Integrating Human Factors in the Web Personalization Process: The AdaptiveWeb System

Panagiotis Germanakos[1,2], Nikos Tsianos[1], Zacharias Lekkas[1], Constantinos Mourlas[1], Mario Belk[2], George Samaras[2]
[1]Faculty of Communication and Media Studies,
National & Kapodistrian University of Athens, 5 Stadiou Str, GR 105-62, Athens, Hellas
{pgerman, ntsianos, mourlas}@media.uoa.gr
[2]Computer Science Department, University of Cyprus, CY-1678 Nicosia, Cyprus
{belk, cssamara}@cs.ucy.ac.cy

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.

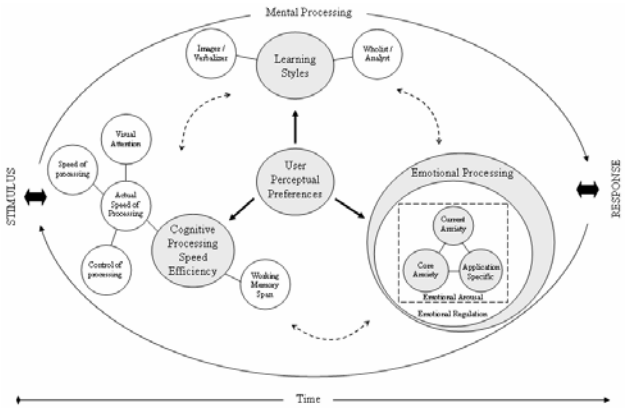

Figure 1. User perceptual preference characteristics (UPPC) – three-dimensional approach

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.

Description of the system

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:

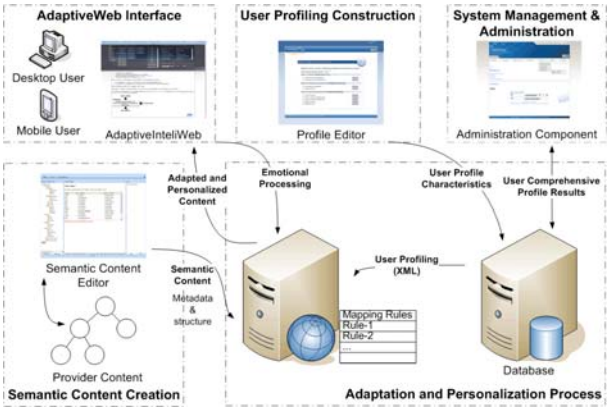

Figure 2. AdaptiveWeb system architecture

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.
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 in-

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

terface 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, and has been evaluated in the field of *eLearning* [3], and *eCommerce* multimedia environment.

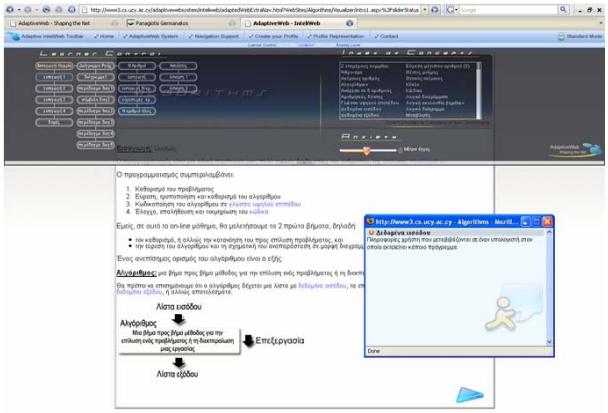

Figure 3. AdaptiveInteliWeb

Evaluation of the eLearning paradigm

A total sample of 232 students used, 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. This fact demonstrates the effectiveness of incorporating human factors in Web-based personalized environments.

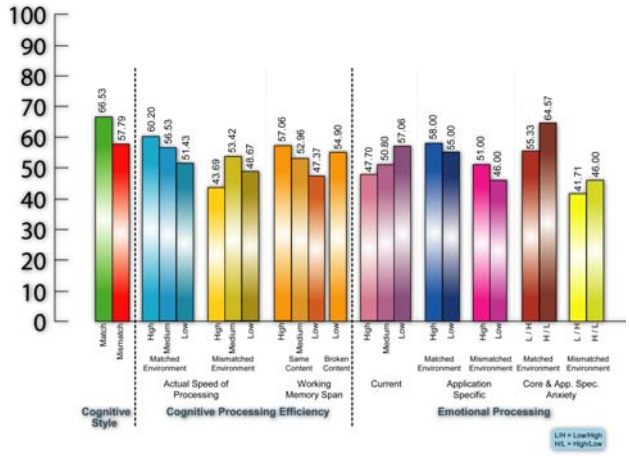

Figure 4. Basic Performance Indicators according to UPPC Factors

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. 4), with regards to their cognitive style, actual cognitive speed of processing, working memory span, and emotional processing.

Evaluation of the eCommerce paradigm

A total sample of 89 students used from the Universities of Cyprus and Athens. The content was about a series of laptop computers. The dependent variables that were considered as indicators of differences between the two environments (original and personalized) were: (a) Task accuracy (number of correct answers), (b) task completion time, and (c) user satisfaction. The most robust and interesting finding was the fact that users in the personalized condition were more accurate in providing the correct answer for each task. The same user in the raw condition had a mean of 1 correct answer, while in the personalized condition the mean rose to 1.9.

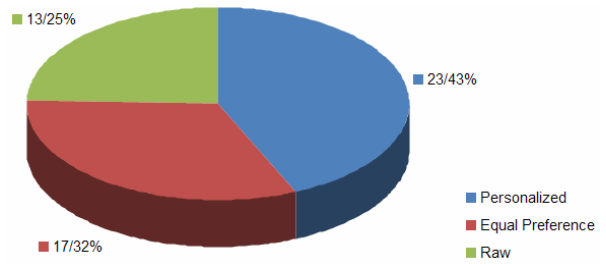

Figure 5. Users' perception in different interaction environments

Equally interesting is the fact that users in the personalized condition were significantly faster at task completion. The mean aggregated time of answering all three questions was 541 seconds in the raw condition, and 412 in the personalized. Both results were statistically significant at zero level of confidence. As it concerns the satisfaction questionnaire, 31 users leaned towards the personalized environment, 38 had no preference while 20 preferred the raw (see Fig. 5). The evaluation results of the eCommerce environments are consistent to our previous findings, and perhaps are a little more impressive, considering the fact that such an approach in a non-educational setting is rather novel.

References

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Additional information

[1] AdaptiveWeb URL:www3.cs.ucy.ac.cy/adaptiveweb

[2] Related publications: www.media.uoa.gr/~pgerman