Visual Information: Graphical Representation at the Interface

Lecture #7

Part B

Agenda

- How theories of vision can influence interface design
  - Graphical modeling
  - Graphical coding

Graphical Representation

- From the design point of view
  - Screen → two-dimensional
  - Objects → two-dimensional/three-dimensional
  - Representation of 2D objects on a 2D screen
    - Straightforward graphics is enough
  - Representation of 3D objects on a 2D screen
    - Required special techniques
    - Human vision psychology is required to be considered

Graphical Representation

- Representation of 3D objects on a 2D screen
  - Graphical modeling techniques
    - Used to represent 3D objects and scenes
  - Graphical coding
    - Used to represent different types of information at the interface
    - A powerful way of displaying quantitative data

Graphical Modeling

- Representation of 3D objects on 2D screen

  Underlying principles are

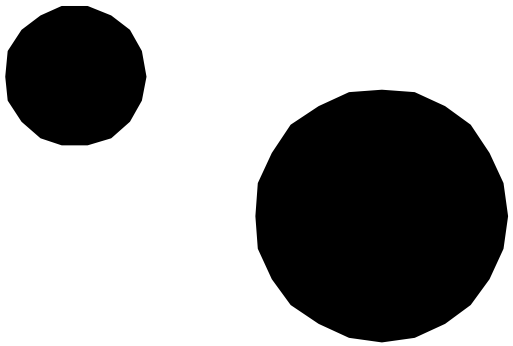
  - Monocular depth cues
    - To make objects appear as three-dimensional
  - Binocular depth cue
    - To make perceived depth
  - Motion parallax
    - To make perceived distance and depth

Monocular Depth Cues

- Size
- Interposition
- Contrast, Clarity and Brightness
- Shadow
- Texture

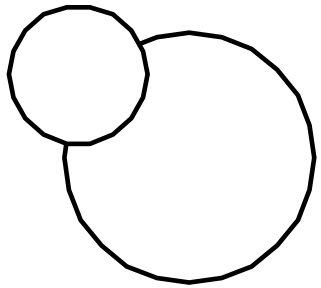
Monocular Depth Cues: **Size**

- The larger of two otherwise identical objects appears to be closer than the smaller one



Monocular Depth Cues: **Interposition**

- If one object partially obscures a second object then the blocked object is perceived to be behind and beyond the blocking object



Monocular Depth Cues: **Contrast, Clarity and Brightness**

- Sharper and more distinct objects appear to be nearer, and duller objects appear to be further away

Monocular Depth Cues: **Contrast, Clarity and Brightness**

Here, the sharper rocks appear closer and the duller mountains further away

Monocular Depth Cues: **Shadow**

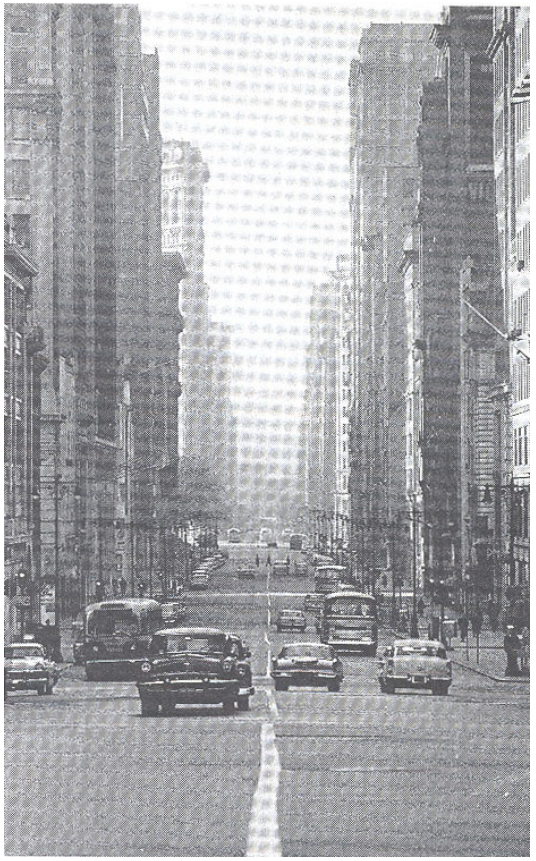
- Shadows cast by an object provide some cues to the relative position of objects

Monocular Depth Cues: **Shadow**

Monocular Depth Cues: **Texture**

- As the apparent distance increases, the texture of a detailed surface becomes less grainy

Monocular Depth Cues: **Texture**



Binocular Depth Cue

- Three-dimensional models can also be constructed using stereoscopic effect
  - Two images of the same objects are presented separately to each eye from slightly different angle
  - The visual apparatus in the brain put theses two images together to recreate a three-dimensional object

Motion Parallax

- Based on the fact that when we move our eyes
  - Different objects are displaced at different rate
  - Objects that are further away appear to move more slowly than objects that are closer

Example

We see likewise scenes while moving in a train

- Alternatively, if there is a relative speed between objects and observer
  - Observer is moving
  - Objects are moving
  - Both objects and observer are moving

Other Approaches

- Solid-objects modeling
  - Using color and shading
  - Less risk of misinterpreting
  - Costly and time consuming in terms of computing resources

- Wire-frame modeling
  - Using schematic line drawings
  - Useful for depicting outside of objects only
  - Require less computing power

Graphical Coding

- Use of graphics as a form of coding
  - Red, Amber and Green are three colors used in traffic control
  - Abstract system processes, data objects and other features of the interface can be represented by different forms of graphical coding

Graphical Coding: Some Examples

- Abstract codes to represent files
- Reverse video represent the current status of files
- Abstract shapes to represent different objects
- Color to represent different options
- Alphanumeric to represent data objects

Graphical Coding: Some Examples

- More direct mapping exist where there is some correspondence between the objects being represented and the form of representation that is used
  - Different sizes to reflect different file sizes (e.g. small, medium, large)
  - Different line widths to represent the increasing sizes of pencil width available in a drawing package
  - Bar charts to show trends in numerical data

Graphical Coding: Some Examples

- Most direct mapping includes various types of icons that are designed to resembles the objects they are portraying at the interface
  - A west bin to represent the place to dispose of unwanted files
  - A paper file to represent a file
  - etc….

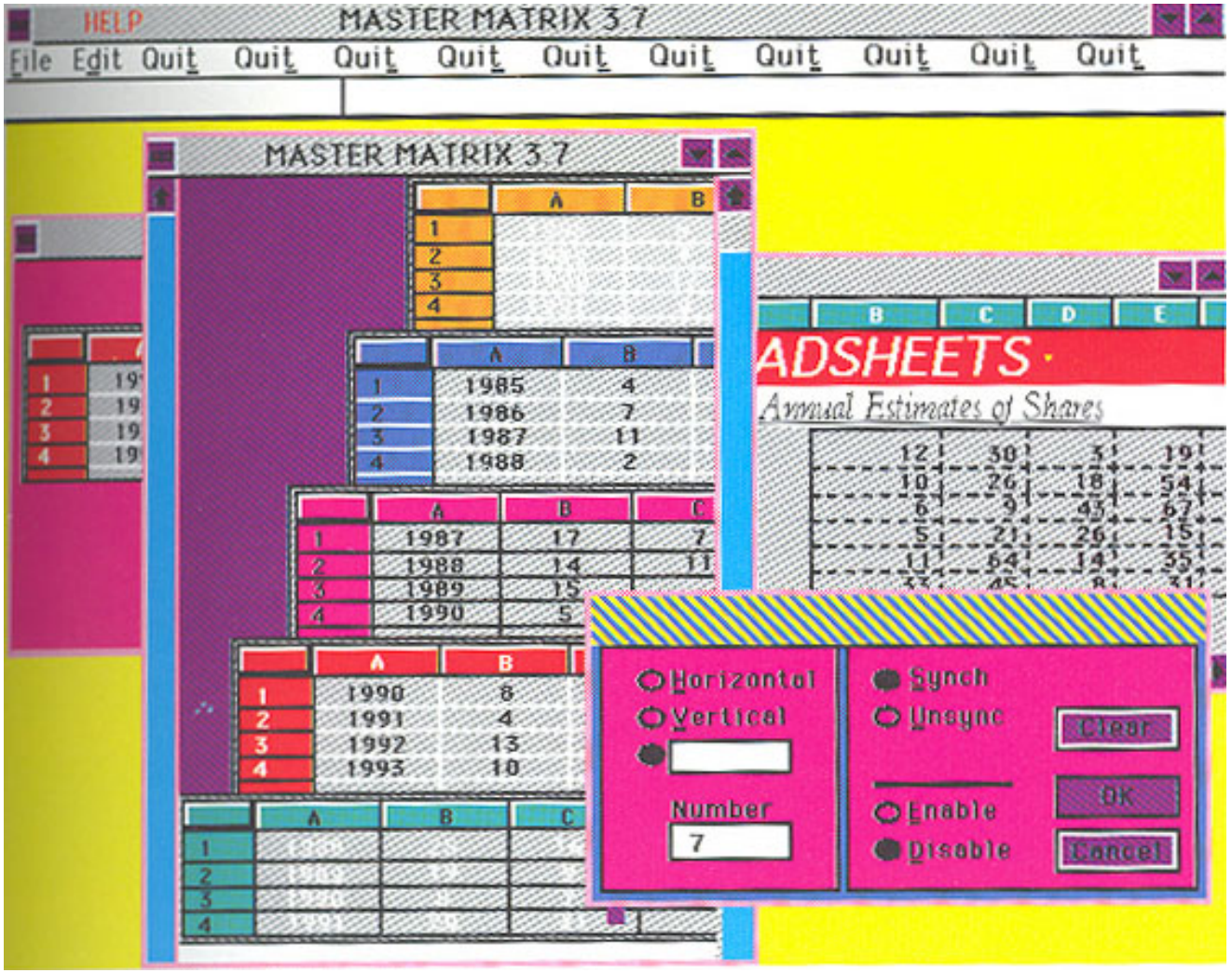
Graphical Coding: Some Examples

- Graphical coding also provides a powerful way of displaying quantitative data
- Example
  - Graph chart, Bar chart, pie chart, log chart, scatter plot, area curve etc.
- The main advantages of using graphical representation of quantities data are it can be easier to perceive
  - The relationship between multidimensional data
  - The trends in data that is constantly changing
  - Detects in patterns of real-time data

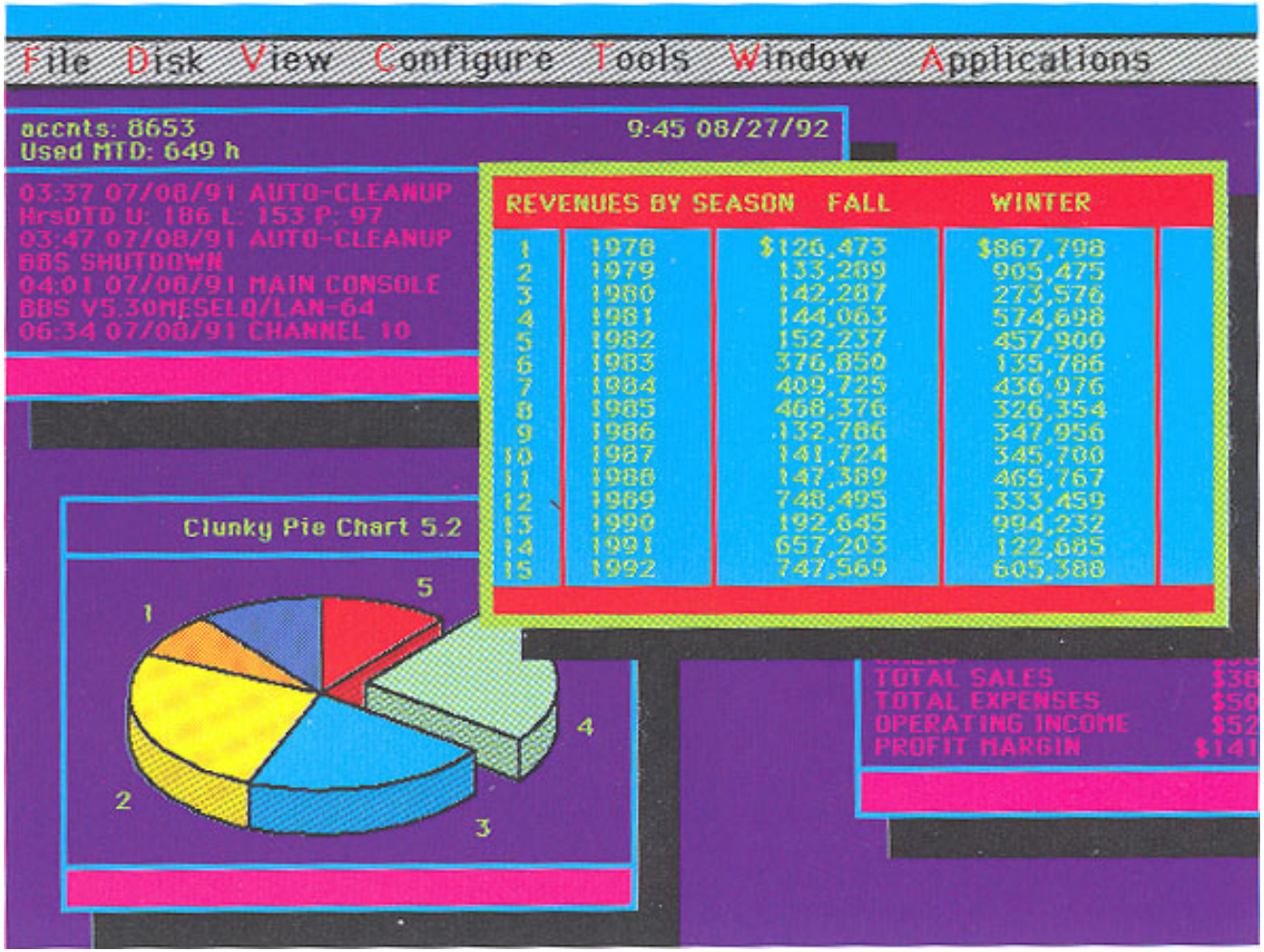
Colors in Graphical Coding

- Provides many opportunities for coding and structuring information at the interface
- As well as making it pleasant and enjoyable to look at
  - Matching dresses (blue pant + red shirt)!
- Color pollution
  - Excessive use of colors
    - Results in garish, difficult to interpret and confusing interfaces

Colors in Graphical Coding



Colors in Graphical Coding



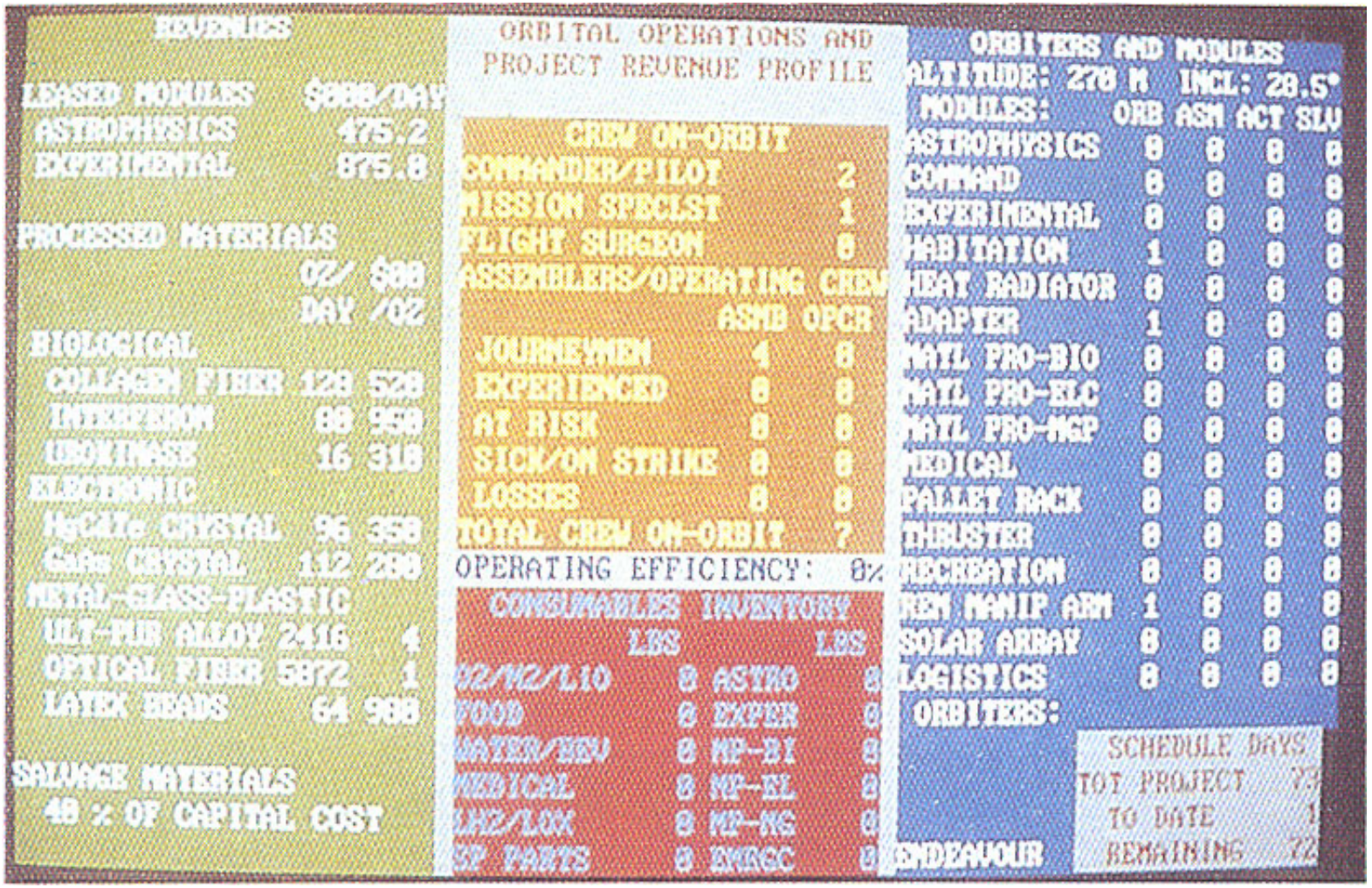
Rules in Color Coding

- Segmentation
  - Use different colors to display a different category of information
  - Areas that need to be seen as belonging together should have the same color
    - Easy to search/detect the right information
- Amount of Color
  - Too many colors in a display will increase search times, so they should always be used conservatively
- Task demands
  - Color is most powerful for search task and of less use in tasks requiring categorization and memorization of objects
- Experience of user
  - In comparison with achromatic (B/W) coding, color has been shown to be more use in search tasks for inexperienced than for experienced users

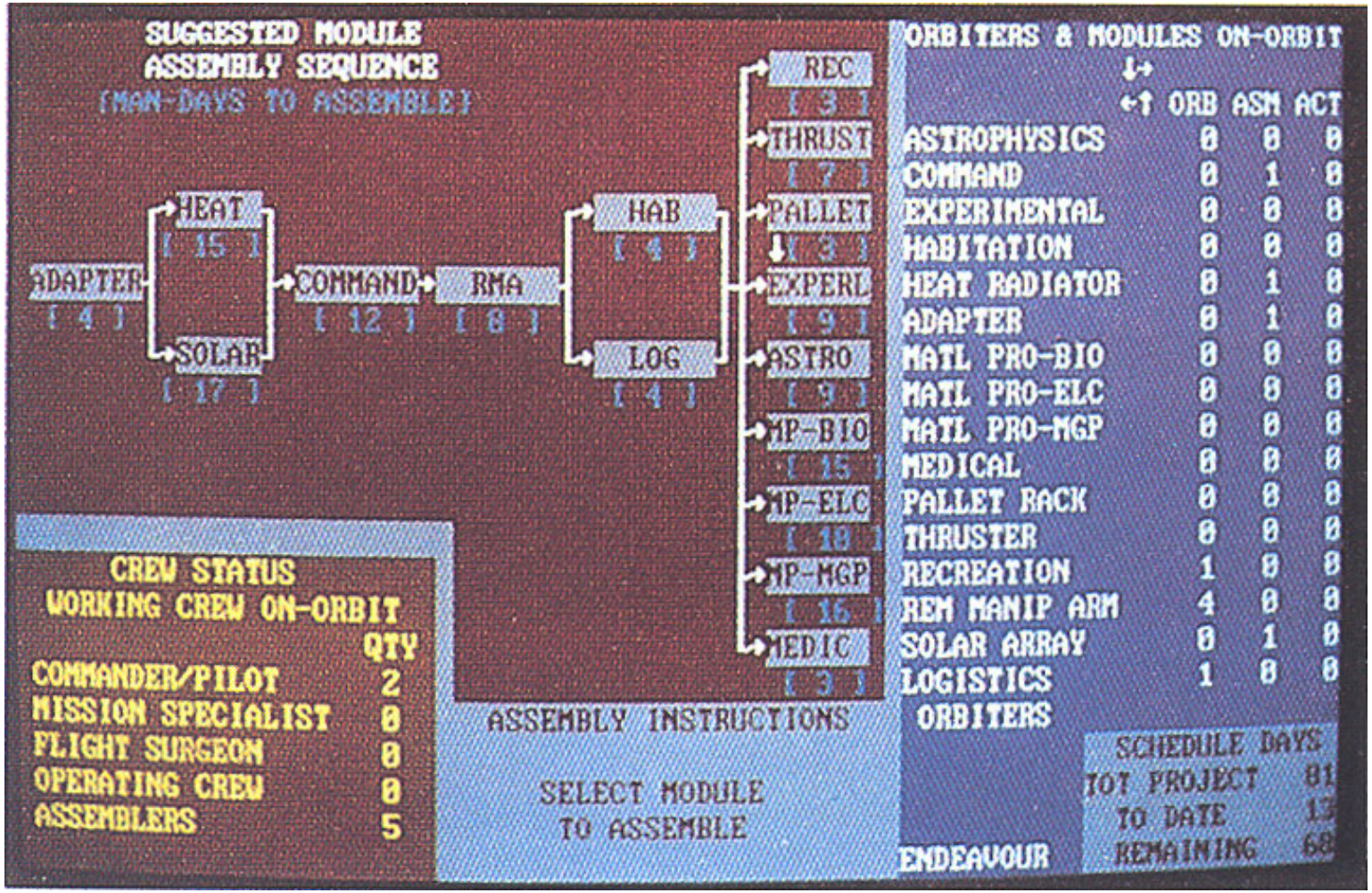
More Rule of Thumbs

- Use different colors to distinguishing layers (e.g. background and foreground)
- Use color to make features prominent
- Use the background color as dark or dim (such as blue) and bright colors for the foreground (such as never yellow)

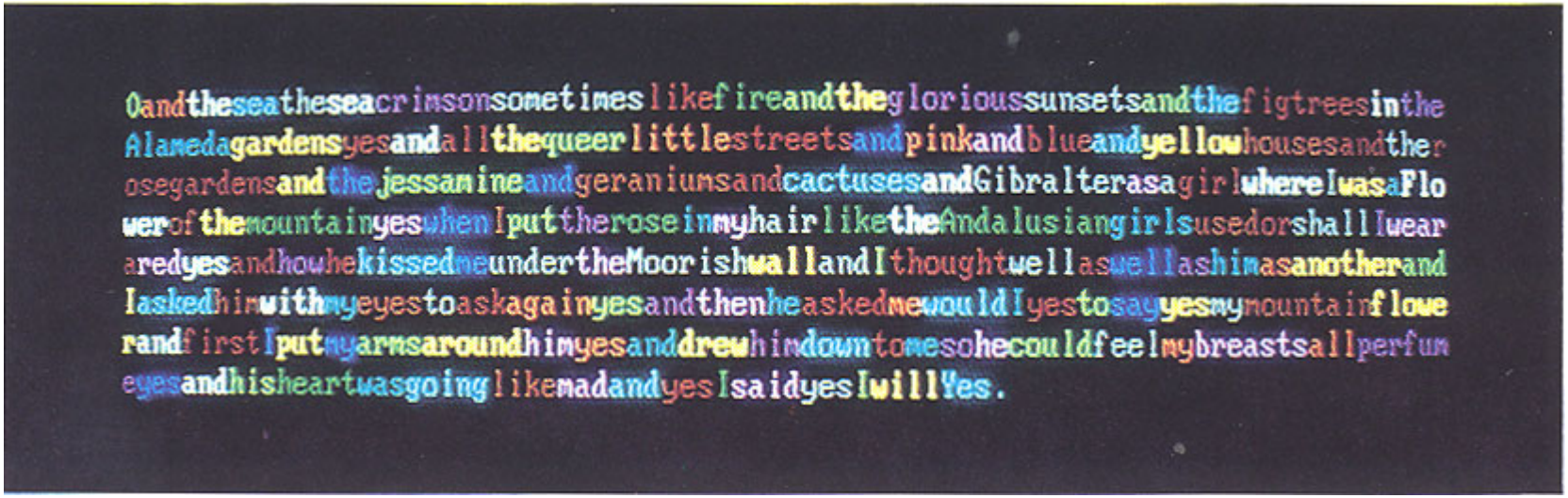
Example 1: Redundant Coding



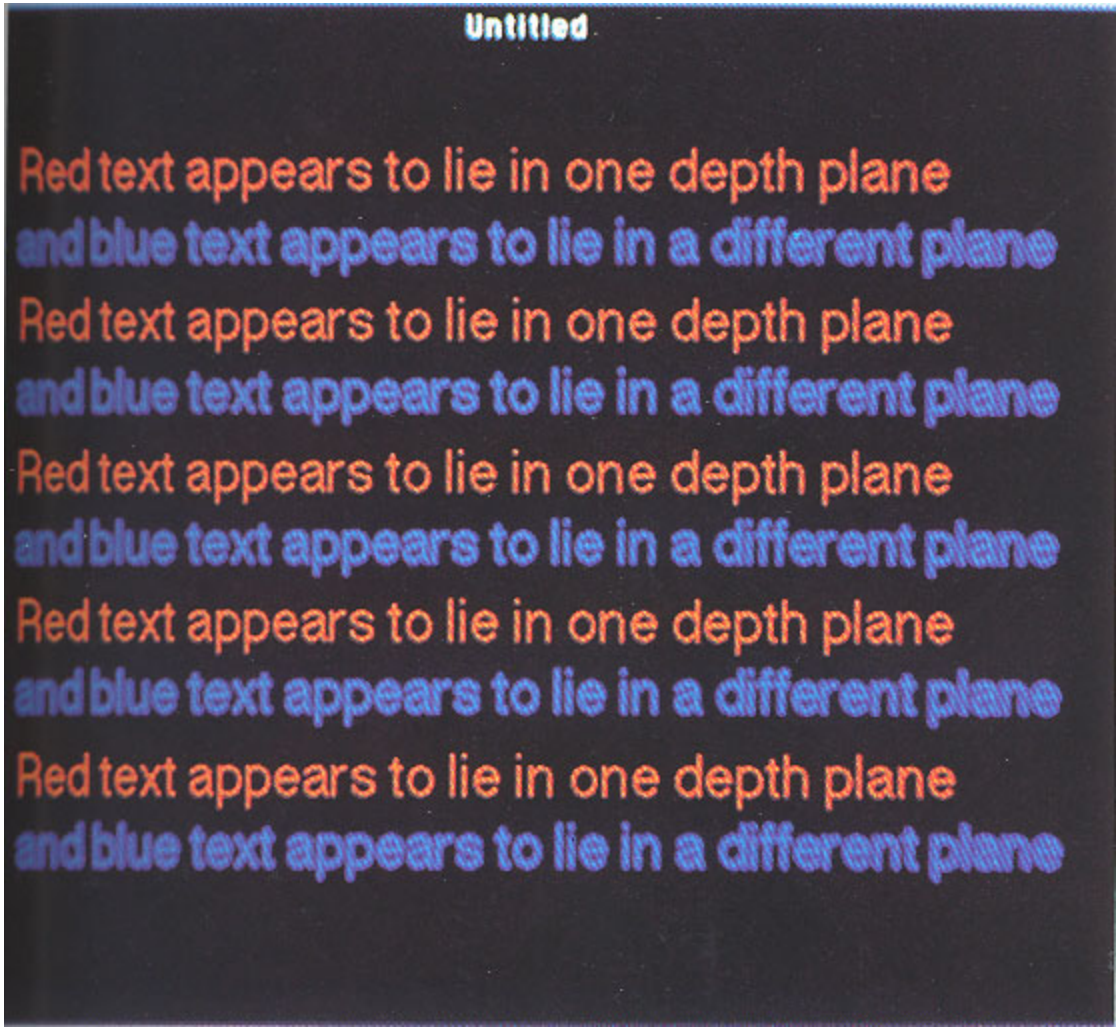
Example 2: Structure of Information



Example 3: Text Stand Out



Example 4: Color Stereoscopy



Comparison of Coding Methods

Coding method		Maximum number of codes	Comments
Alphanumeric		Unlimited	Highly versatile. Meaning can be self-evident. Location time may be longer than graphic coding
Shapes		10-20	Very effective if code matches objects or operation represented
Color		4-11	Attractive and efficient. Excessive use confusing. Limited value for the color-blind
Line	Angle	8-11	Good in special cases.
	Width	2-3	Good
	Style	5-9	Good
	Length	3-4	Good can clutter display if many code displayed

Comparison of Coding Methods

Coding method	Maximum number of codes	Comments
Object size	3-5	Fair. Can take up considerable space. Location time longer than for shape and color
Brightness	2-4	Can be fatiguing, especially if screen contrast is poor
Blink	2-4	Good for getting attention but should be suppressible afterwards. Annoying if overuse. Limit to small fields
Reverse Video	No data	Effective for making data stand out. If large area is in reverse video, flicker is more easily perceived
Underlining	No data	Useful but can reduce text legibility
Combinations of codes	Unlimited	Can reinforce coding but complex combinations can be confusing

Recommended Materials

- My Home page

  http://facweb.iitkgp.ernet.in/~dsamanta

  (For the presentation slides of the current lecture

- Book

  Human-Computer Interaction by Jenny Preece and et al. Addison-Wesley, New York

  Chapter 4