

3

Finding out about the users and the domain

1 Introduction

In gathering requirements you will be trying to collect particular sorts of information for your UI design. Whether you are redesigning the user interface (UI) to an existing system or designing the UI for a new system that will computerize tasks currently being performed manually, the investigations involved in requirements gathering are the same. (Though, of course, the design of a completely new computer system, which happens quite rarely, may require more in-depth investigations and the collection of more detailed information.) In either case, the starting point for your investigations should be to determine what the users are currently doing, how they are working, and where they are working. You can then use these findings to guide the UI design, so that the new or redesigned system enables users to perform their tasks. Although this sounds simple, in reality there is a lot you need to find out and make sense of before you begin the actual activity of designing the UI. Table 3.1 gives an overview of the main areas of investigation and the information gathered for UI design. We'll discuss the users, and characteristics of the users and the domain in this chapter. The tasks and environment are discussed in Chapter 4. Qualitative usability aspects, quantitative usability goals, constraints, and trade-offs are discussed in Chapter 6.

Traditionally, the classic software design life cycle focuses on the system's requirements rather than the users' requirements. As we emphasized in Chapter 1, a user-centered design approach focuses instead on the importance of the user. In Chapter 2 we discussed some suitable techniques for gathering requirements. Keeping the user uppermost in your mind, you should undertake the following activities in gathering the requirements:

- *Observe* users — *real* users — doing real work, where the application is to be used.
- *Observe* and talk to *real* users. Many people will have information to offer or will have something to say about the system. But you must also remember to observe and talk to *real* users — the people who will actually use the system.

Table 3.1 Areas of Investigation and Information Gathered for UI Design

Focus of investigation	Information gathered
The domain	Wider specialist knowledge Specific knowledge for a computer system
The users	Who they are; focuses on the <i>real</i> (primary) users, but also considers other stakeholders (secondary users)
Characteristics of the users	Age, sex, culture, physical abilities and physical disabilities, educational background, computer/IT experience, motivation, attitude, enjoyment, satisfaction
Characteristics of the tasks	Are the tasks easy, complex, novel, variable, repetitive, frequent or infrequent, single tasks or multitasking, time critical, requiring individual or collaborative working? Are there safety issues in relation to the work?
Physical environment	Noise, stress, comfort, dirt, dust, heating, lighting, ventilation, furniture, working space, individual offices, open-plan areas, equipment layout, hazards in the workplace
Social environment	Pressure of work, individual or collaborative working, individual offices or open-plan areas
Organizational environment	Organizational mission and aims, organizational attitude to IT, organizational policies, job design, and roles
User support environment	Availability of training, availability of colleagues/experts, availability of manuals or online help
Qualitative usability aspects	General, often unquantifiable goals, such as easy to learn, UI intuitiveness
Quantitative usability goals	Measurable goals, such as usability metrics
Constraints	Costs, timescales, budgets, technology hardware and software
Trade-offs	Conflicting/contradictory requirements

- *Observe*, talk to, and involve *real* users throughout the design process and its activities.

The real users are those people who use the application on an everyday basis for their work. For example, you may frequently visit your local library to borrow books or CDs. Although you are a user in the sense that the library computer system keeps a record of who you are and the items you have borrowed, you are a secondary user of the library system. The primary users of the library computer system are the librarians. They interact directly with the system as part of their job; they perform all the loan and return functions on your behalf. The process of booking a vacation provides a similar example. Most travel agencies employ a computer system to check the availability of flights or hotels (among other functions). The travel agents are the primary users of the system. Customers interact with the system indirectly, through the travel agent, when trying to achieve their goal of booking a holiday. Thus, the customers are secondary users. Although they interact with the system only indirectly, customers will be affected as much as the agents if the computer system has any usability problems. At best, the process may take more time than anticipated; at worst, the customer may miss a bargain.

We hope the point has been made as to how important primary users are in ensuring the development of a good UI design. Secondary users are important too, and they will have views that need to be taken on board; but your focus must be on the *primary* users who are and will be using the user interface.

2 Users: Finding Out Who They Are

In UI design it is imperative to know who the application is being designed for and what the users believe they want from an application. People or groups of people in an organization who use the application directly are referred to as the **primary users**. **Secondary users** are people or groups of people who are not primary users but who are affected or influenced in some way by the computer system or who affect or influence its development. Together the primary users and secondary users are known as **stakeholders**.

The intended primary users — or just **users** — of the system should be involved first and foremost in the system development, and they should continue to be involved throughout the UI design and development life cycle.

2.1 Describing the Users: Users Have “Characteristics” That Are Relevant to UI Design

An important part of UI design is ensuring that the UI matches the attributes, or *characteristics*, of the intended real users. We are aware from our everyday experiences that people differ in many ways (see Box 3.1). In UI design, users or user groups are described in relation to their characteristics. In other words, a profile of the real users of the application is created that describes the users in terms of their

Box 3.1**User Characteristics**

The idea that people possess *characteristics* has caused difficulty for some students in the past. However, on an everyday level we all make assessments of people by their attributes or characteristics. For example, suppose you are introduced to someone who is very tall. You would not say to yourself, “That person has the characteristic of being tall.” But you *would* unconsciously attribute the feature of being tall to that person. We all see a number of physical characteristics when we look at people, and we may unconsciously use those characteristics to classify them. For example, we may classify someone as short, stocky, slim, or robust.

particular attributes, such as age, sex, and physical abilities and disabilities (Mayhew, 1999). In addition to physical characteristics, it is also necessary to know about the educational background of the users and how much IT experience they possess. Users’ psychological characteristics are also important. For example, when designing a computer system, you will need to be aware of the users’ levels of motivation and their attitudes toward computer use or computerization of their work. It has been found that no matter how good or effective an application is, acceptance or nonacceptance of the application often hinges on the users’ attitudes to the use of computers in their work. A user’s cultural background will also have a bearing on particular aspects of UI design. For example, icons that are easily recognized by Westerners may be less easily recognized by users from Eastern societies. Table 3.2 lists the user characteristics that are relevant to UI design.

2.2 Designing for Physical Limitations

One of the characteristics listed in Table 3.2 is “physical abilities and disabilities.” Many countries now have legislation that makes it unlawful to discriminate against disabled people in the provision of goods or services.

The United Nations collects the statistics on disability that are available from all its member nations. As the organization points out:

Many countries collect data on disability but the prevalence rates derived from these data vary greatly for a variety of reasons including:

- *conceptual issues — disability is the result of an interaction between the person with the disability and their particular environment. Disability is, therefore, a complex phenomenon with no static state; it can be conceptualized in many ways, including at the level of the body, the person, or the society.*
- *measurement issues — the questions used, their structure and wording, and how they are understood and interpreted by the respondents all affect the identification of the persons with disabilities in data collection.*

Table 3.2 User Characteristics Relevant to UI Design

Age
Sex
Culture
Physical abilities and disabilities
Educational background
Computer/IT experience
Motivation
Attitude

For these reasons, the observed differences among countries in the rates (or percentages) reflect conceptual and measurement differences, to varying degrees, as well as “true” differences.

*United Nations Statistics Division
<http://unstats.un.org/unsd/disability/introduction.asp>
Visited July 8, 2004*

Broadly, countries in the “developed” world (such as the United States, Canada, Australia, New Zealand, and the European Union) ask questions in their censuses and surveys that mostly concentrate on whether or not people can perform everyday tasks, and they rely on the person’s own view of their abilities or disabilities. For example, the New Zealand census asked the two questions in Figure 3.1.

Generally, these countries report that between 15% and 35% of the population as a whole has some sort of impairment or disability that interferes with everyday activities. These are important figures for us as interface designers. We do not need to know what condition might cause an impairment or difficulty in using a computer; we simply need to know how many people might have such a difficulty.

One particularly important group for user interface design is people who are blind or visually impaired. In the United States, at least 1.5 million blind and visually

You can get a simulation of what an image or web page might look like to a color-blind person by going to www.vischeck.com/vischeck.

14 Mark as many spaces as you need to answer this question

Does a health problem, or a condition, you have (lasting 6 months or more) cause you difficulty with, or stop you doing:

everyday activities that people your age can usually do

or

no difficulty with any of these

15 Do you have any disability or handicap that is long-term (lasting 6 months or more)?

yes no

Figure 3.1 Questions on illness and disability from the New Zealand 1996 census. (Taken from www.stats.govt.nz, visited July 9, 2004.)

Figure 3.2 shows how a web site might be viewed by someone who with full color vision, someone with deuteranopia, and someone with tritanopia.

Thinking about and designing for users' physical limitations is important. It is not only beneficial to those individuals with a limitation, there is often a benefit to people in general. For example, while signs using large, clear print are enabling for the partially sighted, they are also easier for the public in general to read. Public conveniences are another often-cited example: larger toilet cubicles enable the disabled (particularly wheelchair users) but also make the use of public conveniences easier for everyone.

2.3 User Profiling: Describing Your Users and Their Characteristics

There are two main ways to find out about your users so that you can create a user profile. First, if you know who your real users are (that is, if you know who will actually be using the interface), then you can ask them to complete a questionnaire. Remember when developing your own questionnaire that you will need to pilot it before you distribute it to ensure that it gathers the information you are interested in. Second, if you are unsure about who your real users are, then you will need to talk to or interview knowledgeable people in the organization — domain experts, managers, work supervisors, personnel managers, and product development managers — to find out about the users.

Table 3.2 lists the characteristics of users that are considered relevant for UI design. Suppose we need to produce a user profile of customers for an ATM. Using the list in Table 3.2, we might produce the user profile shown in Table 3.3.

impaired people use computers (American Foundation for the Blind, www.afb.org, visited July 9, 2004). Our prediction is that this number will rise as computer usage rises among older people, many of whom find that their vision deteriorates as they age.

An additional consideration for design is that about eight percent of the male population and one percent of the female population suffers from color blindness (Dix *et al.*, 2004). There are three forms of color blindness:

- Deuteranopia, where red/green are difficult to distinguish
- Protanopia, another type that affects the ability to distinguish red/green
- Tritanopia, a rare problem that affects the ability to distinguish blue/yellow

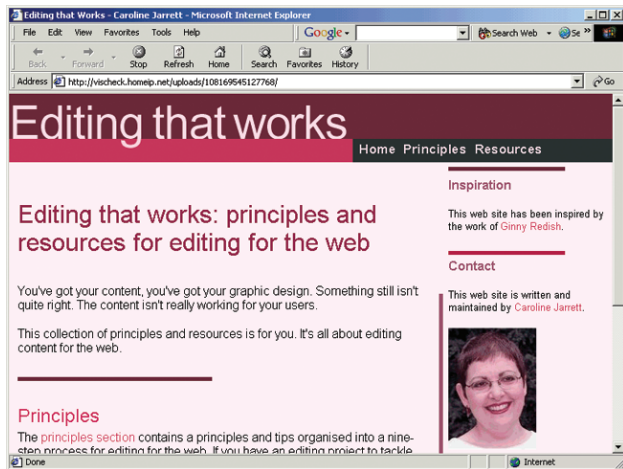
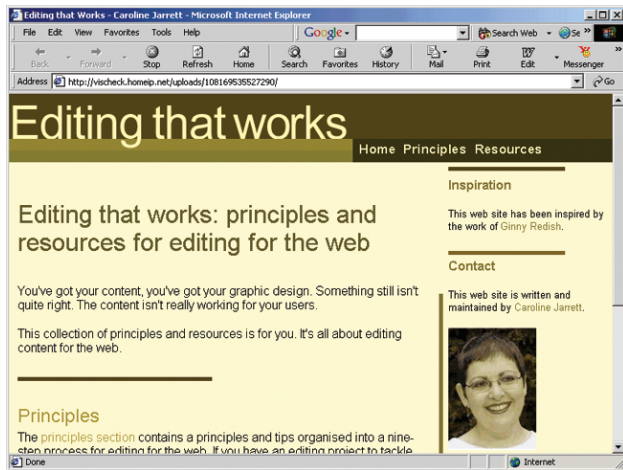
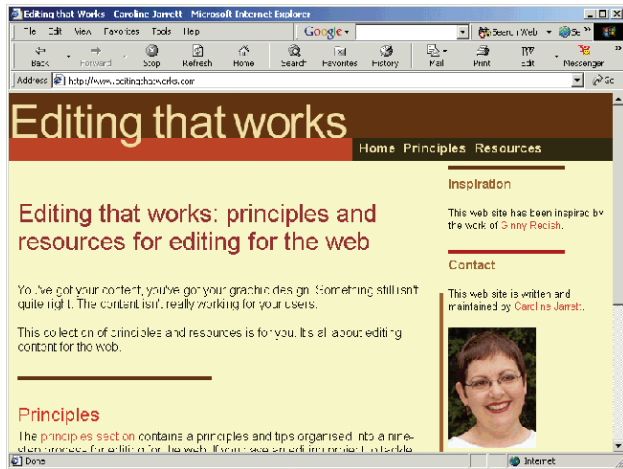


Figure 3.2 The same web site as seen by (top) a person with no problems, (middle) a deuteranope, (bottom) a tritanope. Simulation by www.vischeck.com.

Table 3.3 User Profile of ATM Customers (from Chapanis, 1996)

User characteristics	ATM customer characteristics
Age	Will range in age from about 12 to 80+
Sex	Both male and female
Physical limitations	May be fully able-bodied or may have some physical limitations in relation to hearing, sight, mobility, use of hands, or wheelchair use Will be of varying heights
Educational background	May have only minimal education qualifications and possess limited literacy and numeracy skills
Computer/IT use	May have little or no prior experience of computer or IT use
Motivation	May be very motivated to use the ATM, particularly if they can do their banking quickly and avoid waiting in long lines at the bank
Attitude	Attitudes to use may vary, depending on the services the ATM offers, the reliability of the technology itself, and the attitude of users toward computers

2.4 Smaller User Groups Are Easier to Design For

Table 3.3 reflects a true user profile in that it describes the whole user interface population in terms of the attributes or characteristics relevant to the design of the UI (Mayhew, 1999). However, as it stands, it gets us only part of the way to describing our users. Now we need to break up this large bunch of users into smaller groups. We will have a greater chance of arriving at a successful design if we focus on who the users of the system are than if we just try to accommodate a large band of users and their different patterns of ATM use. You, as a user, probably use an ATM in a different way than your parents do, and they will use an ATM in a different way than children or teenagers might. Let's have another pass through and try to really identify the users in this situation.

EXERCISE 3.1 (Allow 20 minutes)

Look at the user profile for ATM customers presented in Table 3.4. Based on people you know (family members, friends, or work colleagues), split the collection of customers in Table 3.4 into two or more different groups.

Table 3.4 ATM User Groups (adapted from Stone, 2001)

User characteristic	ATM customer characteristics, by group		
	Teens/young adults	Young adults to middle age	Middle age to senior citizens
Age	12 to 25.	25 to 50.	50 to 80+.
Sex	Both male and female.	Both male and female.	Both male and female.
Physical limitations	May be fully able-bodied or may have some physical limitations in relation to, for example, hearing or sight. Will be of varying heights.	May be fully able-bodied or may have some physical limitations in relation to, for example, hearing or sight. Will be of varying heights.	May be fully able-bodied or may have some physical limitations in relation to, for example, hearing or sight, mobility, or use of hands. Will be of varying heights.
Educational background	May have minimal or no educational qualifications.	May have only minimal educational qualifications.	May have only minimal educational qualifications.
Computer/IT use	Probably have some prior experience of computer or IT use.	May have little or no prior experience of computer or IT use.	May have little or no prior experience of computer or IT use.
Motivation	Probably very motivated to use the ATM, especially in relation to their banking habits.	Could be very motivated to use the ATM, especially if they can do their banking quickly and avoid standing in line at the bank.	Could be very motivated to use the ATM, but would probably prefer to stand in a line in the bank.
Attitude	Attitudes to use may vary, depending on the services the ATM offers and the reliability of the technology itself.	Attitudes to use may vary, depending on the services the ATM offers and the reliability of the technology itself.	Attitudes to use may vary, depending on the services the ATM offers and the reliability of the technology itself.

DISCUSSION

Debbie writes: I am a member of a large, extended family. Based on my knowledge of how various members of my family use ATMs, I split the collection into three smaller groups and profiled each as shown in Table 3.4. This is not the only way in which you could split the initial grouping into smaller groups. Depending on whom you modeled your groups, you may only have two groups or you may even have identified four groups.

The teens in my family generally use their account only once a week — to deposit their allowance (or to make a withdrawal if they have saved enough for a particular purchase). There are also occasions, such as Christmas and birthdays, where extra money, received as presents, is deposited. For the teens, and the young teens especially, using a card machine is “cool” and grown up, and it means they won’t have to wait in line on a Friday afternoon or a Saturday morning when the banks and savings institutions are already busy. The young adults in my family use ATM facilities like a wallet. They withdraw small amounts of money frequently — maybe even several times a day — as and when they need it, rather than withdrawing a great wad of cash that they may spend recklessly.

The family members between the ages of 25 and 50 are generally busy, working people. Banking is a necessary part of life, but the quicker it can be done, the better. Waiting in bank lines is something to be avoided, and they prefer to withdraw enough money from an ATM to last several days.

The older members of my family bank even less often. They tend to make a single weekly cash withdrawal to cover the week’s expenses, although where possible they prefer to get their money from a person rather than a machine.

Having drawn up your groups, now is the time to discover how accurate your “commonsense” categories are. The obvious way to do this is to observe and even talk to ATM users. You will have to do this with great care and discretion, or someone might become suspicious and call the police! Alternatively — again with care — you might want to observe the customers who are standing in line waiting to perform their transactions with a human teller. Observation of either user group will give you information about users’ age ranges, physical limitations, and sex. But to uncover information that is not apparent upon observation, like educational qualifications, computer/IT experience, or attitude and motivation, you will need to either interview the users directly or ask them to complete a questionnaire. This type of information could be gathered without the need for them to divulge personal information, like names and addresses. Then, based on the information gathered from observing and talking to real users, you would revise the descriptions of your user groups.

Having iterated to an accurate description of your user groups, the next step is **analysis**. Analysis is the process of taking the information you have gathered, examining it closely, and drawing conclusions about what it tells you. You would then translate your conclusions into requirements for the design of the UI to the application, as shown in Table 3.5.

Table 3.5 Translating User Characteristics into UI Design Requirements (middle age to senior citizen group)

User characteristics	ATM UI requirements
Age range from 12 to 80+	ATM screen height needs to accommodate users of varying height.
May be fully able-bodied or may have some physical limitations	ATM screen height needs to accommodate able-bodied users as well as users with walking sticks or those who use wheelchairs. Arthritis of the hands could be a problem, so any controls used should accommodate this.
May have some physical limitations in relation to hearing	All user inputs should have both visual and auditory feedback.
May have some physical limitations in relation to sight	Screen text should be of a reasonably large font, in order to be read by both the visually impaired and unimpaired.
May have some physical limitations in relation to use of hands	Touchscreens, if used, should have target areas that are large enough to locate with limited manual dexterity. Touchscreens, if used, should be sensitive enough to respond to users with decreased strength in fingers or hands.
Little or no experience of computer/IT use	The application should be easy to use (i.e., the tasks users want to undertake should be simple to perform). The application should be easy to learn (i.e., the user should be able to use the system without help, training, or instruction).

Chapter 12 will step you through the decision-making processes involved in choosing input and output devices for users and the tasks they want to undertake with an application.

Note that although we have presented the conclusions of our analysis in a table, nothing is yet set in stone. For example, we indicated that a touchscreen could be used for the ATM interface, but this is not the only choice you could make. Further on in your development, after undertaking other investigations, you may refine your ideas about what users really want. For example, suppose the bank manager told you that there were an unusually large number of senior citizens with accounts at her bank. Based on this, touchscreens might be unfeasible. Users with physical limitations (arthritis, perhaps, or diminished strength in their limbs) may be unable to place their fingers accurately enough on the screen to make a correct selection, plus there is no tactile feedback to help them know that a selection (right or wrong) has been made. A more appropriate choice for the unusually high number of senior citizens might be a UI that uses a keypad with larger than normal keys. This would make

the selection of options easier, and tactile feedback could be included. Large text labels and even Braille markings on the keys might be appropriate for these users and their banking tasks. This information would then be fed back into the development cycle, and the table revised. In doing this, you would have demonstrated that you were taking an iterative approach to design: the replacement of the choice of touchscreen with a keypad means you are revisiting an activity already completed and making better choices for the interface based on additional acquired information.

2.5 Personas: Another Way to Describe Your Users

More recently, Cooper (1999) has proposed the use of **personas** as an effective way of designing for a broad population. A persona is a precise description of a user and what he or she wishes to do when using a system. Personas are not real; rather, they are imaginary examples of the real users they represent. In defining personas, Cooper recommends that you be as specific as possible about the “madeup” details and also that you give the persona a name, as “[a] persona without a name is simply not useful” (p. 128). Then during the design process, the persona is referred to by name rather than as “the user.” He gives each persona an image, whether it is a stock photograph (from a photo library) or a sketched caricature. All these details serve to make that persona a concrete person in the designer’s mind and in the minds of the design team. Pruitt and Grudin (2003) suggest that personas are of great value in providing a shared basis for communication, enabling a broader range of information to be conveyed to all the project participants and stakeholders.

Cooper suggests that a unique set of personas be defined for each individual project, which he refers to as the project’s “cast of characters.” Within a cast you may also find it useful to have some personas that have been defined only as people whom you are *not* designing for. Every cast, though, should have at least one primary persona who is the main focus of your design. Box 3.2 shows an example of the use of personas in a design situation.

Pruitt and Adlin (in press) point out that although your personas are more likely to be robust and helpful for design if they are based firmly on data, there is also value in personas based on assumptions:

It's impossible to ignore the impact of assumptions . . . [everyone] in your organization has assumptions about the target users . . . [some] so strong that they seem woven into the very fabric of your organization. . . . At the very least, [you] will make all of your organization's assumptions about target users very explicit, and this can be a painful but valuable outcome.

EXERCISE 3.2 (Allow 30 minutes)

Create a persona for each of the three groups profiled in Table 3.4. The discussion for Exercise 3.2 may help you get started.

Box 3.2

The Use of Personas in Developing the Roll-aboard Suitcase

The roll-aboard suitcase makes a good example of how powerful designing for one person can be. This small suitcase with the built-in wheels and retractable handle revolutionized the entire luggage industry, yet it wasn't designed for the general public — it was originally designed just for airline flight crews, a very narrowly defined target user group. The personas used may have included, for example, Gerd, a senior captain flying 747s from Vancouver to Frankfurt for Lufthansa; or Francine, a newly minted flight attendant on Reno Air. Gerd flies long distance flights, while Francine flies the length of California three times a day, serving drinks and handing out peanuts. Gerd and Francine are dramatically different personas, flying on different types of flights and schedules, but their suitcase goals and needs are equivalent.

The design purity of the roll-aboard suitcase pleased airline flight crews enormously. The rest of the travelling public soon saw that it solved their luggage problems, too. Carrying it through crowded airports was as easy as maneuvering it down airliner aisles, or stowing it aboard planes.

After the roll-aboard succeeded in its target segment, it was launched into other markets. Now, you can buy double-sized roll-aboards, designer roll-aboards, armoured equipment roll-aboards, and kid's roll-aboards. Today, purchasing luggage without built-in wheels and a retractable handle is difficult.

From Cooper, 1999, pp. 126, 130.

DISCUSSION

Felix: Persona for the user group “teens/young adults”

Felix is 13 years old. He gets an allowance every week, but spends it while out with his friends, and there usually is not anything left over to bank. He often gets money from his grandparents and uncles for his birthday and at Christmas, and this money is always deposited into his bank account. He saves this for more expensive or extravagant purchases; for example, he has a game console and likes to have the newest games. Plus he likes to be trendy and have the newest jeans and trainers. Felix's account allows him to withdraw small amounts of money from ATMs.

Sandra: Persona for the user group “young adults to middle age”

Sandra is 30 years old. She is married to Jason, and they have two children: Todd, age six, and Carly, age 18 months. When Carly was born the family moved into one of the newly built housing areas in the town; local amenities such as shops, bars, or a bank have yet to be built. This means that any shopping or banking

must be done in the town center, which is a six-mile round-trip from the family home. Jason uses the car for work, and he works long hours — he is often gone from 6:45 a.m. to 8 p.m. Sandra is partially sighted, so she does not drive and depends on public transportation to get anywhere. She tries to do any errands, like shopping and banking, during Todd's school hours, as handling one child by public transportation can be difficult (especially with a stroller), but it is far easier than trying to cope with two. More often than not she needs to make two shopping trips on two separate days to get everything she needs. Sandra likes the ATM for depositing and withdrawing money and for checking her bank balance because she can see the screen if she gets near enough to it, and she has learned the menu sequence. The ATM is in the front wall of the bank, and there is no canopy to protect customers from poor weather conditions.

Grandpa Maurice: Persona for user group “middle age to senior citizens”

Grandpa Maurice is 68 years old. His pension is automatically credited to his bank account once a month. Every week he goes into the bank to withdraw enough cash for the week as he prefers to pay for his groceries and other day-to-day expenses with cash. While standing in line is a bit difficult (Grandpa Maurice has arthritis in his hip), he does it because he prefers to get his money from a person. Also, as he is not very comfortable with technology, he does not have an ATM card.

2.6 Other Stakeholders

We have said that together the primary users and secondary users are known as **stakeholders**. We have discussed the profiling of primary users of a system, using either profiles or personas. While knowledge of the real, direct end users of a system is of the greatest importance, in the information gathering process there will also be secondary users — that is, other stakeholders — who will have an interest or “stake” in the development of an application.

It can be difficult to determine the identity of all the stakeholders in an application development. Besides primary users, these secondary users can include, among others, senior managers, business analysts, system analysts, project managers, application developers, interface designers, marketing and sales representatives, trainers, and customer support staff (Hackos and Redish, 1998).

Identifying stakeholders and gathering their requirements will often identify missed, conflicting, ambiguous, overlapping, and unrealistic requirements (Kotonya and Sommerville, 1998). As each stakeholder or stakeholder group will come to the application development with their own set of issues and their own view of what is important, it can be difficult to reconcile the various views of all involved to specify the requirements for an application. In addition, sometimes what is seen as a benefit by one stakeholder may be seen as a cost by another (Wilson *et al.*, 1996). For example, managers might view an increase in productivity due to computerization as a benefit, while users might view the increased productivity as a cost if it leads to workers being

made redundant. Requirements negotiation will be necessary to resolve any conflicts, overlaps, or ambiguities in requirements, and the final requirements specification will inevitably be a compromise, as you cannot produce a system that will satisfy everyone.

EXERCISE 3.3 (Allow five minutes)

Earlier in this chapter, we discussed the users of a computer system for a lending library. Who might the stakeholders be for this type of application?

DISCUSSION

In addition to the primary users (the librarians), the various stakeholders would include library users, library counter staff who handle the lending and return of library items, and acquisitions staff who, in conjunction with the librarians and resource managers, choose and order items for the library stock. There will also be system administrators and project managers; if it is a new computer system, then there may also be cataloging and data entry clerks. The council or educational institution funding the library will also be a stakeholder.

Once created, your user profiles or personas and details of the other stakeholders involved will be included in the requirements specification and used to inform your design decisions.

3 Users' Needs: Finding Out What Users Want

After identifying the real users of a system, you can then start to discover what they want the system to do — simply by talking to them in order to identify their needs. This sounds straightforward, but one of the problems with trying to identify the requirements for a computer system is that users often do not know what they want, or else their work has become so second nature to them they are unable to tell you what work they do. When they are able to tell you, users will in general describe what they want from an application in terms of two types of need: **felt needs** and **expressed needs**.

Felt needs, in many cases, are hidden or slow in being identified, as users may not know or understand what a system may be able to offer them or how it could make the accomplishment of their goals easier; so they do not realize that they have a need in the first place. You might identify felt needs by questioning individuals or, on a wider basis, by using surveys.

Expressed needs, on the other hand, are what people say they want. For example, users may have grumbled for years about the lack of a particular feature in a computer system without ever doing anything about it; yet when they are consulted, this missing feature may be one of the first things they identify as an essential requirement.

Based on our previous experience as professionals, we will often describe a **normative need**. That is, we will possess a professional view about the nature of the problem and what may be needed. There may be considerable discrepancies or conflicts between the professional normative needs and the felt/expressed needs of users and stakeholders. In addition, felt and expressed needs from users may be excessive or in conflict with each other and we will be in the situation of having to negotiate trade-offs to reconcile needs. It is important, though, that we do not simply impose our opinion as to what is needed upon users. We must listen to what users say, as they will certainly know more about their tasks and their domain than we will.

The output from discovering the users' needs will provide a starting point for the specification of the functional requirements of the computer system — that is, *what* the system must do and the functionality it must have to support users in their tasks.

4 The Domain: What Expert Knowledge Is Relevant to the Application?

In UI design, the term **domain** refers to the area of expertise and specialist knowledge — for example, financial applications or process control systems — for which an application may be developed. A domain may be described using particular concepts that highlight important aspects (Dix *et al.*, 2004). For example, the domain-specific concepts for a financial application would include credits, debits, accounts, and interest rates. Also included in the description of a domain is any specialized knowledge needed to perform tasks and accomplish goals. (We will talk more about goals and tasks in the next chapter.) For example, if you want to accomplish the goal of paying a bill by credit card, you will need to have a general idea about how credit cards operate. You will need to know that you require a credit card that is valid, that you must have enough credit available on your account, and that you will need to repay some or all of your account balance each month.

4.1 Understanding the Domain

The activity of gathering information about a domain is known as **domain analysis**. This involves talking to, observing, and interviewing domain experts, people who are knowledgeable and skilled in the domain area you are investigating. You will also want to look at any existing relevant documentation. For example, if a system already exists, then you can look at any user or training manuals. If this is a completely new UI design, then you will want to look at procedure manuals, job descriptions and forms, or other paperwork used in relation to the job.

Depending on the application area, the identity of the experts will vary. In a financial application, the bank manager might be the initial expert that comes to mind; but bank tellers as well as bank managers will be experts — each will be expert in that part of the financial domain where they have the most experience. This is an important point. To gain a broad view of the domain for which an application is being

developed and to understand the important concepts of a domain that tasks will be based on, several domain experts should be consulted — *including users*. A lack of understanding of, or lack of knowledge about, the computer system domain will lead to errors in specifying the requirements for the application and will result in a UI design that fails to meet the users' needs. This may happen if you interview only one domain expert. However, you should also be aware that different domain experts may contradict each other, and further investigations may be needed to reconcile opinions.

Bear in mind that domain experts are often unable to articulate their knowledge, either because they are poor at talking about what they do and what they know or because their knowledge has become so implicit or second nature to them (that is, *tacit*) that they really cannot say what they do or what they know. Much of the knowledge used by domain experts in relation to their performance of particular activities is acquired informally, without intention to learn, and without awareness that it has been learned (Sternberg and Horvath, 1999). Though unarticulated, personal knowledge and experience is an important part of the way in which individuals undertake their work. For example, in the area of law, knowledge of the law is only a small part of legal expertise. The understanding, interpretation, and application of legal rules to a particular situation is dependent on implicit knowledge gained through experience of having applied law, through the observation of the legal system in action, and through analogy with similar cases. Lawyers, when asked, will recall that learning has taken place in courtroom observation; but when asked specifically what they learned, they are unable to describe it satisfactorily (Marchant and Robinson, 1999).

As well as the problem of trying to elicit implicit tacit knowledge, you may also find yourself in the situation where domain experts are deliberately uncooperative because they are resistant to the idea of a new application being developed and implemented (Bell and Hardiman, 1989). They may feel threatened by what they perceive as negative implications of new technology, such as job losses or changes in work practices leading to decreased job satisfaction. In both cases, therefore, information from other sources, such as any available system documentation, textbooks, or training materials, should also be examined. An iterative cycle of observation and interviews, analysis, and further observations and interviews in the work environment will be necessary if you intend to gain a good understanding of a domain.

In the course of your interviews with domain experts, you are likely to gather unsolicited information about the users, their tasks, and the environments within which the system will be used. This information will provide a starting point for the further requirements-gathering investigations that need to be undertaken in relation to the users, their tasks, and their work environments (Kotonya and Sommerville, 1998). We will discuss this later in the book.

4.2 Representing the Domain

The outputs you arrive at upon completion of a domain analysis are **domain models**, which describe the domain information and concepts relevant to the particular

system under development. These domain models contain a subset of the total expert knowledge of the whole domain (i.e., they contain the information relevant to the area of the computer system under development). Consider the financial application once again. If an automated teller machine (ATM) is being developed, then the relevant domain information and concepts would be related to account transactions, such as depositing and withdrawing money, checking an account balance, or ordering a bank statement. There would be no need to model, say, information about bank loans, mortgages, or life insurance in the computer system. Although these concepts are related to finance and banking, they would be beyond the scope of the system under development. Figure 3.3 shows ATM domain knowledge as a subset of banking domain knowledge.

Domain models can simply be textual descriptions of the relevant domain information, as shown (very briefly) in Figure 3.3, but often graphical notations from systems analysis are used to model the domain. These include, for instance, the **dataflow diagram**, the **entity–relationship diagram**, and the **state transition diagram**. Once created, your domain models — whether textual or graphical — will form part of the **requirements specification** document.

EXERCISE 3.4 (Allow 20 minutes)

Think about your last visit to a library (either physical or online). If you were developing an application for use by librarians, what domain knowledge would be required for the system? Describe the domain knowledge needed. This is an opportunity to consider the skills of direct observation. How easy is it to identify the information you are seeking?

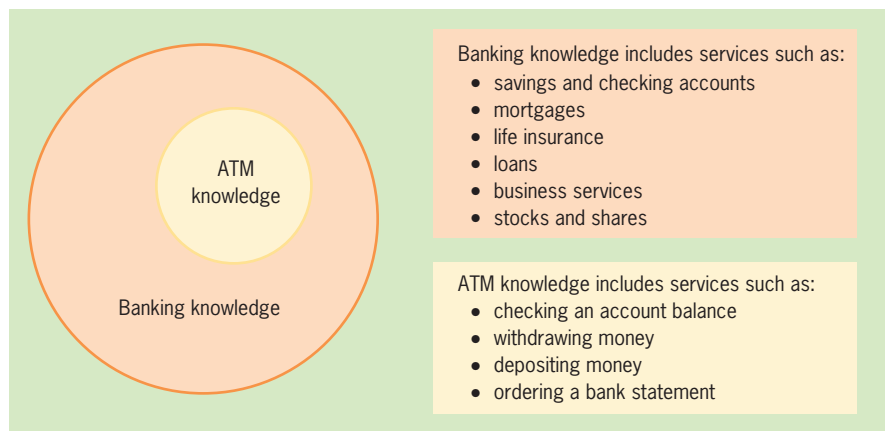


Figure 3.3 ATM Domain Knowledge Is a Subset of Total Banking Domain Knowledge. (From Stone, 2001.)

DISCUSSION

Here are our suggestions for some of the domain knowledge for a library:

- Different categories of books are available. The library can loan some of the books, while others are only for reference or use within the library.
- Different types of media are available: books, audiotapes, CDs, maps, and microfiche.
- Various classification schemes are used for numbering and ordering the items.
- Different types of readers use the library (e.g., children and adults).
- Some readers want to read at the library; others want to borrow or check out items.
- Librarians need to keep track of items in the library.
- Librarians issue loans to users with library accounts.
- Librarians issue overdue notices to users and collect fines from those who return items late.

Many more items could be included here. Did your list of items differ from our list? Most of the items on this list came from our own experiences as library users; confirming that this is an accurate view and gathering any other information required for the domain model would be obtained by interviewing and more detailed observation of librarians at work.

5

Summary

In this chapter we discovered the importance of understanding the characteristics of our users, particularly any physical limitations, and creating user profiles to document the range of users that we are designing for. We described personas, a technique that helps the sometimes bald facts in the user profiles to come alive.

We then mentioned the importance of finding out what users need, and that there may be a difference between what they say they need, what they feel they need but cannot easily express, and what we consider would be most helpful for them.

One especially important aspect of understanding users is establishing how much they know about the domain of the user interface, the area of specialist or expert knowledge that is relevant to this system. This chapter closed with a discussion of how to find out about and represent the domain.

In the next chapter, we continue our investigation of users and their needs by looking at the tasks or work that users will be doing with the system.

