UNIT II

Design process – Understanding how people interact with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business functions.
Screen Designing: Design goals – Screen meaning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design

Understanding how people interact with computers

Why People Have Trouble with Computers

- Historically, the design of business computer systems has been the responsibility of programmers, systems analysts, and system designers, many of whom possess extensive technical knowledge but little behavioral training.
- In recent years the blossoming of the Web, with its extensive graphical capabilities, has found graphic artists being added to design teams. Most graphic artists also possess extensive technical knowledge in their profession but little training in usability.
- Design decisions, therefore, have rested mostly on the designer's intuition concerning the user's capabilities and the designer's wealth of specialized knowledge. Consequently, poorly designed interfaces have often gone unrecognized.
- The intuition of designers or of anyone else, no matter how good or bad they may be at what they do, is error-prone.
- What makes a system difficult to use in the eyes of its user? Following is a list of several contributing factors:
- **Too much flexibility.** When the needs of a user are not well understood, the tendency is to build into a system as many functions as possible. More functions result in higher interface complexity. In general, as the flexibility of a system increases, its usability decreases.
- **Use of jargon.** Systems often speak in a strange language. Learning to use a system often requires learning a new language.
- **Non-obvious design.** Complex or novel design elements are not obvious. Operations may have prerequisite conditions that must be satisfied before they can be accomplished, or outcomes may not always be immediate, obvious, or visible.
- **Fine distinctions.** Different actions may accomplish the same thing, depending upon when they are performed, or different things may result from the same action. Often these distinctions are minute and difficult to keep track of. As illustrated by the user who insisted that problems were caused by pressing the Enter key "in the wrong way."

- **Disparity in problem-solving strategies.** People learn best by doing. They have trouble following directions and do not always read instructions before taking an action. Human problem solving can best be characterized as "error-correcting" or "trial and error," whereby a tentative solution is formulated based upon the available evidence and then tried. This tentative solution often has a low chance of success.
- **Design inconsistency.** The same action may have different names: for example, "save" and "keep," "write" and "list." The same command may cause different things to happen. The same result may be described differently: for example, "not legal" and "not valid." Or the same information may be ordered differently on different screens. The result is that system learning becomes an exercise in rote memorization.

Responses to Poor Design

Psychological

Typical psychological responses to poor design are as follows:

- **Confusion.** Detail overwhelms the perceived structure. Meaningful patterns are difficult to ascertain, and the conceptual model or underlying framework cannot be understood or established.
- **Annoyance.** Roadblocks that prevent a task from being completed, or a need from being satisfied, promptly and efficiently lead to annoyance. Inconsistencies in design, slow computer reaction times, difficulties in quickly finding information, outdated information, and visual screen distractions are a few of the many things that may annoy users.
- **Frustration.** An overabundance of annoyances, an inability to easily convey one's intentions to the computer, or an inability to finish a task or satisfy a need can cause frustration. Frustration is heightened if an unexpected computer response cannot be undone or if what really took place cannot be determined. Inflexible and unforgiving systems are a major source of frustration.
- **Panic or stress.** When a system taxes a person's perceptual and cognitive abilities, panic and stress are often the results. Over complex systems and procedures, unexpected long delays during times of severe or unusual pressure, or long response times are examples of situations that can lead to panic and stress.
- **Boredom.** Boredom results from, among other things, improper computer pacing (slow response times or long download times). A bored individual is also likely to make more performance errors.
- These psychological responses diminish user effectiveness because they are severe blocks to concentration. The result, in addition to higher error rates, is poor performance, anxiety, and dissatisfaction.

Physical

- When effort and the psychological responses exceed the perceived benefits, the results are often the following physical reactions:
- **Abandonment of the system.** The system is rejected and other information sources are relied upon.
- **Partial use of the system.** Only a portion of the system's capabilities are used, usually those operations that are easiest to perform or that provide the most benefits. Many aspects of many systems often go unused.
- **Indirect use of the system.** An intermediary is placed between the would-be user and the computer. Again, because this requires high status and discretion, it is another typical response of managers or others with authority.
- **Modification of the task.** The task is changed to match the capabilities of the system. This is a prevalent reaction when the tools are rigid and the problem is unstructured, as in scientific problem solving.
- **Compensatory activity.** Additional actions are performed to compensate for system inadequacies. A common example is the manual reformatting of information to match the structure required by the computer.
- **Misuse of the system.** The rules are bent to shortcut operational difficulties. This requires significant knowledge of the system and may affect system integrity.
- **Direct programming.** The system is reprogrammed by its user to meet specific needs. This is a typical response of the sophisticated worker.
- These physical responses greatly diminish user efficiency and effectiveness. They force the user to rely upon other information sources, to fail to use a system's complete capabilities, or to perform time-consuming "work-around" actions.

Important Human Characteristics in Design

People are complex organisms with many attributes that have an important influence on interface design. Of particular importance in design are perception, memory, visual acuity, foveal and peripheral vision, sensory storage, information processing, learning, skill, and individual differences.

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 perceptual characteristics include the following:

  - ✓ Proximity
  - ✓ Similarity
  - ✓ Matching patterns
  - ✓ Succinctness
  - ✓ Closure
  - ✓ Unity.
  - ✓ Continuity
  - ✓ Balance.
  - ✓ Expectancies
  - ✓ Context
  - ✓ Signals versus noise.
- The goal in design, then, is to utilize our perceptual capabilities so that a screen can be structured in the most meaningful and obvious way.

Memory

- Memory is not the most stable of human attributes. Today, memory is viewed as consisting of two components: long-term and short-term (or working) memory.
- *Short-term memory*, or working memory, receives information from either the senses or long-term memory, but usually cannot receive both at once because the senses are processed separately. Knowledge, experience, and familiarity govern the size and complexity of the information that can be remembered
- *Long-term* memory contains the knowledge we possess. Information received in short-term memory is transferred to it and encoded within it, a process we call learning. The learning process is improved if the information being transferred from short-term memory has structure and is meaningful and familiar. Learning is also improved through repetition and deep analysis.
- An important memory consideration, with significant implications for interface design, is the difference in ability to recognize or recall. Our power of recognition, therefore, is much greater than our power of recall, and this phenomenon should be utilized in design. To do this, one should present, whenever possible, lists of alternatives to remind people of the choices they have.

- Other general ways to reduce user memory loads :
  - Presenting information in an organized, structured, familiar, and meaningful way.
  - Giving the user control over the pace of information presentation.
  - Placing all required information for task performance in close physical proximity.

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.
- Design the interface so that all aspects and elements serve a definite purpose. Eliminating interface noise will ensure that important things are less likely to be missed.

Visual Acuity

- The capacity of the eye to resolve details is called *visual acuity.*
- The important principle to keep in mind is that fairly small visual chunks will exist on screens and these chunks should be considered in design.
- The eye is also never perfectly steady as it sees; it trembles slightly. This tremor improves the detection of edges of objects being looked at, thus improving acuity

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.
- 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.
- Care should be exercised in design to utilize peripheral vision in its positive nature, avoiding its negative aspects.

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.
- 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.
- In addition to this higher level, there exists a lower level of information processing, and the limit of its capacity is unknown. This lower level processes familiar information rapidly, in parallel with the higher level, and without conscious effort. We look rather than see, perceive

rather than read. Repetition and learning results in a shift of control from the higher level to the lower level.

- Both levels function simultaneously, the higher level performing reasoning and problem solving, the lower level perceiving the physical form of information sensed.
- When a screen is displayed, you usually will want to verify that it is the one you want. If you're new to a system, or if a screen is new to you, you rely on its concrete elements to make that determination, its title, the controls and information it contains, and so forth.
- As you become experienced and familiar with screens, however, you can identify a newly presented screen very quickly with just a momentary glance. Lower-level information processing has assumed the screen identity task.
- Higher-level processing can be impeded by a phenomenon called interference. Perception and cognition involve many different mental systems, each processing information independently of one another. Interference occurs when perception and cognition are exposed to conflicting mental processes that must then be resolved

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.
- A person already familiar with one computer system will bring to another system a mental model containing specific visual and usage expectations. If the new system complies with already-established models, it will be much easier to learn and use

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
- The implications in screen design are:
  - ✓ Provide large objects for important functions.
  - ✓ Take advantage of the "pinning" actions of the sides, top, bottom, and corners of the screen.

Learning

- Learning 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 the performance in almost any task. Too often, however, designers use our learning ability as an excuse to justify complex design.
- A design developed to minimize human learning time can greatly accelerate human performance.
- People prefer to stick with what they know, and they prefer to jump in and get started. Unproductive time spent learning is something frequently avoided.

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.
- Skills are hierarchical in nature, and many basic skills may be integrated to form increasingly complex ones. Lower-order skills tend to become routine and may drop out of consciousness.
- System and screen design must permit development of increasingly skillful performance.

Individual Differences

- In reality, there is no average user. A complicating but very advantageous human characteristic is 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.
- In the past this has usually resulted in bringing designs down to the level of lowest abilities or selecting people with the minimum skills necessary to perform a job. But technology now offers the possibility of tailoring jobs to the specific needs of people with varying and changing learning or skill levels. Multiple versions of a system can easily be created.
- Design must provide for the needs of all potential users

Human Interaction Speeds

- Many researchers have studied the speed at which people can perform using various communication methods.. 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 1.6.

Table : 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:	150–160 words per minute.
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.

Understand the Business Function

- **Business definition and requirements analysis**
  - **Direct methods**
  - **Indirect methods**
  - **Requirements collection guidelines**
- **Determining basic business functions**
  - **Understanding mental models**
  - **Developing conceptual modes**
  - **Users new mental model**
- **Design standards or style guides**
  - **Value of standards and guidelines**
  - **Document design**
  - **Design support and implementation**
- **System training and documentation**
  - **Training**
  - **Documentation**

Business Definition and Requirements Analysis

- The objective of this phase is to establish the need for a system. A requirement is an objective that must be met. A product description is developed and refined, based on input from users, marketing, or other interested parties.

Information Collection Techniques

- There are many techniques for capturing information for determining requirements.
- The techniques are classified as direct and indirect. Direct methods consist of face-to-face meetings with, or actual viewing of, users to solicit requirements. Indirect methods impose an intermediary, someone or something, between the users and the developers.

Direct Methods

- ✓ **Individual Face-to-Face Interview** A one-on-one visit is held with the user. Information can be collected in a friendly and fast way. It may be structured or more open-ended.
- ✓ **Telephone Interview or Survey** This interview is conducted using the telephone. It must have structure and be well planned. Arranging the interview in advance allows the user to prepare for it. Telephone interviews are less expensive and less invasive than personal interviews.
- ✓ **Traditional Focus Group** A small group of users (8 to 12) and a moderator are brought together to discuss the requirements. A typical session lasts about two hours. The purpose of a focus group is to probe users' experiences, attitudes, beliefs, and desires, and to obtain their reactions to ideas or prototypes.

- ✓ **Facilitated Team Workshop** A facilitated team workshop is similar in structure and content to a traditional focus group. . A common technique used in system requirements determination.
- ✓ **Observational Field Study** To see and learn what users actually do, they are watched and followed in their own environment, office, or home in a range of contexts for a period of time.
- ✓ **Requirements Prototyping** A demonstration model, or very early prototype, is presented to users for their comments concerning functionality and to clarify requirements.
- ✓ **User-Interface Prototyping** A demonstration model, or early prototype, is presented to users to uncover user-interface issues and problems.
- ✓ **Usability Laboratory Testing** A special laboratory is constructed and users are brought in to perform actual newly designed tasks. They are observed, and the results are measured and evaluated to establish the usability of the product at that point in time
- ✓ **Card Sorting for Web Sites** This is a technique used to establish hierarchical groupings and the information architecture for Web sites. It is normally used only after gathering substantial potential site content information using other analysis techniques.

Indirect Methods

- ✓ **MIS Intermediary** A company representative who defines the user's goals and needs to designers and developers fulfills this intermediary role. This representative may come from the Management Information Services department
- ✓ **Paper Survey or Questionnaire** A paper questionnaire or survey is administered to a sample of users to obtain their needs.
- ✓ **Electronic Survey or Questionnaire** A questionnaire or survey is administered to a sample of users via e-mail or the Web. Characteristics, advantages, and disadvantages are similar to paper surveys and questionnaires.
- ✓ **Electronic Focus Group** An electronic focus group is similar to a traditional focus group except that the discussion is accomplished electronically using specialized software on a workstation, e-mail, or a Web site.
- ✓ **Marketing and Sales** Company representatives who regularly meet customers obtain suggestions or needs, current and potential
- ✓ **Support Line** Information is collected by the unit (Customer Support, Technical Support, Help Desk, and so on) that helps customers with day-to-day problems. This is fairly inexpensive and the target user audience is correct.
- ✓ **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. Again, the focus of this method is usually only on problems.

- ✓ **User Group** Improvements suggested by customer groups who convene periodically to discuss system and software usage are evaluated.
- ✓ **Competitor Analysis** Reviews of competitor's products, or Web sites, can also be used to gather ideas, uncover design requirements, and identify tasks.
- ✓ **Trade Show** Customers at a trade show can be exposed to a mock-up or prototype and asked for comments. This method is dependent on the knowledge level of the customers and may provide only a superficial view of most prominent features.
- ✓ **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.
- ✓ **System Testing** New requirements and feedback stemming from ongoing system testing can be accumulated, evaluated, and implemented as necessary.

Requirements Collection Guidelines

- Establish four to six different developer-user links.
- Provide most reliance on direct links**.**

- ➢ Each requirements collection method was defined as a developer-user link.
- ➢ **Establish 4 to 6 Different Developer-User Links** The more successful projects had utilized a greater number of developer-user links than the less successful projects. The mean number of links for the successful projects: 5.4; the less successful: 3.2.
- ➢ **Provide the Most Reliance on Direct Links** The problems associated with the less successful projects resulted, at least in part, from too much reliance on indirect links, or using intermediaries.

Possible Problems in Requirements Collection

- ➢ Like other aspects of the design process, problems may occur in the requirements determination phase.

- Not enough user, customer, and other interested party involvement in the process.
- Lack of requirements management or coordination
- Communication problems among all participants.
- Capturing the relevant information may be difficult.
- People who do understand the problem may be constrained
- Organizational and political factors and agendas may influence the process.
- Disparities in knowledge may exist.
- Changing economic and business environments and personnel roles.

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 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.
    - A user task analysis.
- Develop a conceptual model of the system based upon the user's mental model. This includes
    - Defining objects.
    - Developing metaphors.

Understanding the User's Work

- The technique used to gain an understanding of what the computer system must do is called *task analysis.* Another object of task analysis is to gain a picture of the user's *mental model*.

Mental Models

- A mental model is an internal representation of a person's current conceptualization and understanding of something. Mental models are gradually developed through experience, training, and instruction. 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, the way in which people perform tasks, 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.
- The output of a task analysis is a complete description of all user tasks and interactions.
- One result of a task analysis is a description of the user's current tasks, called a *scenario*. Scenarios are narrative descriptions of what people do in the course of completing a task.
- Scenarios 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.
- The goal of the designer is to facilitate for the user the development of a useful mental model of the system.
- 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 processes 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.

- **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.
    - ✓ 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***
- *A metaphor is a concept where one's body of knowledge about one thing is used to understand something else*
  - ✓ 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.

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 by being consistent across all aspects of the interface.
- When system designers have known in advance there was a gap between their conceptual model and the mental model the user would bring to the new system, designers have tried to bridge this gap through extensive documentation and training.
- The problems with this approach are as follows: People are unproductive while being trained, people rarely read the documentation and training materials, and even if the training material is read, the material is presented out of context. This creates difficulties for the users in understanding the material's relevance to their needs and goals.

Design Standards or Style Guides

- In interface design, a design standard or style guide document describes the appearance and behavior of the interface and provides some guidance on the proper use of system components. It also defines the interface principles, rules, guidelines, and conventions that must be followed in detailed design

Value of Standards and Guidelines

Developing and applying design standards or guidelines achieve 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.
- Reduce development and support costs.

- 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.

Customized Style Guides

- A customized style guide can also be created for an organization or system to be developed. Relevant materials from various standards, style guides, and other usability sources can be pulled together to create a document reflecting an organization's specific needs. In creating such a document

✓ 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.

Design Support and Implementation

- ✓ Use all available reference sources in creating the guidelines.
- ✓ Use development and implementation tools that support the guidelines.
- ✓ Begin applying the guidelines immediately.

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.
- ➢ 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.

Interface Design Goals

- The goal in design is to
  - Reduce visual work.
  - Reduce intellectual work.
  - Reduce memory work.
  - Reduce motor work.
  - Minimize or eliminate any burdens or instructions imposed by technology.
- The result will always be improved user productivity and increased satisfaction.

Screen Meaning and Purpose

- Each element----
  - ✓ Every control
  - ✓ All text
  - ✓ The screen organization
  - ✓ All emphasis
  - ✓ Each color
  - ✓ Every graphic
  - ✓ All screen animation
  - ✓ Each message
  - ✓ All forms of feedback
- Must
  - ✓ Have meaning to users.
  - ✓ Serve a purpose in performing tasks.

Organizing Elements Clearly and Meaningfully

- Visual clarity is achieved when the display elements are organized and presented in meaningful, understandable, and recognizable ways.
- A clear and clean organization makes it easier to recognize a screen's essential elements.
- Clarity is influenced by many factors: consistency in design, a visually pleasing composition, a logical and sequential ordering, the presentation of the proper amount of information, groupings, and alignment of screen items.
- **Consistency**
  - ✓ Provide real-world consistency. Reflect a person's experiences, expectations, work conventions, and cultural conventions.
  - ✓ Provide internal consistency. Observe the same conventions and rules for all aspects of an interface screen, and all application or Web site screens, including

- Operational and navigational procedures.
- Visual identity or theme.
- Component
    - Organization.
    - Presentation.
    - Usage.
    - Locations.

- Follow the same conventions and rules across all related interfaces.
- Deviate only when there is a clear benefit for the user.

Starting Point

- Provide an obvious starting point in the screen's upper-left corner.
- Focus user attention on the most important parts of a screen or page.

Ordering of Data and Content

- Divide information into units that are logical, meaningful, and sensible.
- Organize by the degree of interrelationship between data or information.
- Provide an ordering of screen units of information and elements that is prioritized according to the user's expectations and needs.
- Possible ordering schemes include
    - Conventional.
    - Sequence of use.
    - Frequency of use.
    - Function.
    - Importance.
    - General to specific.
- Form groups that cover all possibilities.
- Ensure that information that must be compared is visible at the same time.
- Ensure that only information relative to the users' tasks or needs is presented on the screen.

Ordering Web Pages

- Establish levels of importance.
- Place critical information near the top of the Web site.
- Place important items at the top of a page.
- Organize information clearly.
- Place important items consistently.
- Facilitate scanning.
- Structure for easy comparison.

Screen Navigation and Flow

- Provide an ordering of screen information and elements that
  - ✓ Is rhythmic, guiding a person's eye through the display.
  - ✓ Encourages natural movement sequences.
  - ✓ Minimizes pointer and eye movement distances.
- Locate the most important and most frequently used elements or controls at the top left.
- Maintain a top-to-bottom, left-to-right flow.
- Assist in navigation through a screen by
  - ✓ Aligning elements.
  - ✓ Grouping elements.
  - ✓ Using line borders.
- Through focus and emphasis, sequentially, direct attention to items that are
  1. Critical.
  2. Important.
  3. Secondary.
  4. Peripheral.
- Tab through windows in logical order of displayed information.
- Locate command buttons at end of the tabbing order sequence.
- When groups of related information must be broken and displayed on separate screens, provide breaks at logical or natural points in the information flow.

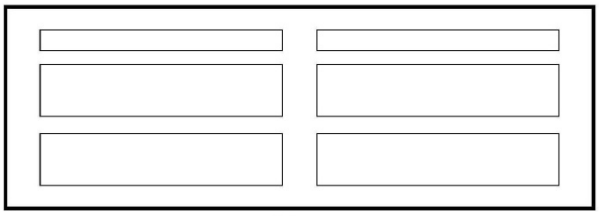
- In establishing eye movement through a screen, also consider that the eye tends to move sequentially, for example:
  - ✓ From dark areas to light areas.
  - ✓ From big objects to little objects.
  - ✓ From unusual shapes to common shapes.
  - ✓ From highly saturated colors to unsaturated colors.
- These techniques can be used initially to focus a person's attention to one area of the screen and then direct it elsewhere.
- Top-to-bottom orientation is recommended for information *entry* for the following reasons:
  - ✓ Eye movements between items will be shorter.
  - ✓ Control movements between items will be shorter.
  - ✓ Groupings are more obvious perceptually.
  - ✓ When one's eye moves away from the screen and then back, it returns to about the same place it left, even if it is seeking the next item in a sequence (a visual anchor point remains).

Visually Pleasing Composition

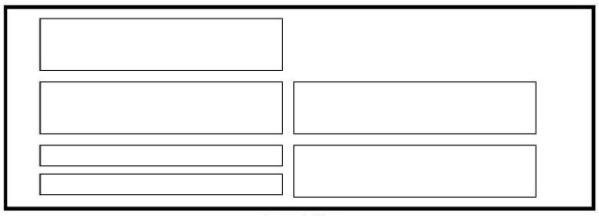
- Provide a visually or aesthetically pleasing composition possessing the following qualities:
  - Balance
  - Symmetry
  - Regularity
  - Predictability
  - Sequentiality
  - Economy
  - Unity
  - Proportion
  - Simplicity
  - Groupings

Balance

- Create screen balance by providing an equal weight of screen elements, left and right, top and bottom.



Balance



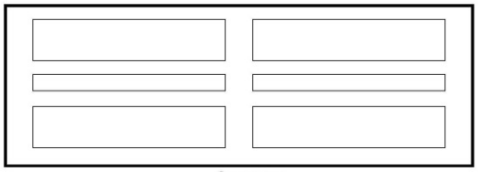
Instability

Balance (versus instability).

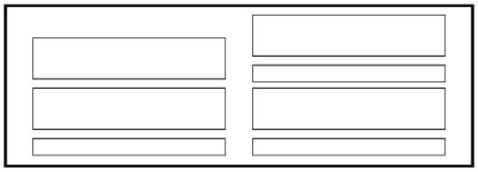
- Dark colors, unusual shapes, and larger objects are “heavier,” whereas light colors, regular shapes, and small objects are “lighter.” Balance on a screen is accomplished through centering the display itself, maintaining an equal weighting of components on each side of the horizontal and vertical axis, and centering titles and illustrations.
- Web pages are often scrollable, thereby shifting the horizontal, or top-to-bottom, balance point as the screen is scrolled. Horizontal balance is therefore more difficult to maintain.

Symmetry

- Create symmetry by replicating elements left and right of the screen centerline.



Symmetry

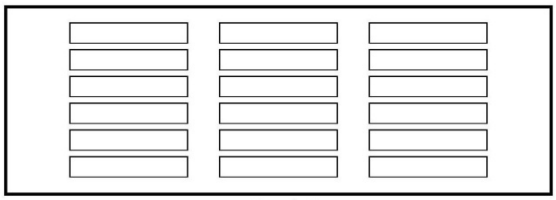


Asymmetry

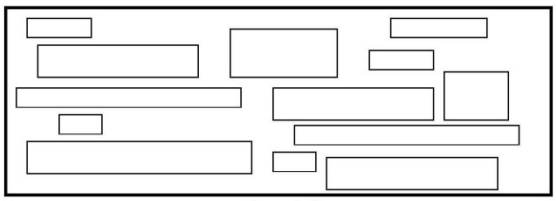
Symmetry (versus asymmetry).

Regularity

- Create regularity by establishing standard and consistently spaced horizontal and vertical alignment points.
- Also, use similar element sizes, shapes, colors, and spacing



Regularity

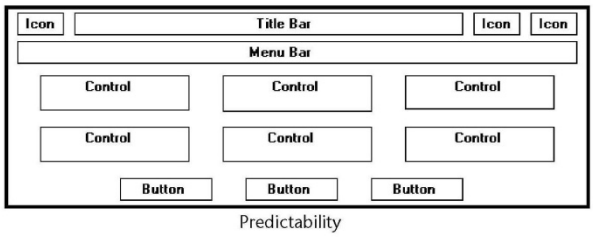


Irregularity

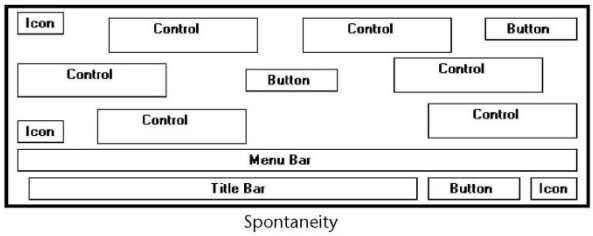
Regularity (versus irregularity).

Predictability

- Create predictability by being consistent and following conventional orders or arrangements.



Predictability

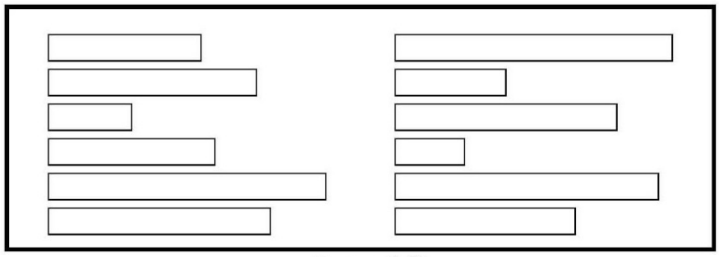


Spontaneity

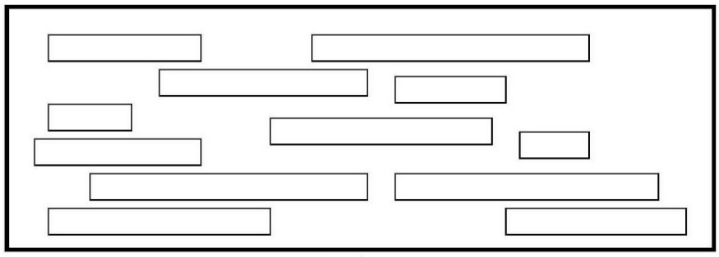
Predictability (versus spontaneity).

Sequentiality

- Provide sequentiality by arranging elements to guide the eye through the screen in an obvious, logical, rhythmic, and efficient manner.
- The eye tends to be attracted to
  - A brighter element before one less bright.
  - Isolated elements before elements in a group.
  - Graphics before text.
  - Color before black and white.
  - Highly saturated colors before those less saturated.
  - Dark areas before light areas.
  - A big element before a small one.
  - An unusual shape before a usual one.
  - Big objects before little objects.



Sequentiality

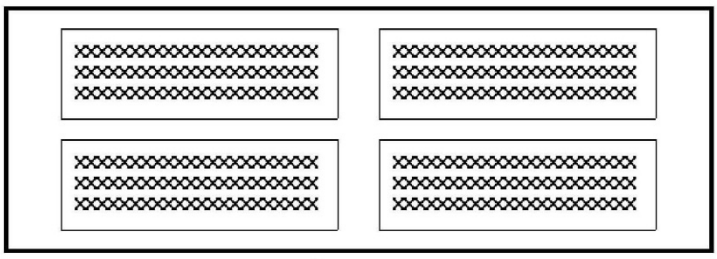


Randomness

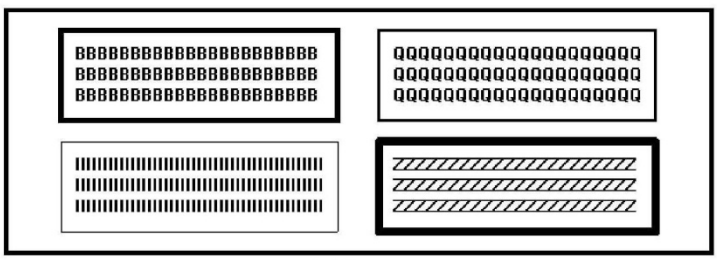
Sequentiality (versus randomness).

Economy

- Provide economy by using as few styles, display techniques, and colors as possible.
- *Economy*, is the frugal and judicious use of display elements to get the message across as simply as possible. The opposite is intricacy, the use of many elements just because they exist.



Economy

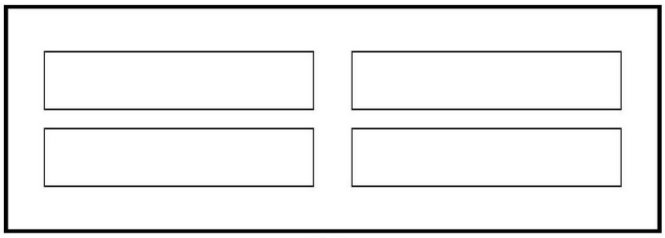


Intricacy

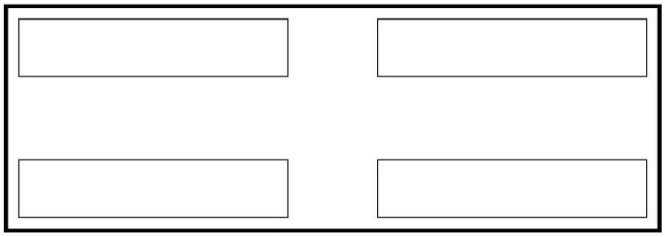
Economy (versus intricacy).

Unity

- Create unity by
  - Using similar sizes, shapes, or colors for related information.
  - Leaving less space between elements of a screen than the space left at the margins.



Unity

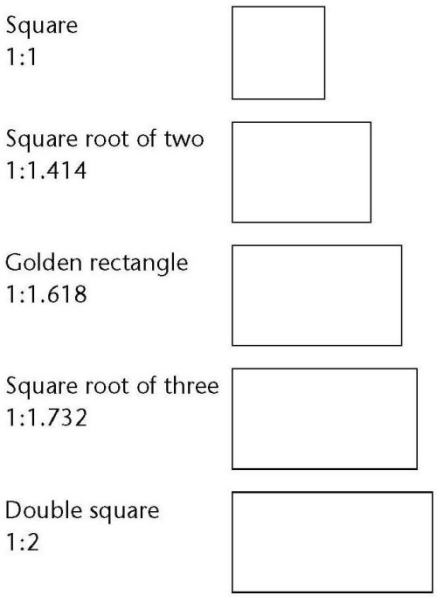


Fragmentation

Unity (versus fragmentation).

Proportion

- Create windows and groupings of data or text with aesthetically pleasing proportions.



Pleasing proportions.

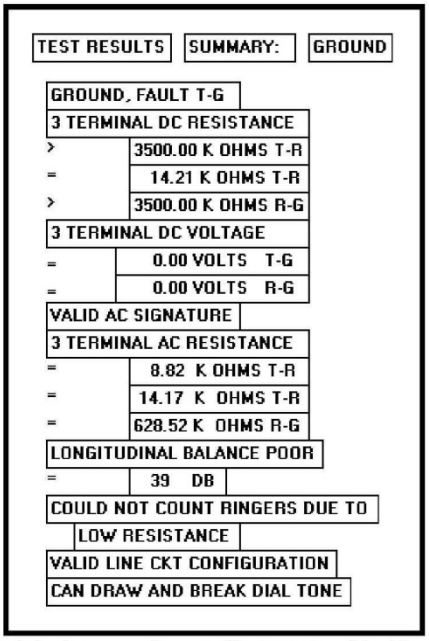
Simplicity (Complexity)

- Optimize the number of elements on a screen, within limits of clarity.
  - Minimize the alignment points, especially horizontal or columnar.
  - Provide standard grids of horizontal and vertical lines to position elements.
- The measure of complexityinvolves the following steps:

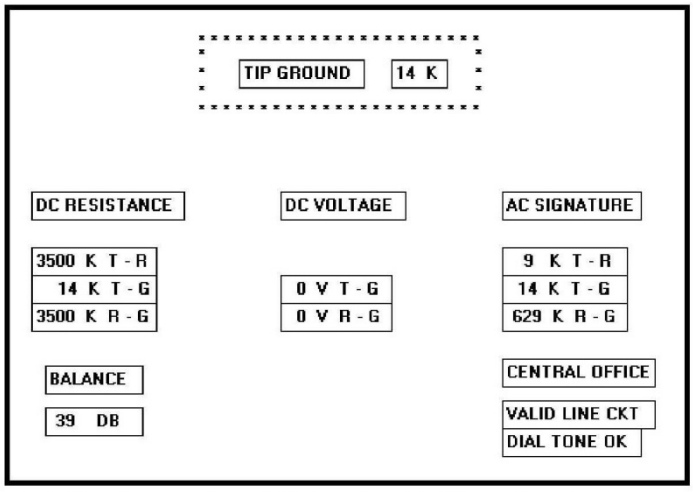
  1. Draw a rectangle around each element on a screen, including captions, controls, headings, data, title, and so on.

  2. Count the number of elements and horizontal alignment points (the number of columns in which a field, inscribed by a rectangle, starts).

  3. Count the number of elements and vertical alignment points (the number of rows in which an element, inscribed by a rectangle, starts).



Original screen, from Tullis (1981), with title, captions, and data inscribed by rectangles.



Redesigned screen, from Tullis (1981), with title, captions, and data inscribed by rectangles.

- A complexity calculation using information theory for each screen is as follows:

  Figure (original):

  ■22 fields with 6 horizontal (column) alignment points = 41 bits.

  ■ 22 fields with 20 vertical (row) alignment points = 93 bits.

  ■Overall complexity = 134 bits.

  Figure (redesigned):

  ■ 18 fields with 7 horizontal (column) alignment points = 43 bits.

  ■ 18 fields with 8 vertical (row) alignment points = 53 bits.

■ Overall complexity = 96 bits.

- An easier method of calculation, however, yielding similar results, is to count the following: (1) the number of elements on the screen, (2) the number of horizontal (column) alignment points, and (3) the number of vertical (row) alignment points. The sums for the original and redesigned screens by this measure are:

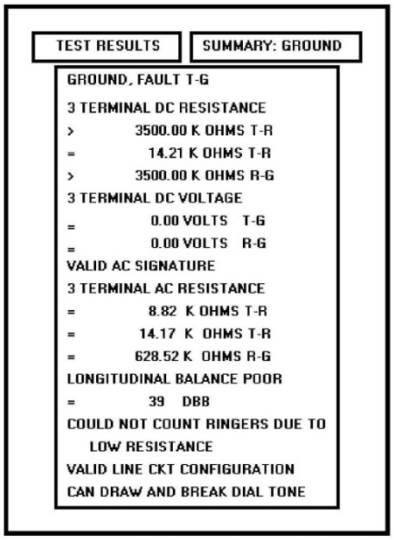
  Figure (original):

  ■22 elements
  ■6 horizontal (column) alignment points
  ■20 vertical (row) alignment points
  ■48 = complexity
  Figure (redesigned):

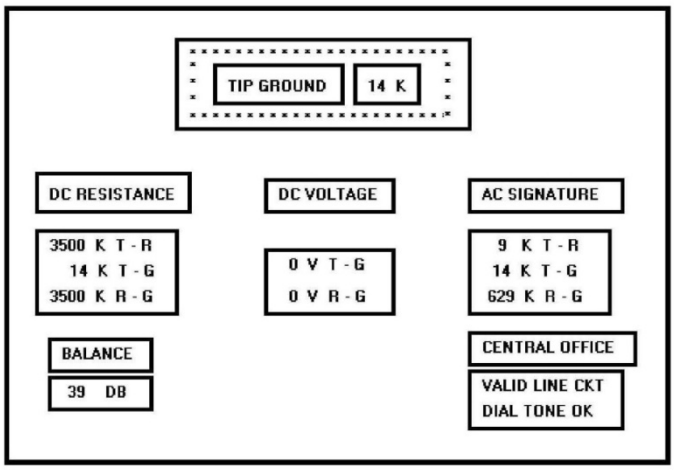
  ■18 elements
  ■7 horizontal (column) alignment points
  ■8 vertical (row) alignment points
  ■33 = complexity
- By this calculation the redesigned screen is about 31 percent simpler, or less complex, than the original screen.

Groupings

- Provide functional groupings of associated elements.
- Create spatial groupings as closely as possible to five degrees of visual angle (1.67 inches in diameter or about 6 to 7 lines of text, 12 to 14 characters in width).
- Evenly space controls within a grouping, allowing 1/8 to 1/4 inch between each.
- Visually reinforce groupings:
  - ✓ Provide adequate separation between groupings through liberal use of white space.
  - ✓ Provide line borders around groups.
- Provide meaningful titles for each grouping.



Original screen, from Tullis (1981), with grouping indicated by bold boxes.



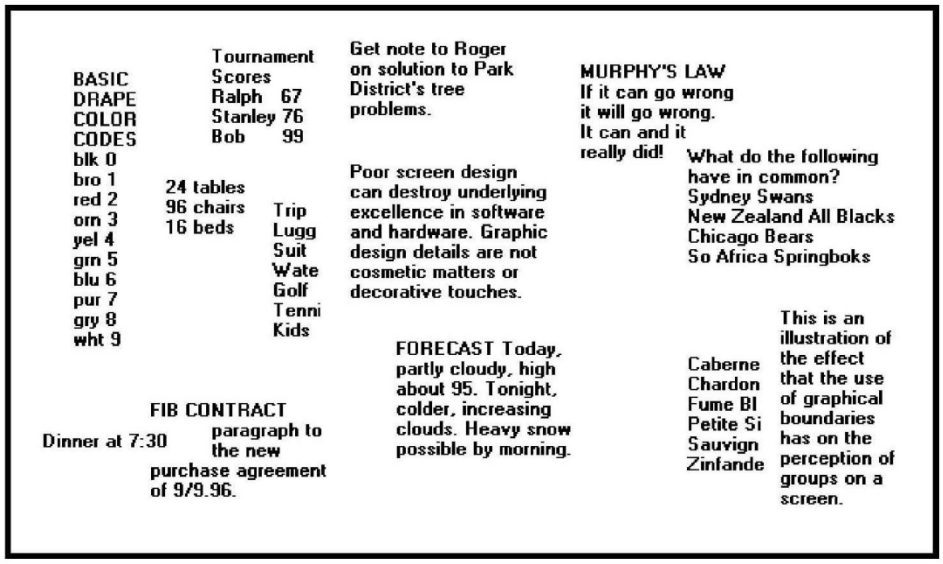
Redesigned screen, from Tullis (1981), with grouping indicated by bold boxes.

Grouping Using White Space

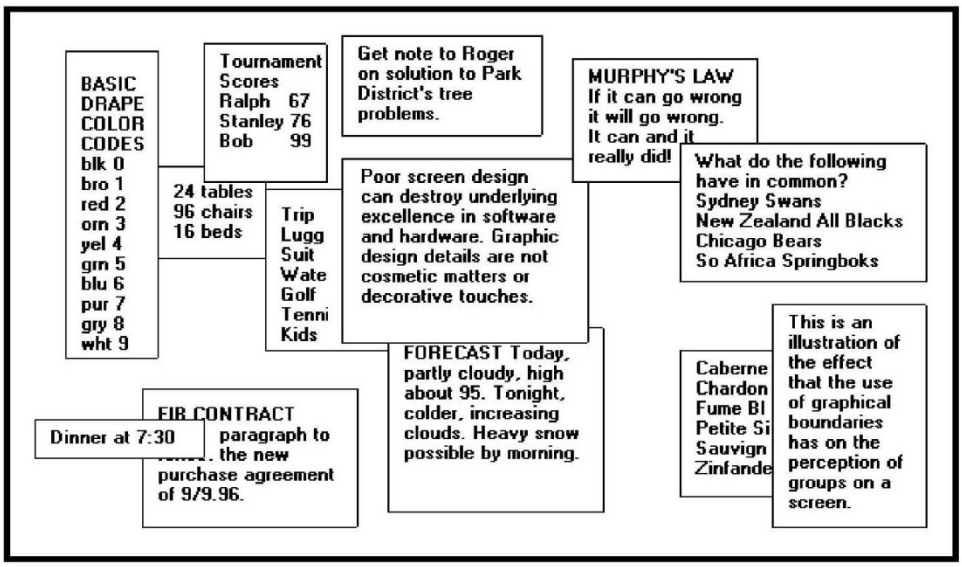
- Provide adequate separation between elements through liberal use of white space.
- For Web pages, carefully consider the trade-off between screen white space and the requirement for page scrolling.

Grouping Using Borders

- Incorporate line borders for
  - ✓ Focusing attention on groupings or related information.
  - ✓ Guiding the eye through a screen.
- Do not exceed three line thicknesses or two line styles on a screen, however.
  - ✓ Use a standard hierarchy for line presentation.
- Create lines consistent in height and length.
- Leave sufficient padding space between the information and the surrounding borders.
- For adjacent groupings with borders, whenever possible, align the borders left, right, top, and bottom.
- Use rules and borders sparingly.
- In Web page design
  - ✓ Be cautious in using horizontal lines as separators between page sections.
  - ✓ Reserve horizontal lines for situations in which the difference between adjacent areas must be emphasized.



The effect of line or graphical borders. Groupings without borders.



The effect of line or graphical borders. Groupings with borders.

Grouping Using Backgrounds

- Consider incorporating a contrasting background for related information.
- ✓ The background should not have the "emphasis" of the screen component that should be attended to. Consider about a 25 percent gray screening.
- ✓ Reserve higher contrast or "emphasizing" techniques for screen components to which attention should be drawn.

Amount of Information to Present

- Present the proper amount of information for the task.
  - ✓ Too little is inefficient.
  - ✓ Too much is confusing.
- Present all information necessary for performing an action or making a decision on one screen, whenever possible.
  - ✓ People should not have to remember things from one screen to the next.
- Restrict screen or window density levels to no more than about 30 percent.

Web Page Size:

- Minimize page length
  - o Restrict to two or three screens of information
- Place critical or important information at the very top so it is always viewable when the page is opened
  - o Locate it within the top 4 inches of page.

Scrolling and Paging

Scrolling:

- ✓ Avoid scrolling to determine a page's subject and what it contains.
- ✓ Minimize vertical page scrolling.
- ✓ When vertical scrolling is necessary to view an entire page
  - Provide contextual cues within the page that it must be scrolled to view its entire contents.
  - Provide short pages if people are looking for specific pieces of information.
  - Facilitate fast scrolling by highlighting major page items.
  - Provide a unique and consistent "end of page" structure.
- ✓ Avoid horizontal page scrolling.
- ✓ Use longer scrolling pages when people are reading for comprehension.
- ✓ Use paging rather than scrolling if system response times are reasonably fast.

Paging:

- ✓ Encourage viewing a page through "paging."
- ✓ Create a second version of a Web site, one consisting of individual screens that are viewed through "paging."

Focus and Emphasis

- Visually emphasize components such as
  - ✓ Most prominent elements.
  - ✓ Most important elements.
  - ✓ Central idea or focal point.
- To provide emphasis use techniques such as
  - ✓ Higher brightness.
  - ✓ Reverse polarity or inverse video.
  - ✓ Distinctive Typeface.
    - • Bold.
    - • Italics.
    - • Underlining.
  - ✓ Blinking.
  - ✓ Line rulings and surrounding boxes or frames.
  - ✓ Color.
  - ✓ Larger size.
  - ✓ Animation.
  - ✓ Positioning.
  - ✓ Distinctive or unusual shape.
  - ✓ Isolation.
- De-emphasize less important elements.
- To ensure that emphasized screen elements stand out, avoid
  - ✓ Emphasizing too many screen elements.
  - ✓ Using too many emphasis techniques.
- Minimize screen clutter.
- In Web page design
  - ✓ Call attention to new or changed content.
  - ✓ Ensure that page text is not overwhelmed by page background.

Presentation Information Simply and Meaningfully

- Provide legibility.
  - ✓ Information is noticeable and distinguishable.
- Provide readability.
  - ✓ Information is identifiable, interpretable, and attractive.
- Present information in usable form.
  - ✓ Translations, transpositions, and references to documentation should not be required to interpret and understand information.
- Utilize contrasting display features.
  - ✓ To attract and call attention to different screen elements.
- Create visual lines.
  - ✓ Implicit and explicit, to guide the eye.
- Be consistent.
  - ✓ In appearance and procedural usage.

Typography

- In typography, by definition a typeface is the name of a font type, such as Times New Roman, Arial, Verdana, or Helvetica. A font has several qualities, including size (Times New Roman 16-point or Arial 12-point) and other characteristics, including case (upper, lower, and mixed), type (serif and sans serif), and styles such as bold, italic, outline or shadow.
- In screen design font's characteristics can be used as a tool to
  - ✓ Communicate the organization of screen elements.
  - ✓ Identify the most important screen elements.
  - ✓ Establish a reading order.
  - ✓ Create a particular mood.

Font Types and Families

- Use simple, common, and familiar fonts to achieve the best reading speed.
  - ✓ Arial or Verdana Sans Serif.
  - ✓ Times New Roman or Georgia Serif.
  - ✓ Avoid specialty or "cool" fonts.
- Use no more than two families, compatible in terms of line thicknesses, capital letter height, and so on.
  - ✓ Assign a separate purpose to each family.
  - ✓ Allow one family to dominate.

Font Size

- Use no more than three sizes.
- For graphical systems use
  - ✓ 12 point for menus.
  - ✓ 10 point for windows.
- For Web pages use
  - ✓ 12 to 14 points for body text.
  - ✓ 18 to 36 points for titles and headings.
- For line spacing use one to one and one-half times font size.
- Never change established type sizes to squeeze in more text.

Font Styles and Weight

- Use no more than
  - ✓ Two styles of the same family.
    - • Standard and italic.
    - • Italic is best presented in a serif font.
  - ✓ Two weights.
    - • Regular and bold.
    - • Bold is best presented in a sans serif font.
- Use italics when you want to call attention.
- Use bold when you want to call attention or create a hierarchy.
- In Web pages, use an underline only to indicate a navigation link.

Font Case

- Use mixed-case for
  - ✓ Control captions.
  - ✓ Data.
  - ✓ Control choice descriptions.
  - ✓ Text.
  - ✓ Informational messages.
  - ✓ Instructional information.
  - ✓ Menu descriptions.
  - ✓ Button descriptions.
- Consider using upper case or capitalization for
  - ✓ Title.
  - ✓ Section headings.
  - ✓ Subsection headings.
  - ✓ Caution and warning messages.
  - ✓ Words or phrases small in point size.
- Use all lowercase with caution.

Consistency

- Establish a consistent hierarchy and convention for using typefaces, styles, and sizes.
  - ✓ Decide on a font for each different level of importance in the hierarchy.
  - ✓ Communicate hierarchy with changes in
    - Size.
    - Weight.
    - Color.

Text Backgrounds

- For rapid reading and understanding present black text on plain, high-contrast backgrounds

Other

- Always consider the visual capabilities of the user.
- Always verify that the design has succeeded using the selected fonts.

Why is text so difficult to read?

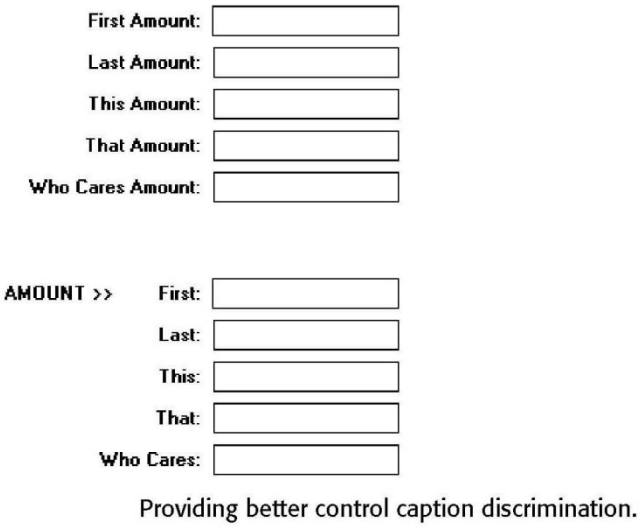
- **Most Web designers are young.** They have perfect vision and tiny text does not bother them like it does those middle-aged or older.
- **Web designers often use expensive high-quality monitors.** These monitors are easier on the eyes.
- **Web designers often don't actually read what they create.** They simply glance at it to make sure it looks great. If you don't have to read the words, it doesn't matter that the characters are small

Screen Elements:

- Elements of a screen include control captions, the data or information displayed on the screen, heading and headlines, instructional information, and the screen's title.

Captions/Labels:

- Identify controls with captions or labels.
- Fully spell captions out in a language meaningful to the user.
- Use a mixed-case font.
- Capitalize the first letter of each significant word.
- End each caption with a colon (:).
- Choose distinct captions that can be easily distinguished from other captions.
  - ✓ Minimal differences (one letter or word) cause confusion.
- Provide consistency.



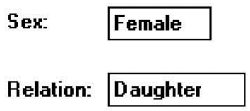
Providing better control caption discrimination.

Data Fields

- For entry or modifiable data fields:
  - ✓ Display data within
    - A line box.
    - A box with a contrasting light-colored background.
  - ✓ Break long structured data items into logical pieces.
  - ✓ Provide a field length commensurate with the size of the entry.
- For inquiry or display/read-only screens containing non-changeable data display the data on the normal screen background with no borders.
- For temporarily inactive data fields display the data content of the data field lighter than active fields.
- Visually emphasize the data fields.

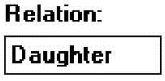
Control Caption — Data Field Differentiation

- Differentiate captions from data fields by using
  - ✓ Contrasting features, such as different intensities, separating columns, boxes, and so forth.
  - ✓ Consistent physical relationships.



- For single data fields
  - ✓ Place the caption to left of the data field.

- Align the caption with the control's data.
- Alternately, place the caption above the data field.



- Align captions justified, upper left to the data field.
- Maintain consistent positional relations within a screen, or within related screens, whenever possible.

- For multiple listings of columnar-oriented data, place the caption above the columnized data fields.

Names:
Deirdra
Karin
Kim
Lauren

Control Caption — Data Field Justification

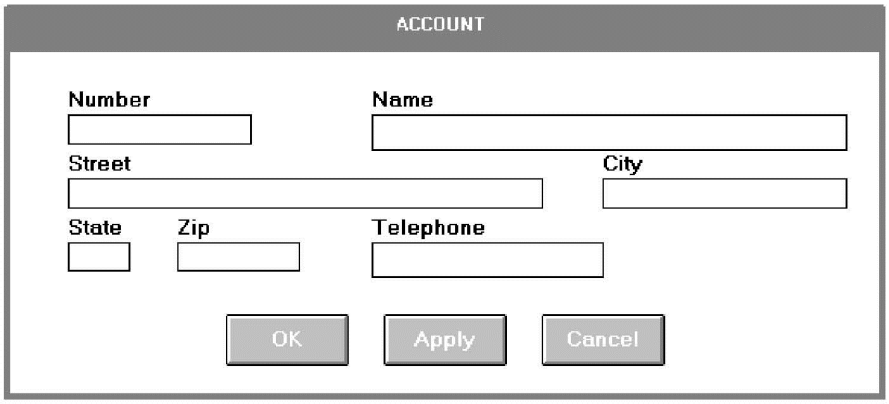
- 1. First Approach
  - ✓ Left-justify both captions and data fields.
  - ✓ Leave one space between the longest caption and the data field column.

Division:
Department:
Title:

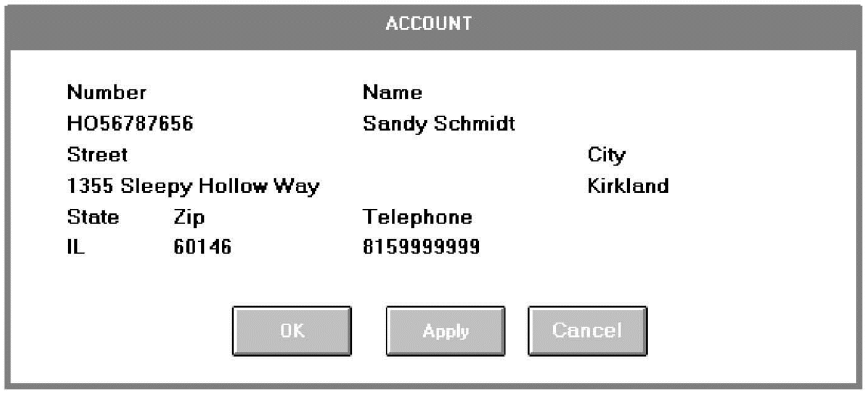
- 2. Second Approach
  - ✓ Left-justify data fields and right-justify captions to data fields.
  - ✓ Leave one space between each.

Division:
Department:
Title:

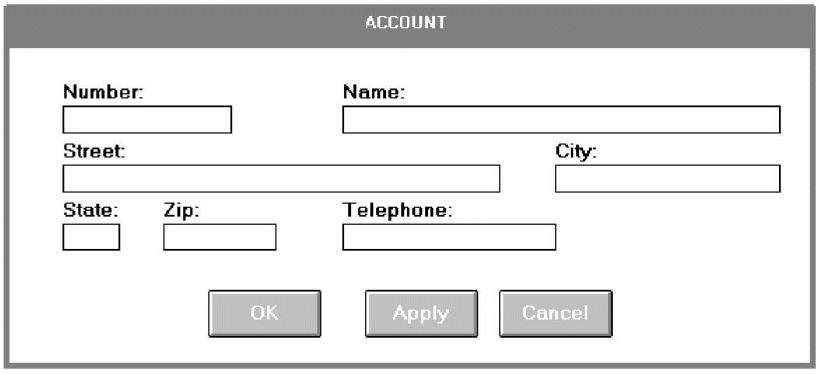
- The following Figures contain a series of screens in a variety of formats containing either entry/modification fields or display/read-only fields



Entry screen with captions above single data fields. Captions distinct from data but with poor alignment and organization of fields. Left-to-right orientation and no groupings. Fair readability.

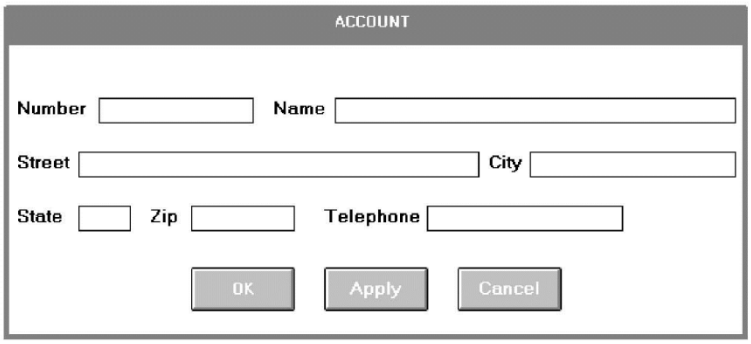


Display/read-only inquiry screen maintaining same structure . Extremely poor differentiation of captions and data. Crowded look and extremely poor readability.

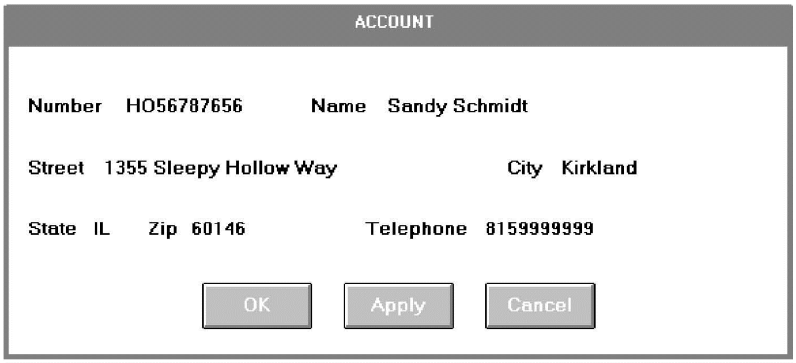


Entry screen in with colons attached to captions. Captions somewhat more distinctive but still with poor alignment and organization of fields, left-to-right orientation and no groupings. Fair readability.

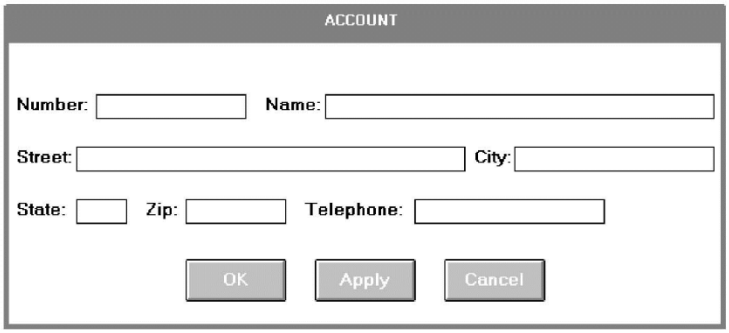
Display/read-only screen maintaining same structure Somewhat better differentiation of captions and data but still with a crowded look and poor readability.



Entry/modification screen with captions to left of single-data fields. Captions distinct from data but with poor alignment and organization of fields. Left-to-right orientation and no groupings. Fair readability.

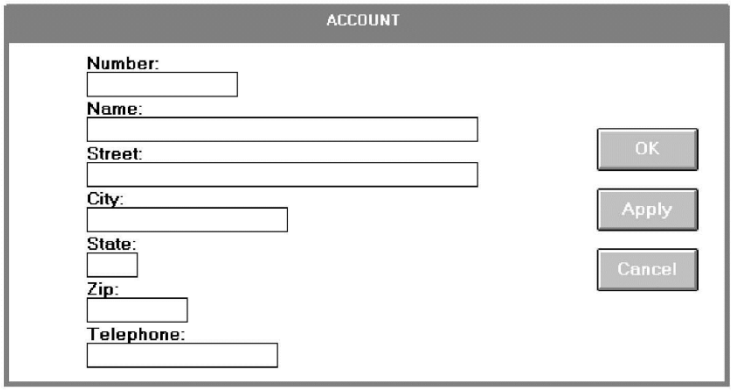


Display/read-only screen maintaining same structure Extremely poor differentiation of captions and data. Less crowded look than previous display/inquiry screens but still poor readability.

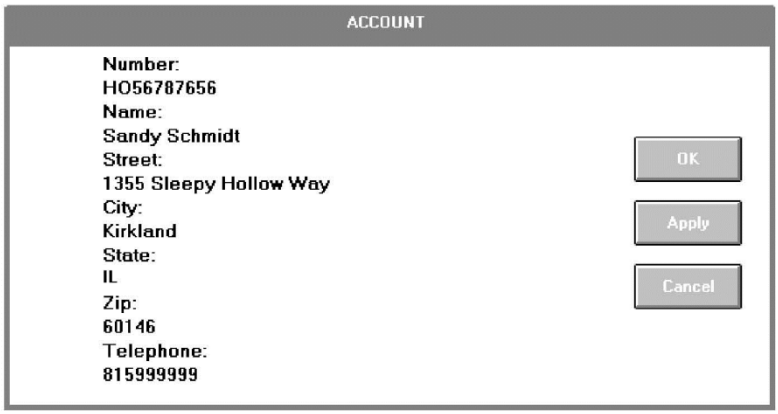


Entry/modification screen with colons attached to captions. Captions somewhat more distinctive but still poor alignment and organization of fields, left-to-right orientation, and no groupings. Fair readability.

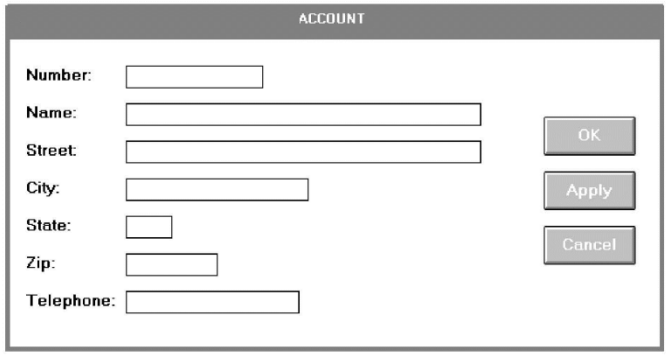
Display/read-only screen maintaining same structure Somewhat better differentiation of captions and data but still poor readability.



Entry/modification screen with much better alignment and readability than previous screens. Captions crowd data fields, however. Also, has no groupings and does not maintain post office suggested format for City, State, and Zip.

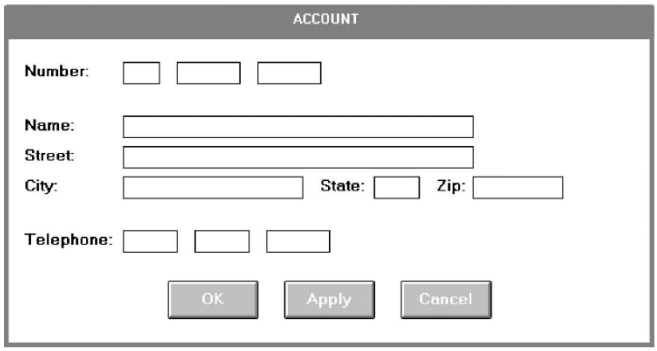


Display/read-only screen maintaining same aligned structure Captions not very distinctive and poor readability. Again, it looks very dense and crowded.



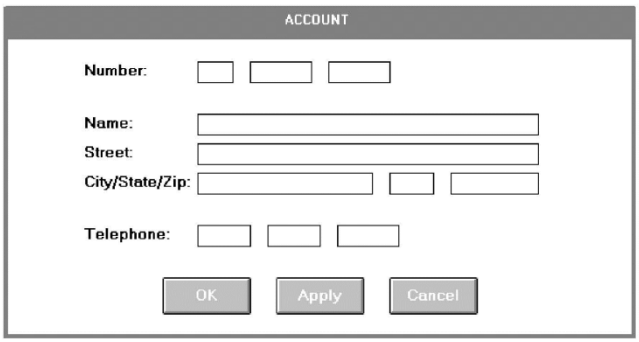
Entry/modification screen with the better alignment and readability Caption positioned to left, however, resulting in more distinctive data fields. Still no groupings, though, and does not maintain post office suggested format for City, State, and Zip.

Display/read-only screen maintaining same alignment and positioning of captions Captions and data much more distinctive. Still no groupings though, and does not maintain post office suggested format for City, State, and Zip.



Entry/modification screen providing alignment, groupings, and the suggested and familiar post office address format. Data fields also segmented to enhance readability (Number and Telephone).

Display/read-only screen maintaining same item alignment and positioning, and data field segmentation Some data distinctiveness is lost and minor crowding occurs, however, because of the location of the captions for State and Zip between data fields.



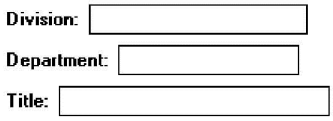
Entry/modification screen that captions for State and Zip are stacked with City, enhancing distinctiveness and readability of the data fields. The screen also achieves a more compact and balanced look. The recommended style for this kind of entry screen.

Display/read-only screen maintaining same alignment, item positioning, and data segmentation Good readability but the lengthy caption City/State/Zip does impinge upon the distinctiveness for the data.

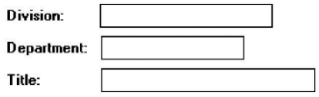
Display/read-only screen the captions Street and City/State/Zip have been eliminated to improve data field distinctiveness. The content of the data should make the identity of these fields obvious. The recommended style for this kind of display/read-only screen.

- Justification of single captions and data fields can be accomplished in several ways. These include

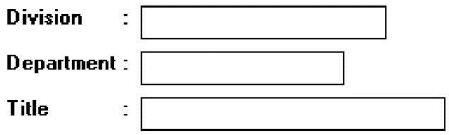
A. Left-justifying captions; data field immediately follows caption.



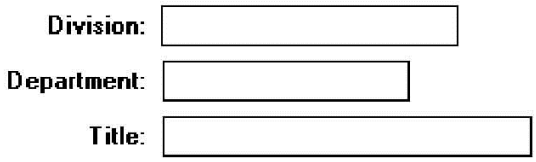
B. Left-justifying captions; left-justifying data fields; colon (:) associated with captions.



C. Left-justifying captions; left-justifying data fields; colon (:) associated with data field.



D. Right-justifying captions; left-justifying data fields

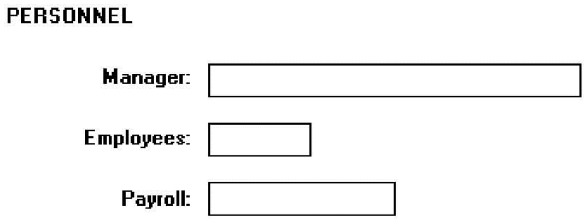


Headings

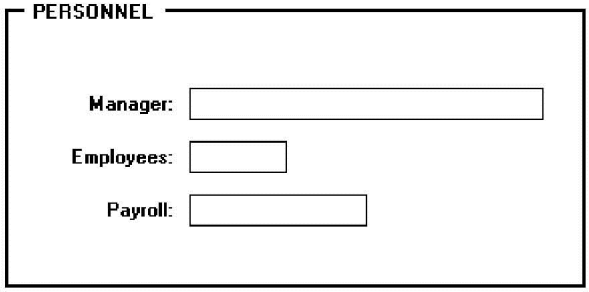
- Used with related controls in applications, headings are primarily incorporated to create a common identity.

Section Headings

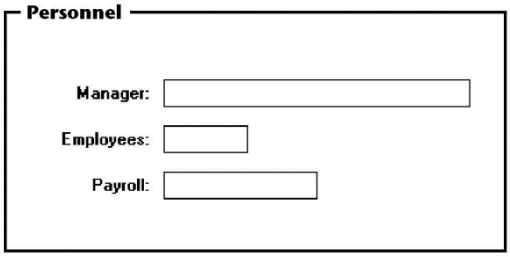
- Provide a meaningful heading that clearly describes the relationship of the grouped controls.
- Locate section headings above their related screen controls.



- Display in a distinguishable font style and size in mixed case, using the headline style.
- Alternately, headings may be located within a border surrounding a grouping, justified to the upper-left corner.



- Indent the control captions to the right of the start of the heading.
- Fully spell out in an uppercase font.
- Display in normal intensity.
- Alternately, if a different font size or style exists, the heading may be displayed in mixed case, using the headline style.

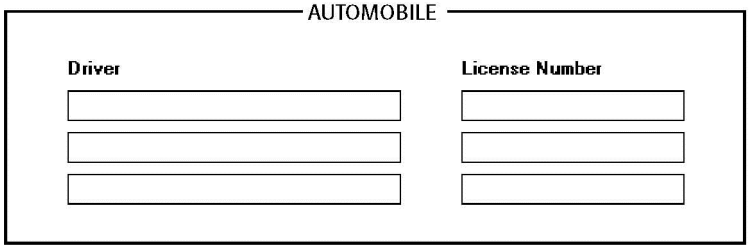


Subsection or Row Headings

- Provide a meaningful heading that clearly describes the relationship of the grouped controls.
- Locate to the left of the
  - ✓ Row of associated fields.
  - ✓ Topmost row of a group of associated fields.
- Separate from the adjacent caption through the use of a unique symbol, such as one or two greater-than signs or a filled-in arrow.
- Subsection or row headings may be left- or right-aligned.
- Display in a distinguishable font style and size in mixed case, using the headline style.

Field Group Headings

- Provide a meaningful heading that clearly describes the relationship of the grouped controls.
- Center the field group heading above the captions to which it applies.
- Relate it to the captions by a solid line.
- Display in a distinguishable font style and size in mixed case, using the headline style.

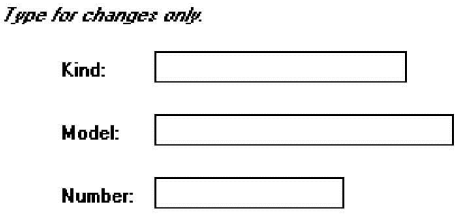


Special Symbols

- Consider special symbols for emphasis.
- Separate symbols from words by a space.

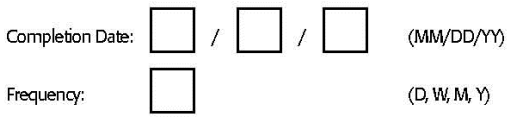
Instructions

- Incorporate instructions on a screen, as necessary
  - ✓ In a position just preceding the part, or parts, of a screen to which they apply.
  - ✓ In a manner that visually distinguishes them, such as
    - • Displaying them in a unique type style.
    - • Displaying them in a unique color.
  - In a position that visually distinguishes them by
    - • Left-justifying the instruction and indenting the related captions, headings or text to the right.
    - • Leaving a space line, if possible, between the instruction and the related control, heading, or text.
  - Using a mixed-case font.



Completion Aids

- Incorporate data field completion aids on a screen, as necessary:
  - ✓ In a position to the right of the text entry control to which they apply.
  - ✓ In a manner that visually distinguishes them, including
    - Displaying them within parentheses ( ).
    - Possibly displaying them in a unique font style.
  - ✓ If the controls are arrayed on the screen in a columnar format, position the completion aid, or aids
    - Far enough to the right so as to not detract from the readability of the entry controls within the column.
    - But close enough to the related control so that they easily maintain an association with the related control.
  - ✓ Left-alignment of completion aids in a column of controls is desirable but not absolutely necessary.



Keying Procedures

- For large-volume data entry applications substantial keying may still be required. The following must be considered in establishing keying procedures.

Keystrokes

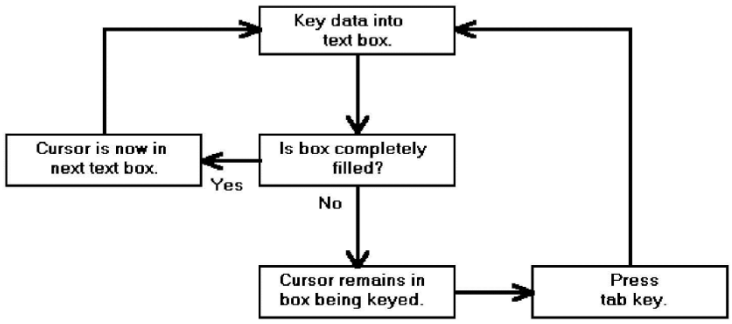
- Do not focus on minimizing keystrokes without considering other factors such as
  - ✓ The keying rhythm.
  - ✓ The goals of the system.

Tabbing

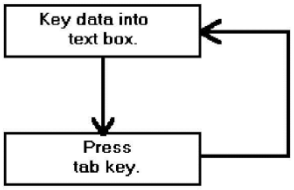
- Initially, position the cursor in the first field or control in which information can be entered.
- Tab in the order in which the screen's information is organized.

Manual Tab versus Auto Skip

- Define fields to permit manual tabbing.
- Consider using Auto Skip for
  - ✓ Expert users.
  - ✓ Easily learned entry screens.
  - ✓ Screens containing fields always completely filled.
  - ✓ Moving within common fixed-length fields segmented into parts.



Text entry using auto skip.



Text entry using manual tabbing.

Keying Rules

- Do not require recoding, changing, omitting, or including data based on special rules or logical transformations.
- Do not require formatting of data.
- Do not make keyed codes case-sensitive.
  - ✓ Exception: Passwords.
- Do not require units of measurement to be keyed.
- Minimize use of the Shift key.
- Ensure that double-clicking will not cause problems.

Information Retrieval On Web

- The Web has an almost unlimited supply of information. Web users access a site for different reasons: a focused search for a piece of information or an answer, a less focused browsing, or simply to surf.
- Easy information scanning is very important. People seldom read more than a few words as they seek items of interest.
- So, the user is impatient, with little time to waste. Things like a slow download, pages that are not easily scannable, and confusing navigation, will quickly drive people away from a Web site.

Initial Focus of Attention

- When a Web page is presented, like most screens, it will be scanned in a clockwise direction, people being influenced by its balance and the weight of its title, graphics, headings, and text.
- Studies of Web users indicate that attention is then immediately directed to the page's content

Page Perusal

- Focusing on the page's content, the user's eyes are first drawn to the page's text, particularly headings, captions, summaries, and notes. Individual words and phrases are read for meaning and relevance.
- Studies find that the most frequent method used in perusing a page is scanning or skimming, concentrating less on detail and word for word reading.

Scanning Guidelines

- A Web page must be structured to facilitate scanning, its key points made very obvious.
- Organization:
  - ✓ Minimize eye movement.
  - ✓ Provide groupings of information.
  - ✓ Organize content in a logical and obvious way.
- Writing:
  - ✓ Provide a meaningful title.
  - ✓ Provide meaningful headings and subheadings.
  - ✓ Concisely write the text.
  - ✓ Write short paragraphs containing only one idea.
  - ✓ Use the inverted pyramid style of writing.
  - ✓ Use bulleted and numbered lists.
  - ✓ Array information in tables.
  - ✓ Provide concise summaries.
- Presentation:
  - ✓ Highlight: Key information-carrying words or phrases and Important concepts.

Browsing Guidelines

- Facilitate scanning.
- Provide multiple layers of structure.
- Make navigation easy.
- Respect the user's desire to leave.
- Upon returning, help the users reorient themselves.

Searching

- People search on the Web when they have a specific goal or need for which they seek an answer. Their focus may be directed toward something specific, a fact, document, or product; toward gaining an understanding of some more general topic; or the search may be directed toward collecting multiple pieces of information (not necessarily looking for one particular piece), or to evaluate multiple products or answers in order to make a decision.
- Currently, the design of a Web site is the most effective searching tool, not a search facility itself.

Problems with Search Facilities

- Not understanding the user
- Difficulties in formulating the search
- Difficulties in presenting meaningful results

Search Facility Guidelines

- Search services on the Web will be judged on how well they enable the user to easily find what is needed in the galaxy of information space.

Know Your Search User

- Identify the level of expertise of the user.
- Anticipate:
  - ✓ The nature of every possible query.
  - ✓ The kind of information desired.
  - ✓ The type of information being searched.
  - ✓ How much information will result from the search.
- Plan for the user's switching purposes during the search process.
- Plan for flexibility in the search process.

Express the Search

- What:
  - ✓ For insite facilities, structure the searching function to the Web site's information and the user's needs.
  - ✓ Integrate searching and browsing.

- Where:
  - ✓ Make the search facility prominent on the home page.
  - ✓ Include a search facility on every page.
- How:
  - ✓ Permit users to specify the extent of searches.
    - • Within a section.
    - • Across a site.
    - • Within specified sources.
    - • Globally.
  - ✓ Provide methods of specifying search parameters, including:
    - • Keywords:For large sites include an internal glossary of terms and a thesaurus.
    - • Phrases.
    - • Variants. Case insensitivity, Partial matches, Synonyms.
  - ✓ Provide a spell checker.
  - ✓ Provide search controls, including:
    - • A text box
      - – Size: Large enough to enter a minimum of 20 characters.
      - – Font: Arial. ; – Font size: 10 points.
    - • Structured controls.
      - – Check boxes.
      - – List boxes or drop-down list boxes
    - • A command button.
      - – Label: Search.
      - – Location: to right of search text box.
  - ✓ Provide separate interfaces for simple and advanced search.
    - • Place “Advanced Search” link under text search box.
  - ✓ Provide guidance and assistance.
    - • Present clear instructions.
    - • Offer online help.
    - • Offer a search wizard.

Progressive Search Refinement

- Allow the user to control the size of the result set by providing a simple mechanism to:
  - ✓ First perform a rapid rough search that reports only:
    - • The number of items in the result set, or • A preliminary list of topical matches.
  - ✓ Then perform a refinement phase to narrow the search and retrieve the desired result set.

Launch the Search

- Permit search activation by clicking on the command button or pressing the Return key.
- In search refinement, permit changes to a parameter to automatically produce a new set of results.

Present Meaningful Results

- Goal:
  - ✓ Provide exactly the information or answer the user is looking for.
  - ✓ Present it in a language and format that is easy to understand and use.
- Criteria summary:
  - ✓ Present a summary of the search criteria with the search results.
- Explanatory message:
  - ✓ Provide a meaningful message to explain search outcomes.
  - ✓ Indicate how many items compose the search result set.
- Results presentation:

  • Present a textual listing that is:

  – Concise. – Arrayed in order of relevance. – Clear. – Easily scannable.
- Permit the user to:
  - ✓ Modify the result set sequencing.
  - ✓ Cluster the result set by an attribute or value.
- For multipage listings, make obvious the link to the next search result page. For results with only one item, immediately present the result page.

Destination Pages

- Describe how the page relates to the search query.
  - ✓ Provide page summary.
  - ✓ Highlight keywords

Locatability

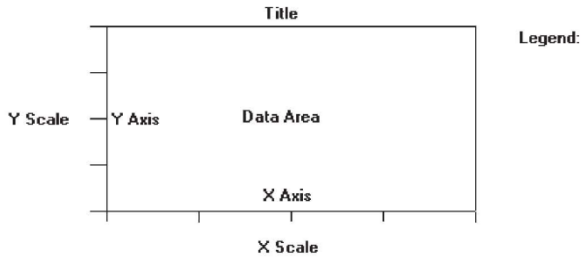
- Provide text-based content.
- Repeat keywords frequently throughout the text.
- Provide a page title:
  - ✓ That possesses meaningful keywords.
  - ✓ Whose first word is its most important descriptor.
  - ✓ That makes sense when viewed completely out of context.
  - ✓ Is different from other page titles.
  - ✓ Is written in mixed-case, headline style, with no highlighting.

Statistical Graphics

- A *statistical graphic* is data presented in a graphical format. A well-designed statistical graphic, also referred to as a *chart* or *graph*, consists of complex ideas communicated with clarity, precision, and efficiency.

Components of a Statistical Graphic

- Most statistical graphics have at least two axes, two scales, an area to present the data, a title, and sometimes a legend or key, as illustrated in Figure. Pie charts are the exception to this general rule.



Components of a statistical graphic.

Data Presentation

- Emphasize the data.
- Minimize the nondata elements.
- Minimize redundant data.
- Show data variation, not design variation.
- Provide the proper context for data interpretation.
- Restrict the number of information-carrying dimensions depicted to the number of data dimensions being illustrated.
- Employ data in multiple ways, whenever possible.
- Maximize data density.
- Employ simple data-coding schemes.
- Avoid unnecessary embellishment of:
  - ✓ Grids.
  - ✓ Vibration.
  - ✓ Ornamentation.
- Fill the graph's available area with data.

Axes

- Values on an axis should increase as they move away from the origin.
- Use the horizontal axis (X) to show time or cause of an event (the independent variable).
- Use the vertical axis (Y) to show a caused effect (the dependent variable).

Scales and Scaling

- Place ticks to marks scales on the outside edge of each axis.
- Employ a linear scale.
- Mark scales at standard or customary intervals.
- Start a numeric scale at zero (0).
- Keep the number of digits in a scale to a minimum.
- Display only a single scale on each axis.
- For large data matrices, consider displaying duplicate axes.
- Provide aids for scale interpretation.
- Provide scaling consistency across two or more related graphics.
- Clearly label each axis in a left-to-right reading orientation.

Proportion

- Provide accurate proportion of the displayed surfaces to the data they represent.
- Provide proper proportion by:
  - ✓ Conforming to the shape of the data.
  - ✓ Making the width greater than the height.

Lines

- Data lines should be the heaviest.
- Axes lines should be of medium weight.
  - ✓ Extend the lines entirely around the graphic.
- Grid lines should be very thin or absent.

Labeling

- Employ clear, detailed and thorough labeling.
- Maintain a left-to-right reading orientation.
- Integrate the labeling with the drawing.
  - ✓ Do not curve letters to match the shape of curved lines.
- Use only one typeface, font, and weight.
  - ✓ For emphasis, use different type sizes.
- Do not separate labeling from the data through ruled lines.
- Provide information about the source of the data.
- Use a legend for complicated graphs.

Title

- Create a short, simple, clear, and distinctive title describing the purpose of the graphic.
- Position the title above, centered, or left-aligned to the rectangle formed by the extended axes.
- Spell it out fully, using a mixed-case or uppercase font.

Aiding Interpretation of Numbers

- Display a grid on request.
- Permit the viewer to click on a data point to display actual values.
- Show numeric values automatically for each point or bar.
- Permit the viewer to zoom in on an area of the graphic.
- Permit the user to change the scale values.
- Permit toggling between a graphic and a table.

Types of Statistical Graphics

- Statistical graphics take many forms. There are curves and line graphs, surface charts, scatterplots, bar graphs, histograms, segmented or stacked bars, and pie charts.

Curve and Line Graphs

- Display data curves or lines that must be compared in a single graph.
- Display no more than four or five curves in a single graph.
- Identify each curve or line with an adjacent label whenever possible.
- If a legend must be included, order the legend to match the spatial ordering of the lines.
- For tightly packed curves or lines, provide data differentiation with a line-coding technique, such as different colors or different line composition types.
- Highlight curves or lines representing important or critical data.
- When comparing actual to projected data:
  - ✓ Use solid curves or lines for actual data.
  - ✓ Use broken curves or lines for projected data.
- Display a reference index if the displayed data must be compared to a standard or critical value.
- Display differences between two data sets as a curve or line itself.

Surface Charts

- Order the data categories so that: The least variable is at the bottom, and the most variable at the top. The largest is at the bottom and the smallest at the top.
- Use different texture or shading coding schemes to differentiate the areas below each curve
- Incorporate labels within the bands of data.

Scatterplots

- Limit use to two-dimensional displays of data.
- Maintain consistent scale size intervals.
- Provide distinguishable, equal-sized plot points.
- If there is more than one set of data on the plot, use different symbols for each data set's points.
- Visually distinguish points of particular significance through a highlighting technique.

Bar Graphs

- Orient bars consistently, either horizontally or vertically.
- Use vertical bars when the item being counted is of greatest interest.
- Use horizontal bars:
  - ✓ When the data labels are long.
  - ✓ To highlight the information rather than the count.
- Use a meaningful organizing principle.If none exists, arrange the bars so that the length of bars is in ascending or descending order.
- Make the spacing between bars equal to one-half the width of the bars or less. If groupings of bars are presented, leave space between the groupings only.
- If different kinds of bars must be easily distinguished, provide differentiation through a coding technique. If possible, use a pattern or color that reinforces the data.
- Highlight bars representing important or critical data.
- Provide a consistent ordering for related groups of bars.
- Display a reference index if displayed data must be compared to a standard or critical value.
- Identify each bar with an adjacent label. Place labels below, or to the left of, the baseline.
- When a great many pieces of data must be compared, consider using histograms or step charts.

Pie Charts

- Pie charts should be used with caution.
- If pie charts are used:
  - ✓ They must add up to 100 percent.
  - ✓ Use five segments or fewer.
  - ✓ Each segment should take up at least 5 percent (18 degrees) of the circle.
  - ✓ Place the largest segment starting at 12:00.
  - ✓ Directly label each segment in the normal reading orientation. If leaders for labels in small segments are necessary, orient them in as few angles as possible.
  - ✓ Include numbers with segment labels to indicate percentages of absolute values.
  - ✓ Texture- or color-coding selected for segments should not emphasize one segment over another (unless it is intended).
  - ✓ Highlight segments requiring particular emphasis through a contrasting display technique or by “exploding” it.
  - ✓ Never tilt a pie.

Technological Considerations in Interface Design

- Interface design is also affected by the physical characteristics of the display device itself and the characteristics of the interfaces controlling software.

Graphical Systems

- Screen design must be compatible with the capabilities of the system, including:
  - ✓ System power.
  - ✓ Screen size.
  - ✓ Screen resolution.
  - ✓ Display colors.
  - ✓ Other display features.
- Screen design must be compatible with the capabilities of the:
  - ✓ System platform being used.
  - ✓ Development and implementation tools being used.
  - ✓ Platform style guide being used.

Web Systems

- Understand the current level of Web technology.
- Design for system configuration used by most users.
- Refrain from haphazard use of leading-edge technology.

Browsers

- Compatibility:
  - ✓ Make the Web site accessible to all users' browsers.
  - ✓ Use browser defaults as much as possible.
- Monitor size and resolution:
  - ✓ Design within the boundaries of an image-safe area for all browsers.
  - ✓ Present images at a resolution appropriate for all users' monitors.
- Fonts:
  - ✓ Use fonts that can be displayed on a variety of browsers.
- Colors:
  - ✓ Use colors that succeed on a variety of browsers and platforms. A palette of 216 colors.
- Bandwidth:
  - ✓ Design for the most commonly used bandwidth.
    - o A 56-kbps modem is most common for home users.
- Versions
  - ✓ Create multiple versions that support multiple browsers.
    - • Always provide a text-only version.
    - • Make use of browser sniffers.

Other Web Considerations

- Downloading:
  - ✓ Provide fast page download times, no more than 8 to 10 seconds per page. Minimize the use of design techniques that cause longer download times.
    - ✓ Long pages.
    - ✓ Large chunky headings.
    - ✓ Numerous or large graphics and images.
    - ✓ Animation.
    - ✓ Excessive amount of color.
    - ✓ Excess use of frames.
  - Provide enough information to the user so that whether or not to request a download can be determined, including:
    - Program or document description.
    - Type of download.
    - Size of download.
    - Download version.
    - Estimated loading time.
    - Special operating requirements.
- Currency:
  - ✓ Keep Web site information current.
- Page printing:
  - ✓ Provide a means to print:
    - Groups of related pages.
    - Individual pages.
    - Sections of pages.
- Maintainability:
  - ✓ Ensure easy Web site maintainability.