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| **Module II The User Interface Design Process** |
| **Obstacles and Pitfalls in the Development Path** |
| Nobody ever gets it right the first time.  Development is chock-full of surprises.  Good design requires living in a sea of changes.  Making contracts to ignore change will never eliminate the need for change.  Even if you have made the best system humanly possible, people will still make mistakes when using it.  Designers need good tools.  You must have behavioral design goals like performance design goals. |
| **Usability** |
| **Introduction** |
| Bennett (1979) was the first to use the term usability to describe the effectiveness of human performance. In the following years a more formal definition was proposed by Shackel (1981) and modified by Bennett (1984). Finally, Shackel (1991) simply defined usability as “the capability to be used by humans easily and effectively, where,  easily = to a specified level of subjective assessment,  effectively = to a specified level of human performance |
| **Mandel (1994) lists the 10 most common usability problems in graphical systems as reported by IBM usability specialists**. |
| They are |
| 1. Ambiguous menus and icons.  2. Languages that permit only single-direction movement through a system.  3. Input and direct manipulation limits.  4. Highlighting and selection limitations.  5. Unclear step sequences.  6. More steps to manage the interface than to perform tasks.  7. Complex linkage between and within applications.  8. Inadequate feedback and confirmation.  9. Lack of system anticipation and intelligence.  10. Inadequate error messages, help, tutorials, and documentation. |
| **The Five Commandments that should be followed while designing for people** |
| **(i) Gain a complete understanding of users and their tasks** |
| The users are the customers. People expect a level of design sophistication from all interfaces, including Web sites. The product, system or Web site must be geared to people’s needs, not those of the developers. A wide gap in technical abilities, goals, and attitudes often exists between users and developers. A failure to understand the differences will doom a product or system to failure. |
| (ii) **Solicit early and ongoing user involvement** |
| Involving the users in design from the beginning provides a direct conduit to the knowledge they possess about jobs, tasks, and needs. Involvement also allows the developer to confront a person’s resistance to change, a common human trait. Involvement in design removes the unknown and gives the user a stake in the system or identification with it. |
| (iii) **Perform rapid prototyping and testing** |
| Prototyping and testing the product will quickly identify problems and allow you to develop solutions. The design process is complex and human behavior is still not well understood Prototyping and testing must be continually performed during all stages of development to uncover all potential de |
| (iv) **Modify and iterate the design as much as necessary** |
| While design will proceed through a series of stages, problems detected in one stage may force the developer to revisit a previous stage. |
| **(v)Integrate the design of all the system components** |
| The software, the documentation, the help function, and training needs are all important elements of a graphical system or Web site and all should be developed concurrently. A system is being constructed, not simply software. Concurrent development of all pieces will point out possible problems earlier in the design process, allowing them to be more effectively addressed. |
| **Important Human Characteristics in Design** |
| **1)Perception** |
| Perception is our awareness and understanding of the elements and objects of our environment  through the physical sensation of our various senses, including sight, sound, smell, and so forth. Perception is influenced, in part, by experience. |
| **Other perception characteristics** |
| **Proximity**. Our eyes and mind see objects as belonging together if they are near each other in space.  **Similarity**. Our eyes and mind see objects as belonging together if they share a common visual property, such as color, size, shape, brightness, or orientation.  **Matching patterns.** We respond similarly to the same shape in different sizes. The letters of the alphabet, for example, possess the same meaning, regardless of physical size.  **Succinctness.** We see an object as having some perfect or simple shape because perfection or simplicity is easier to remember.  **Closure.** Our perception is synthetic; it establishes meaningful wholes. If something does not quite close itself, such as a circle, square, triangle, or word, we see it as closed anyway.  **Unity.** Objects that form closed shapes are perceived as a group.  **Balance.** We desire stabilization or equilibrium in our viewing environment. Vertical, horizontal, and right angles are the most visually satisfying and easiest to look at.  **Expectancies.** Perception is also influenced by expectancies; sometimes we perceive not what is there but what we expect to be there. Missing a spelling mistake in proofreading something we write is often an example of a perceptual expectancy error; we see not how a word *is* spelled, but how we *expect* to see it spelled.  **Context.** Context, environment, and surroundings also influence individual perception For example, two drawn lines of the same length may look the same lengthor different lengths, depending on the angle of adjacent lines or what other peoplehave said about the size of the lines.  **Signals versus noise.** Our sensing mechanisms are bombarded by many stimuli,some of which are important and some of which are not. Important stimuli arecalled signals; those that are not important or unwanted are called noise. Signals are more quickly comprehended if they are easily distinguishable from noise inour sensory environment |
| **2) Memory** |
| Memory is not the most stable of human attributes, as anyone who has forgotten why they walked into a room, or forgotten a very important birthday, can attest. Today, memory is viewed as consisting of two components, long-term and short-term (or working) memory. |
| 3) **Sensory Storage** |
| Sensory storage is the buffer where the automatic processing of information collected from our senses takes place. It is an unconscious process, large, attentive to the environment, quick to detect changes, and constantly being replaced by newly gathered stimuli. In a sense, it acts like radar, constantly scanning the environment for things that are important to pass on to higher memory. |
| 4) **Visual Acuity** |
| The capacity of the eye to resolve details is called *visual acuity*. It is the phenomenon that results in an object becoming more distinct as we turn our eyes toward it and rapidly losing distinctness as we turn our eyes away—that is, as the visual angle from the point of fixation increases. It has been shown that relative visual acuity is approximately halved at a distance of 2.5 degrees from the point of eye fixation (Bouma, 1970).Therefore, a five-degree diameter circle centered around an eye fixation character on a  display has been recommended as the area near that character (Tullis, 1983) or the maximum length for a displayed word (Danchak, 1976)  3213123  54321212345  6543211123456  765432101234567  6543211123456  54321212345  3213123  **Figure 1.1** Size of area of optimum visual acuity on a screen. |
| 5) **Foveal and Peripheral Vision** |
| Foveal vision is used to focus directly on something; peripheral vision senses anything in the area surrounding the location we are looking at, but what is there cannot be clearly resolved because of the limitations in visual acuity just described. Foveal and peripheral vision maintain, at the same time, a cooperative and a competitive relationship. Peripheral vision can aid a visual search, but can also be distracting. In its cooperative nature, peripheral vision is thought to provide clues to where the eye should go next in the visual search of a screen. Patterns, shapes, and alignments peripherally visible can guide the eye in a systematic way through a screen. |
| 6) **Information Processing** |
| The information that our senses collect that is deemed important enough to do something about then has to be processed in some meaningful way. Recent thinking (Lind, Johnson, and Sandblad, 1992) is that there are two levels of information processing going on within us. One level, the highest level, is identified with consciousness and working memory. It is limited, slow, and sequential, and is used for reading and understanding. |
| 7) **Mental Models** |
| As a result of our experiences and culture, we develop mental models of things and people we interact with. A mental model is simply an internal representation of a person’s current understanding of something. Usually a person cannot describe this mental mode and most often is unaware it even exists. Mental models are gradually developed in order to understand something, explain things, make decisions, do something, or interact with another person. Mental models also enable a person to predict the actions necessary to do things if the action has been forgotten or has not yet been encountered. |
| 8) **Movement Control** |
| Once data has been perceived and an appropriate action decided upon, a response must be made; in many cases the response is a movement. In computer systems, movements include such activities as pressing keyboard keys, moving the screen pointer by pushing a mouse or rotating a trackball, or clicking a mouse button. |
| **9) Learning** |
| Learning, as has been said, is the process of encoding in long-term memory information that is contained in short-term memory. It is a complex process requiring some effort on our part. Our ability to learn is important—it clearly differentiates people from machines. Given enough time people can improve their performance in almost any task. Too often, however, designers use our learning ability as an excuse to justify complex design. Because people can be taught to walk a tightrope is no excuse for incorporating  Tightropes in a design when walkways are feasible. |
| 10) **Skill** |
| The goal of human performance is to perform skillfully. To do so requires linking inputs and responses into a sequence of action. The essence of skill is performance of actions or movements in the correct time sequence with adequate precision. It is characterized by consistency and economy of effort. Economy of effort is achieved by establishing a work pace that represents optimum efficiency. It is accomplished by increasing mastery of the system through such things as progressive learning of shortcuts, increased speed, and easier access to information or data. |
| 11) **Individual Differences** |
| In reality, there is no average user. A complicating but very advantageous human characteristics that we all differ—in looks, feelings, motor abilities, intellectual abilities, learning abilities and speed, and so on. In a keyboard data entry task, for example, the best typists will probably be twice as fast as the poorest and make 10 times fewer errors. Individual differences complicate design because the design must permit people with widely varying characteristics to satisfactorily and comfortably learn the task or job, or use the Web site |
| Human considerations in design |
| **Table 1.1** Important User/Task Considerations |
| Computer Literacy Highly technical or experienced, moderate computer experience, or none.  System Experience High, moderate, or low knowledge of a particular system and its methods of interaction. Application Experience High, moderate, or low knowledge of similar systems. Task Experience Level of knowledge of job and job tasks. Other Systems Use Frequent or infrequent use of other systems in doing job. Education High school, college, or advanced degree. Reading Level Less than 5th grade, 5th–12th, more than 12th grade.  Typing Skill Expert (135 WPM), skilled (90 WPM), good (55 WPM), average  (40 WPM), or "hunt and peck" (10 WPM).  Native Language or Culture English, another, or several ASK/NEED  Type of System Use Mandatory or discretionary use of the system.  Frequency of Use Continual, frequent, occasional, or once-in-a-lifetime use of system.  Task or Need Importance High, moderate, or low importance of the task being performed.  Task Structure Repetitiveness or predictability of tasks being automated, high, moderate, or low.  Social Interactions Verbal communication with another person required or not required.  Primary Training Extensive or formal training, self-training through manuals, or no training.  Turnover Rate High, moderate, or low turnover rate for jobholders.  Job Category Executive, manager, professional, secretary, clerk.  Lifestyle For Web e-commerce systems, includes hobbies, recreational pursuits, and economic status.  PSYHOLOGICAL CHARACTERISTICS  Attitude Positive, neutral, or negative feeling toward job or system.  Motivation Low, moderate, or high due to interest or fear.  Patience or impatience expected in accomplishing goal.  Expectations Kinds and reasonableness.  Stress Level High, some, or no stress generally resulting from task performance.  Cognitive Style Verbal or spatial, analytic or intuitive, concrete or abstract SICAL CHARACTERISTICS  Age Young, middle aged, or elderly.  Gender Male or female.  Handedness Left, right, or ambidextrous.  Disabilities Blind, defective vision, deafness, motor handicap.  Derived from Mayhew, 1992 |
| **Human Interaction Speeds** |
| The speed at which people can perform using various communication methods has been studied by a number of researchers. The following, as summarized by Bailey (2000), have been found to be typical interaction speeds for various tasks. These speeds are also summarized in Table 1.3. |
| **Table 1.3** Average Human Interaction Speeds |
| **Reading** |
| **Prose text**: 250–300 words per minute.  **Proofreading text on paper:** 200 words per minute.  **Proofreading text on a monitor**: 180 words per minute |
| **Listening:** |
| **Speaking to a computer**: 105 words per minute.  **After recognition corrections**: 25 words per minute. |
| **Keying** |
| **Typewriter**  **Fast typist**: 150 words per minute and higher.  **Average typist**: 60–70 words per minute.  **Computer**  **Transcription:** 33 words per minute.  **Composition:** 19 words per minute.  **Two finger typists**  **Memorized text:** 37 words per minute.  **Copying text:** 27 words per minute |
| **Hand printing**  Memorized text: 31 words per minute.  Copying text: 22 words per minute. |
| **Listening.** |
| Words can be comfortably heard and understood at a rate of 150 to 160 words per minute. This is generally the recommended rate for audio books and video narration (Williams, 1998). Omoigui, et al, (1999) did find, however, that when normal speech is speeded up using compression, a speed of 210 words per minute results in no loss of comprehension. |
| **Speaking** |
| Dictating to a computer occurs at a rate of about 105 words per minute (Karat, et al., 1999; Lewis, 1999). Speech recognizer misrecognitions often occur, however, and when word correction times are factored in, the speed drops significantly, to an average of 25 words per minute. Karat, et al. (1999) also found that the speaking rate of new users was 14 words per minute during transcription and 8 words per minute during composition. |
| **Keying** |
| Fast typewriter typists can key at rates of 150 words per minute and higher.  Average typing speed is considered to be about 60–70 words per minute. Computer keying has been found to be much slower, however. Speed for simple transcription found by Karat, et al. (1999) was only 33 words per minute and for composition only 19 words per minute. In this study, the fastest typists typed at only 40 words per minute, the slowest at 23 words per minute. Brown (1988) re-ports that two-finger typists can key memorized text at 37 words per minute and copied text at 27 words per minute. Something about the computer, its software, and the keyboard does seem to significantly degrade the keying process. (And two-finger typists are not really that bad off after all.) |
| **Hand printing** |
| People hand print memorized text at about 31 words per minute. Text is copied at about 22 words per minute (Brown, 1988). |
| **Some Practical Measures of Usability** |
| **(i)Are people asking a lot of questions or often reaching for a manual?** |
| Many questions or frequent glances at manuals are signs that things are not as clear and intuitive  as they should be. When in doubt, the first reaction of many people is to ask someone for assistance. When no one is around, then we look in a manual. |
| (ii) Their frequency, and loudness, may foretell a strong rejection of a product. The absence of exasperation, however, may not represent acceptance. Some people are not as expressive in their language, or are better able to smother their feelings. |
| (iii) **Are there many irrelevant actions being performed?** |
| Are people doing things the hard way? Are there incidental actions required for, but not directly related to, doing a job? These include excessive mouse clicks or keyboard strokes to accomplish something, or going through many operations to find the right page in a manual or the right window or page display. |
| **(iv)Are there many things to ignore?** |
| Are there many elements on the screen that the user must disregard? Are there many “doesn’t pertain to me” items? If so, remember, they still consume a portion of a person’s visual or information processing  Capacities, detracting from the capacities a person could devote to relevant things. |
| **(v)Do a number of people want to use the product?** |
| None of us goes out of our way to make our own lives more difficult. (Unfortunately, other people may, however.) We tend to gravitate to things easy to work with or do. If a lot of people want to use it, it probably has a higher usability score. Attitudes may be a very powerful factor in a system’s or Web site’s acceptance. |
| **Some Objective Measures of Usability** |
| Shackel (1991) presents the following more objective criteria for measuring usability. |
| **(i)How effective is the interface? Can the required range of tasks be accomplished:** |
| At better than some required level of performance (for example, in terms of speed and errors)? By some required percentage of the specified target range of users?  Within some required proportion of the range of usage environments? |
| **(ii) How learnable is the interface? Can the interface be learned** |
| Within some specified time from commissioning and start of user training?  Based on some specified amount of training and user support?  Within some specified relearning time each time for intermittent users? |
| **(iii) How flexible is the interface? Is it flexible enough to** |
| Allow some specified percentage variation in tasks and/or environments beyond those first specified? |
| **(iv)What are the attitudes of the users? Are they** |
| Within acceptable levels of human cost in terms of tiredness, discomfort, frustration, and personal effort? Such that satisfaction causes continued and enhanced usage of the system? |
| **The Design Team** |
| Provide a balanced design team, including specialists in |
| Development  Human factors  Visual design  Usability assessment  Documentation and Training |
| Effective design and development requires the application of very diverse talents. No one person possesses all the skills to perform all the necessary tasks; the best that can be hoped for is that one person may possess a couple of skills. A balanced design team with very different talents must be established. Needed are specialists in development to define requirements and write the software, human factors specialists to define behavioral requirements and apply behavioral considerations, and people with good visual design skills. Also needed are people skilled in testing and usability assessment, documentation specialists, and training specialists Also, select team members who can effectively work and communicate with one another. To optimize communication, locate the team members in close proximity to one another. |
| **Understanding The Business Functions** |
| **Introduction** |
| A thorough understanding of the user has been obtained, and the focus now shifts tothe business function being addressed. Requirements must be determined and user activities being performed must be described through task analysis. From these, a conceptualmodel of the system will be formulated. Design standards must also be created(if not already available), usability goals established, and training and documentationneeds determined. |
| **The general steps to be performed are** |
| Perform a business definition and requirements analysis.  Determine basic business functions.  Describe current activities through task analysis.  Develop a conceptual model of the system.  Establish design standards or style guides.  Establish system usability design goals.  Define training and documentation needs. |
| **Some Techniques for Determining Requirements** |
| **Direct Methods** |
| **(i) Individual Face-to-Face Interview** |
| A one-on-one visit with the user to obtain information. It may be structured or somewhat open-ended |
| **(ii) Telephone Interview or Survey** |
| A structured interview conducted via telephone |
| **(iii) Traditional Focus Group** |
| A small group of users and a moderator brought together to verbally discuss the requirements |
| **(iv) Facilitated Team Workshop** |
| A facilitated, structured workshop held with users to obtain requirements information. Similar to the |
| **(v) Observational Field Study** |
| Users are observed and monitored for an extended time to learn what they do |
| **(vi) Requirements Prototyping** |
| A demo, or very early prototype, is presented to users for comments concerning functionality |
| **(vii)User-Interface Prototyping** |
| A demo, or early prototype, is presented to users to uncover user-interface issues and problems |
| **(viii) Usability Laboratory Testing** |
| Users at work are observed, evaluated, and measured in a specially constructed laboratory |
| **(ix)Card Sorting for Web Sites** |
| A technique to establish groupings of information for Web sites. |
| **Indirect Methods** |
| **(i)MIS Intermediary** A company representative defines the user’s goals and needs to designers and developers. |
| **(ii)Paper Survey or Questionnaire** A survey or questionnaire is administered to a sample of users using traditional mail methods to obtain their needs |
| **(iii) Electronic Survey or Questionnaire** A survey or questionnaire is administered to a sample of users using e-mail or the Web to obtain their needs |
| **(iv) Electronic Focus Group** A small group of users and a moderator discuss the requirements online using workstations |
| **(v) Marketing and Sales** Company representatives who regularly meet customers obtain suggestions orneeds current and potential |
| **(vi)Support Line Information** collected by the unit that helps customers with day-to-day problems is  Analyzed (Customer Support, Technical Support, Help Desk, etc.) |
| **(vii) E-Mail or Bulletin Board** Problems, questions, and suggestions from users posted to a bulletin board or through e-mail are analyzed |
| **(viii) User Group** Improvements are suggested by customer groups who convene periodically to discuss software usage |
| **(ix) Competitor Analyses** A review of competitor’s products or Web sites is used to gather ideas, uncoverdesign requirements and identify tasks |
| **(x) Trade Show** Customers at a trade show are presented a mock-up or prototype and asked for  comments |
| **(xi) Other Media Analysis** An analysis of how other media, print or broadcast, present the process, information or subject matter of interest |
| **(xii) System Testing** |
| New requirements and feedback are obtained from ongoing product testing |
| **Indirect Methods** |
| **(i) Electronic Survey or Questionnaire** |
| Determine the survey objectives.  Determine where you will find the people to complete the survey.  Create a mix of multiple choice and open-ended questions requiring short answersaddressing the survey objectives.  Keep it short, about 10 items or less is preferable.  Keep it simple, requiring no more than 5–10 minutes to complete |
| **(ii)Electronic Focus Group Similar** |
| An electronic focus group is similar to a traditional focus group except that the discussionis accomplished electronically using specialized software on a workstation, e-mail,or a Web site. As with the direct methods, the opportunity to immediately follow up onvague or incomplete data exists. All comments, ideas, and suggestions are available inhard-copy form for easier analysis. Specialized software can provide ratings or rankingsof items presented in lists, a task requiring much more effort in a traditional focusgroup. |
| (iii) **Marketing and Sales** |
| Company representatives who regularly meet customers obtain suggestions or needs, current and potential. This information is collected inexpensively, since the representative is going to visit the company anyway. Business representatives do have knowledge of the nature of customers, the business, and the needs that have to be met. |
| (iii) **Support Line** |
| Information is collected by the unit that helps customers with day-to-day problems (Customer Support, Technical Support, Help Desk, and so on). This is fairly inexpensive and the target user audience is correct. The focus of this method is usually only on problems, however. |
| **a) E-Mail, Bulletin Boards or Guest Book** Problems, questions, and suggestions by users posted to a bulletin board, a guest book, or through e-mail are gathered and evaluated. |
| **b) User Group** Improvements suggested by customer groups who convene periodically to discuss system and software usage are evaluated. |
| **c) Competitor Analysis** Reviews of competitor’s products, or Web sites, can also be used to gather ideas, uncover design requirements, and identify tasks |
| **d)Trade Show** Customers at a trade show can be exposed to a mock-up or prototype and asked for  comments |
| **e) Other Media Analysis**Analyze how other media, print or broadcast, present the process, information, or subject matter of interest Findings can be used to gather ideas, uncover design requirements, and identify better ways to accomplish or show something. |
| **f) System Testing** New requirements and feedback stemming from ongoing system testing can be accumulated,evaluated, and implemented as necessary. |

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| **Human Considerations in Screen Design** |
| **Introduction** |
| A well-designed screen |
| Reflects the capabilities, needs, and tasks of its users.  Is developed within the physical constraints imposed by the hardware on whichit is displayed.  Effectively utilizes the capabilities of its controlling software.  Achieves the business objectives of the system for which it is designed |
| To accomplish these goals, the designer must first understand the principles of goodscreen design. What follows is an extensive compilation of general screen design guidelinesfor the user interface. It begins with a detailed series of guidelines dealing withuser considerations, including the test for a good design, organizing screen elements,screen navigation and flow, visually pleasing composition, typography, and reading,browsing, and searching on the Web. The step concludes with considerations imposedby a system’s hardware and software. |
| Use of a screen, and a system, is affected by many factors. These include: how much informationis presented on a screen, how a screen is organized, the language used on thescreen, the distinctiveness of the screen’s components, its aesthetics, and a screen’sconsistency with other screens. First, let’s look at what aspects of poor screen designcan be distracting to the user, what a user is looking for in good design, and the kinds of things screen users do interacting with a system or Web site. Then, we’ll address theprinciples of good design. |
| **Poor design Aspects that Distract the Screen User** |
| **(i)Unclear captions and badly worded questions.** These cause hesitation, and rereading, in order to determine what is needed or must be provided. They may also be interpreted incorrectly, causing errors.  **(ii)Improper type and graphic emphasis**. Important elements are hidden. Emphasis is drawn away from what is important to that which is not important.  **(iii)Misleading headings**. These also create confusion and inhibit one’s ability to see existing relationships.  **(iv)Information requests perceived to be irrelevant or unnecessary**. The value of what one is doing is questioned, as is the value of the system.  **(v)Information requests** that require one to backtrack and rethink a previous answer, or look ahead to determine possible context. Inefficiency results, and mistakes increase.  **(vi)Cluttered, cramped layout**Poor layout creates a bad initial impact and leads to more errors. It may easily cause system rejection.  **(vii)Poor quality of presentation,** legibility, appearance, and arrangement. Again, this degrades performance, slowing the user down and causing more errors. |
| **The most common problems in visual interface design are:** |
| Visual inconsistency in screen detail presentation and with the operating system.  Lack of restraint in the use of design features and elements.  Overuse of three-dimensional presentations.  Overuse of too many bright colors.  Poorly designed icons.  Bad typography  Metaphors that are either overbearing or too cute, or too literal thereby restrictingdesign options. |
| **Distractions with respect to Web Screens** |
| Numerous visual and auditory interruptions.  Extensive visual clutter  Poor information readability.  Incomprehensible screen components.  Confusing and inefficient navigation.  Inefficient operations and extensive waste of user time.  Excessive or inefficient page scrolling.  Information overload.  Design inconsistency.  Outdated information.  Stale design caused by emulation of printed documents and past systems.  Poor design is not a new phenomenon. It has existed since people began interacting |
| To conclude Poor design is not a new phenomenon. It has existed since people began interactingwith media used for presenting and collecting information. |
| **What Screen Users Want** |
| An orderly, clean, clutter-free appearance.  An obvious indication of what is being shown and what should be done with it.  Expected information located where it should be.  A clear indication of what relates to what, including options, headings, captions,data, and so forth.  Plain, simple English.  A simple way of finding out what is in a system and how to get it out.  A clear indication of when an action can make a permanent change in the data or system |
| To conclude The desired direction is toward simplicity, clarity, and understandability—qualitieslacking in many of today’s screens. |
| **What Screen Users Do** |
| **1. Identifies a task to be performed or need to be fulfilled. Th**e task may be verystructured, including activities such as: enter this data from this form into the system,answer a specific question regarding the status of an order, or collect the necessaryinformation from a customer to make a reservation. Alternatively, the taskmay have some structure but also include more free-form activities, including answering questions such as: what is the best local rehabilitation program inwhich to enroll my client, or what are my customer’s exact needs and then whichof our products features are best suited for him or her. Finally, the need may bevery general or even vague. Where should I take an exotic vacation near a beautifulbeach? Where can I get the best price on a new PC? |
| **2. Decides how the task will be completed or the need fulfilled.** For a structuredor semi-structured task a set of transaction screens will be available. The propertransaction is identified and the relevant screen series retrieved. To satisfy a generalor vague need will require browsing or searching through screens that mightpossibly have relevance. |
| **3. Manipulates the computer’s controls.** To perform the task or satisfy the need,the keyboard, mouse, and other similar devices are used to select choices fromlists, choose commands to be performed, key data into text boxes, and so forth. |
| **Determining Basic Business Functions** |
| A detailed description of what the product will do is prepared. Major system functions are listed and described, including critical system inputs and outputs. A flowchart of major functions is developed |
| **The process the developer will use to determine the basic business functions is summarized as follows** |
| Gain a complete understanding of the user’s mental model based upon the user’s needs and the user’s profile and the user task analysis |
| Develop a conceptual model of the system based upon the user’s mental model which includes defining objects and Developing metaphors |
| **Understanding the User’s Mental Model** |
| The next phase in interface design is to thoroughly describe the expected system user or users and their current tasks. The former will be derived from the kinds of information collected in Step 1 “Understand the User or Client,” and the requirements analysis techniques described above. A goal of task analysis, and a goal of understanding the user, is to gain a picture of the user’s mental model. A mental model is an internal representation of a person’s current conceptualization and understanding of something.  Mental models are gradually developed in order to understand, explain, and do something. Mental models enable a person to predict the actions necessary to do things if the actions have been forgotten or have not yet been encountered. |
| **Performing a Task Analysis** |
| User activities are precisely described in a task analysis. Task analysis involves breaking down the user’s activities to the individual task level. The goal is to obtain an understanding of why and how people currently do the things that will be automated. Knowing why establishes the major work goals; knowing how provides details of actions performed to accomplish these goals. Task analysis also provides information concerning workflows, the interrelationships between people, objects, and actions, and the user’s conceptual frameworks. The output of a task analysis is a complete description of all user tasks and interactions. |
| Work activities are studied and/or described by users using the techniques just reviewed; direct observation, interviews, questionnaires, or obtaining measurements of actual current system usage. Measurements, for example, may be obtained for the frequency with which tasks are performed or the number of errors that are made. |
| One result of a task analysis is a listing of the user’s current tasks. This list should be well documented and maintained. Changes in task requirements can then be easily incorporated as design iteration occurs. Another result is a list of objects the users see as important to what they do. The objects can be sorted into the following categories: |
| Concrete objects—things that can be touched.  People who are the object of sentences—normally organization employees, customers, for example.  Forms or journals—things that keep track of information.  People who are the subject of sentences—normally the users of a system.  Abstract objects—anything not included above. |
| **Developing Conceptual Models** |
| The output of the task analysis is the creation, by the designer, of a conceptual model for the user interface. A conceptual model is the general conceptual framework through which the system’s functions are presented. Such a model describes how the interface will present objects, the relationships between objects, the properties of objects, and the actions that will be performed. A conceptual model is based on the user’s mental model. Since the term mental model refers to a person’s current level of knowledge about something, people will *always* have them. Since mental models are influenced by a person’s experiences, and people have different experiences, no two user mental models are likely to be exactly the same. Each person looks at the interface from a slightly different perspective |
| The goal of the designer is to facilitate for the user the development of useful mental model of the system. This is accomplished by presenting to the user a meaningful conceptual model of the system. When the user then encounters the system, his or her existing mental model will, hopefully, mesh well with the system’s conceptual model. As a person works with a system, he or she then develops a mental model of the system. The system mental model the user derives is based upon system’s behavior, including factors such as the system inputs, actions, outputs (including screens and messages), and its feedback and guidance characteristics, all of which are components of the conceptual model. Documentation and training also play a formative role. Mental models will be developed regardless of the particular design of a system, and then they will be modified with experience. What must be avoided in design is creating for the user a conceptual model that leads to the creation of a false mental model of the system, or that inhibits the user from creating a meaningful or efficient mental model. |
| **Guidelines for Designing Conceptual Models** |
| Reflect the user’s mental model, not the designer’s.  Draw physical analogies or present metaphors.  Comply with expectancies, habits, routines, and stereotypes.  Provide action-response compatibility.  Make invisible parts and process of a system visible.  Provide proper and correct feedback.  Avoid anything unnecessary or irrelevant.  Provide design consistency.  Provide documentation and a help system that will reinforce the conceptual model.  Promote the development of both novice and expert mental models. |
| **Reflect the user’s mental model, not the designer’s** |
| A user will have different expectations and levels of knowledge than the designer. So, the mental models of the user and designer will be different. The user is concerned with the task to be performed, the business objectives that must be fulfilled. The designer’s model is focused on the design of the interface, the kinds of objects, the interaction methods, and the visual representations on the screen. Objects must be defined, along with their relationships, behaviors, and properties. Interaction methods must also be defined, such as input mechanisms, interaction techniques, and the contents of menus. Visual screen representations must also be created, including functionality and appearance. |
| **Draw physical analogies or present metaphors** |
| Replicate what is familiar and well known. Duplicate actions that are already well learned. The success of graphical systems can be attributed, in part, to their employing the desktop metaphor. A metaphor, to be effective, must be widely applicable within an interface. Metaphors that are only partially or occasionally applicable should not be used. In the event that a metaphor cannot be explicitly employed in a new interface, structure the new interface in terms of familiar aspects from the manual world |
| **Comply with expectancies, habits, routines, and stereotypes** |
| Create a system that builds on knowledge, habits, routines, and expectancies that already exist. Use familiar associations, avoiding the new and unfamiliar. With color, for example, accepted meanings for red, yellow, and green are already well established. Use words and symbols in their customary ways. Replicate the language of the user, and create icons reflecting already known images. |
| **Provide action-response compatibility** |
| All system responses should be compatible with the actions that elicit them. Names of commands, for example, should reflect the actions that will occur. The organization of keys in documentation or help  screens should reflect the ordering that actually exists on the keyboard. |
| **Make invisible parts of the system visible**. |
| Systems are composed of parts and processes, many of which are invisible to the user. In creating a mental model, a person must make a hypothesis about what is invisible and how it relates to what is visible. New users of a system often make erroneous or incomplete assumptions about what is invisible and develop a faulty mental model. As more experience is gained, their mental models evolve to become more accurate and complete. Making invisible parts of a system visible will speed up the process of developing correct mental models |
| An example of a process being made visible can be illustrated by moving a document between files. In a command language interface, the document must be moved through a series of typed commands. The file is moved invisibly, and the user assumes correctly, unless an error message is received. In a graphical direct manipulation system, the entire process is visible, with the user literally picking up the file in one folder by clicking on it, and dragging it to another folder. |
| **Provide Proper and Correct Feedback** |
| Be generous in providing feedback. Keep a person informed of what is happening, and what has happened, at all times, including: |
| **Provide a continuous indication of status** |
| Mental models are difficult to develop if things happen, or are completed, unknown to the user. During long processing sequences, for example, interim status messages such as loading, “opening . . .” or “searching . . .” reassure the user and enable him or her to understand internal processes and more accurately predict how long something will take. Such messages also permit the pinpointing of problems if they occur. |
| **Provide visible results of actions** |
| For example, highlight selected objects, display new locations of moved objects, and show files that are closed |
| **Display actions in progress** |
| For example, show a window that is being changed in size actually changing, not simply the window in its changed form. This will strengthen cause-and-effect relationships in the mental model. |
| **Present as much context information as possible** |
| To promote contextual understanding, present as much background or historical information as possible.  For example, on a menu screen or in navigation, maintain a listing of the choices selected to get to the current point. On a query or search screen, show the query or search criteria when displaying the results. |
| **Provide clear, constructive, and correct error messages** |
| Incomplete or misleading error messages may cause false assumptions that violate and weaken the user’s mental model. Error messages should always be structured to reinforce the mental model. For example, error messages addressing an incomplete action should specify exactly what is missing, not simply advise a person that something is incomplete |
| **Avoid the unnecessary or irrelevant** |
| Never display irrelevant information on the screen. People may try to interpret it and integrate it into their mental models, thereby creating a false one. Irrelevant information might be unneeded data fields, screen controls, system status codes, or error message numbers. If potentially misleading information cannot be avoided, point this out to the user. Also, do not overuse display techniques, or use them in meaningless ways. Too much color, for example, may distract people and cause them to make erroneous  Assumptions as they try to interpret the colors. The result will be a faulty and unclear mental model. |
| **Provide design consistency** |
| Design consistency reduces the number of concepts to be learned. Inconsistency requires the mastery of multiple models. If an occasional inconsistency cannot be avoided, explain it to the user. For example, if an error is caused by a user action that is inconsistent with other similar actions, explain in the error message that this condition exists. This will prevent the user from falsely assuming that the model he or she has been operating under is incorrect. |
| **Provide documentation and a help system that will reinforce the conceptual model** |
| Consistencies and metaphors should be explicitly described in the user documentation. This will assist a person in learning the system. Do not rely on the people to uncover consistencies and metaphors themselves. The help system should offer advice aimed at improving mental models. |
| **Promote the development of both novice and expert mental models** |
| Novices and experts are likely to bring to bear different mental models when using a system. It will be easier for novices to form an initial system mental model if they are protected from the full complexity of a system. Employ levels of functionality that can be revealed through progressive disclosure. |

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| **Defining Objects** |
| Determine all objects that have to be manipulated to get work done. Describe:  The objects used in tasks.  Object behavior and characteristics that differentiate each kind of object.  The relationship of objects to each other and the people using them.  The actions performed.  The objects to which actions apply  State information or attributes that each object in the task must preserve, display, or allow to be edited  Identify the objects and actions that appear most often in the workflow.  Make the several most important objects very obvious and easy to manipulate. |
| **Developing Metaphors** |
| Choose the analogy that works best for each object and its actions.  Use real-world metaphors.  Use simple metaphors.  Use common metaphors.  Multiple metaphors may coexist.  Use major metaphors, even if you can’t exactly replicate them visually.  Test the selected metaphors. |
| A metaphor is a concept where one’s body of knowledge about one thing is used to understand something else. Metaphors act as building blocks of a system, aiding understanding of how a system works and is organized. Select a metaphor or analogy for the defined objects. Choose the analogy that works best for the objects and their actions. Real-world metaphors are most often the best choice. Replicate what is familiar and well known. Use simple metaphors, as they are almost always the most powerful. Use common metaphors; uniqueness adds complexity. Multiple metaphors may coexist. Use major metaphors even if you can’t exactly replicate them visually on the screen |
| A common metaphor in a graphical system is the desktop and its components, items such as folders and a trash bin. The Web utilizes a library metaphor for the activities of browsing and searching. Browsing in a library occurs when you wander around book stacks looking for something interesting to read. When searching you devise an active plan to find some specific information. For example, first, check the topic in the card catalog. Next, ask the librarian, and so forth. |
| **The User’s New Mental Model** |
| When the system is implemented, and a person interacts with the new system and its interface, an attempt will be made by the person to understand the system based upon the existing mental model brought to the interaction. If the designer has correctly reflected the user’s mental model in design, the user’s mental model is reinforced and a feeling that the interface is intuitive will likely develop. Continued interaction with the system may influence and modify the user’s concept of the system, and his or her mental model may be modified as well. Refinement of this mental model, a normal process, is aided by well-defined distinctions between objects and being consistent across all aspects of the interface. |
| A design standard or style guide documents is an agreed-upon way of doing something In interface design it describes the appearance and behavior of the interface and provides some guidance on the proper use of system components. It also defines the interface standards, rules, guidelines, and conventions that must be followed in detailed design. It will be based on the characteristics of the system’s hardware and software,  **The principles of good interface and screen design, the needs of system users, and any unique company or organization requirements that may exist**. |
| **Value of Standards and Guidelines** |
| Developing and applying design standards or guidelines achieves design consistency |
| This is valuable to users because the standards and guidelines |
| Allow faster performance.  Reduce errors.  Reduce training time.  Foster better system utilization.  Improve satisfaction.  Improve system acceptance |
| They are valuable to system developers because they: |
| Increase visibility of the human-computer interface.  Simplify design.  Provide more programming and design aids, reducing programming time.  Reduce redundant effort.  Reduce training time.  Provide a benchmark for quality control testing. |
| **Business System Interface Standards and Guidelines** |
| Concurrently government and trade organizations also began working on developing interface guidelines and standards. Organizations addressing these issues have included the International Standards Organization (ISO), the American National Standards Institute (ANSI), and the Human Factors and Ergonomics Society. Unfortunately, past research on guideline utilization in business systems has hardly  been encouraging. Standards conformance problems identified include difficulties in finding information being sought, difficulties in interpreting information, and numerous rules violations. Thovtrup and Nielsen (1991), for example, reported that designers were only able to achieve a 71 percent compliance with a two-page standard in a laboratory setting. In an evaluation of three real systems, they found that the mandatory rules of the company’s screen design standard were violated 32 to 55 percent of the time. |
| **Web Guidelines and Style Guides** |
| Web interface design issues have also unleashed a plethora of Web-specific design guidelines and style guides, many of which are found on the Web itself. These guidelines can be seen on the sites of the various computer companies and interface consulting firms, in newsletters, and even on personal Web sites. While many of the traditional interface guidelines are applicable in a Web environment, the Web does impose a host of additional considerations. |
| The haste to publish Web design guidelines has been fueled by the explosive growth of the Web and a corresponding explosive growth in the number of developers creating sites for public access. In the brief existence of the Web, there has not been an opportunity for conventions and style guides to be properly developed and then accepted by the development community. This situation is made worse by the fact that many Web developers have had limited knowledge of traditional interface issues and concerns, and many are unfamiliar with the traditional interface design guidelines. Web guideline documents have attempted to fill this void. |
| **Document Design** |
| Include checklists to present principles and guidelines.  Provide a rationale for why the particular guidelines should be used.  Provide a rationale describing the conditions under which various design alternatives are appropriate.  Include concrete examples of correct design.  Design the guideline document following recognized principles for good document design.  Provide good access mechanisms such as a thorough index, a table of contents, glossaries, and checklists |
| **Checklists and rationale** |
| Provide checklists for presenting key principles and guidelines.  Checklists permit ease in scanning, ease in referring to key points, and make a document more readable by breaking up long sequences of text. Also provide a rationale for why the particular guidelines should be used. Understanding the reasoning will increase guideline acceptance. This is especially important if the guideline is a deviation from a previous design practice. Also, when two or more design alternatives exist, provide a rationale describing the conditions under which the alternatives are appropriate. It may not be easy for designers to infer when various alternatives are appropriate. You have probably noticed that this book uses a checklist format to present key guidelines and thoughts, and guideline rationale is described in the text. |
| **Concrete examples** |
| To be effective, a guideline must include many concrete examples of correct design. Learning by imitation is often a way we learn. |
| **Document design and access** |
| Always design the document, be it paper or electronic, by following recognized principles for good document design. This greatly enhances readability. Provide good access mechanisms such as a thorough index, a table of contents, glossaries, and checklists. An unattractive or hard to use document will not be inviting and consequently will not be used |
| Use all available reference sources in creating the guidelines.  Use development and implementation tools that support the guidelines.  Begin applying the guidelines immediately. |
| **Available Reference Sources** |
| Use all the available reference design sources in creating your guidelines. References include this text, other books on user interface design, project-specific guidelines, and the style guides for interface design and Web design created by companies such as Apple, IBM, Microsoft, and Sun. Other reference sources that meet your needs should also be utilized. |
| **Tools** |
| Use tools that support implementation of the guidelines you have established. Development tools make the design process much easier. If the design tools cannot support the guideline, it cannot be adhered to. |
| **Applying the Guidelines** |
| Two questions often asked are, “Is it too late to develop and implement standards?” and “What will be the impact on systems and screens now being used?” To address these questions, researchers reformatted several alphanumeric inquiry screens to improve their comprehensibility and readability. When these reformatted screens were presented to expert system users, decision-making time remained the same but errors were reduced. For novice system users, the reformatted screens brought large improvements in learning speed and accuracy. Therefore, it appears, that changes that enhance screens will benefit both novice and expert users already familiar with the current screens. It is never too late to begin to change. |
| **System Training and Documentation Needs** |
| Training and documentation are also an integral part of any development effort. |
| **Training** |
| System training will be based on user needs, system conceptual design, system learning goals, and system performance goals. Training may include such tools as formal or video training, manuals, online tutorials, reference manuals, quick reference guides, and online help. (Various types of training methods are more fully addressed in Step 9.) Training needs must be established and training components developed as the design process unfolds. This will ensure that the proper kinds of training are defined, properly integrated with the design, and developed correctly. This will also assure that the design is not imposing an unreasonable learning and training requirement on the user. Any potential problems can also be identified and addressed earlier in the design process, reducing later problems and modification costs. |
| **Documentation** |
| System documentation is a reference point, a form of communication, and a more concrete design—words that can be seen and understood. It will also be based on user needs, system conceptual design, and system performance goals. Creating documentation during the development progress will uncover issues and reveal omissions that might not otherwise be detected until later in the design process. As with training, any potential problems can be identified and addressed earlier in the design process, again  Reducing later problems and modification costs. |