







◆ Objectives

-  **Be able to establish conventions to be used in operator displays.**
-  **Be able to determine color conventions.**
-  **Be able to name objects correctly and consistently.**
-  **Be able to design displays that are consistent with Windows interface guidelines or with your own site's guidelines.**

Objectives

At the end of this module you will be able to do the following:

- Be able to establish conventions to be used in operator displays.
[This should be discussed with the users of the displays(the operators)]
- Be able to determine color conventions.
- Be able to name objects correctly and consistently.
- Be able to design displays that are consistent with Windows interface guidelines or with your own site's guidelines.

Design and Conventions for GUS Displays

Introduction

The principal interface for the plant personnel (operator) to their processes is the ***Graphical Display System***.

Some of these displays are standard elements of the system while others are custom graphics made by the user specific to their process.

The Human Interface is the sum of all communication between the computer and the user.

Introduction

It's important to realize that there are two types of displays - the prebuilt system standards (Group Displays, Alarm Summaries, etc.) and the custom (user) built displays (schematics).

The interface to the process is usually built by an engineer, although sometimes it is built by the operator.

Whoever is responsible for building this interface should follow fixed conventions that have been developed by their site.

Philosophy

View of the User

People are instinctively curious. They want to learn and they learn best by active self-directed exploration of their environment.

People like to have a sense of control over what they are doing, to see and understand the results of their own actions.

They are most productive and effective when the environment in which they work and play is enjoyable and challenging.

Philosophy

Curiosity killed the cat.

This does not mean that we should develop displays that will dampen the user's natural curiosity.

Look at this example of a dialog box.

Open the file entitled Life.exe in your Student folder and double-click on the smiling face.

Does this illustrate the point ?

Philosophy

General Design Principles

Users don't have years of experience with different computing/operating systems. What they have is years of direct experience with their immediate world.

Operators for example would know how to monitor and control their process, so use metaphors that will make their tasks easier.

General Design Principles

Always remember that users should spend minimum amounts of time trying to figure out the display. Design displays with intuitive interfaces. Also think of displays that the operator would have seen and used before - standard system displays.

Principles of Display Design

Here are some display design principles that you should consider:

1. DIRECT MANIPULATION
2. CONSISTENCY
3. SIMPLICITY
4. USER CONTROL
5. FEEDBACK
6. FORGIVENESS
7. AESTHETIC INTEGRITY

Principles of Display Design

A well-designed user interface (display) is built on the above principles and a development process that centers on *users and their tasks*.

Each of the above design principles will be discussed further on the following pages.

Display Principles and Methodology

DIRECT MANIPULATION

- Design your display so that users can directly manipulate representations of information. Users should see how the actions they take affect the objects on the screen.
- Visibility of information and choices also reduces the user's mental workload.
- Familiar metaphors provide a direct and intuitive interface to user tasks.

Direct Manipulation

- If a user changes the output of a pump, confirmation of this action should result in a color change to indicate that the change occurs.
- Information on the screen should be visible; for example, a PV value should be clearly indicated by a specific color, the output by another color etc.
- Familiar metaphors should be used; for example, to show an alarm condition, use the system convention of red and yellow. The use of the ackstat collector can also be used.

Display Principles and Methodology

CONSISTENCY

- This allows users to transfer existing knowledge to new tasks, learn new things more quickly, and focus more on tasks on hand.
- By providing a sense of stability, consistency makes the display familiar and predictable.
- Consistency is important through all aspects of the display, including names of objects, visual presentation of information and operational behavior.

Consistency

Try to be consistent with the naming of objects with scripts, color of static texts, color of process information like pv, sp, and op. For example, if an operator clicks on the value of a point in a display the changezone may appear or the display may modify to provide additional information. Make tasks as easy as possible through consistency.

Display Principles and Methodology

SIMPLICITY

- The display should be simple, easy to learn, and easy to use.
- It must provide access to all functionality of the process.
- Reduce the presentation of information to the minimum required to communicate adequately.
- Progressive disclosure can be used.

Simplicity

- Use the **KISS** rule and your displays will be more effective.
- Do not clutter the display with information that the operator may not need.
- Progressive disclosure will allow you to only show relevant information when needed; for example alarm menus can be shown only when alarms are generated.

Display Principles and Methodology

USER CONTROL

- An important principle of display design is that the user should always feel in control, rather than feeling controlled by the display.

User Control

The user should play an active, rather than reactive, role.

You can use techniques to automate tasks, but implement them in a way that allows the user to choose or control the automation.

Display Principles and Methodology

FEEDBACK

- Always provide feedback for user actions. Visual and sometimes audio cues can be used to confirm that the display is responding to the user's input.
- Provide the user with information regarding the state of the process and how to cancel that process if that is an option. A typical user will only tolerate a "dead" screen for a few seconds.
- The type of feedback is also important. Pointer changes, status bar messages, or more complex feedback may require a message box

Feedback

- Provide feedback to the user.
- Users will need to know that their actions are carried out, indicate by color changes or by some sort of action; if not they will think that the display has not responded.

An example of feedback is the Target Manager that we examined in a previous module. When a tag is selected an operator is provided immediate feedback indicating the point that they selected.

Display Principles and Methodology

FORGIVENESS

- Users like to explore a display and often learn by trial and error.
- An effective display allows for interactive discovery. It provides only appropriate sets of choices and warns users about potential situations where they may damage the process or data, or, better yet, makes actions reversible or recoverable.
- Users make mistakes. These mistakes can be physical or mental. An effective design avoids situations that are likely to result in errors.

Forgiveness

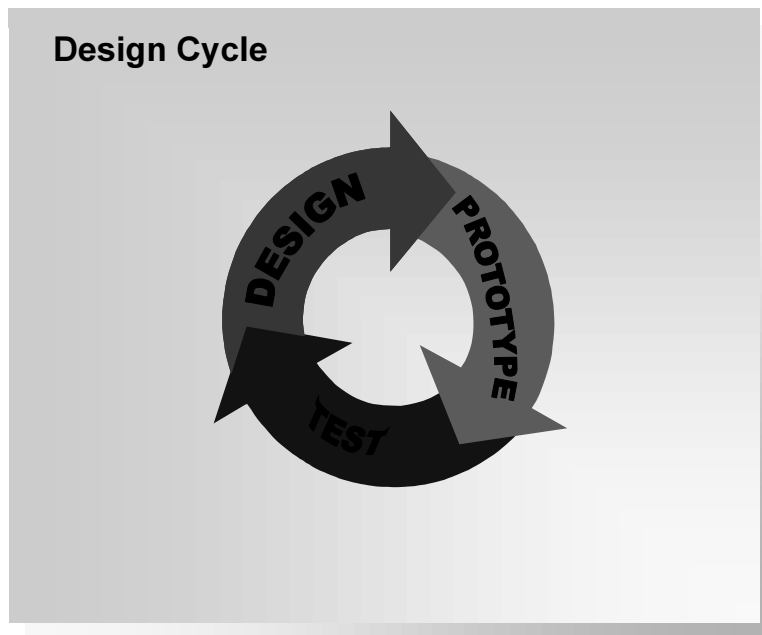
- Always have a confirmation for every user action. For example, if a user decides to shut a pump down, always request a confirmation before the action is carried out. The second action is useful if touch screen is used and this can create the 'fly by bee' scenario.
- Always offer a valid cancel button for the operator, if an action needs to be cancelled.
- Incorporate error checking and handling into your scripts.

Display Principles and Methodology

AESTHETIC INTEGRITY

- Visual design is an important part of the display. Visual attributes provide valuable impressions and communicate important cues to the interaction behavior of particular objects.
- Remember that that every visual element that appears on the screen competes for the user's attention.
- Provide a pleasant environment that clearly contributes to the user's understanding of the information presented.

Design Methodology



Design Methodology

Effective display design is more than just following a set of rules. It requires a *user-centered attitude* (think like an operator) and design methodology.

The Design Cycle

An effective *user-centered design* involves a number of important phases: designing, prototyping and testing.

Design Methodology

The Design Cycle

Design

- Decide on the general shape of the display. If the foundation work is flawed, it may be difficult to correct afterwards.
- Define the objectives and features of the display.
- Understand who the users are, their tasks, intentions and goals.
- Create a design model that fits the user's view of the tasks to be performed.
- Document your design.

Design

- It is important to know who your **users** are. Understand factors such as:
 - **their background:** - age, gender, expertise, experience level, physical limitations, and special needs;
 - **their work environment** - equipment, social and cultural influences, and physical surroundings;
 - **their current task organization** - the steps required, the dependencies, redundant activities, and the output objective.
- **Document your Design**

Committing your planned design to a written format not only provides a valuable reference point and form of communication but often helps make the design more concrete and reveals issues and gaps.

Design Methodology

Prototype

- On paper, create illustrations of the display to which other elements may be attached.
- A prototype is a valuable asset in many ways.
 - It provides an effective tool for communicating the design.
 - It can help to define the task flow and better visualize the design.
 - It provides a low-cost vehicle for getting user input on a design.

Prototype

A prototype is a model or an example of what your display will look like. It is very useful to put it on paper and to map out tasks for your user.

When the user sees your ideas, some valid input from the user may drastically change your design. Remember that the display will be used by the operators and not necessarily used by the designer.

On your prototype, the user may suggest where to put other elements such as the changezone or faceplate, the trends, menus etc.

Design Methodology

Test

- Usability testing a design, or a particular part of the design, provides valuable information and is a key part of the display success.
- This kind of testing will assess how well the display fits user needs and expectations.
- Testing will also provide information about the user's perceptions, satisfaction, questions, and problems.

Test

During the test always use participants who fit the profile of your target audience.

The testing can be used to look for potential problems in your design or you can focus on two or more designs to determine which is better.

Visual Communication

Introduction

- Visual information communicates nonverbally, but very powerfully.
- It can include cues that motivate, direct, or distract.
- How information is organized on the screen can make the difference between a display that communicates a message and one that leaves a user feeling puzzled or overwhelmed.

Introduction

- The best display functionality can suffer if its visual presentation does not communicate effectively.
- It is a good idea to work with a designer who has experience in this area.
- Good graphic designers provide perspective on how to take the best advantage of the screen and how to effectively use the concepts of shape, color, contrast, focus, and composition. They also understand how to design and organize information, and the effects of fonts and color on perception.

Visual Communication

Hierarchy of Information

- What information is most important to the user ?
- What does the user want or need to do first, second, third, and so on ?
- What should the user see on the screen first, second, third, and so on ?

Hierarchy of Information

- Importance - What are the priorities of the user when they first see the display ?
- Will the ordering of information support or complicate the user's progression through the display ?
- What the user first sees should match the priorities.

Visual Communication

Focus and Emphasis

- These two principles are related; determining focus involves identifying the central idea, or the focal point.
- Culture and display design decisions can govern this principle.
- People in western culture look at the upper left corner of the screen or window for the most important information. It makes sense to put a top-priority item there.

Focus and Emphasis

- Choose the element that must be prominent and isolate it from the other elements or make it stand out.
- Place Menu type items on the upper left corner, since this is where most people usually look for important information.

Visual Communication

Color

- One of the most important properties for a display. Because of its attractive qualities, use it to identify elements in the display to which you want to draw the user's attention.
- If used indiscriminately, color can have a negative or distracting effect. It can make it difficult to focus on a task.
- Use color to show relatedness or grouping.
- Color is a very subjective property. Everyone has different tastes in color. What is pleasing to you may be distasteful to someone else.
- Some percentage of the population may have color-identification problems.

Color

- The human eye can distinguish millions of different colors, using too many colors can result in visual clutter and make it difficult for the user to discern the purpose of the color information.
- The colors you use should fit their purpose. Muted, subtle, complementary colors are usually better than bright, highly saturated ones, unless you are looking for a carnival like appearance where bright colors compete for the user's attention.
- Color affects color; be aware of adjacent or background colors, perceived brightness, or shades of a particular color. A neutral color like light gray is often the best background color. Opposite colors like red and green can make it difficult for the eye to focus. Dark colors recede in the visual space; light colors come forward.

Visual Communication

Color Usage

The following are recommended color usage

WHITE	HALF	Labels, engineering units, descriptors, tagnames
	FULL	Titles, messages, labels with emphasis
	REVERSE	Display titles, selected tagnames or items
CYAN	FULL	Live process values (PV, SP, OP, MODE, etc.)
	HALF	Less critical values, inactive points
MAGENTA		No use known to man
BLUE		Backgrounds, outlines, replacement for black
YELLOW	FULL	Piping, physical equipment, valves, not "normal" indication
	HALF	Shading for above, less critical physical equipment
	REVERSE	Display titles, large text areas
GREEN	FULL	Live process values, "normal" indication
	HALF	Labels, descriptors, target boxes
	REVERSE	Display titles, tagnames
RED	FULL	Process values in alarm, alarm indication
	HALF	Low priority alarms, acknowledged alarms
	BLINK	Unacknowledged alarms, alarm indicators (NOT values)
BLACK		Backgrounds, lines over solids, interior outlines

Color Usage Guidelines

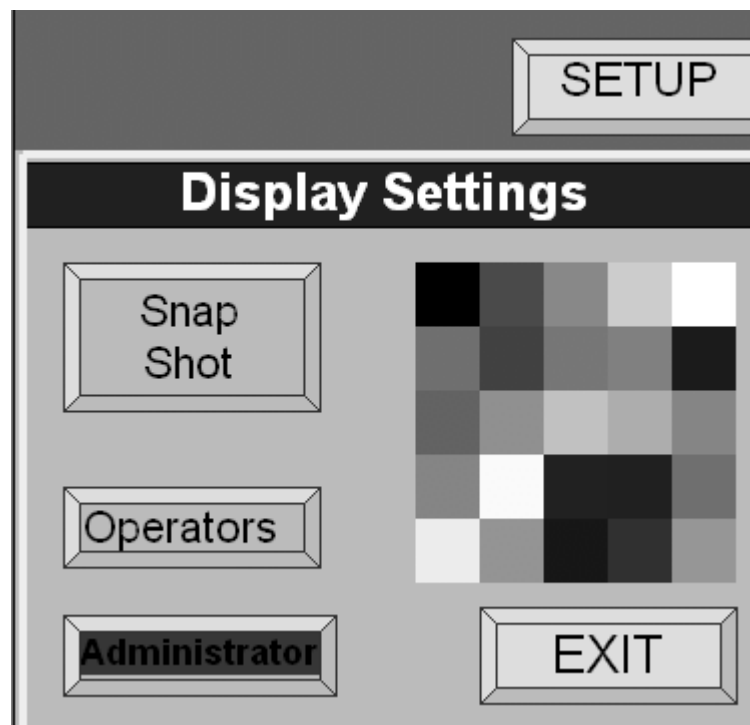
- Each user will determine their own set of rules for color. This will depend on the established rules that a site will have decided on.
- Once a color standard is chosen, **STICK TO IT !**
- Use as many system standards as possible.
- Never indicate critical information by color alone (color blind operators).

Visual Communication

Options to Change Colors

- Color is a subjective, personal preference, so allow the user to change colors where possible.
- To change colors the user could be given a palette with a limited set of colors.

Example for a palette



Visual Communication

Fonts and Text

- Fonts organize information or create a particular mood.
- By varying the size and weight we see text as more or less important and perceive the order in which it should be read.
- Avoid italic and serif fonts, these are too hard to read.
- Limit the number of fonts and styles you use, too many usually results in visual clutter.
- Wherever possible, use a standard font to provide visual consistency.

Fonts and Texts

- PV values and other critical values should be in larger fonts size, all other text can be in smaller font size.
- A display with many values should have the values line up horizontally and vertically as much as possible. This makes the information much more readable and the display well organized.

Visual Communication

Process Related Objects

- *Targets* - Avoid single target actions which directly manipulate the process. Include a keyboard second action or a direct operator input.
- *Blinking Objects* - These draw attention better than anything else if not overdone. Never blink live process values for alarm indication - blink an asterisk or some other item next to the value.
- *Bars* - Thin bars give the same information as wide bars