CHAPTER 2

WHAT IS USER EXPERIENCE DESIGN AND, WHO CREATES IT?

After more than twenty years of mobile phone design and nearly as long since the initial definition of ubiquitous computing, there is still no common agreement about what constitutes the ubiquitous computing user experience and who is responsible for it.

The joy felt at the first game of Wii Tennis, or the first time checking out a Berlin Call-a-bike, or the first zoom into a map on an iPhone goes well beyond the utility of the device. It is a pleasure that's coupled with satisfaction at the depth of the experience like that of a luxury hotel where the staff have prepared everything just right — even when "just right" was not articulated in advance. But who is responsible for this user experience? Is it the industrial designers who selected and sculpted the materials? Is it the interaction designers who made it easy to make the device do what was expected? Was it the service designers who created the underlying infrastructure enabling the smooth operation? Or was it the identity designers who created a brand that makes users feel that they are part of something special that goes beyond just the device?

Of course all of these disciplines have a role, but which disciplines contributed the key factors?

Similarly, whose fault is it when a product fails? The Motorola ROKR E1 iTunes phone seemed to have all of the right components: Motorola technology, the industrial design team that created the hit RAZR phone, and Apple's market-proven iTunes music service with its familiar iTunes brand. Sony Ericsson's Walkman phone had Sony's legendary design, Ericsson's technology, and the famous Walkman brand. Both phones had a two-year market advantage on Apple. Yet despite early criticism[1] the iPhone was able to beat both in the market, and better user experience was often described as the chief reason. So who was responsible for the failed user experience of the ROKR and Walkman phones?

Rapidly evolving technology and changing social patterns have made identifying best user experience design practices difficult. Ubiquitous computing products are hybrids of hardware, software, and services. It is not clear what skills are required to design in this environment, much less what the titles of the people who hold those skills should be.

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[1] The first-generation iPhone's camera, the lack of a keyboard, the price, the quality of the underlying data network, and the battery life were all common early criticisms (for example, by *PC World* editors in 2007).

This chapter attempts to provide a definition of user experience and to identify the design disciplines involved in creating a ubiquitous computing user experience.

2.1 A DEFINITION OF USER EXPERIENCE

No universal definition of the user experience exists. Definitions from researchers and practitioners extend all the way from examining neurological phenomena (Norretranders, 1991) to macroeconomic behaviors. Somewhere between counting the firings of neurons and calculating profit and loss statements is a practical set of boundaries that defines what to consider in a design process. Usability, for example, is the practice of making things easy to use. It is often equated with user experience, but while bad usability can break a good product, good usability is insufficient to create a good experience. An experience can be usable without being useful or valuable to enough people to justify the expense of creating it. For example, Lovegety, an early mobile social dating device (CNN, 1998), had a simple, highly usable interface: a device owner set a switch to the kind of social interaction they were interested in and the gender of the person they were interested in having it with. Whenever anyone whose profile matched the setting came into the vicinity of that device, both devices would vibrate. The device was popular for a short time in Japan, but it never took off in the United States and its use quickly faded in Japan. This failed because it was not useful, not because people did not find it usable.

Any definition of the user experience has to take into account the totality of what people engaged in using a product or service consider part of their experience. This ranges from how easy the product is to use to associations they may have with the vendor selling the experience.[2] Here is my definition:

> The user experience is the totality of end users' perceptions as they interact with a product or service. These perceptions include effectiveness (how good is the result?), efficiency (how fast or cheap is it?), emotional satisfaction (how good does it feel?), and the quality of the relationship with the entity that created the product or service (what expectations does it create for subsequent interactions?).

This definition attempts to transcend ergonomic, attitudinal, and visual metrics to include all facets that an audience considers relevant to an experience. The goal is to align developers' understanding of the role a product plays in a person's life with how that person perceives the design of that product. For example, the use of devices is rarely the most important activity in someone's

[2]Think of buying a book at an old, revered neighborhood bookstore versus buying the same book at a big box store, versus finding it lying on the sidewalk near a trash can. It is the same book, but the emotions associated with it may be different depending on where and how it was acquired.

life, but the devices form part of a larger flow of needs, desires, and activities. Having an experience may be impossible without the use of a specific device, but the device does not form the whole experience.

In addition, a good user experience satisfies the needs of its makers. Otherwise there is no incentive to maintain or improve it. What developers do to satisfy their organization's needs may lead to compromises to a purely user-centric experience. For example, to make an experience more profitable, and thus more sustainable from the organization's perspective, it may need to be less efficient from the user's perspective. How designers resolve these tensions determines the user's relationship with and attitudes to a product's creator. That attitude, in turn, forms people's expectations for future interactions. For example, some commodity products are designed with no expectation of an ongoing customer relationship. In their design, emotional satisfaction may be inconsequential relative to the short-term effectiveness of the design at the point of purchase. Thus, the design of a USB cable may be entirely focused on lowering the retail price. An automatic heart defibrillator user experience may emphasize effectiveness and interaction efficiency. Its use needs to be learned as quickly as possible with little expectation a user will ever use it again. A high-fashion kitchen appliance may highlight color, finish, and materials to create a positive emotional association with the brand.

2.2 EXTENDING GARRETT'S ELEMENTS OF USER EXPERIENCE

Jesse James Garrett (Garrett, 2002) created a model (Figure 2-1) that attempted to identify and classify the elements that comprise the end user experience of software and Web sites. It is also useful when examining any kind of user experience, since the broad categories apply to the creation of devices or services as well as to Web sites.

This model is also valuable in that it visually captures the key notion that many aspects of user experience design are interrelated, but at different levels of granularity. If you discuss one level, say the visual appearance, you are implicitly discussing all of the layers below it, even if you have not explicitly defined them (the pedantic follow-up question then becomes: If you have not, *why not*?).

There are two additional layers that exist in ubiquitous computing that do not exist in the Internet product ecology Garrett was describing: services and shape.

First, let's review services: ubicomp devices are often networked with other devices with which they share data, and they reflect the services to which they are attached (see Chapter 8). How they work is a product of how — and with what people and devices — they exchange data. The design of networked products, whether those products are stand-alone devices, software, or Web sites, should account for services. But the service plane (which I put between Garrett's scope and structure plane) is especially critical for ubicomp user experience. If an

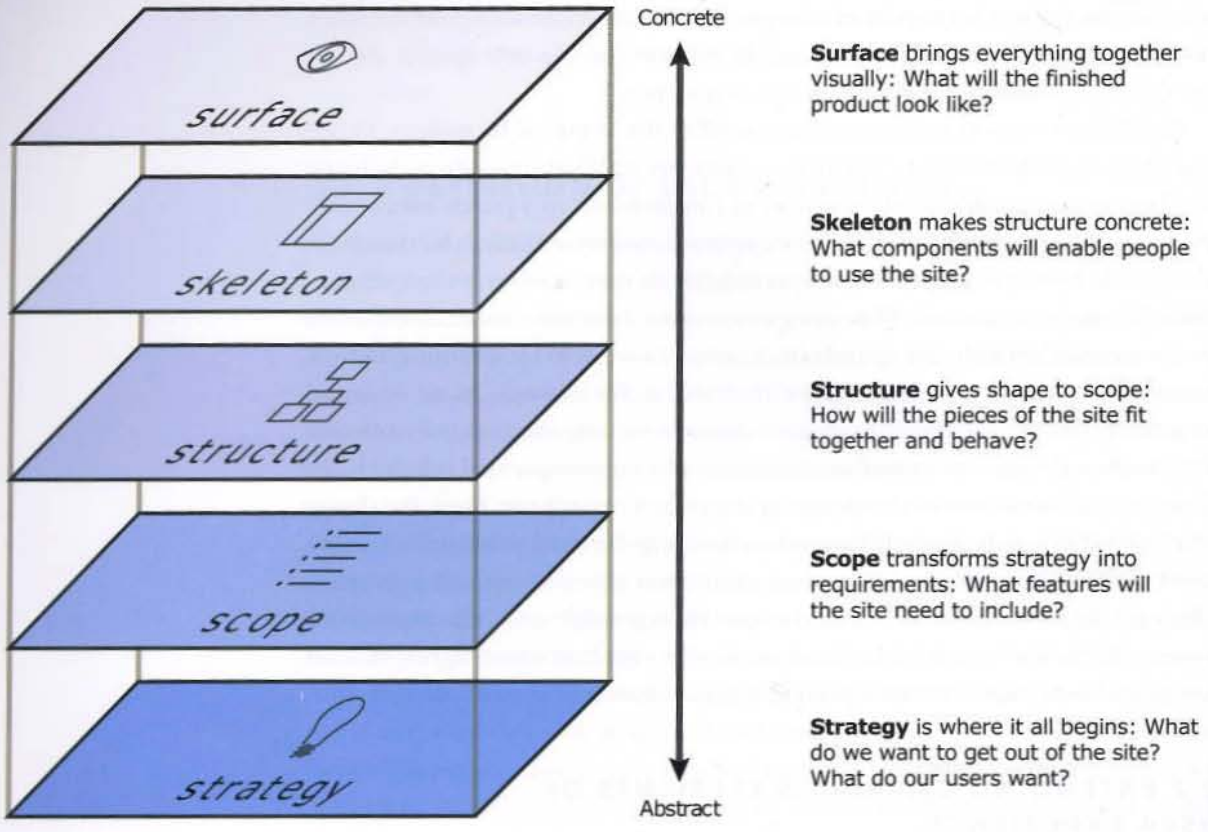

Figure 2-1

Simplified planes of user experience. (Based on Garrett, J. J., Elements of User Experience, New Riders Press, Indianapolis, IN, 2002)

object is a special purpose device, then it is inherently less flexible than software running in an open-ended environment. This rigidity means that the design of the service it represents is that much more important, because the options for changing the experience at the device's end are so much smaller.

Because ubicomp devices are physical, their shape becomes very important. Software and Web interaction design are constrained by the toolkits used to generate them and the software design traditions of those particular fields. The consistency this creates has been (mostly) a boon for software developers, many of whom can evolve a product based on previous examples, focusing on what it does differently than other products in the same operating system environment. That kind of consistency is largely alien to the ubicomp user experience world. It took almost a decade for mobile phone designs to settle down to several basic interaction types (the candy bar, the clamshell, and, more recently, the slider[3]), and they are just one of an ever-expanding class of new devices (although a very important one). The physical aspects of the device are therefore key to the device communicating a successful user experience.

[3]Other form factors and variations appear on a regular basis, such as the touch tablet design of the Apple iPhone and the Palm Pre, but the phone form factor variety in 2010 is much smaller than it was in 2003, when some phones had screens that twisted around a corner, others resembled makeup compacts, and others were designed to be worn as necklaces.

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Figure 2-2

Bratz digital camera.

Sidebar: Design and Emotion

Fear, pleasure, and desire play enormous roles in our everyday lives interacting with products. Many ubicomp devices exist in the intimate spaces that we inhabit, which are where these emotions play out. Unfortunately, traditional design approaches prove insufficient at modeling the many relationships between emotion, cognition, desire, and behavior that constitute how people actually relate to products and environments.

The complexity and difficulty of systematically approaching the emotional aspects of design has led to the frequent treatment of designers as intuitive artists whose working methods are mysterious, even to themselves. Classical industrial design styling, for example, relies almost exclusively on the experience and intuition of the designer to create "beauty," rather than a systematic analysis of how to meet the emotional needs of a target audience. Products that rely on brand identity are especially vulnerable to this kind of mystical design thinking. It almost certainly does not have to be that way, but the field of design for emotion is still brand new.

How, for example, did the designers of the first Bratz digital still camera (Figure 2-2) arrive at that shape, color, and texture, and why did the second revision of the camera look more like a traditional camera? This is exactly the kind of design that is currently largely off-limits to traditional analytical design, yet understanding it is critical. Some researchers, such as Don Norman, Anthony Ortony, and David Freeman (Freeman, 2004; Norman, 2004; Norman et al., 2005), recognized how important this was and began to study how emotion and design interact, but the field is still completely new.

Figure 2-2
Bratz digital camera.

2.3 DESIGN DISCIPLINES

The design of any product requires the cooperation between many design disciplines. Industrial designers, identity designers, packaging designers, and marketing designers are all required to develop and sell an electric fan (whose box may be as important in selling it as how its knobs look and work). Designing smart things requires the design of:

- The physical object
- Its software interface
- Its hardware interface
- How it interacts with other devices over the network
- How it is represented on a network to people and to other devices

This means that ubicomp user experience design can include a wide range of design disciplines.

As can be seen in Figure 2-3, even a relatively straightforward device — in this case a pedometer that connects to a Web site through a computer and uploads step data to a Web site that helps people monitor the progress to their fitness goals — involves many design disciplines. In a development project, it is not unusual to find a single person doing many of these kinds of designs, but it is important to remember that these are different kinds of designs with different skills associated with each one, regardless of the title of the person doing the work.

Figure 2-3

A partial list of design disciplines involved in creating the user experience of Fitbug, a pedometer that collects step information and uploads it to a Web site that tracks progress. (Image source: Fitbug)

① Identity design
② Interface design
③ Industrial design
④ Interaction design
⑤ Information design
⑥ Service design
⑦ Information architecture

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2.3.1 IDENTITY DESIGN

A product's identity communicates its values and weaves its way through all of the other kinds of designs, but is separate from them. The identity is what makes the product memorable and what makes it unique. It is what carries much of the emotional weight of the product (see Sidebar: Design and Emotion). In some cases, such as with fashion goods, a product's identity will rival its functionality.[4] The identity is the combination of what the product does, how it looks, what associations it evokes, and how it emphasizes certain features over others. It is communicated through the editorial voice of text copy, shared design details (such as Apple Computer's consistent use of black, white, and silver as the colors its flagship products come in), advertising messages, and the kinds of products a company makes. It is the core of the product's brand.

One example is Oakley. The sportswear and sports technology company's brand evokes science fiction films (Figure 2-4).[5] The products resemble props and costumes, the stores look like movie sets, and the advertising resembles film advertising. The identity transcends any single product and lets someone wearing Oakley clothes and using Oakley products pretend they are a character in a science fiction film, if only for a few minutes.

2.3.2 INTERFACE DESIGN

This is probably the oldest of the terms I'm using in this section, so it carries the heaviest historical baggage. I define interface design narrowly as the design of a single mode of functionality. This could be a single screen in a software application or Web site, or the way a single function works in a device. It is the immediate organization of design elements experienced at the same time, usually for a single purpose or a closely related set of purposes. An interface design emphasizes aspects such as task flow (the sequence in which different interface elements are invoked), feedback, and consistency over other aspects of the experience.

One example is a stopwatch (Figure 2-5) that also acts like a countdown timer and an alarm clock. Though the interfaces should be related and likely will use the same set of buttons, they are actually three distinct interfaces. Each of the interface designs is the result of a set of decisions about which buttons do what, how the display for each is organized, and how various functions are invoked.

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[4] Although it is rarely actually more important, as proven by many good marketing campaigns that failed to sell bad products.

[5] Specifically the *Alien* film series and *Blade Runner*.

Figure 2-4
The design of Oakley's company headquarters clearly communicates their identity. (Photo © ronploof, licensed under Creative Commons Attribution — Share Alike 2.0, found on Flickr)

2.3.3 INDUSTRIAL DESIGN

Mobile and ubiquitous computing devices are, for the most part, physical objects. They are smart things, but they are still objects. Unlike software, they have shape, texture, color, weight, temperature, etc. They have buttons or dials that trigger behavior and displays that communicate information.

Specialized ubiquitous computing devices, such as ATMs, personal video players, and reactive floors, require specialized controls. These controls must match the ergonomic requirements, the capabilities of construction materials, the heat and power properties of the device's electronics, etc. Industrial designers, in coordination with mechanical and manufacturing engineers, work with materials until they produce the desired effects for end users, for the smooth functioning of the device, and for the organization.

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For example, in a digital stopwatch such as the one in Figure 2-5, industrial design effects are responsible for how the buttons feel when pushed and how the watch resists water and impacts. Perhaps most important, industrial design also helps make a stopwatch that looks accurate and tough, as its identity design demands.

Figure 2-5
A Casio G-Shock sports wristwatch. (Photo © William Hook, licensed under Creative Commons Attribution — Share Alike 2.0, found on Flickr)

2.3.4 INTERACTION DESIGN

When using a device or environment, people need to understand how to accomplish their goals. They need to know what choices are available and how to make them. Interaction design determines how the various user interfaces fit and flow together as a whole.

One example is the interaction design of a digital parking meter[6] that takes credit cards for payment (Figure 2-6). This involves decisions about communicating three different states (at a minimum). Meters must show the amount of money currently on the meter, where the parker should put the card, the amount of time and money being added to the meter, and the final state of payment. Each of the meter's modes is a different, if simple, interface. The interaction design of the meter is the practice of tying them all together so that the driver perceives a single consistent experience.

2.3.5 INFORMATION DESIGN

Much interaction design focuses on getting input into a device, but output is just as important. Information design becomes a critical piece of the experience, since digital systems must collect and display aggregate information well, whether it is recently played songs, the number of steps walked on different days, or who telephoned recently.[7] Information designers visually organize and prioritize representations of information to match people's needs and maximize clarity.

For example, designing a digital video recorder screen (Figure 2-7) requires carefully arranging the information to display the maximum amount without seeming busy or cluttered to its users.

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[6] Thanks to Derek Lindner for this example.
[7] Edward Tufte's *The Visual Display of Quantitative Information* (Tufte, 1983/2001) is a classic text that describes good information design practices and critiques bad visual display, in general. Its lessons apply to everything from diagram design to infographics.

Figure 2-6

Credit card parking meter. (Photo © paulswansen, licensed under Creative Commons Attribution — No Derivative Works 2.0, found on Flickr)

Figure 2-7

Information screen from the XBMC digital video software, using the Mediastream skin by Team Razorfish. (Courtesy xbmc.org; XBMC is covered by a GNU GPL license)

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2.3.6 SERVICE DESIGN

Many different devices and interfaces access distributed services. From a business perspective, service design unifies the ways users interact with an organization to create a consistent set of methods to relate to a company. From an experience design perspective, service design creates the tools that people use to access a service in concert with designing the service itself. Rather than treating the tools as individual consumer-facing products and the service as a purely internal design project, service design treats them as different facets of the same thing. This creates consistency and lets products build on each other's strengths, rather than merely replicating functionality.

For example, a checking account can be accessed through a Web site, an ATM, over the phone, through a paper checkbook, by using a debit card, or by speaking with a human teller (Figure 2-8). The services that the bank provides are a safe place to store money and convenient ways to access that money. Because many banking services rest on the older technology of checks, and checks rest on the capabilities of paper, much of the banking service results from design based on those capabilities. Mobile phones have an entirely different set of capabilities, so the service of transferring money with mobile phones does not necessarily need to mimic checking, but can redefine it by using the capabilities of rapid communication, data encryption, dynamic displays, etc. Rather than writing a check or using a debit card, for example, people can trade phone minutes (*The Economist*, 2009).

Because networked technological tools enable access to a broad, often shifting, set of capabilities, designing the service they connect to becomes much more important.

2.3.7 INFORMATION ARCHITECTURE

All information created by people has some underlying structure, and there is always some organizational principle that defines how all the information in a given work fits together. Often that structure is quite explicit, as in the case of the phone book, the Library of Congress, or the Yahoo! hierarchy. These structures did not come about randomly. People concerned with information architecture designed them with the interests of their audience in mind. The Library of Congress classification system, for example, is only one of several common ways to organize books, each designed for a different audience and environment. Every information organization and navigation task requires an information architecture that matches users' needs, expectations, and understanding.

Creative's Zen V Plus (Figure 2-9) has a top-level menu structure organized by what the designers believe are the most common ways that users want to use their MP3 player. It starts with a link to a Music Library, then has a listing by artist, a listing of all tracks by name, and a random shuffle of all tracks. The order of this

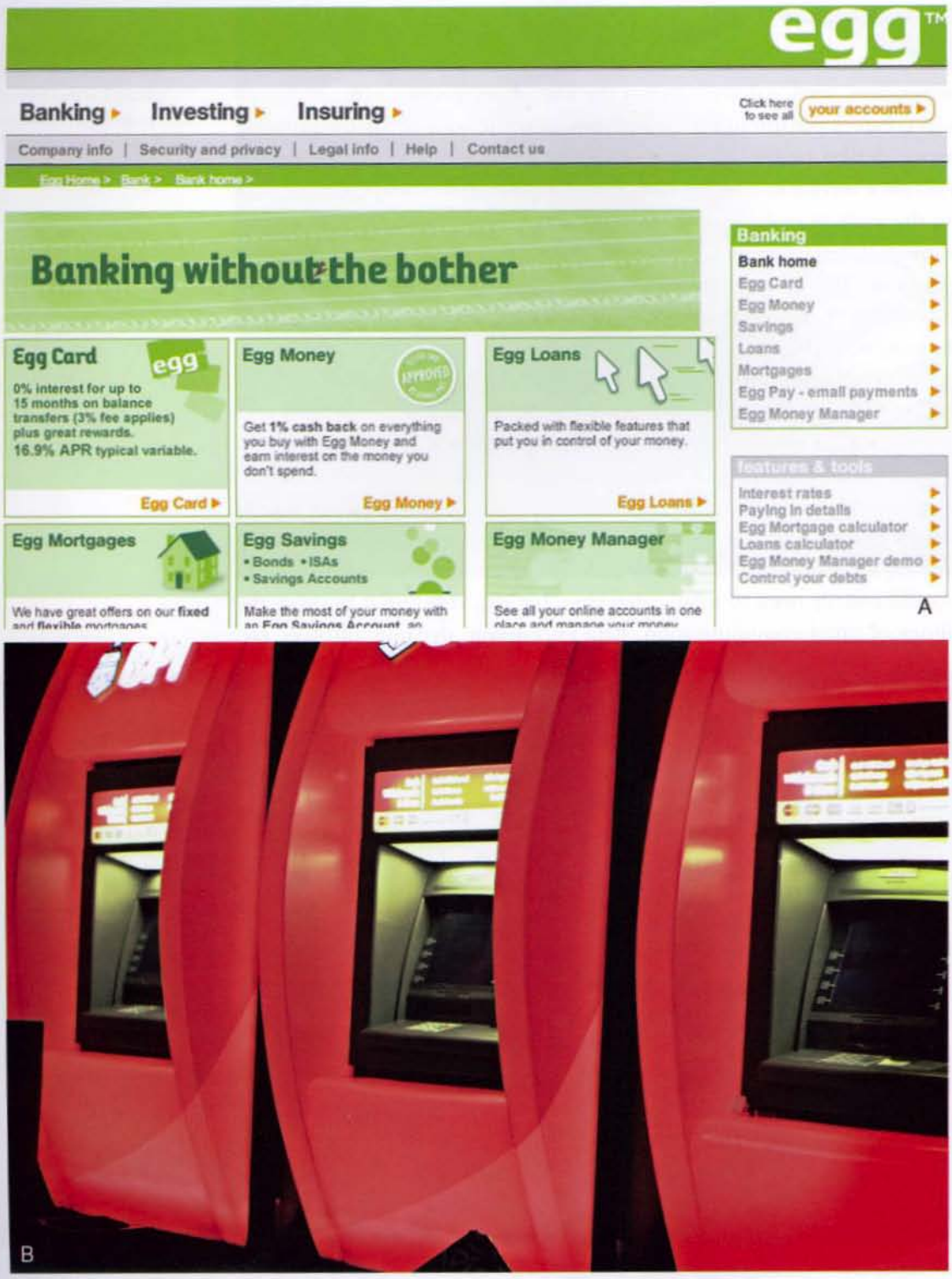

Figure 2-8

Methods of accessing a bank service: (A) Web site, (B) ATM.

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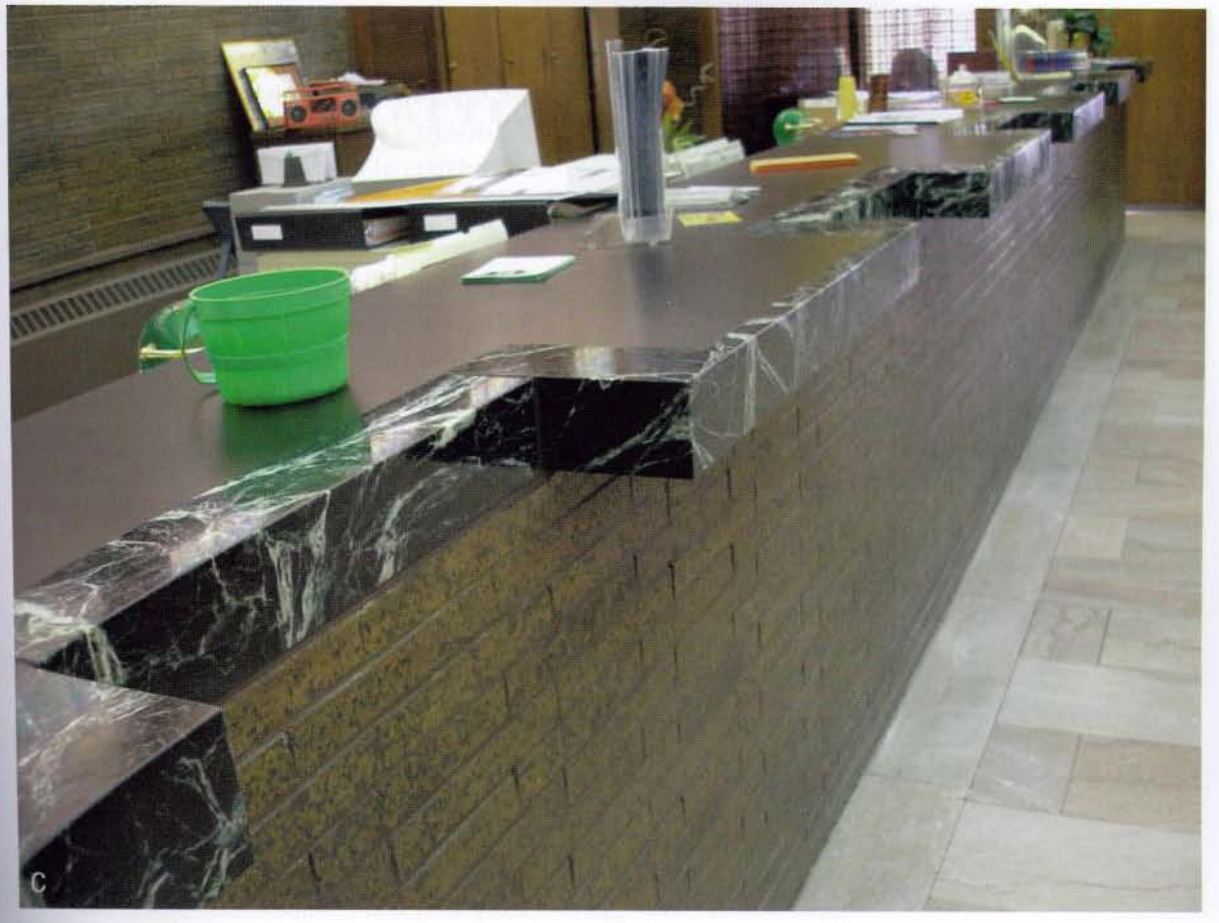

Figure 2-8—Cont'd

Methods of accessing a bank service: (C) inside the bank. (ATM photo © DucDigital, licensed under Creative Commons Attribution 2.0; bank interior photo by Liz Bustamente, licensed under Creative Commons Attribution 2.0, both found on Flickr)

list has little to do with creating a consistent organization scheme for either the music or the functions of the device. Instead, it is an information architecture that reflects the company's model of user preferences. Thus, rather than distinguishing between qualities of the music (such as the name of the artist) and capabilities of the device (such as shuffle play), it is organized to minimize movement through the Zen V player's menu structure. Apple's original iPod Shuffle had even simpler information architecture: all the tracks were randomly mixed.

2.4 THE IMPORTANCE OF CONTEXT

When designing ubiquitous computing devices, the frame is no longer the chrome around a browser window, but the world. When looking at the entire user experience, this situation presents different challenges than inventing technology or applying existing content to a new form factor. In fact, much of

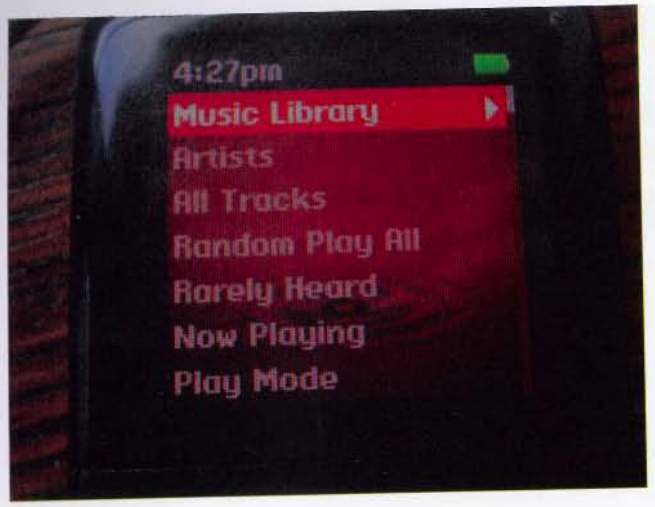

Figure 2-9

Top-level menu structure from a Creative Zen V Plus MP3 player.

ubicomp user experience design today is the design of a completely new thing used for the first time. When neither the audience nor the designer has encountered a technology, the boundaries of its use and the criteria by which it can be successful remain unknown.

Designing "1.0" products (i.e., things that have never existed before) requires close attention to the social and cultural environment in which these products will be used.

A number of approaches[8] have been developed to aid designers in understanding how technologies, especially novel technologies, relate to the larger context of everyday life:

- Participatory Design is a technique that involves representatives of a target audience deep in the design process. By bringing the people who will ultimately use a technology into the development process at its earliest stages, the technique can include their perspectives at a deep level.
- Contextual Inquiry (Beyer and Holtzblatt, 1998) is a set of interlocking techniques for observing people in the environment into which a technological solution will be introduced. The techniques focus on analyzing the observations to produce a set of design constraints for that technology.
- Distributed cognition (Hutchins, 1996) is a psychological theory that includes social networks, tools, and the environment as key components of reason. Thus, for example, planning emergency room staffing does not just involve contemplation to make sense of the problem, it also involves cognitive artifacts such as "schedules, display boards, lists, and worksheets" (Nemeth et al., 2004).
- Actor Network Theory (Latour, 2007), named by sociologist Michel Callon, is less an explanatory theory than a provocative conceptual toolkit for studying developments of science and technology. The core premise is that we need to treat technologies and people similarly: as more-or-less stable networks of relationships between lots of different kinds of things. In identifying the associations that make you, you — and make your computer, your computer — we gain insight into the trials faced by would-be products and services, and how seemingly solid associations can fall apart.

Finally, a significant portion of the challenge of ubicomp user experience design, beyond simply identifying what it is and who does it, is understanding the actual design practice. This practice is changing quickly, and the role of technology creators is deeply transformative. With that power comes responsibility that needs to be actively defined and managed.

[8] It is outside the scope of this book to discuss these techniques in detail, but I wanted to mention them in passing, as their fields of inquiry play an increasingly important role in user experience design.