

## UNIT-II

### **OBSTACLES AND PITFALLS IN DEVELOPMENT PATH:**

Developing a computer system is never easy. The path is littered with obstacles and traps, many of them human in nature. Gould (1988) has made these general observations about design:

- Nobody ever gets it right for the first time
- Development is chock full of surprises.
- Good design requires living in a sea of changes.
- Designers need good tools.
- Performance design goals
- People may make mistakes while using a good system also

### **COMMON PITFALLS:**

- No early analysis and understanding the users needs and expectations.
- A focus on using design features or components
- No usability testing.
- No common design team vision.
- Poor communication

### **COMMON USABILITY PROBLEMS:**

- Ambiguous menus and icons.
- Languages that permit only single direction movement through a system.
- Input and direct manipulation limits.
- Complex linkage.
- Inadequate feedback.
- Lack of system anticipation.
- Inadequate error messages.

### **IRRITATING CHARACTERS:**

- Visual clutter
- Impaired information readability
- Incomprehensible components
- Annoying distractions.
- Confusing navigation.
- Inefficient operations
- Inefficient page scrolling
- Information overload

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**DESIGN TEAM:**

- Development
- Human factors
- Visual Design
- Usability assesment
- Documentation
- Training

**HUMAN INTERACTION WITH COMPUTERS:**

Understanding How People Interact with Computers Characteristics of computer systems, past and present, that have caused, and are causing, people problems. We will then look at the effect these problems have –

- Why people have trouble with computers
- Responses to poor design
- People and their tasks

**Why People Have Trouble with Computers:**

- Extensive technical knowledge but little behavioral training.
- With its extensive graphical capabilities.
- Poorly designed interfaces.
- What makes a system difficult to use in the eyes of its user?
- Use of jargon
- Non-obvious design
- Fine distinctions
- Disparity in problem-solving strategies
- an "error-preventing" strategy
- Design inconsistency

**PSYCHOLOGICAL:**

Typical psychological responses to poor design are:

Confusion: Detail overwhelms the perceived structure. Meaningful patterns are difficult to ascertain, and the conceptual model or underlying framework cannot be understood or established.

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Annoyance: Roadblocks that prevent a task 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:** Unexpectedly long delays during times of severe or unusual pressure may introduce panic or stress. Some typical causes are unavailable systems or long response times when the user is operating under a deadline or dealing with an irate customer.

**Boredom:** Boredom results from improper computer pacing (slow response times or long download times) or overly simplistic jobs.

These psychological responses diminish user effectiveness because they are severe blocks to concentration.

--Thoughts irrelevant to the task at hand are forced to the user's attention, and necessary concentration is impossible.

--The result, in addition to higher error rates, is poor performance, anxiety, and dissatisfaction Physical.

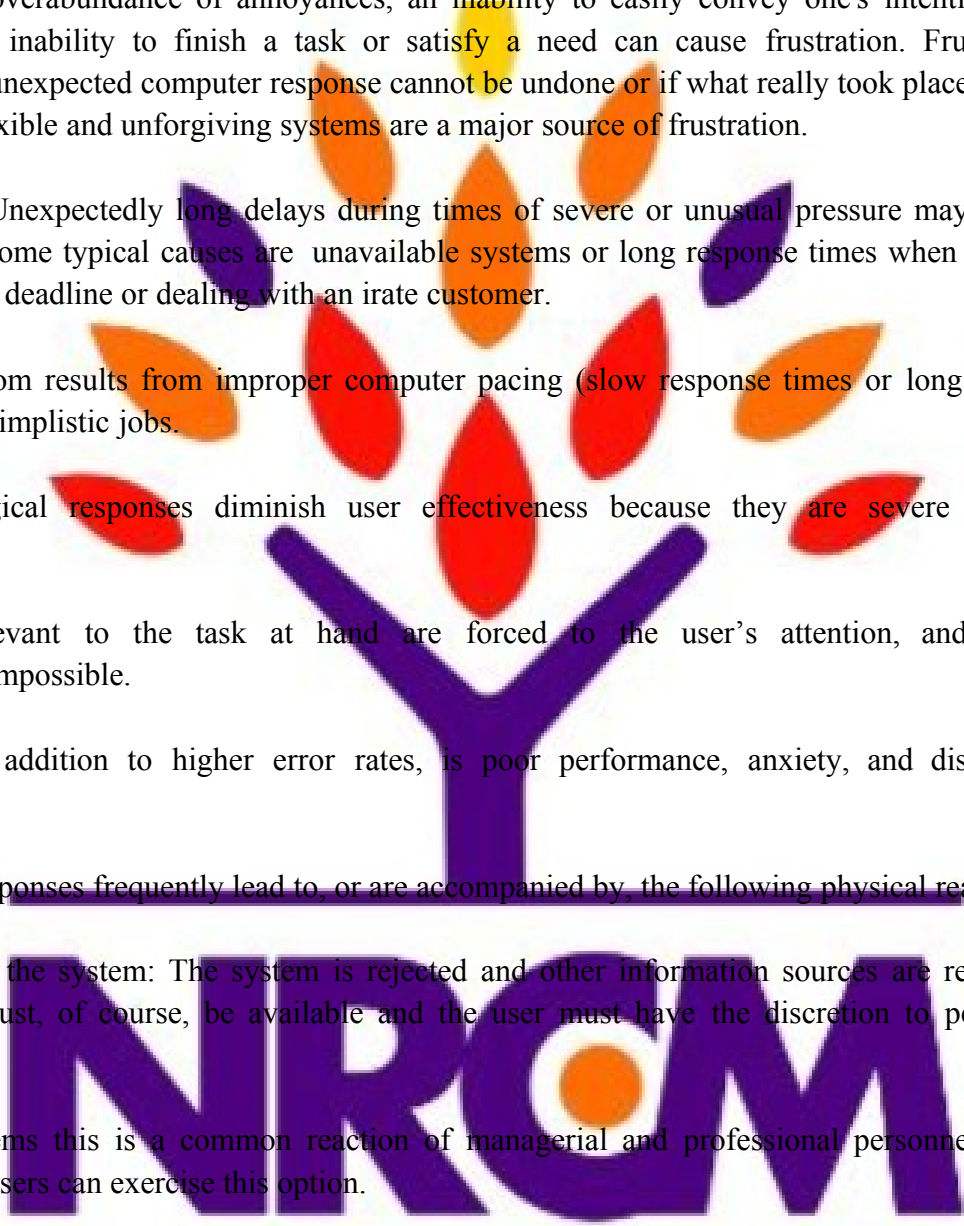
Psychological responses frequently lead to, or are accompanied by, the following physical reactions.

**Abandonment of the system:** The system is rejected and other information sources are relied upon. These sources must, of course, be available and the user must have the discretion to perform the rejection.

In business systems this is a common reaction of managerial and professional personnel. With the Web, almost all users can exercise this option.

**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. Historically, this has been the most common user reaction to most computer systems. 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, since 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. This is a reaction common to workers whose discretion is limited, such as clerical personnel.

Misuse of the system: The rules are bent to shortcut operational difficulties. This requires significant knowledge of the system and may affect system integrity.

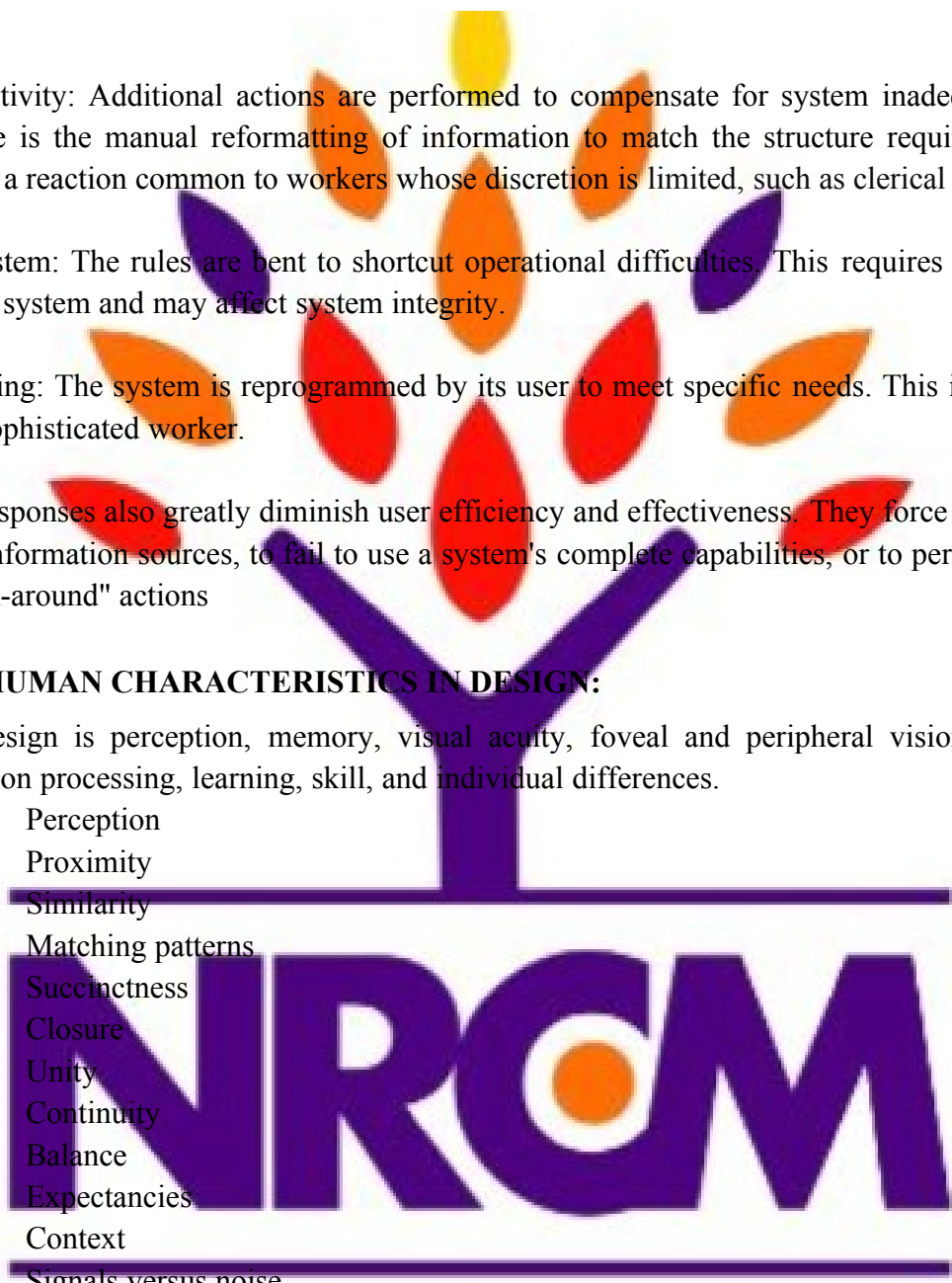
Direct programming: The system is reprogrammed by its user to meet specific needs. This is a typical response of the sophisticated worker.

These physical responses also 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:**

Importance in design is perception, memory, visual acuity, foveal and peripheral vision, sensory storage, information processing, learning, skill, and individual differences.

- Perception
- Proximity
- Similarity
- Matching patterns
- Succinctness
- Closure
- Unity
- Continuity
- Balance
- Expectancies
- Context
- Signals versus noise



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.  
 -Short-term, or working, memory.

Long-term memory

Mighty memory

## Sensory Storage

**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 model 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.

**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:

**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 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 CONSIDERATIONS IN DESIGN:**

#### **The User's Knowledge and Experience**

The knowledge possessed by a person, and the experiences undergone, shape the design of the interface in many ways. The following kinds of knowledge and experiences should be identified.

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

### **HUMAN CONSIDERATIONS IN DESIGN:**

Task Experience - Other Level of knowledge of job and job tasks

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.

### **JOB/TASK/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.



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## PSYCHOLOGICAL CHARACTERISTICS:

Attitude - Positive, neutral, or negative feeling toward job or system

Motivation - Low, moderate, or high due to interest or fear

Patience - 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.

## PHYSICAL CHARACTERISTICS:

- Age Young middle aged or elderly
- Gender Male or Female
- Handness Left, right or ambidextrous
- Disabilities Blind, defective vision, deafness, motor handicap

## HUMAN INTERACTION SPEEDS:

The speed at which people can perform using various communication methods has been studied by a number of researchers.

Reading: The average adult, reading English prose in the United States, has a reading speed in the order of 250-300 words per minute. Proof reading text on paper has been found to occur at about 200 words per minute, on a computer monitor, about 180 words per minute.

One technique that has dramatically increased reading speeds is called Rapid Serial Visual Presentation, or RSVP. In this technique single words are presented one at a time in the center of a screen. New words continually replace old words at a rate set by the reader. For a sample of people whose paper document reading speed was 342 words per minute. (With a speed range of 143 to 540 words per minute.) Single words were presented on a screen in sets at a speed sequentially varying ranging from 600 to 1,600 words per minute. After each set a comprehension test was administered.

## READING:

Prose text - 250-300 words per minute. Proof reading text on paper - 200 words per minute. Proof reading text on a monitor - 180 words per minute.

## LISTENING:

Speaking to a computer. 150-160 words per minute. After recognition corrections: 105 words per minute.

## KEYING:

Typewriter

Fast typist: 150 words per minute and higher Average typist: 60-70 words per minute Computer.

Transcription: 35 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:**

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.

Business definition and requirements analysis

- Direct methods
- Indirect methods
- Requirements collection guidelines

Determining basic business functions

- Developing conceptual modes
- Understanding mental models
- 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

### **DIRECT METHODS:**

The significant advantage of the direct methods is the opportunity they provide to hear the user's comments in person and firsthand. Person-to-person encounters permit multiple channels of communication (body language, voice inflections, and so on) and provide the opportunity to immediately follow up on vague or incomplete data. Here are some recommended direct methods for getting input from users.

- Individual Face-to-Face Interview
- Telephone Interview or Survey
- Traditional Focus Group
- Facilitated Team Workshop
- Observational Field Study
- User-Interface Prototyping

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- Usability Laboratory Testing
- Card Sorting for Web Sites
- A technique to establish groupings of information for Web sites

### INDIRECT METHODS:

An indirect method of requirements determination is one that places an intermediary between the developer and the user. This intermediary may be electronic or another person. Using an intermediary can certainly provide useful information. Working through an intermediary, however, takes away the multichannel communication advantages of face-to-face user-developer contact. Some electronic intermediaries do provide some advantages, as will be described shortly. Imposition of a human intermediary can create additional problems. First, there may be a filtering or distortion of the message, either intentional or unintentional. Next, the intermediary may not possess a complete or current understanding of the user's needs, passing on an incomplete or incorrect message. Finally, the intermediary may be a mechanism that discourages direct user-developer contact for political reasons. Indirect methods include the following:

- MIS Intermediary
- Paper Surveyor Questionnaire
- Electronic Surveyor Questionnaire
- Electronic Focus Group
- Marketing and Sales
- Support Line
- E-Mail or Bulletin Board
- User Group
- Competitor Analyses
- Trade Show
- Other Media Analysis
- System Testing

### DETERMINING BASIC BUSINESS FUNCTIONS:

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.

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## **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.
- Task analysis involves breaking down the user's activities to the individual task level.
- Knowing why establishes the major work goals;
- Complete description of all user tasks and interactions.
- Work activities are studied using the techniques just reviewed;
- Direct observation, interviews, questionnaires, or obtaining measurements of actual current system usage.
- Listing of the user's current tasks.
- Another result is a list of objects the users see as important to what they do

## **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

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## DEVELOPING CONCEPTUAL MODELS:

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.

### 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.

**SCREEN DESIGNING:**

Use of a screen or Web page, and a system, is affected by many factors. These include how much information is presented, how the information is organized, what language is used to communicate to the user, how distinctly the components are displayed, what aesthetics are used, and how consistent a screen or page is with other screens or pages. First, let's look at what aspects of poor design can 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 the principles of good design

**How to distract the screen user**

- Unclear captions
- Improper type and graphic emphasis
- Misleading headings
- Irrelevant and unnecessary headings
- Inefficient results
- Clustered and cramped layout
- Poor quality of presentation
- Legibility
- Appearance
- arrangement
- Visual inconsistency
- Lack of design features
- Over use of 3D presentations
- Overuse of too many bright colors
- Bad typography

**Variety of distractions**

- Numerous audio and visual interruptions
- Extensive visual clutter
- Poor information readability
- Incomprehensible screen components
- Confusing and inefficient navigation

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- Inefficient operations
- Excessive or inefficient page scrolling
- Information overload
- Design in consistency
- Outdated 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.
- Plain and simple english
- A clear indication of when an action can make a permanent change in data

**What screen users do**

- Identifies a task to be performed or need to be fulfilled.
- Decides how the task will be completed or need fulfilled.
- Manipulates the computers controls.
- Gathers necessary data.

**Design goals:**

- Reduce visual work
- Reduce intellectual work
- Reduce memory work
- Reduce mentor work
- Eliminate burdens or instructions.

**SCREEN MEANING AND PURPOSE:**

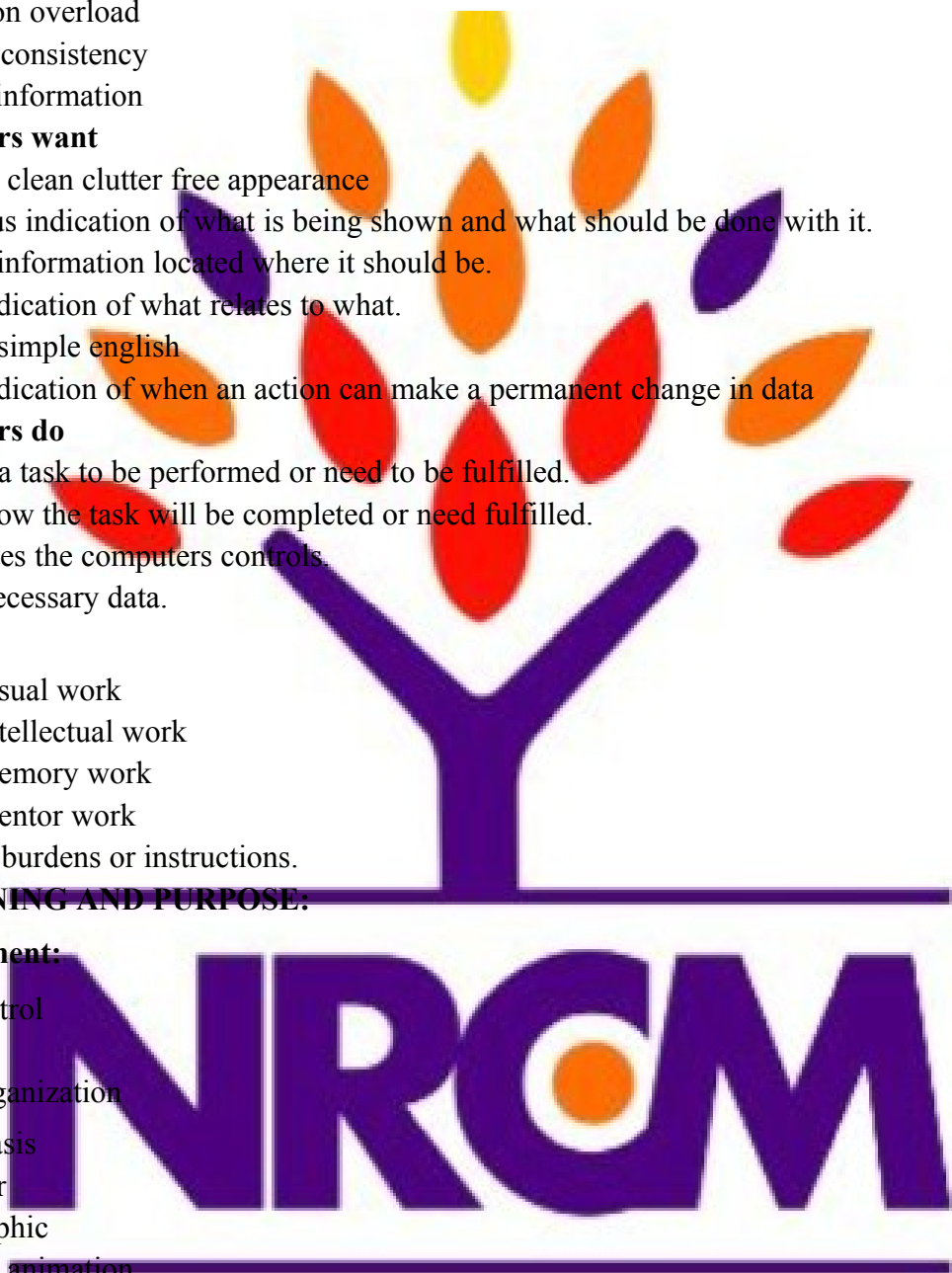
**Each screen element:**

- Every control
- All text
- Screen organization
- All emphasis
- Each color
- Every graphic
- All screen animation
- All forms of feedback

**Must:**

- Have meaning to screen users
- Serve a purpose in performing task organizing screen elements

**Consistency**



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- Provide real world consistency
- Provide internal consistency
- Operational and navigational procedures
- Visual identity or theme
- Component
- Organization
- Presentation
- Usage
- Locations
- Follow the same conventions
- Deviate only when there is clear benefit to user

#### **ORDERING OF SCREEN DATA & CONTENT:**

- Divide information into units that are logical, meaningful and sensible.
- Organize by interrelationships between data or information.
- Provide an ordering of screen units of elements depending on priority.
- 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 is visible.
  - Ensure that only information relative to task is presented on screen.
  - Organizational scheme is to minimize number of information variables.
  - Upper left starting point
  - Provide an obvious starting point in the screen's upper left Corner.

#### **SCREEN NAVIGATION AND FLOW**

Provide an ordering of screen information and elements that:

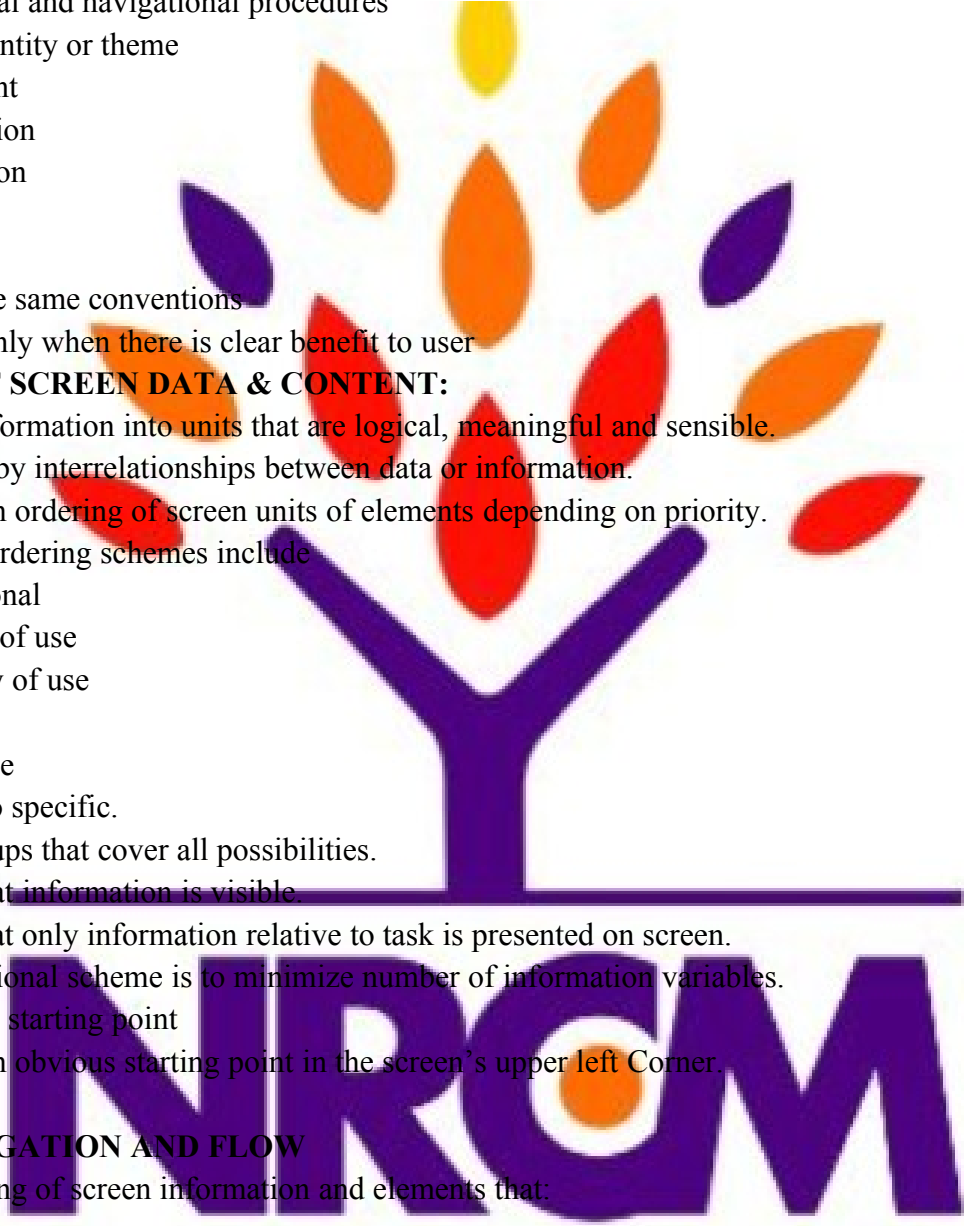
- Is rhythmic guiding a person's eye through display
- Encourages natural movement sequences.
- Minimizes pointer and eye movement distances.

Locate the most important and most frequently used elements or controls at top left.

Maintain top to bottom , left to right flow

Assist in navigation through a screen by

- Aligning elements
- Grouping elements



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- Use of line borders

Through focus and emphasis, sequentially, direct attention to items that are

- Critical
- Important
- Secondary
- Peripheral

Tab through window in logical order of displayed information.

- Locate command button at the 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 initially used to focus a person's attention.

Maintain top to bottom, left to right through the screen. This 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 eyes moves away from the screen and then back, it returns to about same place it left, even if it is seeking next item in sequence.

Most product style guides recommend a left to right orientation.

Our earliest display screens reflected this left to right entry orientation.

Top to bottom orientation is also recommended for presenting displays of read only information that must be scanned.

### **VISUALLY PLEASING COMPOSITION:**

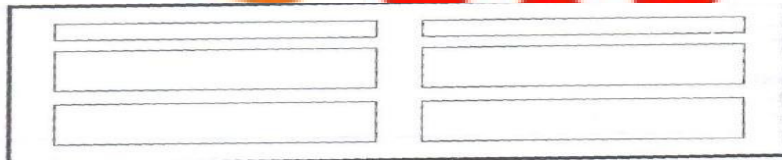
Eyeball fixation studies also indicate that during the initial scanning of a display in a clockwise direction, people are influenced by the symmetrical balance and weight of the titles, graphics, and text of the display. The human perceptual mechanism seeks order and meaning, trying to impose structure when confronted with uncertainty. Whether a screen has meaningful and evident form or is cluttered and unclear is immediately discerned. A cluttered or unclear screen requires that some effort be expended in learning and understanding what is presented. The screen user who must deal with the display is forced to spend time to learn and understand. The user who has an option concerning whether the screen will or will not be used may reject it at this point if the perceived effort in understanding the screen is greater than the perceived gain in using it.

• Provide visually pleasing composition with the following qualities –

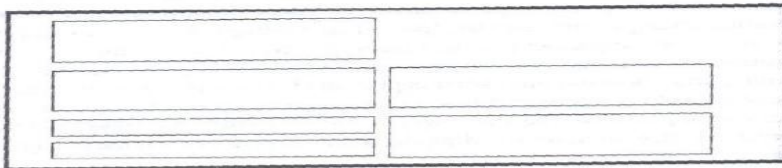
- balance
- Symmetry
- Regularity
- Predictability
- Sequentiality
- Economy
- Unity
- Proportion
- Simplicity
- Groupings.



**Balance:**



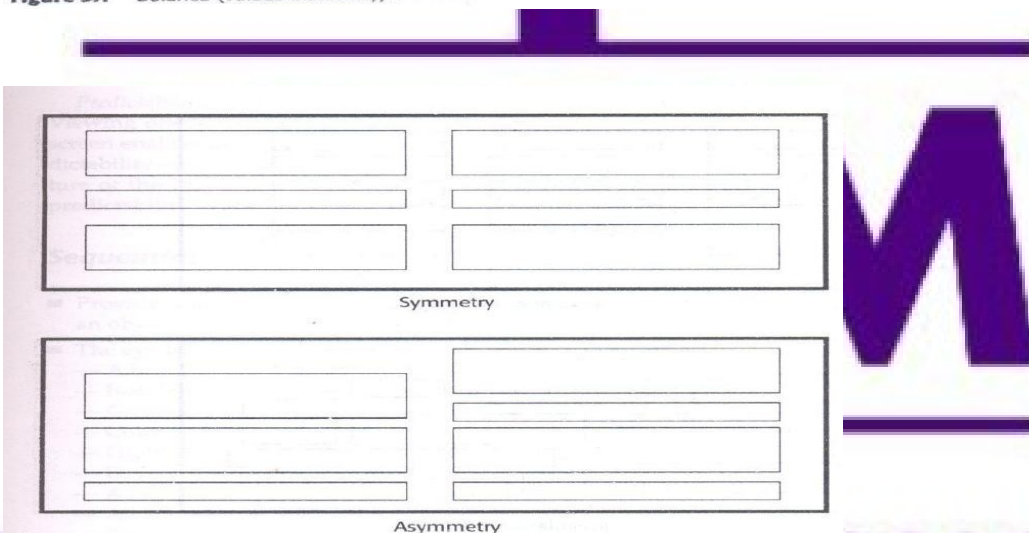
Balance



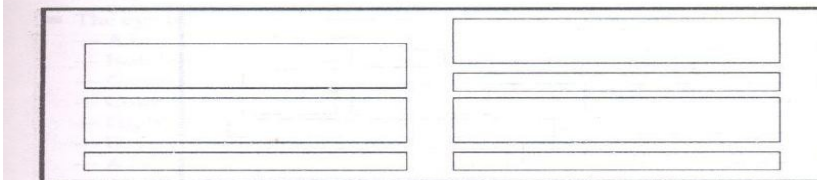
Instability

Figure 3.1 Balance (versus instability).

**Symmetry:**



Symmetry



Asymmetry

Figure 3.2 Symmetry (versus asymmetry).

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**Regularity:**

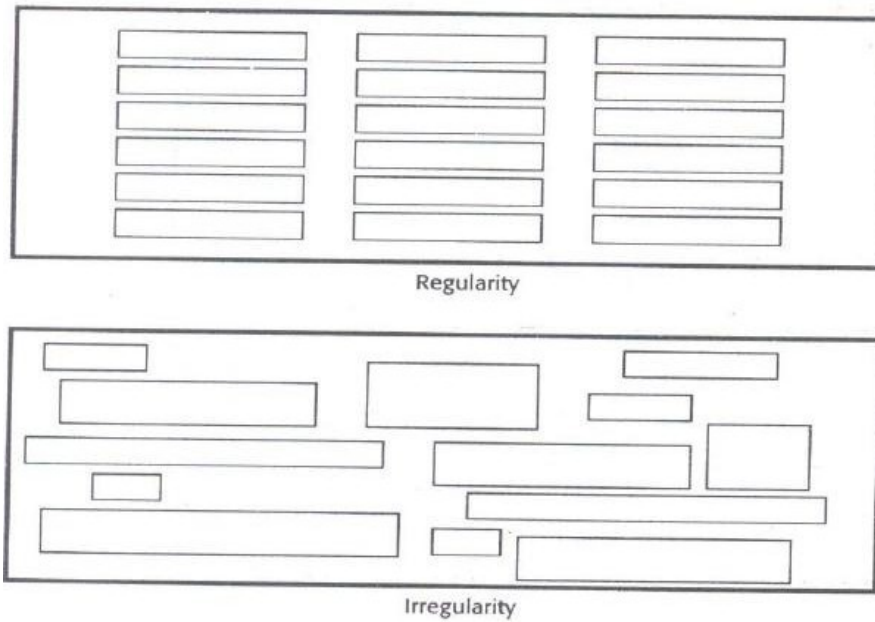


Figure 3.3 Regularity (versus irregularity).

**Regularity**, illustrated in Figure 3.3, is a uniformity of elements based on some principle or plan. Regularity in screen design is achieved by establishing standard and consistently spaced column and row starting points for screen elements. It is also achieved by using elements similar in size, shape, color, and spacing. The opposite of regularity, irregularity, exists when no such plan or principle is apparent. A critical element on a screen will stand out better, however, if it is not regularized.

**Predictability:**

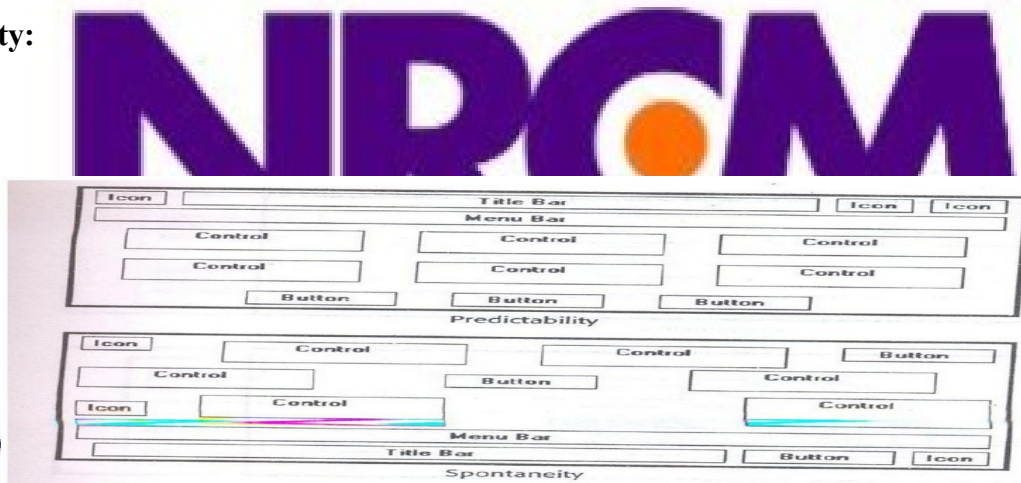


Figure 3.4 Predictability (versus spontaneity).

Predictability, illustrated in Figure 3.4, suggests a highly conventional order or plan.

Viewing one screen enables one to predict how another will look. Viewing part of a screen enables one to predict how the rest of the screen will look. The opposite of predictability — spontaneity — suggests no plan and thus an inability to predict the structure of the remainder of a screen or the structure of other screens. In screen design predictability is also enhanced through design consistency.

### Sequentially:

- The eye trends 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*, illustrated in Figure 3.5, is a plan of presentation to guide the eye through the screen in a logical, rhythmic order, with the most important information significantly placed. Sequentiality can be achieved by alignment, spacing, and grouping as illustrated.

The opposite of sequentiality is randomness, whereby an arrangement and flow cannot be detected. The eye tends to move first to the elements listed above, and then from one to the other. For example, it moves from highly saturated colors to unsaturated colors, from dark to light areas, from big to little objects, and from unusual to usual shapes.

Visually Pleasing Composition is a crucial aspect of Human-Computer Interaction (HCI) design. Here are some key principles and guidelines to create visually pleasing compositions in HCI:

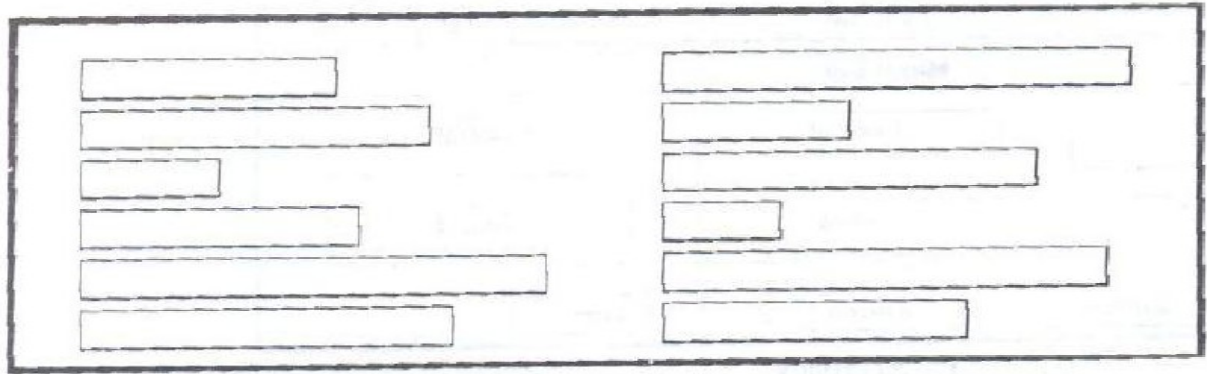
### Principles of Visually Pleasing Composition:

1. Balance: Balance refers to the arrangement of visual elements to create a sense of stability and harmony.
2. Proportion: Proportion refers to the relationship between the size of different elements in a composition.
3. Emphasis: Emphasis refers to the focal point in a composition that draws the user's attention.
4. Movement: Movement refers to the way the user's eye moves through a composition.

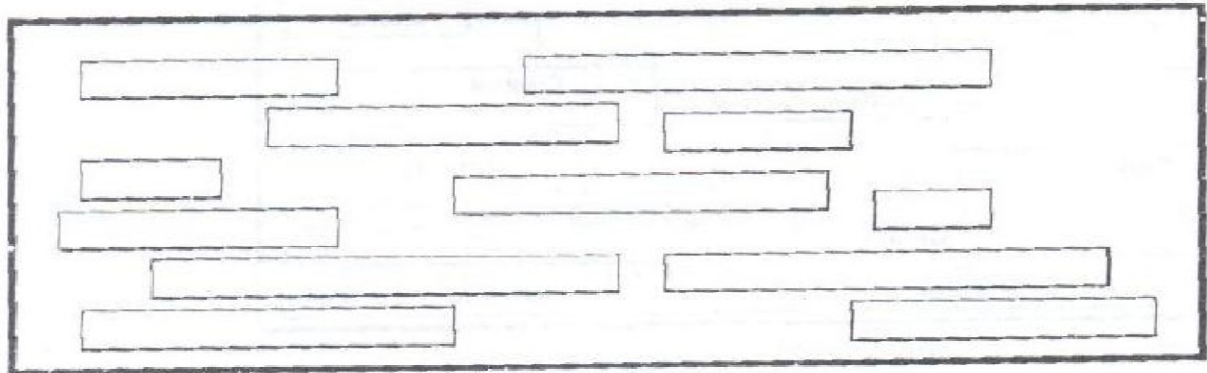
5. Pattern: Pattern refers to the repetition of similar elements in a composition.
6. Unity: Unity refers to the sense of oneness and coherence in a composition.
7. Variety: Variety refers to the use of different elements, such as color, texture, and shape, to create visual interest.



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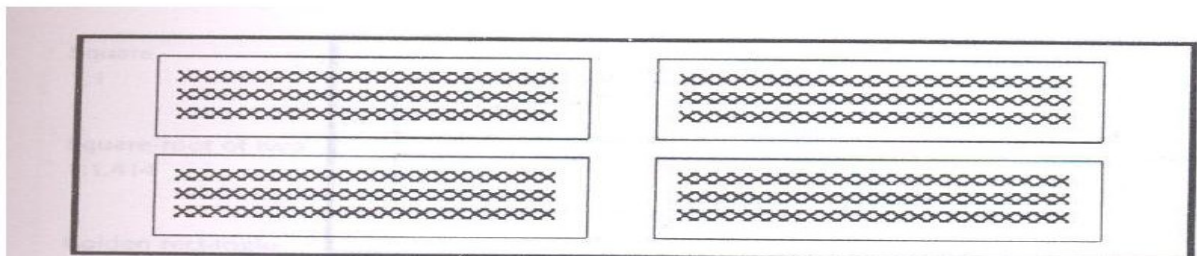


Sequentiality

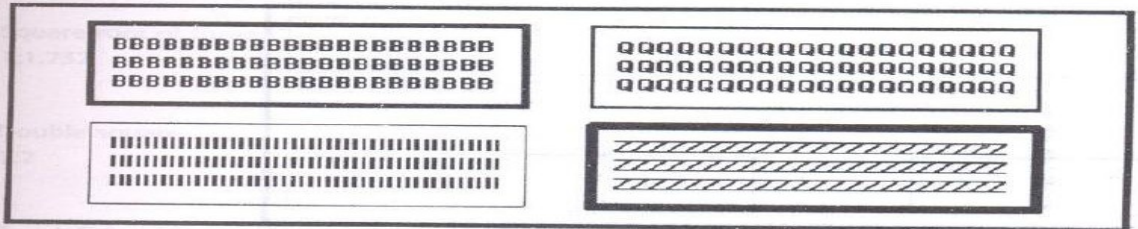


Randomness

Figure 3.5 Sequentiality (versus randomness).



Economy



Intricacy

Figure 3.6 Economy (versus intricacy).

yc

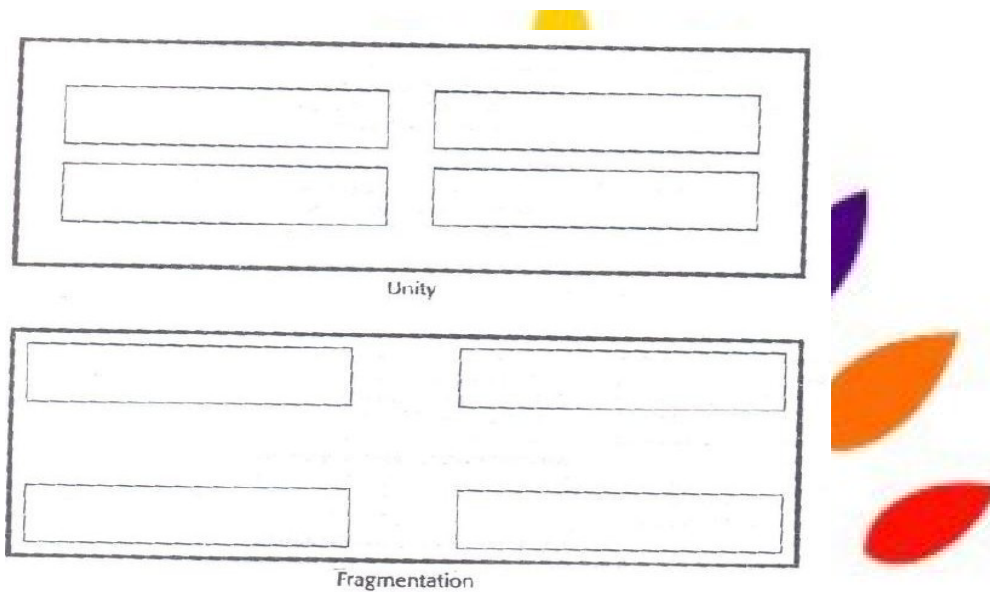


Figure 3.7 Unity (versus fragmentation).

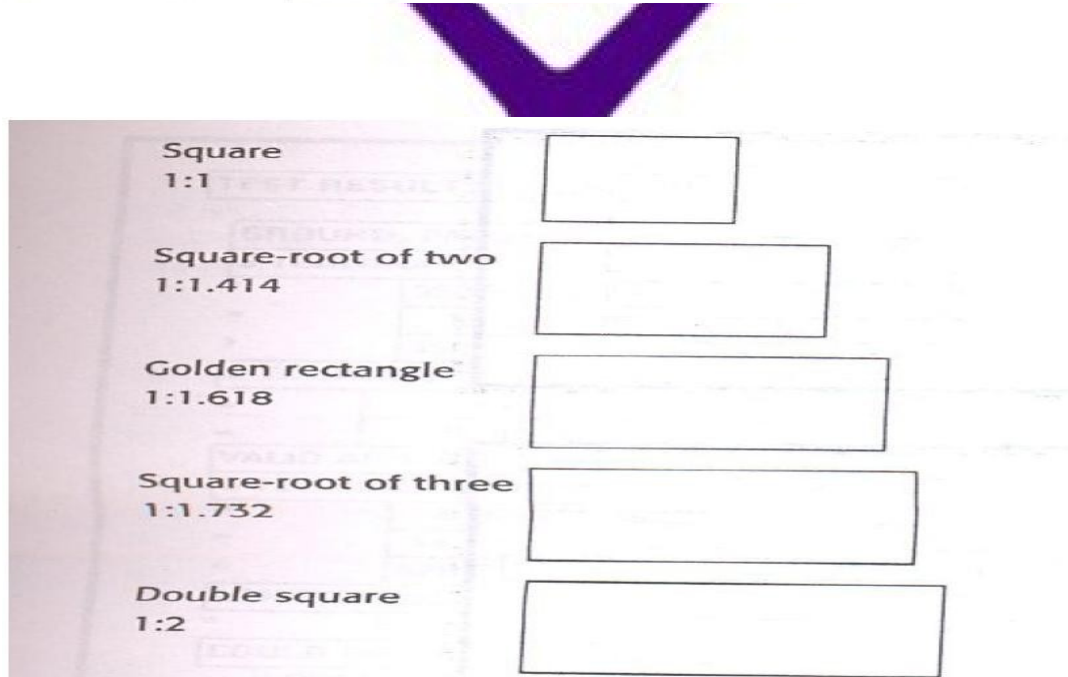
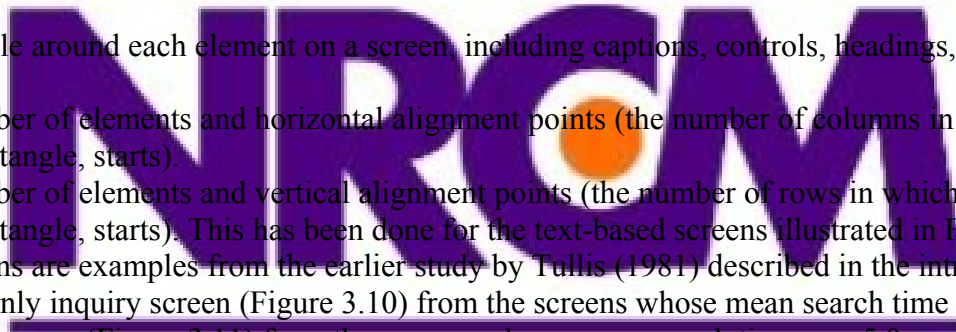


Figure 3.8 Pleasing proportions.

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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). This has been done for the text-based screens illustrated in Figures 3.10 and 3.11. These screens are examples from the earlier study by Tullis (1981) described in the introduction. They are an original read-only inquiry screen (Figure 3.10) from the screens whose mean search time was 8.3 seconds, and a redesigned screen (Figure 3.11) from the screens whose mean search time was 5.0 seconds. A complexity calculation using information theory for each screen is as follows:

Optimize the number of elements on a screen, within limits of clarity. Minimize the alignment points, especially horizontal or columnar.

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- Figure 3.11 (redesigned):
  - 18 fields with 7 horizontal (column) alignment points = 43 bits.
  - 18 fields with 8 vertical (row) alignment points = 52 bits.



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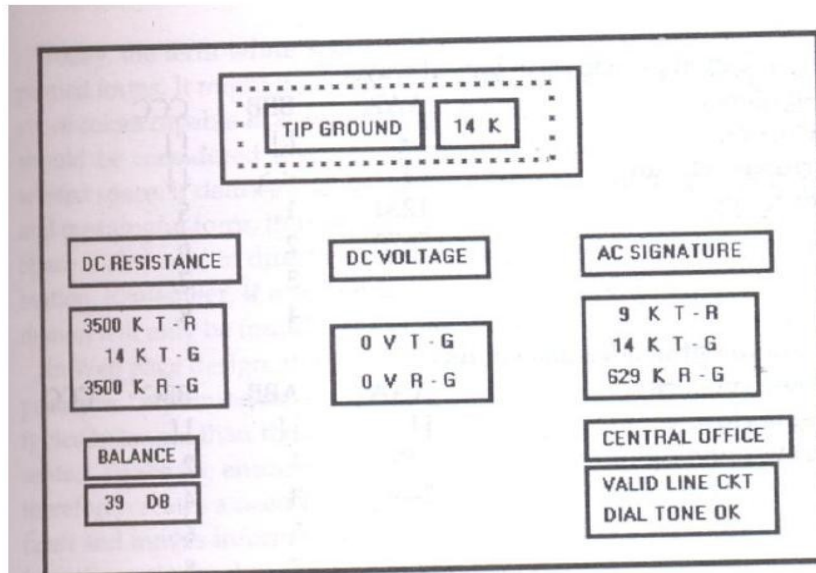


Figure 3.13 Redesigned screen, from Tullis (1981), with grouping indicated by bold boxes.

### GROUPING USING BORDERS:

Grouping screen elements aids in establishing structure, meaningful relationships, and meaningful form. In addition to providing aesthetic appeal, past research has found that grouping aids in information recall and results in a faster screen search. The study by Grose et al. (1998) found that providing groupings of screen elements containing meaningful group titles was also related to shorter screen search times. In this study groupings also contributed to stronger viewer preferences for a screen.

- Provide functional groupings
- Create spatial groupings
- Provide meaningful titles for each grouping
- Incorporate line borders
- Do not exceed three line thickness
- Create lines consistent in height and length
- For adjacent groupings with borders where ever possible
- Use rules and borders sparingly

### FOCUS AND EMPHASIS

- Visually emphasize the
- Most prominent element
- Most important elements
- Central idea or focal point
- De-emphasize less important elements
- To ensure that
- Too many screen elements are emphasized.
- Screen clutter

- Using too many emphasize techniques
- To provide emphasis use techniques such as :
- Higher brightness
- Reverse polarity
- Larger and distinctive font
- Underlining
- Blinking
- Line rulings
- Contrasting colors
- Larger size
- Positioning
- Isolation
- Distinctiveness
- White space

### INFORMATION RETRIEVAL ON WEB:

- The most sought after web commodity is content.
- Behavior is often goal driven.
- Reading is no longer a linear activity.
- Impatience.
- Frequent switching of purpose.
- Web users access site for different reasons: a focused search for a piece of information or an answer less focused for browsing or surf.
- High tech capabilities, fancy graphics do not compensate for inefficient or poor content.
- Initial focus on attention
- Page perusal
- Scanning guidelines
- Browsing
- Browsing guidelines
- Searching
- Problems with search facilities
- Search facility guidelines
- Express the search
- Progressive search refinement
- Launch the search
- Present meaningful results

### SCANNING GUIDELINES:

To aid in finding information, a Web page must be structured to facilitate scanning. Studies report that about 80 percent of viewers scan a new page when it first appears. When they find something interesting, then they read. Only 16 percent read word-by-word. People also spend about 12 percent of their time trying to find desired information.

People that scan generally read only headings, not full text prose. Useful information buried in dense text is

often missed (Koyani et al., 2004). Difficult-to-scan pages may cause a viewer to give up and move on, preferring to spend what is often limited time elsewhere. Organization. Pages should be organized to guide a person's eye through the page in a systematic way. Efficient eye movement, and scanning direction, can be made obvious through the alignment and columnization of page elements, and effective use of white space. Order information page information to be consistent with the viewers expected scanning path. Highlight. Emphasize important information, issues, and topics through use of varying font sizes and boldness. Links can serve as emphasis entities since the underlining makes them stand out. Headings and subheadings. Distinctive and obvious headings are often targets for page scanning. Well-written headings can be important cues in helping people classify and organize page information, understand page structure, and maintain orientation. Headings should be written clearly, conceptually relating to the information or functions that follow.

### Organization

- Minimize eye movement
- Provide groupings of information
- Organize content in a logical and obvious way.

### Writing:

- Provide meaningful headings and subheadings.
- Provide meaningful titles
- Concisely write the text.
  - Use bullets/ numbers
  - Array information in tables
  - Presentation
    - Key information in words or phrases
    - Important concepts

### BROWSING GUIDELINES:

A person, in looking for a particular item of information on the Web, can implement “find” strategies commonly called browse and search. As mentioned previously, browsing is non-specific surfing. People wander around a Web site, or Web sites, at their own pace, following discovered links, scanning headings, and using other presented page cues to try and locate what they are interested in. Search is a much more structured find mechanism. In search, one or more keywords are entered into a search field, sometimes with restrictive parameters, and then the user is presented with a collection of descriptions and links that might possibly contain the information of interest.

- Facilitate scanning
- Provide multiple layers of structure
- Make navigation easy
- Respect users desire to leave
- Upon returning help users reorient themselves.
- Users can browse deeply or simply move on.
- Provide guidance to help reorientation
- Understand terms to minimize need for users to switch context.

### PROBLEMS WITH SEARCHING:

- Not understanding the user.

- Difficulties in formulating the search.
- Difficulties in presenting meaningful results.
- Identify the level of expertise of user.

**KNOW THE SEARCH USER:**

- Plan for user’s switchig purposes during search process.
- Plan for flexibility in the search process.
- Anticipate
- Nature of every possible query
- Kind of information desired
- How much information will result the search.

**STATISTICAL GRAPHICS:**

- A statistical graphic is data presented in a graphical format.
- A well designed statistical graphic also refered to as chart or graph.
- Use of statistical graphics
  - reserve for material that is rich, complex or difficult.
- Data Presentation
- emphasize the data
- Minimize non data elements
- Minimize redundant data
- Fill the graph’s available area with data.
- Show data variation
- Provide proper context for data interpretation.

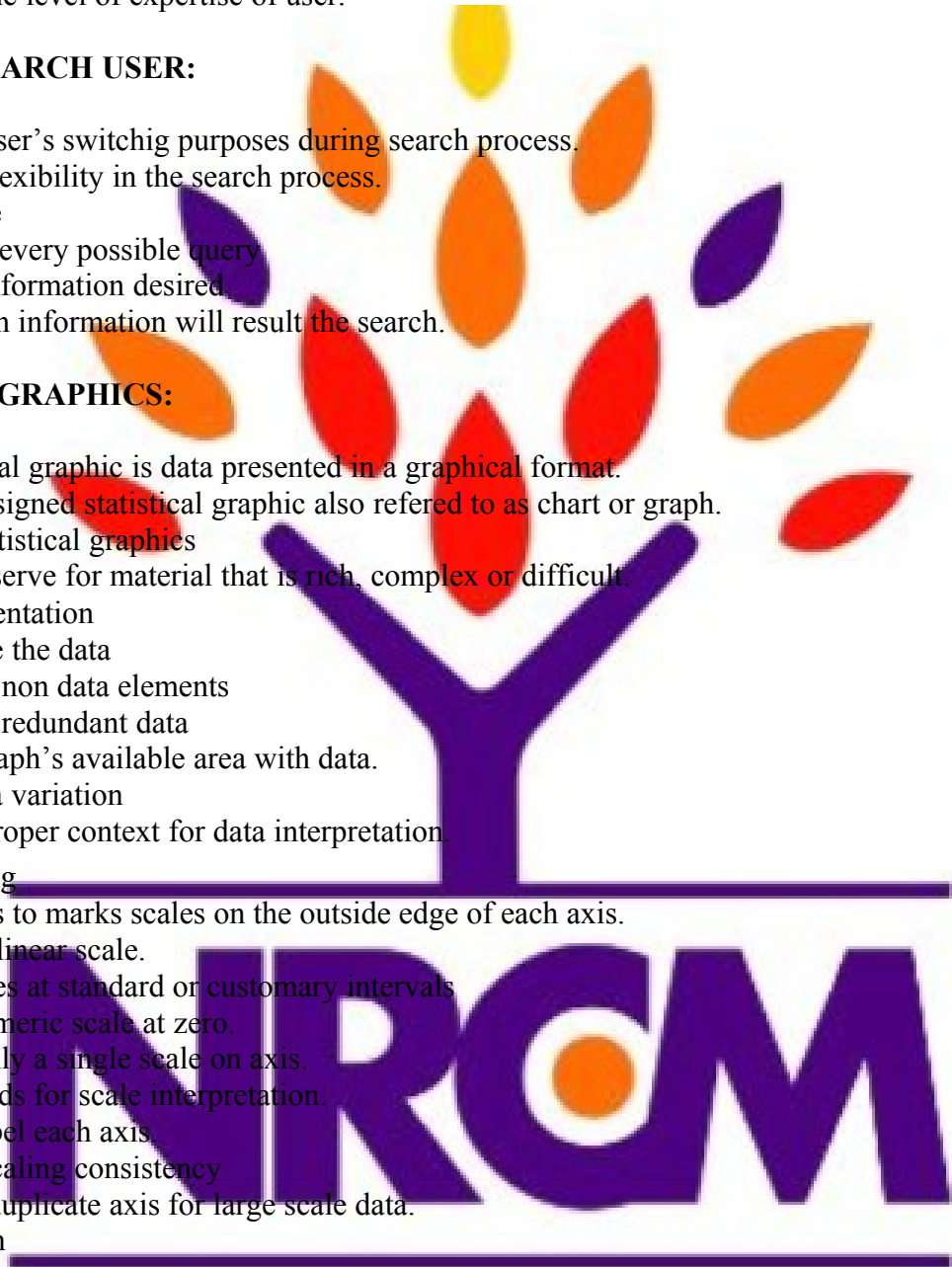
**Scales and shading**

- 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.
- display only a single scale on axis.
- provide aids for scale interpretation.
- clearly label each axis.
- Provide scaling consistency
- consider duplicate axis for large scale data.
- Proportion
- Lines
- Labeling
- Title
- Interpretation of numbers

**TYPES OF STATISTICAL GRAPHICS:**

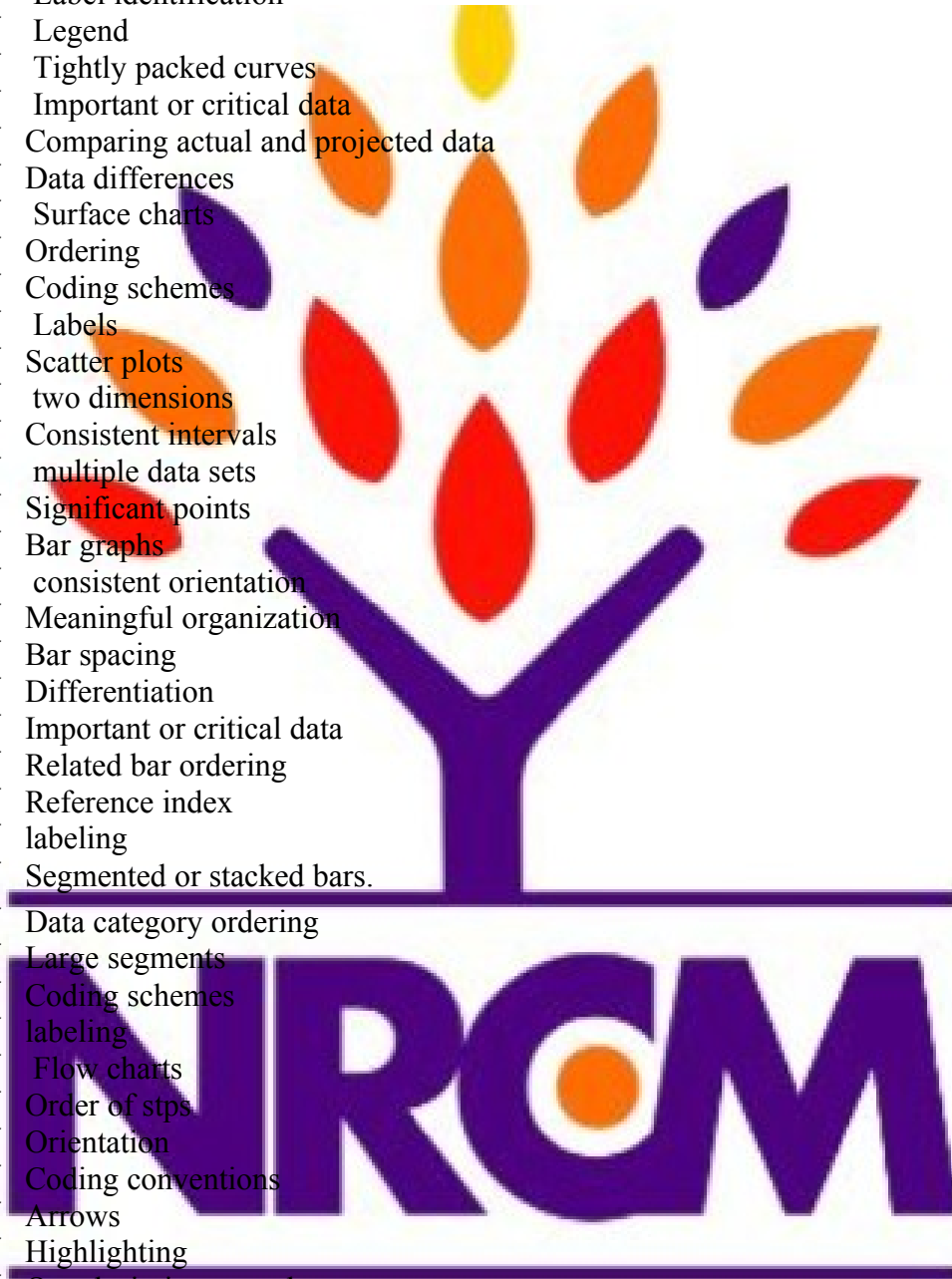
Statistical graphics take many forms. There are curve and line graphs, surface charts, scatterplots, bar charts, histograms, segmented or stacked bars, and pie charts

- ✓ curve and line graphs



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- ✓ Single graph
- ✓ Four or five maximum
- ✓ Label identification
- ✓ Legend
- ✓ Tightly packed curves
- ✓ Important or critical data
- ✓ Comparing actual and projected data
- ✓ Data differences
- ✓ Surface charts
- ✓ Ordering
- ✓ Coding schemes
- ✓ Labels
- ✓ Scatter plots
- ✓ two dimensions
- ✓ Consistent intervals
- ✓ multiple data sets
- ✓ Significant points
- ✓ Bar graphs
- ✓ consistent orientation
- ✓ Meaningful organization
- ✓ Bar spacing
- ✓ Differentiation
- ✓ Important or critical data
- ✓ Related bar ordering
- ✓ Reference index
- ✓ labeling
- ✓ Segmented or stacked bars.
- ✓ Data category ordering
- ✓ Large segments
- ✓ Coding schemes
- ✓ labeling
- ✓ Flow charts
- ✓ Order of stps
- ✓ Orientation
- ✓ Coding conventions
- ✓ Arrows
- ✓ Highlighting
- ✓ One decision at each step
- ✓ Consistently order and word all choices
- ✓ Pie chart



**TECHNOLOGICAL CONSIDERATION -INTERFACE DESIGN**

Interface design is also affected, and constrained by, characteristics of the hardware being used and the interface's controlling software.

**Graphical systems:**

Graphical system design must be compatible with the system's power, screen size, screen resolution, and

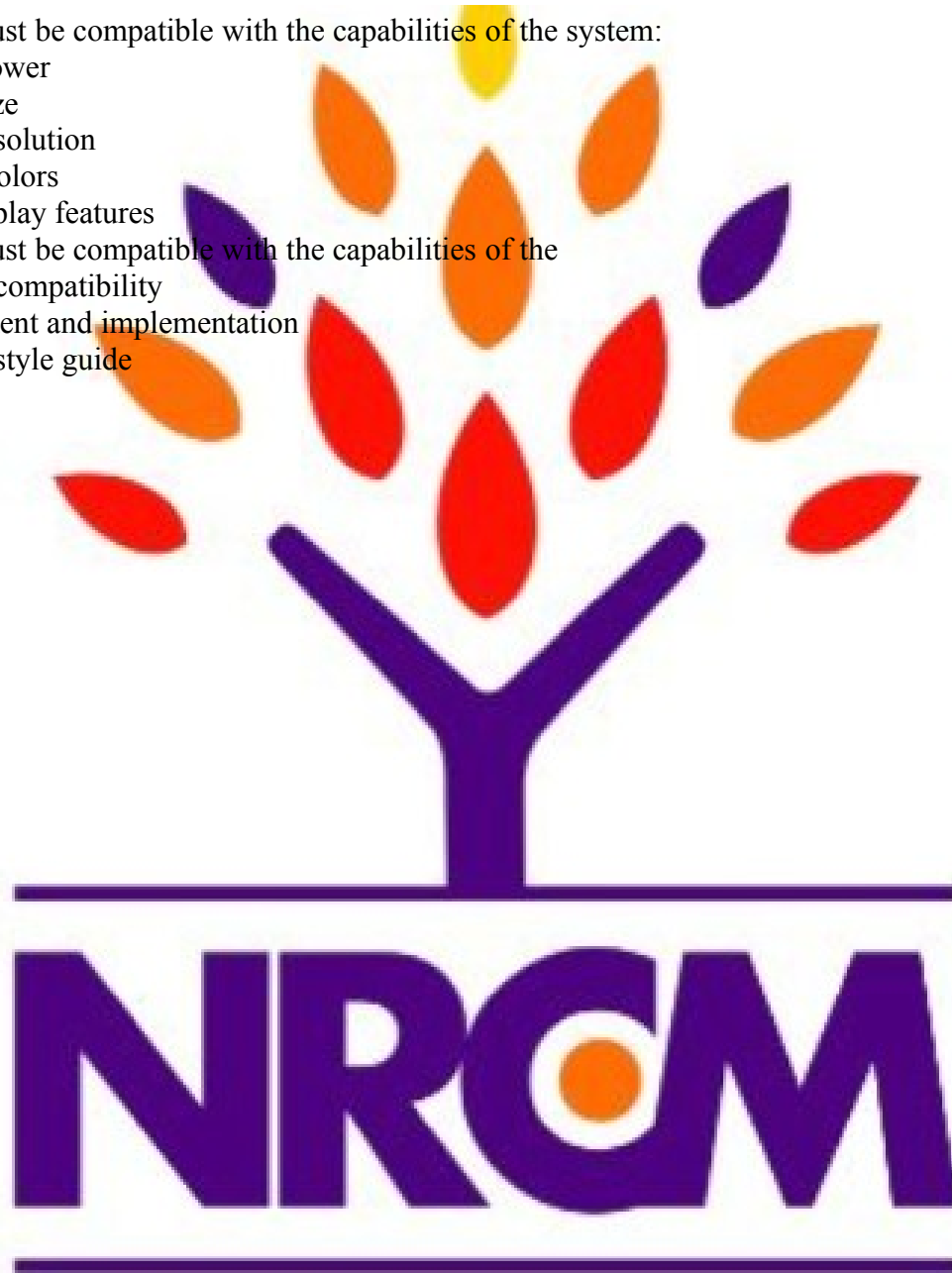
displayable colors, fonts and other features. Designs for Web systems must also take into consideration the characteristics of the browsers being used and the bandwidth of the communication medium.

Screen design must be compatible with the capabilities of the system:

- system power
- Screen size
- Screen resolution
- Display colors
- Other display features

Screen design must be compatible with the capabilities of the

- Platform compatibility
- development and implementation
- Platform style guide



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