

# DESIGNING FOR A PERVASIVE INFORMATION ENVIRONMENT: THE IMPORTANCE OF INFORMATION ARCHITECTURE

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## ABSTRACT

The HCI community has become increasingly interested in pervasive computing and pervasive technologies. In this paper, we discuss the broader topic of pervasive *information* environments and our experience with designing pleasurable and meaningful customer interactions with such environments. We argue that to design for complex, multifaceted environments, HCI practitioners must 1) understand the needs of customers and stakeholders; 2) tame the complexity by creating a coherent, manageable model of the situation (an information architecture); and 3) use the IA to inform the design strategy and to validate design decisions and implementation issues.

## Keywords

Customer-Centered Design, Information Architecture, Environmental User Interface Design, Pervasive Information Environments, Personas, Public Library

## 1. INTRODUCTION

In recent years the HCI community has become increasingly concerned with the proliferation of small, ubiquitous computing devices that pervade our lives. This trend toward multiple, invisible and often-connected devices is referred to as pervasive computing. In this paper however, we discuss the broader topic of designing for pervasive *information* environments. As Peter Lucas [6] has argued, the challenge for HCI professionals is to shift from designing computing devices to designing information. In other words, the design of the information space will become more important than the design of the objects that interact with that space.

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The environment that we discuss in this paper is that of a public library, an environment comprising physical spaces (buildings, rooms, shelves, and materials), organizers (including classification schemes and an online catalog), and human beings (including customers, librarians, and staff). Because our work on this project is ongoing, we cannot describe our implemented solutions, but we can discuss our research and analysis methods and some initial design recommendations.

## 2. PROJECT DETAILS

The directors of a national, public library wanted to reinvent it—to change the public’s perception of the library as a dark, forbidding place full of old, irrelevant books to one of a bright, inviting place, teeming with up-to-date, relevant information. To help with the reinvention, they hired an architecture firm to renovate the physical space and our firm, MAYA Design, to conduct human-centered research, define an information architecture, and recommend design directions.

### 2.1 Process

We divided the project into several stages:

- Research, in which we talked with the stakeholders, interviewed and shadowed librarians and customers [1, 3, 4, 7], and walked a mile in the customers’ shoes [6]
- Analysis, in which we defined an information architecture [8] and created personas [2]
- Design, in which we used three interdisciplinary, inter-company tiger teams to quickly generate a variety of design concepts [6]
- Refinement & implementation (currently underway), in which we are refining the information architecture, defining a signage strategy, and testing the information architecture by implementing some designs

## 3. RESEARCH

Before we could construct an information architecture [8], we first needed to understand the scope of the project, including who would be interacting with the information (the users, or customers), as well the kinds of information that they interacted with most frequently.

To understand the library domain, we interviewed and shadowed librarians. The librarians, in the role of “key informants” [7], served as invaluable field guides—helping us to more quickly understand the scope of materials in the library and the range of customers’ activities and tasks. We also observed customers for half a day, noting their location in the library, general demographic information (e.g., age, gender, and race), and their apparent task.

### 3.1 Pervasive Information

After observing customers and talking with librarians, we had a much more complete picture of the kinds of information available and how people accessed that information. We discovered, for example, that information a customer is seeking might reside in multiple media (books, bulletin boards, magazines, microfiche, newspapers, videotapes, posters, electronic articles, and other people) in different locations (buildings, floors, shelves, computers) with different access and organization methods (Dewey decimal system, Library of Congress, ad hoc special collections). The variety and complexity of these choices demonstrate the pervasiveness of information in a library.

## 4. ANALYSIS

### 4.1 Initial Information Architecture

With a better understanding of the library domain and its customers, we focused on creating different diagrams that communicated various aspects of the information architecture of the library.

For the initial set of diagrams, we had two goals:

- 1) Identify the basic components of the system as it stood during our analysis
- 2) Communicate our understanding of the system to the stakeholders

We wanted to create a useful communications tool that would allow people from different disciplines, companies, and viewpoints to collaborate effectively. We’ve found that well-designed diagrams encourage more efficient collaboration by enabling the stakeholders to use a common “design language,” rather than forcing each group to learn the others’ language.

#### 4.1.1 Basic Components of the Library

Identifying the basic components of the system was an important element of the information architecture. We identified four major components of the library experience (Figure 1):

- Customers (Users): the people who use the library
- Organizers: the things and systems that organize the materials (including the library’s physical space, categorization schemes, and librarians)
- Materials and activities: the things that customers want

- Use/Participation: customers’ interaction with the materials and activities



Figure 1. The four main components of the library and how they relate to one another

#### 4.1.2 The Customer Lifecycle

One of the goals of the redesign was to create a place to which people wanted to return. Consequently, we wanted to ensure that the IA captured the customer’s lifecycle. Figure 2 shows a representation of the lifecycle, beginning with customers’ concept of the library when they are away from it, moving toward it, entering it, discovering its resources, searching for materials or activities, locating items, acquiring and using them, and then returning them.

Each point in the lifecycle represents a potentially important experience for the customer and an opportunity for the designers to enhance that experience and encourage people to explore more materials and activities. For example, in the “follow through” step, which encompasses the checkout process, the library could include book recommendations on the checkout receipt or proactively schedule the customer for lectures by their favorite authors.

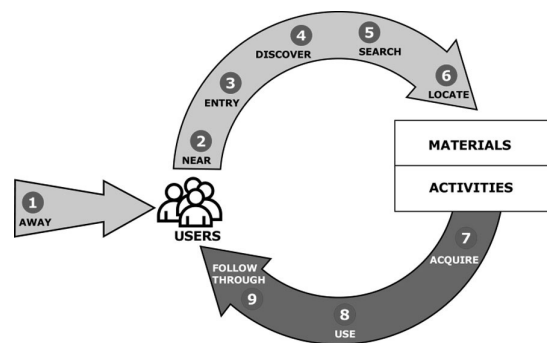


Figure 2. The customer lifecycle

### 4.2 Personas, Scenarios, & Breakpoints

We also used elements of the information architecture as a framework for analyzing and communicating the customers’ experience to the stakeholders. In particular, we mapped personas onto the IA to demonstrate how customers interacted with and accessed information.

Figure 3 shows a narrative (a persona walking through a scenario) of Naomi, a first-time customer of the library, as she tries to find a recent Stephen King novel. An important feature of the diagram is that it shows the

different organizers (physical space, categorization schemes, and librarians) that Naomi encountered, when she encountered them, and whether she was successful, satisfied, or frustrated with her interactions.

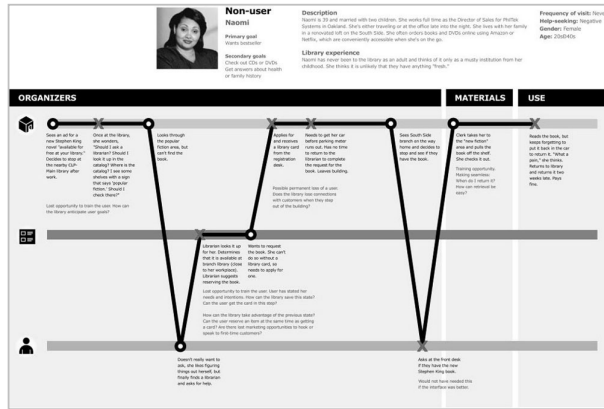


Figure 3. An example of a narrative: a persona (Naomi) paired with a scenario (find a novel)

Each organizer (space, categorization, and librarian) represents a row in the diagram. Thus, when Naomi moved from one organizer to another (e.g., from the physical space to a librarian), her path reflected that movement. Consequently, the valleys don't represent a negative experience, but merely the movement from one organizer to another. We represented negative experiences with an "X": each X represented a breakpoint—a failure of the system to help Naomi accomplish her goal.

By using an information architecture diagram to represent the basic components of the system, and then placing a customer into that framework, we could more clearly see how the system was failing to support its users. That is, we could easily see which parts of the system, or types of information, customers had difficulty finding, understanding, and using.

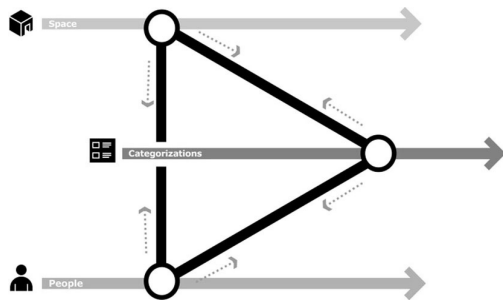


Figure 4. The difficulties associated with moving from one organizer to another

After analyzing all the narratives, we saw a pattern of problems. Namely, many personas had difficulty understanding when and how to move from one organizer to another. We mapped these difficulties onto another

information architecture diagram that summarized the problems across all personas (see Figure 4).

## 5. INITIAL DESIGN DIRECTIONS

After mapping customer breakpoints to the information space, we generated several design directions. We focused on improving customers' wayfinding experience (helping them orient themselves and quickly understand the scope of the library) and helping them transition gracefully from one organizer to another (giving them clues about when to ask librarians for help, when to use the categorization schemes, when to navigate the physical space). Our initial concept sketches are discussed elsewhere [6].

## 6. REFINEMENT

In the next stage of the project, we will refine the information architecture for two of the organizers: the physical space and the categorization schemes. Currently we are working on the IA for the physical space, in which we have focused on signage and wayfinding mechanisms.

Although we are focusing on creating the IA for one aspect of a larger system, we realize that in a pervasive information environment, no IA is an island—each must be consistent with the meta-IA. For example, as we created a lexicon for the signs (what the various desks should be called, what certain rooms should be named), we were acutely aware that the words on the signs must translate to, and be consistent with, other media. If, for instance, we decided to call the rows of bookcases containing books "shelves" rather than "stacks", then that same terminology should be used in the online systems that people use to find the books. By using consistent terminology in the framework of a larger IA, we can facilitate peoples' ability to understand the environment. Once customers learn what something is called in one medium, they can reapply that knowledge across all media.

### 6.1 Signage & Information

In the library we were helping to redesign, there were hundreds of signs and other kinds of information that needed to be broadcast or displayed (e.g., announcements of classes, events, and community happenings). To understand the scope of signs that the library had, we visited the library, taking over 400 pictures. Next, we organized the signs, so that we could create a coherent strategy for creating, producing, and maintaining them.

#### 6.1.1 Categories

As part of this strategy, we needed to determine which signs were still needed, the priority of each, where they should be displayed, how they should be displayed (movable or fixed, printed or electronic), how they should be produced (by special vendors, printed on common printers, as part of a larger electronic content-management system), and who should maintain them (specific sign vendors, the librarians).

We grouped the signs into four categories: orient, identify, educate, and connect. In general, the categories can be placed along a continuum from immediate attention to delayed attention. For example, customers' initial thoughts when entering a library are likely to be about orientation (Where am I? Where can I go? What's in this place? What can I do?). Once they determine where they want to go, they need to be able to identify that place. Next, they may want to learn more about the library processes (e.g., how to search for materials) and library resources (events, classes).

The categories can also be placed on a continuum from more static information to highly changeable. The orient and identify signs tend to contain more static information (maps and identification signs), whereas educate and connect contain more temporary, or changeable information (e.g. Book signing at noon).

## 7. IMPLEMENTATION

The information architecture for the signage was invaluable in helping us determine how the signs should be implemented. Because the information architecture identified both level of attention and degree of permanence, we were able to make generalizations about the signs belonging to each category. Specifically, the orient and identify signs needed to be large to ensure that they captured customers' attention immediately. They could also be produced by a special vendor, since they were unlikely to change. On the other hand, the educate and connect signs would most likely need to be produced by the librarians, since the content on them changes frequently. As a result, such signs would need to be easy to create, produce, and maintain. Furthermore, we decided that content that was likely to change frequently was a prime candidate for being displayed electronically (e.g., on plasma screens).

With the information architecture in hand, we were able to work with the architects to determine how the signs should be implemented, and, as a consequence, to decide which information was important to display throughout the library (pervasive) versus which was more appropriate for specific contexts. For example, in the architects' plan, there is a "ribbon" of glass winding through several areas of the library. This surface is ideal for displaying information that is of general interest to everyone, since it is a pervasive architectural element and not confined to a particular room. Looking at the information architecture, it was clear that information in the connect category (e.g. Book signing at noon, Research your family roots in the Heritage room) would be best suited for a pervasive display.

## 8. CONCLUSION

As information flows through devices and spaces, it becomes even more important to have a coherent organizing scheme—an information architecture—that provides a more structured and consistent customer experience. HCI professionals can use IA to manage the explosion of information, making a more useful, usable, and pleasurable experience for customers. IAs can be used as a strategy for organizing information, prioritising it, and determining which information should be presented in which contexts to which people.

## 9. ACKNOWLEDGMENTS

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