Chapter 16: Displays

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Ergonomics

Learning Outcomes
After careful studying this chapter You should be able to:

1. Define What are displays and why they are used?
2. Discuss the characteristics of a good display
3. Explain causes of Failures,
4. Describe the types of warning messages and know how to send them,
5. To locate displays correctly,
Learning Outcomes

After careful studying this chapter You should be able to:

6. Design displays suitably to fit human needs and human characters (Font, Size, Text, Abbreviation, code, Tables, Formulas, Graphs, Maps, symbolic messages)

7. Distinguish between the types of Instrument Display,

8. Locate Font, Size, Text, Abbreviation, code, Tables, Formulas, Graphs, Maps, symbolic messages in an easy way to be understood.

Displays

• Purpose of Displays—convey (send) information about a certain entity (unit) in an environment or surrounding.

  – Visual Displays—display information to the sight sense
    • Conspicuous (attention getting)
    • Legible (easy to see and detect)
    • Understandable (tell you state of the entity or required action to take)
    • Main problem: this sense is overloaded
Visual Displays

- Quantitative
- Qualitative
- Check Reading
- Situation awareness

Quantitative displays
- Fixed scale with a moving pointer is preferred, is not digital (speedometer), more attention getting, allows you to see a trend in performance or in the data,
- Linear scale is better when presenting information that must be interpreted,

Qualitative displays
- Use color to enhance meanings
- Use shape coding to enhance meaning
- Use zone coding to enhance meaning
Visual Displays

• Check reading and situation awareness
  – Design to ensure there is an individual difference between the normal/abnormal states
  – Use signal lights to complement the display
    • Flashing lights for hazards
    • Use a continuous light in emergencies
  – Use auditory signals to complement the display

• For all, the display type should be chosen based on the task
• New displays should be tested and evaluated

Spatial Compatibility

• Spatial Compatibility (relative placement of the control to the display)
  – Physical Similarity
    – Design to enforce the relationship between the physical features of the control and the mode of operation
    – Example: levers for vertical displays, rotary knobs for rotary displays, etc.
  – Proximity
    • Closeness, best if the display associated with a control is directly above the control
Here are several guidelines for computer workstations:

1. Displays should be placed at 15 degrees below the horizontal line (a hypothetical line at the eye level).
2. A good lumbar support is important. The chair should provide adequate support.
3. Forearms should ideally be horizontal. To achieve this, adjustable chairs can be used.

4. The chairs should provide support for arms to rest.
5. Wrists and hands should be comfortable. To achieve this, there should be space in front of the keyboard for wrist rest. Similar to hand tool design, the keyboard layout can be designed for a natural wrist position when typing.
Display Location

- Placement of displays is important. If the person is using multiple displays, they should be visible during work. In the examples on the right, operator's view is blocked. This is a poor example of display placement.

- Every time the operator needs to check the displays that are not visible by the seated position, the person has to stand up or stretch his/her body to be able to see the displays.

Causes of Failure

- Legibility or detectability
- Understanding
Guideline (GL)1: Select Legible Characters

• Font
  – Use printed characters.
  – Avoid Roman numerals.
  – Use mixed-case with large open spaces in letters.
  – For VDT, use more pixels and lower dot pitch.

• Size
  – Character height = \( K \times \) Distance from eye
  – Visual angle should be 15–25 min of arc.
  – For very short messages use all capitals.

GL2: Arrange Characters and Symbols

Text
• Print text in columns.
• Consider 11-point type.
• Use space between number and unit.
• Use double-spacing.
• Do not justify right side.
• Use headings for organization.
GL2: Arrange Characters and Symbols (cont.)

Codes

• Automate the code transfer.
• Make codes checkable.
• Use short codes.
• Make the code meaningful.

Abbreviations:

• Use with caution.
• Do not include period.
• Use rules to form abbreviations.
• Rules best for encoding are not necessarily the best for decoding.
• Consider vowel deletion.
GL 3: Decide on Type of Display Menus

- Make them deep, not shallow.
- Avoid multiple pages.
- Provide multiple paths and shortcuts.
- Highlight options.
- Use blank space and grouping.
- Minimize complexity of layout.

GL 3: Decide on Type of Display Menus (cont.)

Tables

- Round data to 2 significant digits.
- Use explicit tables.
- Avoid matrix tables.
- Make the primary comparison down the column.
- Reduce row alignment errors and column selection errors.
GL 3: Decide on Type of Display Menus (cont.)

Formulas

• Use to permit exact calculations.
• Present in units that the user will enter.
• Decide on significant digits necessary.

GL 3: Decide on Type of Display Menus (cont.)

Graphs

• Use to compare complex relationships.
• Use instead of tables when:
  – Displayed data have inherent structure.
  – Structure is relevant to the task.
• Provide titles, labels, units.
• Place close to the text it illustrates.
Types of Graphs & Conversion line

- Conversion line
- Time series
- Pie chart
- Doughnut chart (Doughnut chart are functionally identical to pie charts, it also has single-series and multi-series versions, the only difference is that it has a hole in the middle.)

Pie chart

Conversion line
Islamic University of Gaza - Palestine

Types of Graphs & Conversion line

Time series

Doughnut chart

Guidelines for Good Graphs

- Make graphs wider than tall.
- Use units of 5 or 2 on axes; start at zero.
- Show scale subdivisions with tick marks.
- Avoid hatching.
- Use only a few curves on a single graph.
- Indicate data points with open symbols.
GL 3: Decide on Type of Display Menus (cont.)

Symbolic messages

- Include shapes and colors, diagrams, pictographs.
- Consider using “real items.”
- Use color to identify categories.
- Consider using icons.
- Arrows should have a head and shaft.
- Weigh benefits vs. costs.

Maps

- Can show data distributions and location relationships.
- May be scaled to distance or time.
- May be not to scale.
GL 4: Project Your Message

- Slides
  - 35 mm slides
  - Computer projection
- Transparencies
- Video

Guideline 5: Select the Instrument Display

- Discrete: finite choice of options
- Continuous: point on a scale
  - Analog
  - Digital
- Representational: provide diagram or picture
- Video
Warning Messages

- Types of Signals:
  - False signals
  - Missing signals
  - Multiple signals
- Should be both visual and aural.
- Should be within primary field of view.
- Should provide guidance information.

GL 6: Locate/Arrange the Display

Location

- Locate to be seen easily.
- Provide appropriate lighting.
- Consider eye height and head orientation.
- Keep data within a $20^\circ$ cone of line of sight.
- Angle should be about $30^\circ$ below the Frankfurt Plane.
GL 6: Locate/Arrange the Display (cont.)

Arrangement

• Determine what the operator is required to do.
• Maintain consistency on panel and within facility.
• Decide on grouping logic.
• Consider computer simulation.

End of Chapter 16