

Personalization Techniques and Their Application

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INTRODUCTION

Personalization is an approach to increase the usability of complex information systems and present the user with a comprehensible interface that is tailored to his or her needs and interests. In this article, we examine general techniques that are employed to achieve the personalization of Web sites. This is followed by a presentation of real-world examples. It will be shown how different levels of personalization can be achieved by employing the discussed techniques. This leads finally to a summary of the current state in personalization technologies and the issues connected with them. The article closes with some ideas on further research and development, and a conclusion.

In general, the concept of personalization refers to the ability of tailoring standardized items to the needs of individual people. It is originally derived from the ideas of Pine (1993) who proposed that companies should move from the paradigms of standardized products and homogeneous markets to customizable products that meet the requirements of many different customers. The principle of mass customization applies to a certain degree to most car manufacturers and some computer manufacturers, for example, Dell.

In the digital world of the World Wide Web, the degree of customization can be much higher than in the physical world. Currently, a number of online portals and e-commerce shops make use of personalization to provide a better user experience. Although Web sites may be the most popular examples of personalization, the concept is not limited to the Web. Every information system that deals with large amounts of data and/or has a heterogeneous group of users can benefit from it. Examples include e-learning environments, electronic books, computer-operated voice and telephony services, and tourist guides.

Personalization is also very useful for mobile devices like personal digital assistants (PDAs) or mobile phones (cf, Mulvenna, Anand, & Buchner, 2000). Technologies like mobile Internet access, WAP (Wireless Application Protocol), and future multimedia applications based on

high-capacity wireless technologies require the designers of services for these devices to deal with limited input capabilities and small display sizes. For that reason, every method that assists the user in navigating and finding information easily adds real value to applications for such devices.

PERSONALIZATION TECHNIQUES

The core idea of personalization is to customize the presentation of information specifically to the user to make user interfaces more intuitive and easier to understand, and to reduce information overload.

The main areas of tailoring presentation to individual users are content and navigation. Content refers to the information being displayed, and navigation refers to the structure of the links that allow the user to move from one page to another. Personalized navigation can help the user to easily find what he or she is looking for or to discover new information. For example, a system discussed by Belkin (2000) assists users in refining search queries by giving recommendations on related or similar terms.

Adaptable vs. Adaptive

There are two approaches to achieve personalization: adaptable and adaptive methods. The former is a term for systems that can be customized by the user in an explicit manner; that is, the user can change the content, layout, appearance, and so forth to his or her needs. This data is called a user profile, and all personalized presentation is based on data the user provided for configuration purposes. It is important to note that the customized appearance does not change over time until the user decides to change his or her preferences.

In contrast, adaptive methods change the presentation implicitly by using secondary data. This data can be obtained from a variety of sources, for example, from the user's actions, from the behaviour of other users on that

Table 1. Application of adaptable and adaptive methods to content and navigation

	Content	Navigation
Adaptable	<ul style="list-style-type: none"> ▪ explicit selection and ordering of content items by the user ▪ providing personal information to be listed in directories ▪ setting up stock portfolios 	<ul style="list-style-type: none"> ▪ building link lists (favourites, bookmarks) ▪ setting default links for generic navigational structures/menus to omit intermediate step(s)
Adaptive	<ul style="list-style-type: none"> ▪ present the user new items which are related to the current items (recommendations) ▪ filter content based on current actions (remove items which are dissimilar) 	<ul style="list-style-type: none"> ▪ hiding unsuitable links based on the context ▪ annotate links to give meta-information about value of the linked content relating to the user's navigation history (e.g. "no new information", "insufficient previous knowledge" etc)

site, or based on the currently displayed content. Methods that use this data as input are discussed in detail below. The most distinctive characteristic of adaptive methods is that they are constantly monitoring the user's activities to adjust the arrangement and selection of relevant information.

Adaptive methods or machine-learning algorithms are huge steps toward automated customization. Current static interfaces suffer from the fact that the designer has to anticipate the needs, interests, and previous knowledge of the users in advance. As these preferences change over time, customization that requires human interaction for collecting and identifying preferences leads quickly to outdated user profiles.

Table 1 shows how adaptive and adaptable methods can be applied to customize content and navigation. The examples given are intended to be generic; more concrete examples are examined in the case studies below.

Degree of Personalization

Another important criterion for classification is the degree of personalization. Systems can have *transient* or *persistent personalization*, or be *nonpersonalized*. With transient personalization, the customization remains temporary and is largely based on a combination of the user's navigation and an item-to-item correlation. For example, if an item is selected, the system attaches similar items as recommendations to it whereby the content of the shopping cart is taken into consideration.

Persistent personalization systems maintain a permanent user account for every user to preserve his or her settings and preferences across separate sessions. Although this raises privacy issues and is the most difficult to implement, it offers the greatest benefit. These systems can make use of user-to-user correlation algorithms and thus provide higher accuracy.

Another technology that belongs to the broad area of personalization is *recommender systems* (Mulvenna et al., 2000). Whereas straight personalization tailors just the presentation of information, recommender systems support the user in discovering new information. As recommendation relies on user preferences and interests, it is often part of personalized systems. From another perspective, one can say that recommender systems provide a selection of the most suitable content for the user. The application of recommender systems to e-commerce is discussed by Schafer, Konstan, and Riedl (2001).

In the following sections, we look at two cases that highlight the adaptive and adaptable approaches to personalization.

APPLICATION AND IMPACT OF PERSONALIZATION: AMAZON.COM

Amazon.com is one of the pioneers of e-commerce. Originally set up as a bookstore, it has grown to a general retailer for a wide range of products. It also provides an auction platform and a marketplace where customers can sell used goods. The marketplace is seamlessly integrated into the main product catalogue, therefore customers can decide whether they want to buy a particular product as a new or a used one.

Goal

As the Amazon.com product catalogue contains more than 2 million products, users can easily get frustrated if they do not find what they are looking for. Thus, one of the main goals is to tailor the product catalogue as much as possible to the needs and interests of the user.

Aside from easy navigation, the site offers a seamlessly integrated recommendation system. It is intended to offer customers products that are either related to their interests or to the product that is currently displayed to exploit cross-selling potentials.

Personalization Techniques

Amazon.com is a highly developed online shopping site and incorporates a combination of numerous adaptive and adaptable methods. The generated user profile is stored in a database on the server; that is, the degree of personalization is persistent.

The prevalent recommendation method is based on the purchases of other customers. It appears as a list beginning with the phrase "Customers who bought this book also bought..." on each product detail page (Figure 1a). A second list contains up to five authors whose

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