, we focus on two theoretical issues. The first concerns the description of a flow from initial perceptions of an interface to behavioural outcomes. We draw from existing models of interface and product design (Bloch, 1995; Hassenzahl, 2003; and Huang, 2003) that incorporate relevant constructs. It is posited that a time-course of users' interactions with interfaces can be charted in which their assessments of the interface become increasingly elaborate, drawing in more and more information, and culminate in behavioural intentions (or outcomes). In this respect, we identify four sequential stages. The first (stage 1) emphasises sensory processing and concerns users' perceptions of 'fundamental' design features. These are held to be relatively context-free, e.g., assessments of the extent to which a particular web page design is perceived to be 'symmetrical' or 'balanced' can be made with little or no recourse to assessments of other web page designs. In stage 2 effects of context are more central. Users are held to assess stage 1 constructs in the light of the task, the environment, and their own abilities and preferences. Specific constructs addressed at this stage include 'usability' and 'individuality'. In stage 3 users make more generic assessments of the interface design. To do this, they amalgamate assessments made during stage 1 and 2. These assessments 'feed into' the final stage (4) in which behavioural outcomes are effected (e.g., revisiting a favoured web site).

The second theoretical issue addressed in the proposed model concerns the distinction between cognitive evaluations and affective experiences (Bloch, 1995). It has been suggested that important information is lost if this distinction is not maintained when assessing user responses to products (Dubé, Cervellon, and Jinghuan, 2003) and, consistent with this distinction, differences in the effects that manipulations of cognitive demand have on the processing of cognitive and affective information have been identified (Shiv and Fedorikhin, 1999). In the context of human-computer interaction, effects of variation in cognitive demand may be particularly relevant. To facilitate the assessment of these constructs of cognition and affect we distinguish between attributions directed at the interface (e.g., a web design might be considered to be 'novel') and attributions directed at the user (e.g., a user might experience 'frustration' when using a particular web page).

A programme of empirical work

To test this model, and the embodied theoretical issues, we are engaging in a programme of empirical studies. In an initial experiment, that will be reported in detail elsewhere (Westerman, Shaerf, Tuck, & Gardner, *in preparation*) participants were required to assess five university psychology department web sites with a view to identifying an undergraduate course. Participants rated each on 53 psychometric items selected to reflect key components of the model. A series of factor and path analyses was used to examine the structure of specific constructs and the associations between them. Convergent and divergent validity of constructs was supported by the identification of two patterns of association. The first related to cognitive evaluations of quality (stage 3) that were evoked by perceptions of an 'organised' (stage 1) and 'usable' (stage 2) design. The other pattern concerns users' experience of 'positive affect' that was related to assessments of 'flamboyance' (stage 1) and 'individuality' (stage 2). Both cognitive evaluations and affective experiences contributed to the

prediction of outcomes (self reports of intentions to reuse sites and assessments of the extent to which they were memorable and drew attention).

A second, and more extensive, study is currently underway and results will be reported at the workshop. A multi-method approach to assessment is being adopted. In addition to psychometric measures (based on a refined and extended item pool), facial EMG and eye tracking are being used as potential indices of users' responses to different web page designs. Each participant will be allocated a fixed amount of money and asked to view five charity websites prior to deciding how to donate their allocation. Ward (2004) has reported evidence to suggest that facial movement tracking is a viable technique in the study of affective computing. The present study aims to assess whether facial EMG can provide a useful index of affective experience, and whether correlations differentiate assessments of cognition and affect. In contrast, eye movement data tend to reflect areas of high information or interest rather than pleasing aspects of the design. In this regard, such data should help to identify those areas of websites, and the type of information contained therein, that can lead to behavioural change (i.e. donating money).

Workshop demonstration

The demonstration component of this contribution to the workshop will involve attendees viewing the websites (or a subset) from the above study and the completion of the psychometric measures used. Discussion would then involve consideration of the items used in these measures and how they relate to the design of affective systems.

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