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# Embracing Cognitive Aspects in Web Personalization Environments – The Adaptive Web Architecture

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## Abstract

This paper<sup>1</sup> presents a Web adaptation and personalization architecture that uses cognitive aspects as its core filtering element. The innovation of the proposed architecture focuses upon the creation of a comprehensive user profiling that combines parameters that analyze the most intrinsic users' characteristics like visual, cognitive, and emotional processing parameters as well as the "traditional" user profiling characteristics and together tend to give the most optimized adapted and personalized result to the user.

## 1. 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. Therefore, a serious analysis of user requirements has to be undertaken, documented and examined, taking into consideration their multi-application to the various delivery channels and devices. 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, especially if they are moving.

## 2. Comprehensive User Profiling Construction

A user profile could be considered complete if designers and developers of Web-based applications take into consideration more intrinsic users' preferences in order to provide them with a really personalized Web-based content. These values could be referred to as *User Perceptual Preference Characteristics*, that is, as all the critical factors that influence the visual, mental and emotional processes

liable of manipulating the newly information received and building upon prior knowledge, that is different for each user or user group. These characteristics, which have been primarily discussed in [1], determine the visual attention, cognitive and emotional processing taking place throughout the whole process of accepting an object of perception (stimulus) until the comprehensive response to it. The proposed Comprehensive User Profiling could be considered as the main raw content filtering module of an Adaptive Web-based Architecture. It is composed of three elements: (a) the User Characteristics (the so called "traditional" characteristics of a user: knowledge, goals, background, experience, preferences, activities, etc.), (b) the Device / Channel Characteristics (contains characteristics referring to the device or channel the user is using and contains information like: bandwidth, size, connectivity, power processing, interface and data entry, memory and storage space, battery lifetime, etc.), and (c) the User Perceptual Preference Characteristics (see Fig. 1) that contains all the visual attention, cognitive and emotional processing parameters that completes the user preferences and fulfils the user profile.

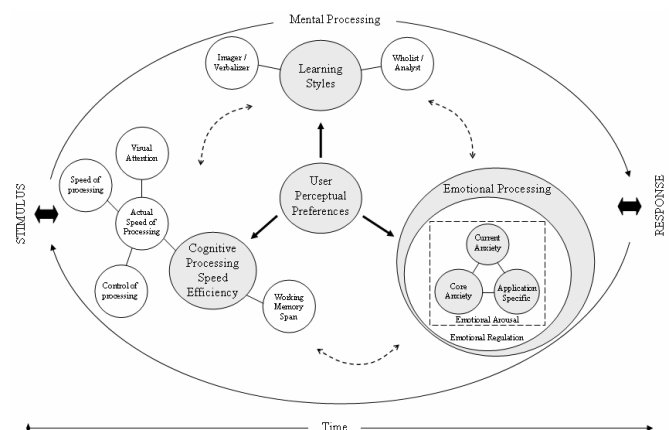


Figure 1. User perceptual preference characteristics – three-dimensional approach

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### 3. The AdaptiveWeb Architecture

Based on the abovementioned considerations, an adaptive Web-based environment is overviewed trying to convey the essence and the peculiarities encapsulated. The current system, AdaptiveWeb<sup>2</sup> [3] (see Fig. 2, the current status of the system is in Greek but shortly will be implemented in English), is a Web-based and mobile Web application<sup>3</sup>, each one representing a stand alone Web system outlined below:

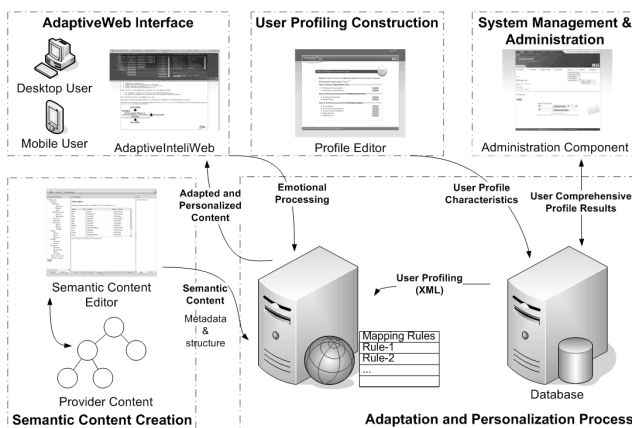


Figure 2. AdaptiveWeb system architecture

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 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

<sup>2</sup> <http://www3.cs.ucy.ac.cy/adaptiveweb>

<sup>3</sup> The technology used to build each Web component is ASP .Net.

field of eLearning multimedia environment, due to the fact mainly 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.

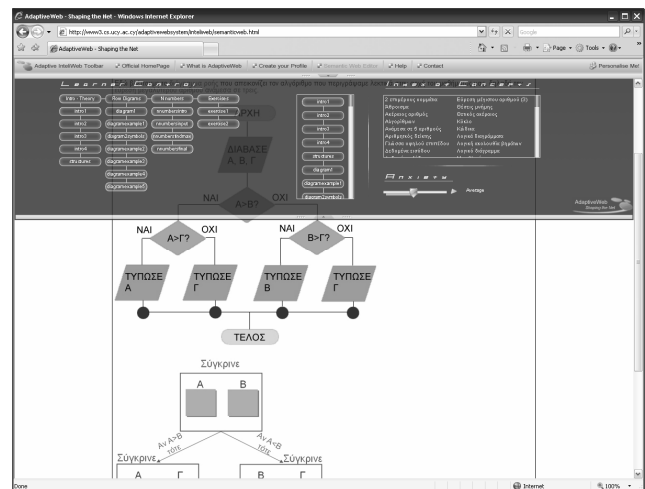


Figure 3: AdaptiveInteliWeb

### 4. Conclusion

The basic objective of this paper was to approach the theoretical considerations and technological parameters that are based upon more intrinsic users’ characteristics. Running under a common filtering element (User Perceptual Preference Characteristics), they could provide a more comprehensive user profiling that supports the provision of a more apt and optimized user-centered Web-based result. Finally, the AdaptiveWeb system architecture has been overviewed.

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