User Interface Design Process

**Create Meaningful Graphics,
Icons, and Images
&
Choose the Proper Colors**

Today's Topics

Part I

- Icons
- Multimedia
- Graphics

Part II

- Color
- Color Uses
- Possible Problems with Color
- Color and Human Vision
- Choosing Colors
- Using Color to Avoid

- Icons are pictorial images most often used to represent objects and actions with which users can interact with or that they can manipulate.
- Icons may stand alone on a desktop or in a window, or be grouped together in a toolbar.
- A secondary use of an icon is to reinforce important information, such as a warning icon in a dialog message box.
- Provide icons that are familiar, clear and legible, simple, consistent, direct, efficient, and discriminable.
- Also consider the
  - Context in which the icon is used.
  - Expectancies of users.
 - Complexity of task.

Kinds of Icons

Marcus (1984):
- **Icon**. Something that looks like what it means.
- **Index**. A sign that was caused by the thing to which it refers.
- **Symbol**. A sign that may be completely arbitrary in appearance.

Rogers (1989):
- **Resemblance.** An image that looks like what it means.
  Ex. A book → a dictionary
- **Symbolic.** An abstract image representing something.
  Ex. A cracked glass → something fragile
- **Exemplar.** An image illustrating an example or characteristic of something. Ex. A freeway exit picturing knife and fork → restaurant
- **Arbitrary.** An image completely arbitrary in appearance whose meaning must be learned. Ex. Menu and sizing icons on screens
- **Analogy.** An image physically or semantically associated with something. Ex. a wheelbarrow full of bricks → move command
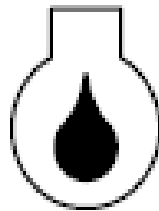
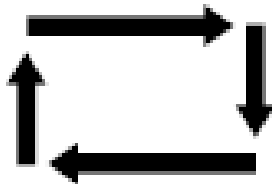# Some common icons. What do they stand for?
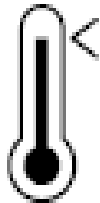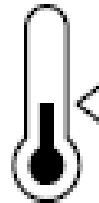
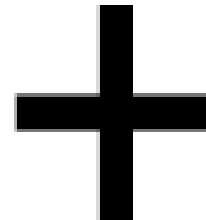|			
Hot	*Cold*	*Fast*	*Slow*
Engine Oil	*Ammeter/ Generator*	*Straight*	*Turn*
Automatic	*Variable Regulation*	*Plus/ Positive*	*Minus/ Neg*

Max Number of Codes for Effective Human Differentiation

Encoding Method	Recom. Max.	Comments
Alphanumeric	Unlimited	High versatile. Meaning usually self-evident. Location time may be longer than for graphic coding.
Geometric Shapes	10-20	High mnemonic value. Very effective if shape relates to object or operation being represented
Size	3-5	Fair. Considerable space required. Location time longer than for colors and shapes.
Line Length	3-4	Will clutter the display if many are used.
Line Width	2-3	Good.
Line Style	5-9	Good.
Line Angle	8-11	Good in special cases (Such as wind direction)
Solid and Broken Lines	3-4	Good
Number of Dots or Marks	5	Minimize number for quick assimilation.

Max Number of Codes for Effective Human Differentiation

Encoding Method	Recom. Max.	Comments
Brightness	2-3	Creates problems on screens with poor contrast.
Flashing/ blinking	2-3	Confusing for general encoding but the best way to attract attention. Interacts poorly with other codes. Annoying if overused. Limit to small fields.
Underlining	No data	Useful but can reduce text legibility.
Reverse Polarity	No data	Effective for making data stand out. Flicker easily perceived in large areas.
Orientation (location on display surface)	4-8	-
Color	6-8	Attractive and efficient. Short location time. Excessive use confusing. Poor for the color blind.
Combinations of codes	Unlimited	Can reinforce coding but complex combinations can be confusing.

A Successful Icon

- Looks different from all other icons.
- Is obvious what it does or represents.
- Is recognizable when no larger than 16 pixels square.
- Looks as good in black and white as in color.
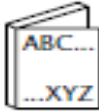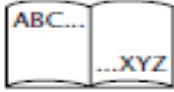
Choosing Icons Images:
- Use existing icons when available.
- Use images for nouns, not verbs.
- Use traditional images.
- Consider user cultural and social norms.

Concrete and familiar shapes

	Concrete/Familar	Abstract/Unfamilar
File Folder		
Book		
Telephone		

Visually & conceptually distinct shapes

Conceptually	Visually	DICTIONARY	TELEPHONE BOOK
Similar	Distinct		
Distinct	Similar	ABC... ...XYZ	SSS-1212
Distinct	Distinct	ABC... ...XYZ	SSS-1212

Examples
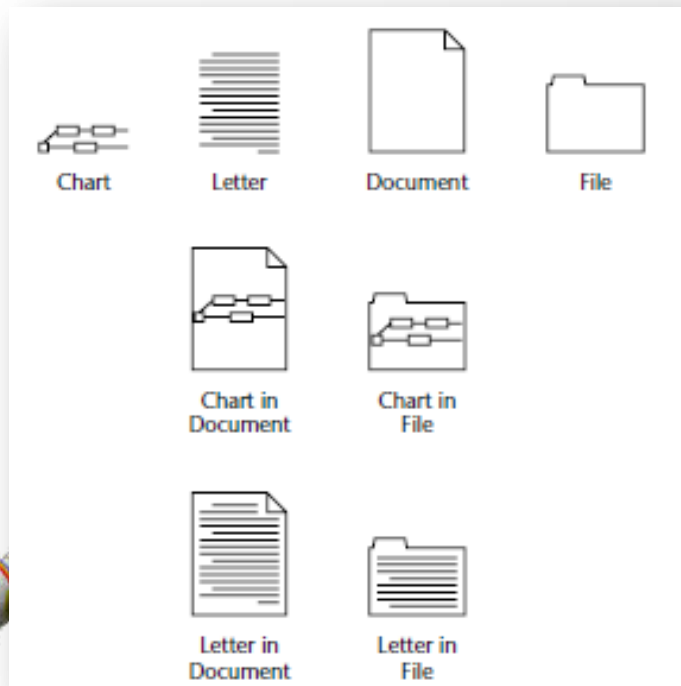
Communication relationships in icons
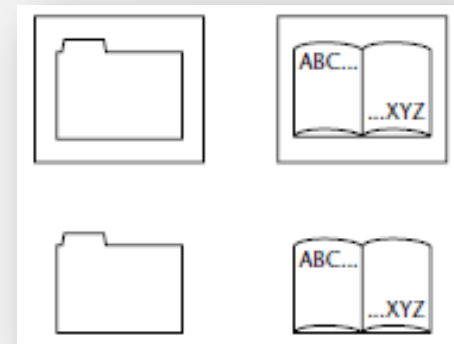
Borders degrading icon distinctiveness
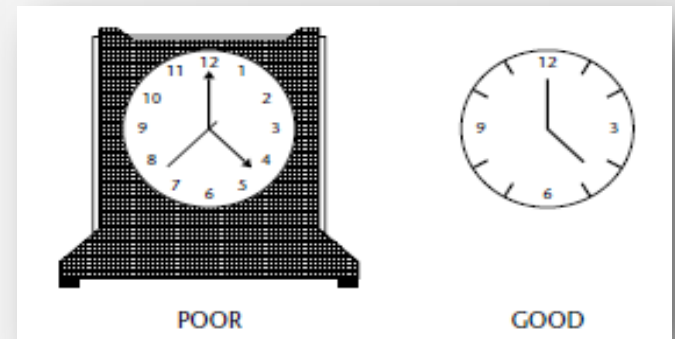
Avoid excessive detail in icon design

Multimedia

- The graphical flexibility of the Web permits inclusion of other media on a screen, including images, photographs, video, diagrams, drawings, and spoken audio.
- On the one hand, the various media can be powerful communication and attention-getting techniques.
- On the other hand, effective use of multimedia in design has been hindered by a lack of knowledge concerning how the various media may best be used, and a scarcity of applied design guidelines.
- The objective is **good interaction design**, not "sparkle."

Graphics

- Use graphics to
  - Supplement the textual content, not as a substitute for it.
  - Convey information that can't be effectively accomplished using text.
  - Enhance navigation through
    - Presenting a site overview.
    - Identifying site pages.
    - Identifying content areas.
- Limit the use of graphics that take a long time to load.
- Coordinate the graphics with all other page elements.
- Graphics should not look like gratuitous decorations or banner ads.
- Types of graphics (by purpose):
  - **Navigational**. To identify links that may be followed
  - **Representational**. To illustrate items mentioned in text
  - **Organizational**. To relate items mentioned in text
  - **Explanative**. To show how things or processes work
  - **Decorative**. To provide visual appeal and emphasis

Graphics

- **Images**: should convey their intended messages
- **Image maps**: to provide navigation links to other content
- **Photographs/ Pictures**: used when every aspect of the image is relevant
- **Video**: to show things moving/ changing over time
- **Diagrams**: to show the structure/ relationship of objects
- **Drawings**: when selected parts need to be emphasized/ represented
- **Animation**: to explain ideas involving a change in time/ position
- **Audition**: as a supplement to text and graphics

Combining Mediums

- Use sensory combinations that work **best together**
- Closely **integrate** screen text with graphics
- Both the visual and auditory information should be totally **relevant to the task** being performed
- Visual and auditory textual narrative should be presented **simultaneously**, or the visuals should precede the narrative by no more than 7 seconds
- To control **attention**, reveal information systematically
  - Limit elements revealed to one item at a time and use sequential revelations for related elements.
- Consider **downloading times** when choosing a media
- Thoroughly **test all graphics** for
  - Legibility
  - Comprehensibility
  - Acceptance

Learning Improvements for Various Media

MEDIUM	PERCENT MORE LEARNING
Hearing spoken text and viewing graphics	91%
Viewing graphics alone	63%
Viewing text and viewing graphics	56%
Hearing spoken text, viewing text, and viewing graphics	46%
Hearing spoken text and viewing text	32%
Viewing text alone	12%
Hearing spoken text alone	7%

From Lee and Bowers (1997).

Color

- **Color** adds dimension, or realism, to screen usability.
- Color draws **attention** because it attracts a person's eye.
- If used **properly**, it can emphasize the logical organization of information, facilitate the discrimination of screen components, accentuate differences among elements, and make displays more interesting and attractive.
- If used **improperly**, color can be distracting and possibly visually fatiguing, impairing the system's usability.

Color Dimensions
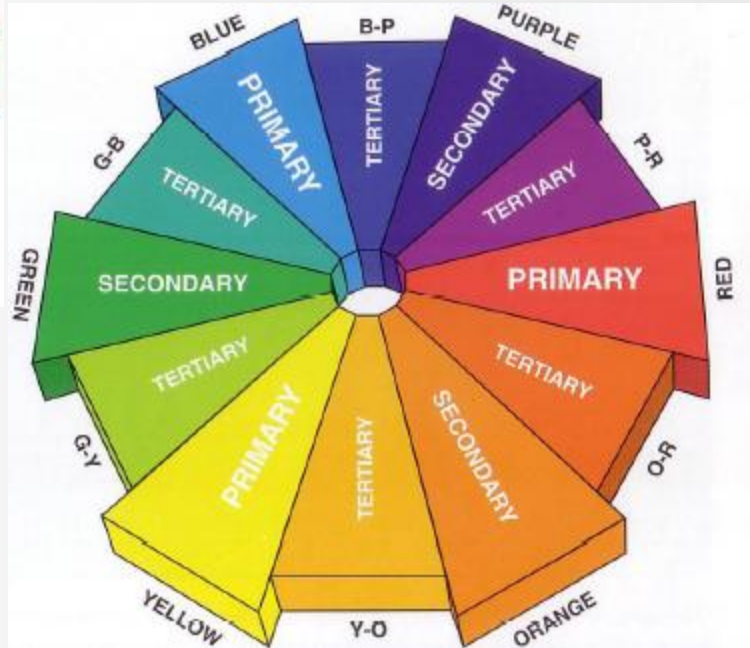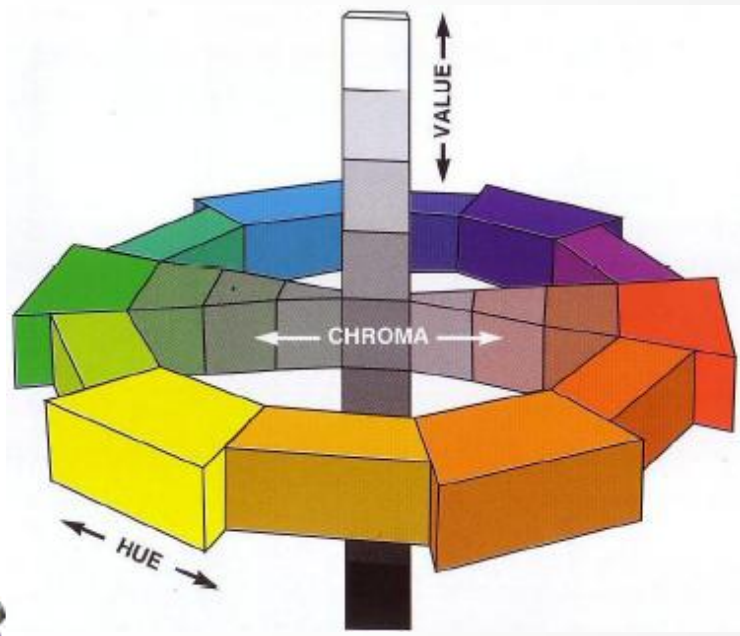
Color Uses

- Use color to assist in formatting a screen
    - Relating or tying elements into groupings
    - Breaking apart separate groupings of information
    - Associating information that is widely separated on the screen
    - Highlighting or calling attention to important information by setting it off from the other information
- Use color as a visual code to identify
    - Screen components
    - The logical structure of ideas, processes, or sequences
    - Sources of information
    - Status of information
- Use color to
    - Realistically portray natural objects
    - Increase screen appeal

Possible Problems with Color

- High Attention-Getting Capacity
- Interference with Use of Other Screens
- Vary
- Colo

ACTUAL COLOR	COLOR SEEN WITH:		
	RED-VIEWING DEFICIENCY (2.04%)	GREEN-VIEWING DEFICIENCY (6.39%)	BLUE-VIEWING DEFICIENCY (0.003%)
Red	Brown	-	-
Yellow	Greenish-Yellow	Orange	Deeper Yellow
Purple	Dark Blue	Red	Deep Red
Green	-	Light Brown	-
Brown	-	Reddish-Brown	-
Blue	-	-	Green

From Barnett (1993); Fowler and Stanwick (1995).

- Color Connotations
- Cross-Disciplinary and Cross-Cultural Differences

Common Color Connotations

COLOR	POSITIVE	NEGATIVE
Red	Active, Attractive, Dominating, Exciting, Invigorating, Powerful, Strong	Aggressive, Alarming, Energetic
Blue	Abstinent, Controlled, Deep, Dreamy, Faithful, Harmonious, Intellectual, Mysterious, Pornography, Rational, Sensible, Tenderness	Aggressive, Cold, Introverted, Melancholic
Blue-green or turquoise	Refreshing	Aloof, Cold, Self-willed, Sterile, Unemotional
Green	Calm, Close to nature, Conciliatory, Gentle, Harmonious, Optimistic, Refreshing, Strong willed	Envious, Inexperienced, Jealous
Yellow	Cheerful, Colorful, Extroverted, Full of fun, Light, Lively, Youthful	Cowardly, Exaggerated, Superficial, Vain
Orange	Alive, Communicative, Direct, Exciting, Joyful, Warm	Cheap, Intimate, Possessive, Vigorous
Purple	Luxurious, Royal, Serious	Sad

Derived from Gotz (1998) and Stone et al. (2005)

Color – the Research Shows

- ▪
  - ▪ to improve performance (Kopala, 1981; Nagy and Sanchez, 1992; Sidorsky, 1982),
  - ▪ to improve visual search time (Christ, 1975; Carter, 1982),
  - ▪ to be useful for organizing information (Engel, 1980), to aid memory (Marcus, 1986b),
  - ▪ to demarcate a portion of a screen (as opposed to lines or type font, Wopking et al., 1985)
- Color:
  - ▪ Does not improve performance (Tullis, 1981),
  - ▪ Does not affect on reading text (Legge and Rubin, 1986),
  - ▪ May impair performance (Christ and T, 1973; Christ, 1975),
  - ▪ Is less important than display spacing (Haubner and B, 1983).
- For simple displays, color may have no dramatic impact. As display complexity increases, however, so does the value of color. **To be effective, color must be properly used**.

Effective Foreground / Background Combinations

FOREGROUND	BLACK	BLUE	GREEN	CYAN	RED	MAGENTA	BROWN	WHITE
BLACK	x			Good		Good		Good
BLUE		x			Poor			Good
H.I. BLUE			Poor	Poor			Poor	Poor
CYAN	Good		Poor	x			Poor	
H.I. CYAN	Good	Good		Good	Good	Good		
GREEN	Good	Good	x	Poor	Good		Poor	Poor
H.I. GREEN		Good						
YELLOW	Good	Good		Good		Good		
RED			Poor		x	Poor	Poor	
H.I. RED			Poor					
MAGENTA			Poor		Poor	x	Poor	
H.I. MAGENTA	Good		Good			Poor		
BROWN			Poor			Poor	x	
GRAY		Poor			Poor		Poor	
WHITE		Good		Poor				x
H.I. WHITE	Good		Good	Good				

(H.I. = High Intensity)
From Lalomia and Happ (1987).

Choosing Colors for Web Pages

- Color must always have a meaningful purpose
- Use the browser 216-color palette
- Presentation:
  - Minimize the number of presented colors
  - Always consider color in context
  - Use similar or the same color schemes throughout
  - For foregrounds: Use black or strong colors for text and headings
  - For backgrounds: Use weaker contrasting colors such as off-white or light gray
  - Use a uniform color in large areas
  - The smaller the element, the more contrast is required between it and its background
  - Larger images should use
    - Flat, Web-safe colors
    - Fewer colors than small images
  - Select colors to be easily reproduced in black and white
- Use default colors for links
- Do not display non-link text in link colors
- Test all colors

Uses of Color to Avoid

- Highly saturated, spectrally extreme colors together:
  - Red and blue, yellow and purple
- Low-brightness colors for extended viewing or older viewers
- Colors in small areas, or for fine details.
- Colors lacking contrast:
  Ex. yellow and white; black and brown; reds, blues, brown
- Fully saturated colors for text or other frequently-read screen components
- Pure blue for text, thin lines, and small shapes.
- Non-opponent colors.
- Red and green in the periphery of large-scale displays.
- Adjacent colors that only differ in the amount of blue.
- Single-color distinctions for color-deficient users.
- Using colors in unexpected ways.
- Using color to improve legibility of densely packed text.