An AdaptiveWeb System for Integrating Human Factors in the Personalization of Web-based Content

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Introduction

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. One of the key technical issues in developing personalization applications is the problem of how to construct accurate and comprehensive profiles of individual users and how these can be used to identify a user and describe the user behaviour. The objective of user profiling is the creation of an information base that contains the preferences, characteristics, and activities of the user. But, could user profiling, incorporating only these dimensions, be considered complete? In the proposed system we extend the notion of the "traditional" user profile introducing the *User Perceptual Preference Characteristics* (see Fig. 1), that serve as the primal personalization filtering element. This approach emphasizes also on critical factors that influence the visual, mental and emotional processes that mediate or manipulate new information that is received and built upon prior knowledge, respectively different for each user or user group.

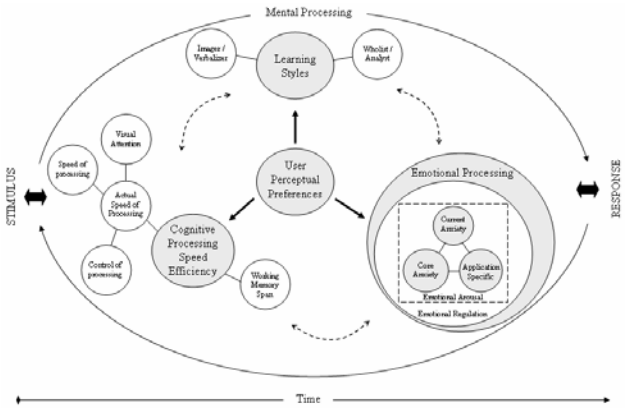

Figure 1. User perceptual preference characteristics (UPPC) – three-dimensional approach

These characteristics, which have been primarily discussed in our previous publications [2], have a major impact on visual attention, cognitive and emotional processing that takes place throughout the whole process of accepting an object of perception (stimulus), until the comprehensive response to it. Henceforth, with the use of the AdaptiveWeb system, users will be able to switch between the raw and the personalized content, realizing in practice that their individual characteristics play an important role during the adaptation and personalization process, in order to reach higher levels of usability, user satisfaction, effectiveness and quality of presentation.

Demonstration outline

The current system, AdaptiveWeb (see Fig. 2) [1], is an adaptive Web-based application. It is detached into four stand alone interrelated components[2], outlined below:

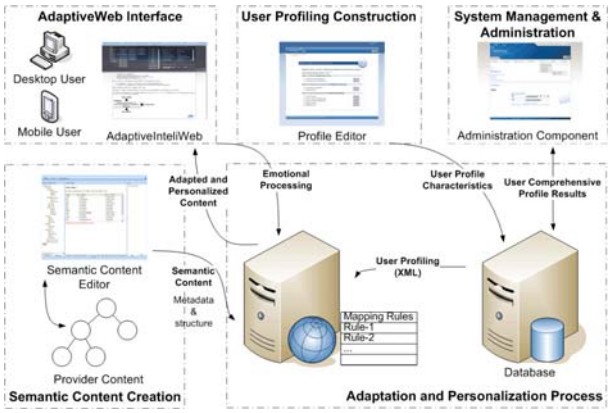

Figure 2. AdaptiveWeb system architecture

1. The *User Profiling Construction* component. The user gives his / her traditional and Device Characteristics and further the component extracts the *User Perceptual Preference Characteristics* by completing a number of real-time tests (attention and cognitive processing efficiency grabbing psychometric tools) as well as answer some questionnaires for generating his / her cumulative profile.

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[2] The technology used to build each Web component is ASP .Net.

2. The *Semantic Web Editor*. The provider will create his / her own content by defining the content as semantic objects and metadata for describing data and the relation between them.
3. The *Adaptation and Personalization* component. It runs the "mapping rules" process applied to the provider's content according to the user's comprehensive profile.
4. The *AdaptiveWeb User Interface*, AdaptiveInteliWeb (see Fig. 3). It provides a framework where all personalized web sites can be navigated. Using this interface the user will navigate through the provider's content (normal and personalized mode), with the necessary learner and navigation support provided based on his / her profile.

The AdaptiveWeb system is currently at its final stage. All the components, except the Semantic Web Editor have been developed and smoothly running. For this reason, all the tests implemented so far to prove components efficiency have been based on a predetermined online content in the field of eLearning multimedia environment, mainly due to the fact that there is an increased interest on distant education via the Web. In this case, we were able to control factors as previous knowledge and experience over distributed information, by integrating this e-learning procedure into an undergraduate course on algorithms in our department.

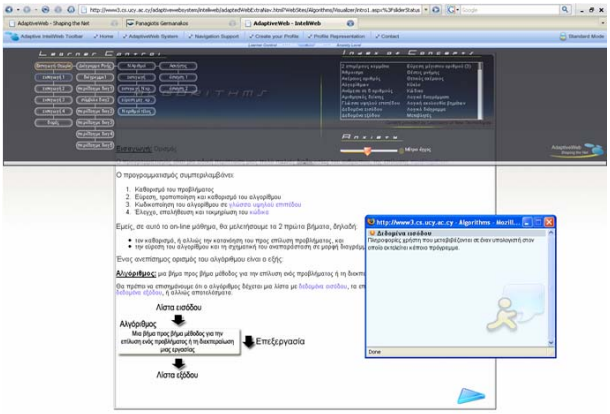

Figure 3. AdaptiveInteliWeb

We managed to have a total sample of 232 students conducting our tests, providing matched and mismatched environments, depending on the factor we were controlling each time. Our main hypothesis was that students in matched environment perform better than those in mismatched conditions. The initial evaluative results were really encouraging for the future of our work since we found that in many cases there is high positive correlation of matched conditions with performance, as well as between the dimensions of the various factors of our model (see Fig. 4). This fact demonstrates the effectiveness of incorporating human factors in Web-based personalized environments. More specifically, our methodology and control hypothesis was successful since we have seen increased performance by students interacting and learning through matched environments (see Fig. 5) with regards to their cognitive style (imager / verbalizer, wholist / analyst), actual cognitive speed of processing (time availability based on their type, fast / medium / slow), and working memory span (complete or broken content provision depending if they had high / medium / low capacity).

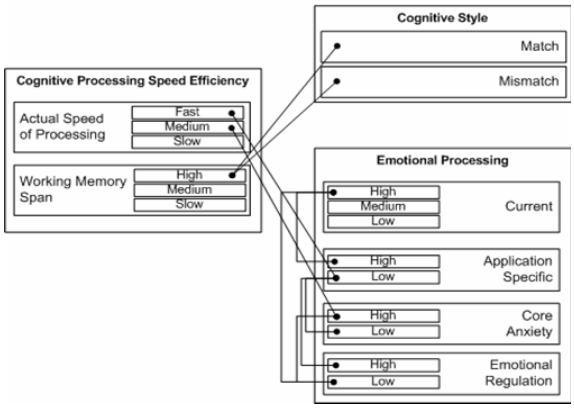

Figure 4. UPPC Factors Correlation Diagram

Finally, emotional processing, and more specifically anxiety, turned out to be an equally important factor; medium levels of anxiety are supportive of increased performance, while aesthetics and extra navigation support helped significantly students that were high anxious, in terms of performance.

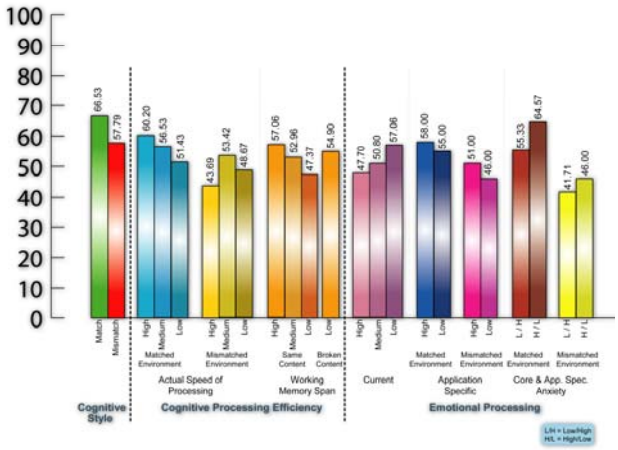

Figure 5. Basic Performance Indicators according to UPPC Factors

Audience

The system will be useful to academics, teachers and researchers, professionals in the field of education (eLearning) and technology (eServices), concentrating on the various aspects of adaptivity and personalization. Main emphasis is given to the correlation and integration of Human Factors with "traditional" characteristics during the comprehensive user profiling construction.

Additional information

[1] AdaptiveWeb URL:www3.cs.ucy.ac.cy/adaptiveweb
[2] Related publications: www.media.uoa.gr/~pgerman

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