INTRODUCTION

LEARNING OBJECTIVES

Upon completion of this chapter, students should be able to do the following:

- Explain the terms *human–computer interaction* and *usability*
- Discuss the importance and scope of HCI
- Discuss the main ideas underlying this book: fit, levels of abstraction, human concerns, and context
- Overview the methodology for HCI development
- Describe the overall structure of the book

SCENARIO

Imagine a large organization that is about to upgrade its computer systems. The company is in a rush to begin development because it feels that the company is too slow in providing services to the clients. And complaints are indeed mounting. The IT department is edgy. The developers are eager to start programming. Imagine that instead of letting the developers begin, management decides to hire human factors experts to observe how workers in the company go about doing their jobs. To do so, the experts spend six whole months observing the workers in their natural work environment, interviewing workers and customers, recording and analyzing their observations, and simulating changes. Then, after six months, the experts get to spend more time developing a prototype of the new system, step-by-step, adding a function, testing it, expanding the functionality, and again testing it, going through 30 such iterations. Sound unreal?

The New York Stock Exchange (NYSE) did so (see the full story in Gibbs, 1997). Two consultant firms worked for six months to develop a comprehensive understanding of traders on the floor. They observed and modeled the way traders behaved in reality. Only then did they propose new technologies that would fit the traders’ way of performing their tasks but would allow them to do so more effectively. They introduced new devices such as handheld computers, replacing the current paper cards with more accurate and faster devices, but without disrupting work practices. The workers quickly accepted the technology and learned to take advantage in recording quotes and sales. Have these changes enhanced value for the business? William A. Bautz (vice president for technology) reports, “In two weeks we now process as many shares as we handled each year in the late 1970s” (Gibbs, 1997, p. 88). And at the same time, the error rate has dropped by a factor of 10!
1. HUMAN–COMPUTER INTERACTION: DEFINITION, IMPORTANCE, AND SCOPE

This book is about human–computer interaction (HCI) in the context of organizational work. The field of HCI attempts to understand and shape the way people interact with computers: the processes they engage in, the resources they use, and the impact they accomplish. This may seem a very limiting approach to HCI, but it covers the bulk of the field today and we use it to set the scope of this book. We further limit ourselves to HCI in organizations (e.g., clerical work supported by office systems, managerial work supported by Enterprise Resource Planning, project management software and group and individual Decision Support Systems, and professional work supported by an online library). This scope excludes a direct treatment of exciting areas such as HCI in the cockpit, in robotics, on the battlefield, and in entertainment. Yet even with this limited scope, we are still left to explore a vast body of knowledge.

The interactive use of computers is not new. It has been around for several decades, but it has now become an integral, if not dominant, part of work life. What is the state of the art of HCI designs? Are the human–computer interfaces designed well enough to improve work? Improve life? Can they be improved? The cartoon in Figure 1.1, besides being rather amusing in describing the mutual frustration of humans and computers, suggests that there is room for improving the interaction between people and computers.

1.1 Quality Human–Computer Interaction

Today, building the human–computer interface consumes 50–70 percent of the systems development effort. The importance of the interface to user acceptance is well understood. The statement that the interface “makes or breaks the system” is generally no exaggeration because users see the system through the human–computer interface. In other words, to users, the interface is the system. Users care about what they enter into the system and, more importantly, they care about what they get out of the system and how the entire experience of interaction feels. Given that the system has the functionality to make it useful to the user it is expected to be usable too. Usability is the extent to
which a system with given functionality can be used efficiently, effectively, and satisfactorily by specified users to achieve specified goals in a specified context of use.

The World Wide Web, which is perhaps the most accessible computer platform to a diversity of users nowadays, may enlighten us about the current practice of HCI design. Recent surveys paint an uneven picture of quality on the Web: some Web sites are highly useful and usable but others are poorly designed. In a recent large-scale survey of Web users (Kehoe, Pitkow, Sutton, Aggarwal, & Rogers, 1999), nearly 75 percent of the respondents reported dissatisfying experiences because of confusing Web sites. Surprisingly, over 50 percent of novice users reported only good experiences with the Web, so capabilities and expectations are probably changing. Nevertheless, the price organizations pay for poor usability is very high as customers abandon them and employees waste precious time. On the other hand, well-designed Web sites seem to make a difference. Consider IBM, for example. IBM decided in the late 1990s to redesign its Web site to boost online sales, creating an IBM Shop that was much easier to navigate. It was simple, cohesive, and easy to search. IBM claims that online store traffic increased by 120 percent and that sales shot up by 400 percent (see report on InfoWorld, April 19, 1999). As in this story, it is usually not the latest gadgets that make the difference. In the report describing the NYSE experience (see scenario above), Gibbs (1997) discusses the disappointing impact of what seemed to be very promising technologies. Speech recognition, wearable computers, videoconferencing, and virtual reality are exciting HCI technologies (described in Chapter 3). They are slowly maturing but have not yet created value in business that can justify their cost. It appears there is still much to do in order to reap the benefits of commonplace HCI technologies.

Thus we can conclude that the current practice of HCI design in many cases is unsatisfactory and that corporations (and users) pay a high price for this unsatisfactory quality of design. With some effort, however, significant improvements can be achieved. There is a need, therefore, for a more systematic treatment of HCI in the development process and a more prominent presence of HCI experts in information systems projects.

This sense that more should and can be done to improve HCI is reflected in a growing field of HCI researchers and practitioners and in innovative HCI technology. Advancements in the technology of human–computer interaction include speech recognition, touch-sensitive screens, virtual reality devices, and devices for the handicapped, among many others. Impressive too is the support for generating human–computer interfaces. Powerful languages, automated analysis and design tools, and built-in interface objects have all served to make the creation of interfaces less tedious. All this activity is not enough, however, to satisfy the ever-growing appetite of the diverse pool of users. Users now expect a standard of usability that was never available before graphical interfaces became the norm.

What constitutes a good user interface? How do we know whether we have a good HCI design? Ben Shneiderman and Catherine Plaisant (Shneiderman & Plaisant, 2005) reproduced the following standard criteria from the U.S. Military Standard for Human Engineering Design Criteria:

- Achieve required performance by operator, control, and maintenance personnel
- Minimize skill and personnel requirements and training time
- Achieve required reliability of person–computer combinations (reliability, availability, security, and data integrity)
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• Foster design standardization within and among systems (integration, consistency, portability)

To make things even more concrete, here is a list of common measurable goals for usability (Nielsen, 1993):

• Time to learn how to operate the system
• Speed of performance
• Rate of errors made by users
• User's retention time of information presented
• User's satisfaction with the system

Achievement of these goals is no easy task. In fact, some goals—such as time to learn, speed of performance, and subjective satisfaction—may conflict. The study of HCI is aimed at understanding how the human–computer interface can be designed to further such goals. Yet high-quality HCI is not just about usability or performance. It is also about emotions and about the overall physical and social experience of interacting with computers. Thus a balanced view of HCI incorporating many different human concerns is called for.

Consider the two Web pages in Figure 1.2. Both pages are taken from Web sites of online grocery stores (e-stores), and both represent very similar functionality. Thus from the perspective of achieving the goal of purchasing a desired product, the two e-stores are similar. However, their appearance and usability are different. Figure 1.2a is relatively verbal in comparison to the more graphic presentation of Figure 1.2b. The user's

**Figure 1.2a**  An e-store Web page (see also color plate I).
task is to find a candy bar (say M&M), check its price, and, if reasonable, order it. Chances are that the text-based e-store would be faster. Does this mean that users will prefer the text-based e-store over the graphical one? Not necessarily. People are often drawn to a Web page design based on pleasing aesthetics and a positive user experience. Replicating this positive experience becomes a part of the user’s subjective satisfaction when visiting the same site or other sites. We talk about design factors that generate positive affect in the user. Indeed, the designer must understand various design options, understand the pros and cons from a variety of perspectives, and be sensitive to trade-offs among design goals, which can be at both the individual users level and higher or broader levels such as organizational and social goals.

The following section presents how this book is organized to help readers understand and accomplish the broad goals of HCI.

1.2 Scope of HCI

The field of HCI is interdisciplinary and requires students of HCI to be familiar with at least some of the relevant reference disciplines. Figure 1.3 shows the wide range of relevant sources of knowledge and inspiration for developing high-quality HCI. It is based on several similar depictions of the field (Booth, 1989; Preece, Rogers, & Sharp, 2002; Zhang & Li, 2004). Each disciplinary source, from computer engineering to art and philosophy, informs parts of the many aspects of HCI development. In this book, which concentrates on HCI in the organizational context, we select a subset of these sources. These include the organizational perspective, the psychological and physiological perspective, the computer perspective, and the broader social perspective.
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The organizational perspective brings with it a strong influence of behavioral decision-making and organizational behavior. This perspective is invaluable for understanding how to analyze the way people perform their tasks at work and how technology can support their work. Furthermore, the organizational perspective is tightly related to the psychological perspective of HCI, particularly the cognitive and affective aspects of HCI. Additionally, the computer science perspective builds on software as well as hardware engineering to design interactive technologies, relying heavily on the psychological and physiological sources. Finally, the social and global contexts are also explored to meet the increasingly popular trends of social systems, the expansion of the traditional organization to communities of practice, and systems that are developed and used globally (DeSanctis, 2006). Although this is only a subset of the important sources shown in Figure 1.3 (which itself is probably incomplete), it is sufficient to provide a basis for HCI development and, moreover, to emphasize the need to balance the various contributions. For instance, there is a realization that cognitive and affective psychology complement each other in their implications on HCI design, and similarly, the contributions of sociology and psychology should be balanced. The field as it is represented in its research and publications (see the “Bibliography and Additional Readings” section) reflects well the interdisciplinary nature of the field.

2. THEMES IN HCI UNDERLYING THIS BOOK

This book explains the complex phenomena of HCI by building a view of HCI and then using it to organize the vast and growing body of pertinent knowledge. For some, HCI is an interdisciplinary academic field of applied research. For others, it is a practice of design and implementation. For many of us, it is becoming a productive mixture of both approaches. Accordingly, the book first examines the basic and relevant theories. It then applies the theories to practice by exploring the design of HCI components (such as
forms, graphics, and windows) and the design of representative applications (such as an e-store). The last part of the book discusses additional contexts that have important roles in HCI design, as well as the impact of the changing context on HCI development and use. The book presents the theory and practice through some common elements, which are the various concepts and themes to be described in this section.

2.1 Fit

HCI should be designed to achieve a fit between the (human) user, computer, and task, and it should do so for a given context. This is our underlying design philosophy. Fit is initially defined in reference to task performance so that a better fit is expected to improve performance. Performance reflects both the efficiency of performing the task and the quality of the task product. Measures of performance are selected according to the focus of studying HCI, as we shall see in several chapters that address different performance measures. For example, performance can be measured by the speed and accuracy of operating the computer or the speed and accuracy of preparing a document with a word processor. Subjective satisfaction and other measures are sometimes used as surrogates of task performance when more direct measures are infeasible. Fit, however, is difficult to measure objectively. Fit is sometimes operationalized by measures of performance—for example, the input screen design that leads to the fastest update is said to produce the best fit. Nevertheless, the concept of fit directs the designer’s attention to the process of matching the HCI design to the user and the task in a particular context (Te’eni, 2006). If, for example, the order of fields on a screen matches the natural order of receiving information, there can be a high fit between the design and the task. Similarly, if the size of the font adjusts to the user’s eyesight, there can be a high fit between the design and the user. In most cases, reducing the effort required by the user leads to higher fit, and conversely, good fit implies less effort than poor fit. Even before measuring performance, a high level of fit would be considered a superior design. Moreover, fit goes beyond performance to indicate a broader human concern with the user’s overall well-being. An ill-fitted sitting arrangement may result in backaches and severe health problems. Physical aspects of fit are therefore important in ensuring physical well-being. An ill-fitted interface design may increase users’ frustration and stress level, thus affecting users’ mental well-being. Figure 1.4 shows the three elements that feed into fit and the link from fit to both performance and well-being.

Using color to discriminate among objects on the screen may be generally effective but may be counterproductive for users who are color-blind (10 percent of the male population is color-blind). This need to consider the diversity of users and the limitations of some of them illustrates the desire to achieve a good fit between the computer and the user.

The example can be taken one step further. Red and blue have traditionally been used in biology textbooks to depict blood vessels carrying blood that is high or low in oxygen content (see Figure 1.5). In fact, in this particular context, any other color combination would be confusing. This convention is considered essential in medical texts. This relationship illustrates the fit between computer, user, and task within context. To accommodate a color-blind user, a technique such as cross-hatching along with the colors (with an explanatory key and/or floating text explaining the color and meaning) may be an additional design feature choice.

Note, however, that if the task is to train surgeons rather than teach first-year medical students, the whole concept of symbolic colors may be counterproductive. The training task at advanced stages of practice in the operating room is completely different. The red
Figure 1.4  The fit of HCI elements leads to performance and well-being.

Figure 1.5  Blood circulation (see also color plate 1).
and blue color symbols may lead to errors in identification of real blood vessels, which in reality are not painted blue and red. The design of the HCI must fit the task. Furthermore, tasks in the organizational context differ from tasks in other contexts such as command-and-control tasks in the cockpit. Hence, our design philosophy requires a thorough understanding of the nature of the task. Accordingly, we devote an entire chapter to some typical tasks found in organizations.

Fit can be achieved not only by design but also by user training. Users can also be trained to achieve a better fit. Training is part of creating effective HCI. Moreover, the task can be redesigned. Task analysis is also part of building effective HCI.

2.2 Levels of Interaction

The notion of fit leads to two of the three themes that organize the presentation in this book: a multilayer model of HCI and the analysis of user activity as a function of human resources (e.g., memory and attention). User activity encompasses the user’s interaction with the computer to accomplish a task. A multilayer model of user activity (Figure 1.6) can explain how the task context affects the physical design by showing the transition from psychological intentions to physical implementation. The example of using red and blue for learning about blood vessels can be examined at different levels. On one level, we examine the user’s goal of learning the concept of arteries and veins. On another level, we examine the use of colors to enhance pattern recognition in memory. These are different levels of understanding behavior that range from the user’s goals to the physical aspects of the human resources used to achieve these goals. The goals provide the context for the use of resources. In other words, the higher level provides the context for the lower level. Designers must be able to discriminate between these levels but also integrate across them consistently. For example, say the user is moving the cursor (the low level of interaction) to advance from the leftmost character in a text string to the rightmost character (the high level). Imagine how difficult it is for the user to press the left arrow in order to advance one character to the right. It is probably even hard to imagine, let alone to implement. Well, unfortunately this inconsistency often happens when American word processors originally designed for left-to-right English are used for writing texts in languages that progress from right to left. And, indeed, it is very frustrating.
Put more formally, we will examine HCI as a *multilayer activity* (i.e., user activity that is conceptually viewed at multiple and distinct levels of interaction). Of the several multilayer models that exist, we adopt a model with four levels of interaction: task, semantic, syntactic, and lexical (Moran, 1981). We call it the TSSL model. The *task level* pertains to the information requirements that have to be met (e.g., create a word processing document). It relates to the user’s goals most closely. The *semantic level* pertains to the set of objects and operations through which the computer becomes meaningful to the user (e.g., the object “document” can be opened as “New”). It relates to the user’s world of meaning but also to the computer’s logical structure. The *syntactic level* dictates the rules of combining the semantic objects and operations into correct instructions. For example, first designate an object and only after that choose an operation (e.g., select a file and then choose “Open”). The syntactic level directs the user how to manipulate the computer system. The *lexical level* describes the way specific computer devices are used to implement the syntactic level (e.g., move a mouse pointer to the document label and click twice to open it).

Figure 1.6 shows the four levels of interaction, each layer providing the context for the layer below it. The uppermost layer (the task) is closest to the user’s goals. The lowest layer (lexical level) is closest to the resources that are needed to physically implement these goals. Thus, Figure 1.6 depicts the translation of goals to physical implementation as an activity at different levels of interaction. The levels of task and semantics can be viewed independently of their physical implementation. The levels of syntax and lexicon are tied to their implementation. As demonstrated in the example of a cursor moving in the wrong direction, it is important to let the user move smoothly from one level to another. For example, the colors chosen for the interface (lexical level) should not interfere with the interpretation of their meaning (semantics), as in using the color red for a command button “OK.” While the discussion above is about operating the computer, we use the same ideas to talk about more abstract tasks such as computer-supported decision making (Chapter 9). Interestingly, the same hierarchical structure can be used to characterize conversation in natural languages by looking at the characters, words, and sentences as the different levels needed for communication. As we learn to converse, these levels collapse, in practice, into one seamless channel. Good HCI aims to achieve this seamless transition between our goal and the way we implement it. Our job as HCI designers is to make this interface almost transparent so that the user can get on with his or her work.

### 2.3 Human Resources in HCI and Their Impact

The second theme for organizing the material in this book examines the impact of user characteristics on HCI. Users rely on physical and psychological resources in their interaction with computers. We assume that the need to enhance limited human resources determines the potential roles of HCI. For example, using windows can enhance cognitive control, reduce demands on memory, and support shared attention to concurrent information sources. Using graphics can support memory, facilitate comprehension, and enhance cognitive processing for certain tasks such as trend comparison. Furthermore, many users consider graphics or color use to be more pleasing
2. Themes in HCI Underlying This Book

Pleasing is an affective, rather than cognitive, function that has been shown to have an important role in users’ acceptance and use of technology. Affect, together with motivation and other functions, will be discussed in the book as well. People tend to regard the computer as if it were a medium for interaction with other human beings rather than merely an innate tool (Brave & Nass, 2003; Picard, 1997). Hence the importance of emotions and attitudes in understanding how people react to computers and how we should design HCI more effectively should not be overlooked.

Figure 1.7 can be seen as the rationale underlying a strategy for defining the possible roles of any interface-oriented technique—that is, optimizing the physical, cognitive, and affective resources to produce the best possible HCI. Detailed lists of cognitive and affective resources will be developed and will then be used as templates for identifying potential roles of HCI. In general, these resources tend to inhibit performance when pushed to their limits. As a general principle of design, we strive to reduce the need for physical, cognitive, and affective resources and extend human capabilities in order to enhance HCI.

2.4 Context

The TSSL model and the human resources that determine the roles of HCI must be analyzed in context. This book uses the term context at different levels of abstraction. This is because context can be relative to content, which itself is context to more specific content. Thus, context consists of multiple layers, like the coats of an onion. The outer coat provides the context of the inner coats. Looking at the term context in relation to a word in a sentence, the word’s immediate context is the sentence. The more distant context is the paragraph, and that of the paragraph is the whole story. Examining HCI requires an analysis of the immediate context (what the user was doing just before she moved the mouse to click on the option “Save”). It also requires an analysis of the distant context, say of the particular decision-making activity for which the interaction is taking place (e.g., planning a budget). The decision-making activity itself may need to be understood in the context of a great time pressure to get the budget out on time. Time pressure may affect the way we act and therefore the optimal design of the human–computer interface.

The general context of HCI in this book is organizational work. When we get down to building an application, the context must be refined even further. Some of the tasks performed with computers are highly structured and others are less structured. The HCI
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developer will usually find it simpler to analyze the highly structured tasks, such as filling a predefined form of personal data. The less structured tasks will require a deeper understanding of the task and its context. Most of the examples of HCI for less structured tasks will be developed for tasks in a managerial or an office environment. We will look at a broad class of tasks—managerial and decision-making tasks. This type of task has become central to organizations in the information age and is highly representative of the less structured activities in modern organizations. The next chapter provides several examples of this type of task.

Not only different situational contexts but also different users affect HCI design. Different people have different styles and preferences (e.g., learning styles, decision styles, graphic versus verbal orientation). Individual differences can sometimes be accommodated by flexible systems or individually tailored support. Individual styles will be studied whenever possible to supplement the more general approach taken in Figure 1.7.

Using the organizing themes in context will prove necessary when we begin to cover the vast amount of knowledge needed for effective design. We need several sources of knowledge. One is basic knowledge drawn from the fields of ergonomics, cognitive and affective psychology, computer engineering, information systems, and the relevant domain of the applications (i.e., organizational work). The second source is design and implementation paradigms, which build on the basic knowledge. The TSSL view of HCI refers to user goals and their physical implementation. The resources for physical implementation are human and computer, hence the need for basic knowledge about human capabilities for information processing and about design possibilities for the computer system. Additionally, the context for understanding users’ goals requires basic knowledge of managerial work, decision making, and other various tasks. However, these three fields (user, IT, organizational context/task) are inadequate when treated in isolation. Designers need methodologies to apply this knowledge in an integrated fashion. They also need heuristics for thinking about the fit between task, user, and components of the human–computer interface because it is too complex to evaluate all possible design alternatives.

To sum up, our design philosophy is to develop the technology so as to achieve a good fit between the user, the task, and the technology, within a given context. Designers should strive to reduce the user’s expenditure of physical, cognitive, and affective resources and to enhance the user’s capabilities. In parallel, designers should think of the four interaction levels and an easy, almost transparent, movement from task to implementation. The upcoming chapters develop this design strategy as a sequence of steps that include defining information processing needs (e.g., memory), using predefined functions that computerized systems can provide (e.g., graphical displays of quantitative data), and matching the appropriate functions to the task (e.g., according to the type of decision-making task).

3. APPLICATION—A METHODOLOGY FOR HCI DEVELOPMENT

The foundational knowledge of the user, the computer, the task, and the organizational context is applied by pursuing a development methodology that is built around human concerns. The methodology revolves around a systems development life cycle that includes four phases: planning, analysis, design, and implementation. Each phase
includes several techniques that help meet four human concerns: physical, cognitive, affective, and usefulness. In particular, each phase includes evaluation techniques that encompass these four concerns. Together, the four concerns explain the user’s behavior and motivation and therefore serve as the basis for design and evaluation. While the physical, cognitive, and affective concerns reflect aspects intrinsic to the user, the fourth is determined by extrinsic motivation. In the organizational context, the extrinsic motivation is usually tied to performance and well-being. In the last chapters of the book, we expand the discussion to consider sociological, ethical, cultural, and global issues that broaden the scope of extrinsic motivation. The methodology shown in Figure 1.8 is explained in detail in Chapter 11 and briefly overviewed below.

The project selection and planning phase determines the organizational information needs. This first phase is usually general to the entire system being developed without special attention to HCI, unless the HCI needs determine the project’s feasibility. The second phase, analysis, involves several unique HCI techniques. Unlike many popular texts that first address HCI in the design phase, we believe that HCI considerations should start in the analysis stage to uncover user needs and opportunities. HCI analysis therefore begins by determining user requests and then validating them through user feedback. In addition, three major analyses are conducted: context, user, and task analyses. Context analysis determines the technical, environmental, and social settings of the human–computer interactions. User analysis identifies and characterizes the target users, referring to their demographic characteristics, job- or task-related factors, and anticipated use patterns of the target system. Task analysis determines how users meet their organizational goals and how they perform the tasks in terms of information processing, information needs, and representations.

Task analysis involves two types of tasks: organizational-level and tool-level. Using the concept of levels of interaction described above, organizational-level tasks are decomposed into tool-level tasks. Organizational-level tasks are defined in terms of what needs to be done to accomplish organizational goals (e.g., make a purchase order or find a new location for the organization). Tool-level tasks are accomplished by using a tool (the computer) (e.g., select a product from an online list). Task analysis progresses from the organizational-level tasks to the tool-level tasks. As part of the analyses, human constraints and special considerations are identified and serve as a basis for design. The results of the analysis form the HCI expectations of the target system, which are called evaluation metrics. Alternative design strategies can then be constructed and the most likely alternative selected for the next stage.

The design phase specifies the user interface on the basis of the analysis according to HCI principles and guidelines and tested against the evaluation metrics. The main techniques of this phase are interface specification and formative evaluations. Interface specification translates the tool-level tasks into their lower interaction levels: semantic, syntactic, and lexical designs (this follows the TSSL model discussed previously). It includes metaphor, media, dialogue, and presentation designs. Metaphor and visualization design determines appropriate metaphors to understand the system (e.g., using a shopping cart in e-stores). Media design selects the medium that best fits the information requirements, such as text, static images, dynamic images, and sound. Dialogue design determines the specific HCI components used (e.g., the use of menus, form fill-ins, natural languages, dialog boxes, and direct manipulation). Presentation design determines
Figure 1.8 The HCI development methodology.

Finally, the implementation stage makes the target system a reality. This includes coding, testing, and evaluating it to determine whether the completed system meets the user’s expectations. In this book, we do not cover the technical aspects of implementation. We assume that readers have the technical skills necessary to use prototyping tools in order to demonstrate their HCI development ideas and considerations.

4. THE STRUCTURE OF THE BOOK

The structure of the book follows the general discussions developed previously and, in particular, exemplifies the principle of informed design. In other words, design principles are based on theories of how people behave and interact with computers. The book has four parts: Context, Foundations, Application, and Additional Context. The overall structure is depicted in Figure 1.9. The first part (especially Chapter 2) explains the organizational context. Organizational and business systems, such as office systems and e-stores, rely on effective HCI in order to function and compete.

The second part lays the foundations of effective HCI development. Chapter 3 provides a concise description of basic interactive technologies currently employed...
in the development of effective systems. Next, we turn to understanding the human concerns from the physical, cognitive, and affective perspectives (Chapters 4, 5, and 6, respectively). These discussions correspond to the first three human concerns of HCI we overviewed earlier. For example, we discuss ergonomic designs of input/output devices, such as an ergonomic mouse, safe screens, and appropriate noise levels. In cognitive engineering, the designer may want to know the performance implications of the user’s limited capability to recall information (e.g., the maximum number of menu items that can be displayed simultaneously or the implications of the user’s imperfect memory on the provision of feedback to the user).

The third part of the book deals with the application of basic knowledge to the developmental process. The intent is not to provide a comprehensive list of design guidelines but to demonstrate how the foundations are applied to the design and use of representative technologies of interaction. The HCI development methodology described above integrates several elements that are detailed in separate chapters. Central to the development methodology is the evaluation of each phase, which is examined in Chapter 7. This chapter describes in detail the different HCI concerns and the specific methods for conducting evaluations. Chapter 8 deals with HCI design principles and guidelines on issues such as control, consistency, and the use of metaphors. These are applied during the analysis and design phases. Chapter 9 examines the central role of task analysis in HCI development, concentrating on organizational tasks. It complements the discussions of the organizational context (Chapter 2) by examining organizational tasks and their implications on user requirements. Furthermore, it shows how tasks are decomposed into the tool-level tasks that are then modeled by the TSSL levels of interaction. Chapter 10 continues the discussions in Chapter 9 on task analysis to show how specific designs enable the tool-level tasks. It describes several design components of the interfaces such as graphics, color, windows, screen layout, and forms. Finally, Chapter 11 describes in
detail the development methodology (Figure 1.8) that integrates the various components, principles and guidelines, and techniques to produce comprehensive HCI designs.

The fourth and last part of the book is designed to provoke thought beyond the organizational context as we described it into what we see as a rapidly changing world for HCI. Chapter 12 introduces relevant knowledge of relationships and collaboration in the organizational context. In organizations today, many tasks are performed as collaborative activities. Information systems must therefore support not only individual work with computers but also group and organization-wide work. For example, designs of computer systems that support collaboration and organization-wide work should rely on knowledge about how people interact, become aware of each other, share knowledge, make joint decisions, trust each other, and work as a team. Chapter 13 looks at the social and global aspects of HCI, which are becoming an important part of organizational life in the age of globalization and humane societies. Social aspects of HCI include the impacts of computerization and ethics as dimensions of designing HCI, and global aspects include international and intercultural considerations in HCI. Finally, Chapter 14 examines emerging changes and trends in both IT development and IT use and their implications for HCI design.

A few words about what this book does not do. This book does not provide a list of exhaustive guidelines on how to design HCI. Several books provide such lists, and they are listed in the bibliography. The book does describe in detail several HCI techniques, but this is to demonstrate how to apply the conceptual foundations to practical applications rather than to provide a recipe. Furthermore, the book concentrates on analysis and design issues and mentions only briefly issues of physical construction or implementation of interactive systems. Programming issues and User Interface Management Systems (UIMS) are raised only in the context of design issues. Usability issues constitute an important part of the book, but the management aspects of development, such as usability centers, are not discussed. Each chapter provides popular references and advanced readings on topics covered and those relevant but omitted for lack of space.

5. SUMMARY

This introductory chapter presents a view of HCI that will help organize the material in later chapters. Figure 1.9 shows the structure of the book, which has four parts: Context, Foundation, Application, and Additional Context. The main ideas to be developed further in the foundations are depicted concisely in Figures 1.4, 1.6, and 1.7. The notion of fit underlies many of the discussions, and the notion of levels of interaction—the task, semantic, syntactic, and lexical levels (TSSL)—provides a powerful concept that will appear in most chapters of this book. Furthermore, Figure 1.8 depicts the methodology that integrates the application chapters. Thus, the book can move logically through these various sections and provide the student with an understanding of HCI concepts that is grounded in theory and reinforced by concrete examples.

Below is a list of concepts covered in this chapter. These concepts will be used and developed further in later chapters. The bibliography includes a list of other texts on HCI. It also includes advanced readings on specific topics so as to provide
researchers with some leads into advanced research topics. This practice will be repeated in each chapter. Additionally, we list several resources that may become useful as we progress. These include journals that provide not only new technologies and techniques but also new evidence on the impact of HCI designs. Similarly, academic and professional firms publish activities that will be of interest to students thinking of research or practice in the area of HCI.

6. SUMMARY OF CONCEPTS AND TERMS

- Multilayer activity model (the TSSL model)
- HCI development methodology
- Performance
- Usability
- Fit

User activity
Context of HCI
Human resources in HCI
Human concerns of HCI
Well-being

7. BIBLIOGRAPHY AND ADDITIONAL READINGS


Chapter 1  Introduction

7.1 Academic Journals That Frequently Publish HCI Studies (Broadly Defined):

ACM Interactions  
http://www.acm.org/interactions/

ACM Transactions on Computer-Human Interaction (ACM TOCHI)  
http://www.acm.org/tochi/

Behaviour and Information Technology (BIT)  
http://www.tandf.co.uk/journals/tf/0144929X.html

Communications of the ACM (CACM)  
http://www.acm.org/cacm/

Communication of the Association for Information Systems (CAIS)  
http://cais.isworld.org/

Computers in Human Behavior (CHB)  
http://www.elsevier.com/locate/issn/07475632

Computer Supported Cooperative Work (CSCW)  
http://www.springerlink.com/(search CSSW)

Human-Computer Interaction  
http://hci-journal.com/

Information Systems Research (ISR)  
http://isr.katz.pitt.edu/

International Journal of Human-Computer Interaction (IJHCI)  
http://www.leaonlin.com/loi/ijhc

International Journal of Human-Computer Studies (IJHCS)  
http://www.academicpress.com/www/journal/hc/h.htm

Interacting with Computers (IwC)  
http://www.elsevier.com/locate/intcom

Information & Management (I&M)  
http://www.elsevier.com/homepage/sae/orms/infnman/menu.htm

Journal of AIS  
http://jais.isworld.org/

Journal of Management Information Systems (JMIS)  
http://jmis.bentley.edu/

Management Information Systems Quarterly (MISQ)  
http://www.misq.org

7.2 Academic Associations with HCI Focus or Special Interest Group:

ACM SIG/CHI  
http://www.acm.org/sig (Association of Computing Machinery)

AIS SIGHCI  
http://sigs.aisnet.org/SIGHCI/ (Association of Information Systems)

ASIST SIG/HCI  
http://www.asis.org/SIG/SIGHCI/sighci.html (Association of Information Science)

HFES  
http://www.hfes.org (Human Factors and Ergonomics Society)

BCS  
http://www.bcs.org.uk (British Computer Society)

7.3 Professional HCI-Related Associations and Companies:

Usability Professional Association  
http://www.upassoc.org

IBM’s User Interfaces Research  
http://www.research.microsoft.com/research/ui/

User Experience Network  
http://www.uxnet.org/

User Interface Engineering  
http://www.uie.com/
8. CASE STUDY

The following section introduces a case study that runs through the entire book. This example uses an e-Shop development project to illustrate the incorporation of HCI guidelines, principles, and development into a commercial Web site.

World Gourmet Setting

Majorca Fleming has a small imported-food shop in a small town in Illinois. Her shop is called “World Gourmet.” Recently she has been thinking about finding someone to create a Web site to sell her products. She imports products from all over the world in small lots. This approach makes her freight costs quite high and requires her to add a hefty markup to the items she sells. She would like to order larger quantities and save on delivery costs.

Requirements

There is a local company that builds, hosts, and maintains Web sites. She has seen their work and feels that they can produce an adequate Web site for her. She has met with the designer several times and decided on the following requirements for her Web site:

- Clear navigation through product category is a must-have feature.
- Consistent formats from page to page are important.
- Third-party payment transactions will be contracted with a secure and trusted e-payment vendor.
- The product information will be stored in a database from which the records will be read to populate the product Web pages.
- The customers will fill out forms with their essential information. The forms will write customer records and sales transactions to a database.
- The system should be able to identify a repeat customer and tailor some suggested products based on past purchases.
- Customers should be able to get a response from the Web master or the owner within 24 hours of submitting an inquiry.

Each of the remaining chapters in the book will use this running case study to illustrate the concepts introduced in the chapter. Chapter 2, for example, will use the running case study to illustrate HCI issues in the small-business context.

9. EXERCISES

Ex. 1. Where can you find HCI?
Ex. 2. Why is it important to study HCI?
Ex. 3. Design a simple online bio for the class, and write a report about your design.

The objectives of this assignment are (1) for you to experience some design issues and intuitive justifications (uninformed) and (2) for the professor, the TA, and your fellow classmates to get to know you so that groups can be formed later.

In your written report, write down any criteria or considerations you may have when designing your bio page. This includes even tiny decisions you made such as use of colors, icons, font sizes, positions of different parts, requiring or not requiring scrolling, using or not using frames, and so on.

Ex. 4. Explain what the TSSL model is. Use examples to illustrate the different levels of concerns and how they connect to each other.