

## **Designing Personalized User Experiences for eCommerce: An information architecture perspective**

CHI 2003 Workshop position paper

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### **What is IA and why it matters**

Information architecture has an evolving set of definitions, but I think for this workshop, the most important aspect is:

Within the broad user experience team, an information architect is the one who is tasked with focusing on how the content is organized. With that focus, the IA “looks out” to the user interface to help determine the navigation and page layout (for example), and “looks in” to the content management and tagging (for example) that will be needed to make it all happen.

Subsequently, you can think of the information architecture as the “glue” that holds a web site together - the part that hooks the content up with the user interface. It provides the large buckets to place products into and that users can browse by. It specifies the meta-information that ties pieces of content together and enables things like cross-selling.

For large e-business sites, information architecture becomes more than just what links are at the top of every page. IA becomes a strategic issue because the way that the company itself is organized, and how it does business, is directly tied to how it creates its web site. That is, a company cannot create a user-centered e-business site without being run as a customer-centered company. See any of the current org-chart web sites for cases where this is true.

In the smaller context of eCommerce, IA is equally important - it is what enables you to do business with customers. With more statically-defined eCommerce sites, where all customers basically get the same experience, the IA can be done “by hand” and the whole user experience design can be driven from the front end. For example, if we discover that we have put a few products into the wrong category and users cannot find them easily, we can just move them to where users are looking.

But with highly personalized sites, the back-end aspects of IA become a lot more important because the content tagging has to support an infinite number of experiences. There is now a layer of technology on the back end - but this cannot be totally automated. It is the information architecture that is the “hand made configuration” of the personalization technology to specify the structure of the user profiles and the way that content is tagged, enabling the business rules to be implemented to create the personalized user experience.

## **An IA Framework for Personalization**

My white paper (Argus, 2000) explains a basic framework for how personalization works from an information architecture point of view.

[http://argus-acia.com/white\\_papers/personalization.html](http://argus-acia.com/white_papers/personalization.html)

A summary: In personalization systems, users have profiles and content has tagging. Business rules are written that map specific content to users based on their profile values. For example, in a pet store ecommerce setting, we want to show products that are relevant to the specific animals that a customer owns. At a high level, we do not want to feature cat food for our dog lovers, and at detailed levels we want to suggest related products. To make any of this happen, we need taxonomies, controlled vocabularies and thesauri - "back end" information architecture.

(The white paper is included at the end of this position paper.)

## **Research Issues**

This IA-focused view of personalization suggests several research issues.

1) Using this framework, what is the current practice for personalization in eCommerce? What are typical user profiles like? How complex are some of the vocabularies? How are the various aspects of the framework being implemented today (like, what is best practice for explicitly setting a user profile)?

One study that took this approach was -

A Framework for Classifying Personalization Schemes Used on e-Commerce Websites, January 2003 HICSS Conference, Hawaii (co-authored by me)

(Part of this paper is included at the end of this position paper.)

2) The classic "lost in hyperspace" problem has been translated to the web as:

Where am I?

What's here?

Where can I go next?

(see <http://keith.instone.org/navstress/>) and has led to some of the staples of web navigation, like persistent navigation bars, "related links" and breadcrumbs (<http://keith.instone.org/breadcrumbs/>).

Personalization turns this on its head. "Where you are" is not as important as "who you are" - what information is being used to make this experience unique to you. In effect, it is the classic struggle from the early days of hypertext - Ted Nelson's original vision was more like personalization, where content was being brought to users, but "we got it all wrong" (Hypertext '93 quote by Nelson) and turned hypertext into only linking.

Some of the resulting research questions -

How do we design the interface to convey “who you are”? What conventions are / should be forming for this? That is, what is the “who you are” equivalent to location breadcrumbs (that tell you where you are)? Do users even care about the personalization rules that are affecting their experience?

Do we have to totally throw away what we know about designing to tell users “where you are”? Are breadcrumbs and global navigation a very bad thing for personalized user experiences?

How do we mix the navigation metaphor of today (the “visit” metaphor) with the “personalization metaphor” (much more of a relationship metaphor)? How do users “get in” and “get out” of the personalized experience to/from “the old” kind? Is this a sharp distinction in user’s mind (all or nothing) or there shades of gray (can something be half-personalized)?

What basic conceptual models do users have - do they abandon the navigation metaphor of the web (“I browse that one site, but I act differently at this personalized site”), do they view personalization as an extension (“this personalized page is just a different page that is over here”), or do they view where they are within the personalized experience (“I am in the sci fi section of my own view of Amazon.com”). Assuming that the mixed metaphors have to co-exist, which one dominates, under which conditions?

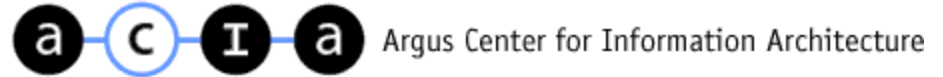
## **About me**

I got my start in HCI doing research at the Computer Science Department at BGSU. One of our areas of study was hypermedia in the early 90s, and when the web “came alive” in the mid 90s I started applying HCI principles and techniques to this medium. For example, Usable Web (<http://usableweb.com>) is my site devoted to the intersection of usability and the web.

In 1999, I joined Argus Associates, a consulting firm, and the leading proponent of information architecture at that time. While there I learned “library science IA” and introduced UCD techniques, all in the context of the strategic issues surrounding very large web sites. The 2nd edition of “Information Architecture for the World Wide Web” covers this evolutionary description of IA.

In 2001 I joined IBM, part of the user experience team for [ibm.com](http://ibm.com). Personalization is one of the key issues we are currently dealing (struggling) with.

Eventually, <http://keith.instone.org/iapersonalization/> will be my compilation of theory, methods and research specific to information architecture and personalization that will result from further preparation for the workshop.



# INFORMATION ARCHITECTURE AND PERSONALIZATION

AN INFORMATION ARCHITECTURE-BASED  
FRAMEWORK FOR PERSONALIZATION SYSTEMS

BY KEITH INSTONE, ARGUS ASSOCIATES

DECEMBER 2000

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# INTRODUCTION

Within the context of many of our information architecture consulting projects at Argus Associates, we are called in to help with personalization efforts. We stress that a solid information architecture, based on user, content and business needs, will provide the foundation for all personalization efforts. Some companies do it the other way around: they find a nifty technology, notice that it supports personalization, and then develop their information architecture while they are learning how to use their new tool.

While the technology-first approach might lead to successful personalization systems in the short term, the information architecture developed within these contexts is often not robust enough to “stand the test of time.” For example, some companies bought into push technology, acquired the technology, and did enough information architecture to implement something. But when push was no longer the “in thing,” they had to start over again with their information architecture when they bought into some new technology.

With a solid information architecture leading the way, you will be able to do personalization today, as well as the next “big thing” tomorrow, whatever it may be.

Within the context of this white paper, we will take a very broad view of personalization. It includes:

- Customization, where users build their own user interface by selecting from channels of information
- 1-to-1 marketing and other processes where customers “automatically” receive different levels of treatment based on past behavior
- Collaborative filtering, where group behavior and preferences are leveraged to provide recommendations for individuals

In general, we will define a personalization system as any piece of software that applies business rules to profiles of users and content to provide a variable set of user interfaces.

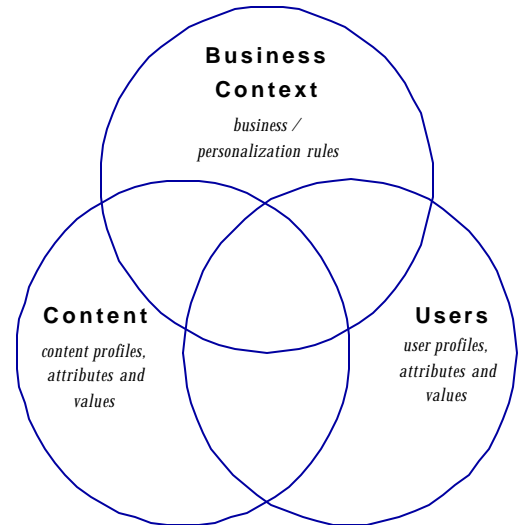
# IA COMPONENTS FOR PERSONALIZATION

The information architecture components for personalization come from the three areas of business context, content and users:

**Users:** Users have profiles that represent their interests and behaviors. Specific values for a profile are determined by the set of defined attributes and the possible values for each attribute.

**Content:** Likewise, content is profiled, based on a set of attributes and assigned specific values.

**Business Context:** The business has certain rules that determine how personalization happens.



## PROFILES: THE NEED FOR CONTROLLED VOCABULARIES

Users will have certain characteristics that you will want to track to leverage for personalization. These attributes could describe:

- where they are located (geographically)
- what their job is (buyer, manager, assistant)
- what their interests are (science fiction books, Burl Ives music, mainframes, pink clothing)

Similarly, the content will have characteristics that will need to be leveraged for effective personalization. These could be:

- price
- author of the content
- manufacturer of the product
- location where the service is offered

These sets of attributes and their possible values are governed by a **controlled vocabulary**. For each attribute, there needs to be a consistent set of values

used throughout the entire system. For example, many products have variations on their names. If users can specify they are interested in “Nintendo 64” but the information about the product is tagged “N64,” there will be big problems in trying to do any personalization.

Sometimes creating the controlled vocabulary means deciding on the preferred term (“Nintendo 64” not “N64”) and changing anything indexed with a variation. Sometimes it is a simple list of synonyms can be created to link the different terms together.

Usually, the problems are harder to solve. One part of the company will use its own classification scheme for its products, while a different department has its own, “better” scheme. The two ways of tagging the products will probably be 80% similar, but each will have its own 20% that works best for them or their customers. Everything is fine until the two areas are forced to work together on the company’s new, personalizable web site. The conflicts will have to be resolved, sometimes peacefully, sometimes violently.

The most important (and hardest) attributes will be those that apply to both the user and content profiles. For example, if you have a site for dog breeders, you will want to know which breeds each user owns. You will have content and products specific to each breed, so this attribute will also need to be part of the content profile. Without this common vocabulary of dog breeds for both your user and content profiles, you will not be able to effectively create personalization rules.

#### PERSONALIZATION RULES: LEVERAGING THE CONTROLLED VOCABULARIES

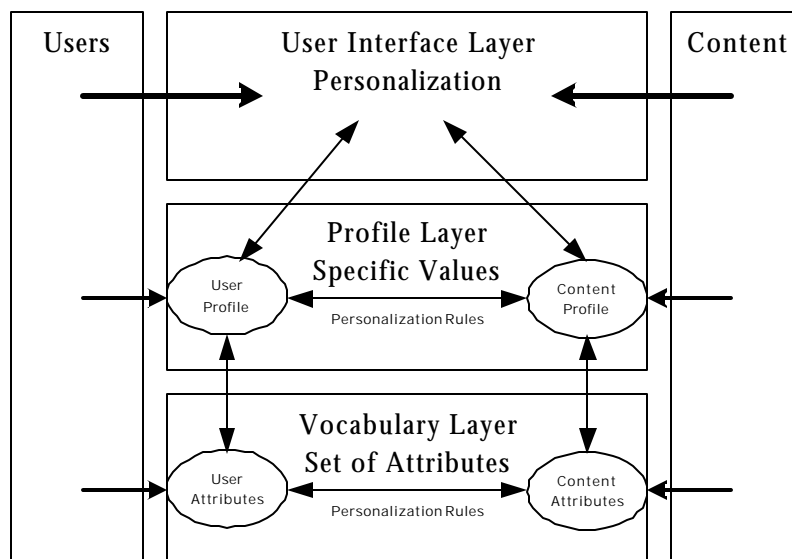
The controlled vocabulary only provides the foundation for the personalization. A very good “static” site can be built based on this controlled vocabulary, but to get personalization, you need specific business rules that govern how users and content are matched up.

The **personalization rules** will need to be based on what is good for the business, of course (selling more higher margin products, for example), but most companies realize that serving customers’ needs and wants is a pretty smart business goal. So the personalization rules will need to be based just as much (if not more) on the quality of the resulting user experience as on the “we want to do more cross-selling and up-selling” requirements.



# FRAMEWORK

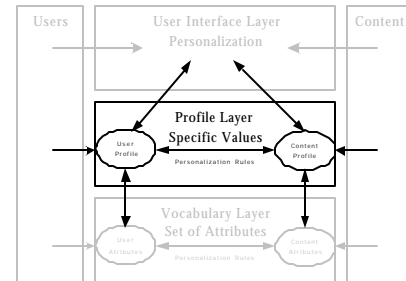
Within the context of personalization, attributes and attribute values provide the “glue” which links together the users and the content and forms the personalized user interface. Attributes of the content are matched up with attributes of users. Specific attribute values about a user are paired with content meta-information to determine which content to display and how to present it at any given time.



In this framework, we have users and the content meeting at the **user interface** through the process of personalization.

## PROFILE LAYER

Underneath the user interface is the **profile layer**, where specific values for the attributes are used to determine what content to present to which user under what conditions. A user's **profile** exists here and can be changed **explicitly** by user actions (such as filling out a form that requests particular profile information), or **implicitly** by certain actions (such as buying certain products). Likewise, a profile of the content exists and is matched with user profiles through a set of rules.



Meta-information for a piece of content can be changed explicitly by users, such as by reviewing a movie with a “thumbs up” rating. Users can also implicitly modify the content profile. For example, purchases of a product can be tracked and enough purchases could change the value for popularity of that product from “average” to “hot,” thereby affecting other users’ experiences.

User Involvement	User Profile	Content Profile
Explicit	Fill in a form of where they are located, what they want to subscribe to, etc.	Pick your favorite brand name for different types of products.
Implicit	Viewing several pages on a single product.	Products purchased, which products were purchased at the same time.

*Users can be explicitly or implicitly involved in setting user and content profiles*

The level of user involvement is an important aspect of personalization because:

- Too much explicit user involvement up front usually turns users away.
- A mix of explicit and implicit over time supports **lifecycle personalization** and allows users to build up a sense of trust before they commit more sensitive profile information.
- Users can set content profiles to affect *other users’* personalization results (often called collaborative filtering).

Attribute values can be set **manually** (by users or by system managers), or **automatically** by some software process.

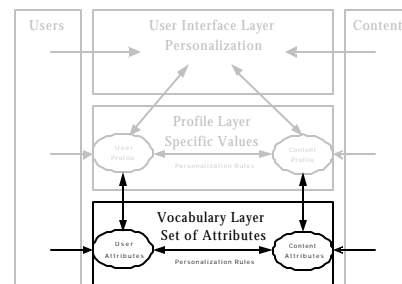
Profile Setting	User Profile	Content Profile
Manual	Managers assign profile values for users (such as after a sales call). User assigns own profile (see table above).	Humans tag content by assigning values to attributes. Humans validate automatic classification recommendations. User assigns content profile (see table above).
Automatic	The system detects certain values, such as browser version or language.	Auto-classification software assigns attribute values based on rules and concept extraction, such as assigning brand name values based on text in product descriptions.

*Profiles can be set by humans (managers, users) or by software*

The ways the personalization system supports profile setting is important because if it is all manual, it will be too much work to maintain. Likewise, some human management will be needed for fine tuning and keeping everything running smoothly.

#### VOCABULARY LAYER

Beneath the profile layer are the vocabularies which regulate the assignment of attribute values. At the **vocabulary layer**, the attributes themselves are defined and the set of acceptable values (preferred terms) are specified. The relationships between attributes are defined, such as child and parent attributes. For example, if we know that a user owns a “German Shepherd,” then a thesaurus can take us to a broader term “Large Dogs,” which we can match with products for “Large Dogs,” and in the end display transportation cages that are the right size for this German Shepherd owner. Both users and content have their own attributes, but they are likewise coordinated to make sure that the higher-level profile information is in sync. Or, defined in the reverse, the vocabulary is the set of all attributes and values, while a profile is merely one specific instance of the vocabulary.



## PERSONALIZATION RULES

The **personalization rules** are what leverage the profiles, attributes and values in order to make the personalized user experience.

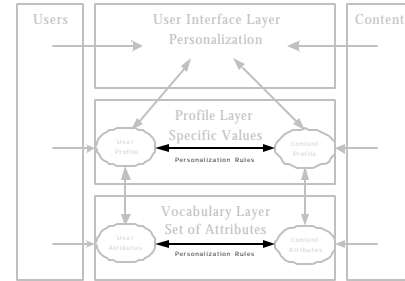
The most powerful rules operate on the set of attributes as a whole, at the “vocabulary” layer. When user and content profiles share the same attributes, then we can make rules that work for all values of those attributes. For example, we can make a vocabulary rule that states: *show CD's by this user's favorite artist*. If the user profile has a “favorite artist” attribute that shares the same values as the content profile’s “sung by” attribute, we can make a general-purpose rule that works for all values. If we cannot do profile-layer rules, we would have to make a series of rules based on each value:

- If the `favorite_artist` is “Elvis,” show CDs `sung_by` “Elvis Presley.”
- If the `favorite_artist` is “Burl Ives,” show CDs `sung_by` “Burl Ives.”
- If the `favorite_artist` is “The Beatles,” show CDs `sung_by` “Paul McCartney” and “John Lennon” and “Ringo Starr” and “George Harrison.”

This would become very inefficient, very quickly.

But we will want to do *some* profile layer rules based on specific values of the user and content profiles. We might want to offer the sale price for all users whose `breed_ownership` is “Daschund” because they turn out to be some of our most loyal customers. Or we may want to feature video games whose brand is “Nintendo” (because we make more money on them) but not whose brand is “PlayStation.”

The set of profile and vocabulary rules is what will make the personalization either good or bad. This is where the business model will become reality and where a large part of the customer’s experience will be determined. It is the combination of the personalization rules, the user and content profiles, and the controlled vocabulary of attributes and values that will determine the effectiveness of the personalization.



## USING THIS FRAMEWORK

We use information architecture components as a foundation for our thinking about personalization. We have found that this framework helps us work with clients in the following ways.

**Explain information architecture.** For those clients who have “personalization on the brain,” this framework helps communicate information architecture concepts by putting them into the context of personalization.

**Think deeper about personalization.** Clients often focus on the user interface and business goals for personalization. This model helps them to look below the user interface to see what is needed to make the user experience a success. It also helps clients see where the information architecture supports the business needs by providing the hooks for the personalization rules to match users with content.

**Evaluate personalization systems.** Features of specific personalization software can be compared and contrasted on how well they support this framework. How much does one system require explicit user profile setting? How does another system support vocabulary level personalization rules? How easy is it to automatically populate content profile values? What features do the personalization systems include to help manage controlled vocabularies?

Overall, the framework helps calm some of the hype around personalization and lets us discuss the deeper, more important issues with our clients.

# A Framework for Classifying Personalization Scheme Used on e-Commerce Websites

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## Abstract

*Personalization is a new system development approach for designing information systems that change configurations based on each user's needs and preferences. Although personalization capabilities are present throughout a large number of commercial software packages, they are just beginning to be incorporated into electronic commerce. Most of this personalization has been done in an ad hoc fashion. In this paper, we present a categorization framework for organizing the various types of personalization that have been attempted on web sites. We develop an algorithm for classifying web sites into high, medium and low personalization support and apply it to a set of well-known web sites such as amazon.com. Finally, we discuss why various web sites have high or low degrees of personalization depending on the organization's goals and product mix and also how personalization might have little or large impact on a web site's achieving its intended goal (e.g., sales, customer service, information dissemination, etc.) We also present future research that needs to be done to support our theories on how personalization impacts a web site's success.*

**Keywords:** Personalization, Electronic Commerce, Recommender Systems, E-commerce

## 1. Introduction

Although the World Wide Web has only been in place for a little over ten years, its adoption and use has had a major impact on human access to information and commercial goods. The Web is heralded as a remarkable opportunity for even very small businesses to significantly expand their customer base. There are so many web sites that the web user is drowning in a

sea of information with search engines being relatively weak flotation devices. Thus, many web sites attempt to develop unique support features for users to encourage repeat visits. One of these features is personalization, adjusting the web site to adapt to the individual user by either keeping an online database of each user or storing information on the user's machine via "cookies". A wide variety of personalization techniques exist. Although company's run their own marketing research and measure continuing user access, little is known about how effective the personalization schemes are in promoting return visits (stickiness), helping the user find information faster or simply making the user more satisfied with the organization supporting the web site.

This paper investigates current personalization strategies being used on web sites and develops a conceptual framework for web site personalization characteristics. We first review existing research that presents the various types of personalization schemes that have been developed for web sites. We then develop a high-level classification of personalization using two contrasting measures (1) the degree of autonomy used in the personalization and (2) the focus of the personalization (on the interface presentation or the content selection). From this classification scheme, we select a variety of web sites (e-commerce, information service, search engine, etc.) and classify them using an algorithm developed for our classification scheme into high, medium and low personalization sites. We then examine the results of this exercise and discuss why each of the web site owners might have chosen a high, medium or low personalization scheme depending on the type of service the web page is offering. Although the web sites we selected were not random, the results of our exercise suggest that degree of web site personalization

might be a key decision for organizations to consider in their e-commerce strategizing.

Before we present our own framework for organizing personalization strategies, we need to develop a clear definition of what constitutes personalization and to review prior frameworks and organizational schemes that have been used to conceptualize personalization.

Most authors of personalization papers neither define nor categorize personalization. Their focus is mostly on the particular personalization mechanisms. We discuss the few who have presented either definitions or frameworks for personalization. McCarthy [7] defines personalization as the ability to customize each individual user's experience of electronic content. He perceives this content to take place along a number of dimensions that are: (1) different sources of content; (2) the arrangement of content on the screen; (3) the delivery mechanisms (system or user initiated) and the delivery vehicles (web browser, mobile phone, pager, etc.). Rather than developing these categories, he extends the discussion of personalization by focusing on adapting personalization techniques to ubiquitous computing where users occupy a physical non-virtual space. His classification is along user properties similar to the classification we apply in this paper.

Instone[4] defines a personalization system to be any piece of software that applies business rules to profiles of users and content to provide a variable set of user interfaces. He presents an information architecture for personalization that is based on user involvement (explicit vs. implicit) and what is profiled (user vs. content). Instone's framework is closest to our framework and is what we have adapted to carry out our web survey. His framework was designed to categorize software used for personalization. Ours is focused on evaluating the user experience with the personalization.

Palmer and Griffith [8] review web practices for the Fortune 500 companies. Although they do not look at personalization per se, they do look at the amount of technical effort embedded in each of the Fortune 500 web sites. They compare the technical richness of each web site to the product and value chain complexities of each industry. They conclude that it is not always appropriate for companies to invest in highly complex web sites, for example, in cases where they already have a rich set of alternate channels for distributing product (high value market chain) that would be affected by selling online. Although this study looks at all technical aspects of web page usage rather than personalization, its focus on business reasons for why or why not a company would have a richly developed

web page also apply to a company's decision to personalize web pages.

Kramer, Noronha and Vergo [6] view personalization as an evolving set of tools that provide value to the end user. Although this might be true, we believe that the categorization of the tools into a framework that takes into account how the user perceives and uses the system will be better able to suggest new and useful tools for the user and also to help a business understand how to make decisions about personalization.

A very good review of personalization strategies is to be found in Rossi et al[10]. In this paper a large variety of personalization strategies are defined and exemplified. We have borrowed sixty percent of our subcategories from this paper. The paper makes no attempt to place the strategies into a higher level framework of software approaches. Its key organizing scheme is on the different ways that the physical web page can be adapted through content changes, link changes or structural changes. Our framework is organized around what the user perceives. This approach encompasses many of the same strategies but also adds user-focused ones such as control.

We define web personalization to be the adjustment and modification of all aspects of a website that are displayed to a user in order to match that users needs and wants. This includes modifications to the content that is displayed to the user, adaptations of the display itself and of the user's passage through the display, that is the set of links the user might take. What we do not perceive as personalization is the update or modification of a web site that occurs to all users, e.g., the presentation of a travel flyer announcing a special cruise deal. In addition, if a user indicates in a check box that they do not wish to receive email advertisements from a website, we do not perceive this as personalization. Thus, although our definition is broad-based, it clearly focuses on adaptations that are exclusively for the individual user.

## **2. Existing Personalization Technologies**

In this section, major strategies for personalization are reviewed with a focus on how the personalization information is acquired.

### **2.1. Cookies**

Cookies are small data files that are stored on a user's local machine. They are created when a user first interacts with a website. As the user provides information such as a name, address or other form of identification, the server running the website stores this

web sites is the product. The differences in the types of information provided (news, weather, health information, etc.) create product differentiation. Because visits to the web site are rarely related to previous visits, it is difficult for the web site to provide a significant amount of personalization. This is particularly true when the information is changing daily as it is at news sites. This is also true for health and medical information web sites that are likely to be visited only once or twice for each health issue. This is not as true at information sites that provide a set of procedures, rules and schedules to new collections of users who need this information on a regular basis. An example of this is a university web site that students can search for course schedules, university procedures and even their own grades. Because each student's plan of education is usually personalized (within university constraints), it will be advantageous to the student if his or her web access is personalized. For example, the web pages for the student's department could be more prominently displayed than other web pages. But university web pages have a dual mission. They also serve as advertisements to prospective students and their parents. Thus, they are visited, often only once, by a myriad of information seekers. There would be little advantage in personalizing this portion of the university web site. The MIT and Harvard web sites examined were external PR web sites. We suspect that password protected university web sites also exist for the enrolled student.

The HICSS conference web site is not personalized and this also makes sense. Users are not likely to visit the site frequently and are only purchasing one product, the conference. In addition, the information is volatile since it becomes irrelevant to most users once the conference has taken place.

Thus, from this quick evaluation of a variety of web sites, we can deduce that several key features are likely to determine whether an organization personalizes their web site or not. Given that personalization is costly, especially implicit personalization, there have to be good rewards that stem from making this software development decision. We list the key factors that we have deduced below.

**Revisit frequency:** If a user revisits the web site frequently, then personalization should be considered.

**Purchase Relationships:** If a user is likely to purchase items similar to items already purchased, then personalization should be considered.

**Product Differentiation:** If the product mix offered by the web site cannot be differentiated from competing

web sites, then personalization that creates this differentiation should be considered.

**Content Stability:** If the content of a web site is relatively stable, then personalization should be considered.

What type of personalization are web sites most likely to exhibit? From our survey of 27 commonly known web sites, we find that explicit techniques are much more common than implicit ones. Table 4 gives a summary of the personalization counts for the web sites we investigated. Fifteen of the 27 sites used anthropomorphic personalization, that is, naming the returning web visitor. Since this is a trivial implementation, it is not surprising to see this widely used. After this, only 4 web sites support implicit control or implicit content presentations. Eighteen of the web sites provided some form of personal tools for the user and nearly half allowed the users to specify the content they wanted to see. So, although there is a lot of business press on how web sites of the future will be customized for each and every user, our small survey does not find this happening. Furthermore, for many product mixes, the value of customizing is not apparent.

**Table 4: Types of personalization usage in the 27 common web sites examined**

		Type of Personalization	Number of Web Sites
<b>Implicit</b>	<b>Interface</b>	Anthropomorphic	15
		Automatic Link	6
		Implicit Control	1
	<b>Content</b>	Implicit Content	3
<b>Explicit</b>	<b>Interface</b>	Explicit Control	6
		Customized Screen Design	7
		Personal Tools	18
	<b>Content</b>	Explicit Content	12

## 6. Future research issues and conclusion

In this paper, we presented a framework for organizing the various personalization approaches taken by commercial web sites. The framework was not based on the various algorithms being used for customization nor was it based totally on what types of changes took place to the web site. We took a user's perspective in establishing the framework and structured personalization around how much the web site adapted to an individual user and also on how much customization was under the user's control vs. the



system's control. Once we set up our framework, we examined a set of representative web sites to see how much personalization each of them provided for their visitors. We selected these web sites with no a priori expectations of their personalization levels. What we found is that personalization is used unequally across web sites depending on the type of service the web site is offering. We distinguish between those web sites that are promoting the purchase and shipping of product vs. those that are delivering the product as part of the web site (information services and search engines). The distribution of personalization methods suggest that if an external product is being promoted by the web site, then a high degree of personalization is useful if visitors return often for similar products. In addition, the distribution suggests that if competing web-based products exist, then high personalization (especially in the form of personal tools) is useful for product differentiation. In no way have we demonstrated in this paper that any of these hypotheses are valid. Setting up our framework allowed us to evaluate a small collection of web sites. Future research is needed that looks at a much larger data set and that also compares the degree of personalization to external variables such as repeat sales, repeat visits, etc.

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