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Departamento de Electrónica,
Telecomunicações e Informática

Screen Layout and colors in user interface

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Outline

- Screen Layout
  - General layout of information
  - Text
  - Numbers
  - Coding techniques
- color
  - Human vision
  - Color models
  - Design guidelines
  - Models

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Screen Layout

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Screen layout

- The screen design is an important part of the UI development
- A poor screen design may degrade user performance
- Screen layout must be carefully designed
- There are numerous guidelines (we have seen already some of them)

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Screen Layout Guidelines

- Guidelines for different categories
  - General layout of information
  - Text
    - Messages
    - Instructions
  - Numbers
  - Coding techniques (color and others)

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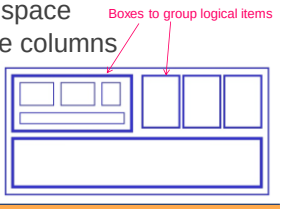
Information layout

- Include only the relevant information
- Include all necessary information
- Begin at the top left corner and align left (Western culture)
- Group items according to type
- Leave plenty of white space
- Use leaders in multiple columns



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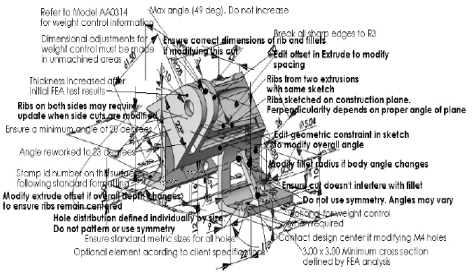
Information layout – only relevant

Avoid Visual Clutter



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Text

- Avoid using only capital letters
- Avoid text with many capital letters
- Do not use too many fonts for emphasis
- In multiple columns use leaders or greying

use fonts for emphasis (but not too many)

ABCDEF HIJKLM
NOPQRSTUVWXYZ

Use greying

Alcântara – Terra		12:36			13:06		13:36	
Campolide	12:15	12:41	12:45		13:11	13:15	13:41	13:45
Rossio	12:19		12:49			13:19		13:49
Sete Rios		12:19	12:43	12:49	13:13		13:19	13:43
Entrecampos		12:22	12:47	12:52	13:17		13:22	13:47
Roma – Areeiro		12:24	12:49	12:54	13:19		13:24	13:49

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Text

Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess

Left aligned: more readable

Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess

Right aligned: fine for effects
But more difficult to read

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Text

In multiple columns it is difficult to read across gaps:

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

use leaders

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

or greying

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

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Text – Error messages

Messages shall:

- Be brief and concise
- Be specific and understandable
- Be positive
- Be helpful
- Have a detail level adequate to user knowledge and experience

	better
Too verbose: The processing of the text editor yielded 23 pages of output	Output 23 pages
Too vague: Error in SIZE field	Error: SIZE range is 4 to 16
Negative: Cannot exit before saving file	Save file before exiting
Bad/illegal file name	Maximum file name length is 8 chars
Not helpful: Syntax error 1542	Unmatched left parenthesis in line 210

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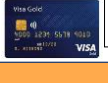
Numbers

- Integers shall be right justified
- Real numbers shall be aligned by the decimal point
- Avoid unnecessary zeros (at left)
- Long numbers shall be divided in groups of 3 or 4

	Better
10 100 1000 10000	10 100 1000 10000
100.00 25.365 5432.01 1.45591	100.00 25.365 5432.01 1.45591
10:1 p.m. 002	10:02 p.m. 2
6173954686	617-395-4686



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Numbers

Which is the largest?

532.56	627.865	
179.3	1.005763	75
256.317	382.583	120
15	2502.56	35
73.948	432.935	27
1035	2.0175	85
3.142	652.87	
497.6256	56.34	

Right align integers

Align decimal points

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Coding techniques

- Blinking
- Bold
- Size
- Font
- Underlining
- Shape
- Special characters and icons
- Proximity
- Borders
- Sound
- color

Main guideline: use parsimoniously any coding technique!

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Coding techniques – Examples

***Blinking* -> time ON > time OFF**

Error:

Account number must be eight digits

Bold

Elective courses

Code	Name	Sem.
123	IHC	1º
124	**CV**	**1º**
345	CG	1º
678	BD	2º

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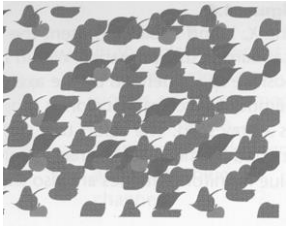
color example

- How many cherries?



(Ware, 2004)

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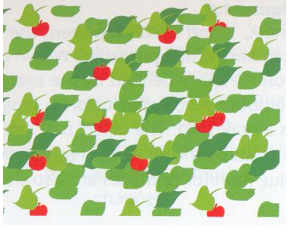
color example

- How many cherries?



(Ware, 2004)

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The Eye

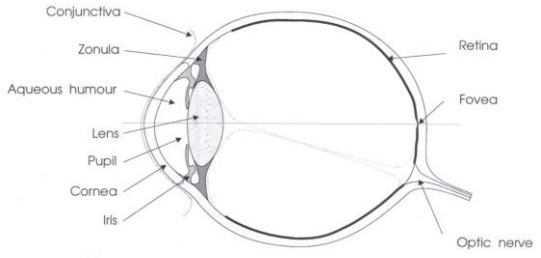

Figure 3: The human eye.

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Photoreceptors

- Rods
  - Only one kind (peak response in green wavelengths)
  - Sensitive to low light ("scotopic vision")
    - Multiple nearby rods aggregated into a single nerve signal
  - Saturated at moderate light intensity ("photopic vision")
    - Cones do most of the vision under photopic conditions
- Cones
  - Operate in brighter light
  - Three kinds: S(hort), M(edium), L(ong)
  - S cones are very weak, centered in blue wavelengths
  - M and L cones are more powerful, overlapping
  - M centered in green, L in yellow (but called "red")

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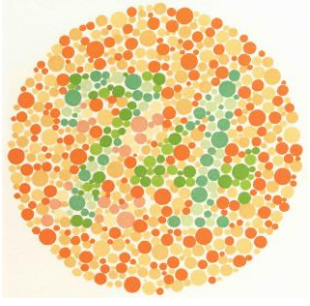
color blindness

- Ishihara's Test for color Blindness



+/- 10% males
+/- 1% females

- Red-Green
  DEUTERANOPIA / PROTANOPIA
- Blue-Yellow
  TRITANOPIA

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Color blindness

- Respect audience using color scale everyone can see (+/-10% male +/-1% female color blindness)
- Common deficiencies are explained by the lack of cones (color sensor cells in the retina) sensitive to the long and medium λ (dicromacies)):
  - Deuteranopia or Red-Green blindness (MW – "Green" cone)
  - Protanopia (LW – "Red" cone)
- Avoid red and green to show difference since difficult to interpret by color blind (Deuteranopia)

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color blindness

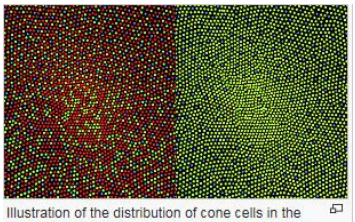

Illustration of the distribution of cone cells in the fovea of an individual with normal color vision (left), and a color blind (protanopic) retina. Note that the center of the fovea holds very few blue-sensitive cones.

http://en.wikipedia.org/wiki/Photoreceptor_cell

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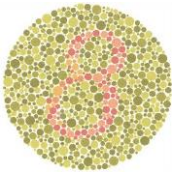
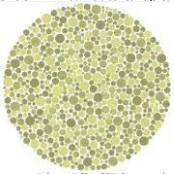
Simulating color vision deficiencies - Ishihara



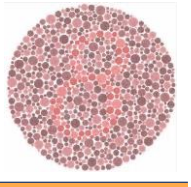
Original image as seen by a normal observer

Green-Blind/Deuteranopia



Red-Blind/Protanopia

Blue-Blind/Tritanopia



http://www.color-blindness.com/coblis/coblis.html

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Rainbow colors as viewed by people suffering from color vision deficeiencies

http://en.wikipedia.org/wiki/color_blindness

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color blindness

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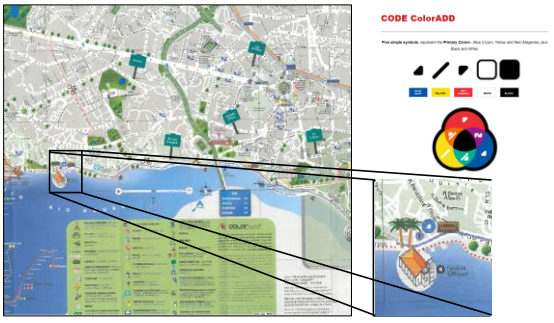
color blindness – ColorAdd – Mapa do Porto



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color blindness

- color blindness simulator:
  - Images:
    - https://www.color-blindness.com/coblis-color-blindness-simulator/
  - url:
    - https://www.toptal.com/designers/colorfilter

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Using color

Besides increasing realism, it may have the following **advantages**:

It may:

- Show the logical organization of the information displayed
- Represent values
- Catch the attention
- Increase satisfaction
- Ease the search in complex displays
- Trigger emotions

…

However, **it may degrade user's performance** if not used properly

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Guidelines for use of color

- **Use color parsimoniously**
- Use a limited number of colors
- Firstly make it work without color
- Use color coherently
- Avoid using simultaneously several saturated colors
- Do not convey information solely through color
- Make color coding support the user task
- Make the color coding as obvious as possible
- Allow the user to control the color code
- Take into account the cultural meaning of colors …

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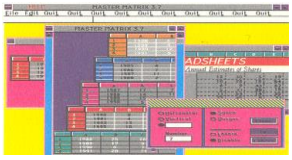
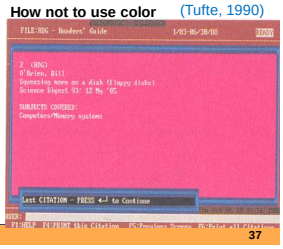
Guidelines for use of color

- **Use color parsimoniously**
- Use a limited number of colors
- Avoid using simultaneously several saturated colors



How not to use color (Tufte, 1990)



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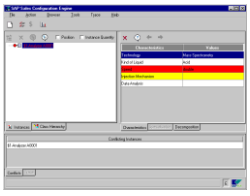
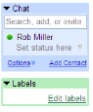
Avoid Saturated Colors





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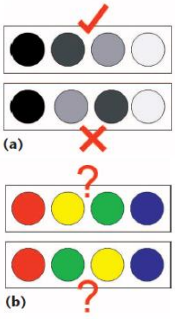
Guidelines for use of color

- Do not expect to easily perceive order from color

(Borland, Taylor II, 2007)



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Use Few Colors

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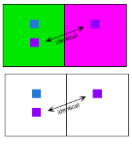
Guidelines for use of color

Don't use color coding on small elements



Use neutral gray surrounds where color judgments are critical.

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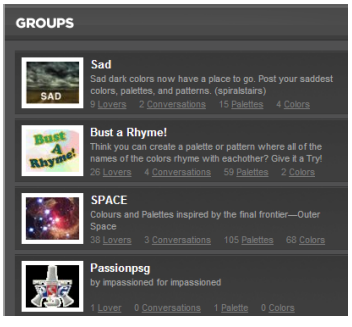
Background Colors

- Good contrast with the foreground
- White good choice but bright displays
- Pale (desaturated) yellow and very light good choice
- Dark not so good: easy to have less legible text



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Guidelines for use of color – color deficiencies

- Don't depend solely on color distinctions

The elements within these sets look identical to deuteranopes, the most common kind of dichromat:

These can be discriminated on the basis of non-color differences:

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Careful with color

- Some advices
  - Avoid saturated colors
  - Get it right, Black an White
  - Use less intense colors (medium hues or pastels)
  - Avoid rainbow and primary colors
  - Use color to highlight

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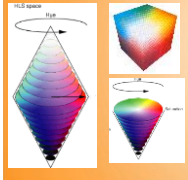
color Models



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color models

- Objects are perceived as having a color depending on the spectrum of the reflected light (or emitted)
- But different spectra may induce similar color sensations
- It is important to be able to describe color objectively
- There are to types of color production systems:
  - Additive (eg.: monitors, TV sets, projectors)
  - Subtractive (e.g.: printers)

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• Any color may be represented by the superposition of 3 basic colors, adjusting their intensity to match the intended color (RGB in additive systems)

$$C = a_1R + a_2G + a_3B$$

Additive system

https://en.wikipedia.org/wiki/Additive_color

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color models

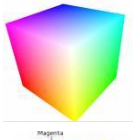
- There are several models that include:

  - a 3D coordinate system

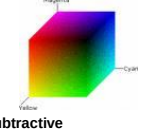
  - a geometric solid

Additive

- **RGB** (Red Green Blue) is H/W oriente and standard for computer monitors



- **CMY** (Cian, Magenta, Yellow) is H/W oriented and standard for printers



Subtractive

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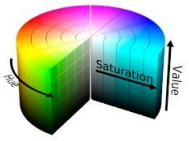
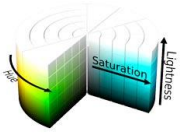
color models

- Models designed to more closely aligned with the way humans perceive color-making attributes

https://en.wikipedia.org/wiki/Hue



- **HSV** (Hue, Saturation and Value)
  - Hue is wavelength of color
  - Saturation is amount of pure color
    - 0% = gray, 100% = pure
  - Value is brightness
    - 0% = dark, 100% = bright



- **HLS** (Hue, Lightness and Saturation)
  - White has lightness 1.0
  - Pure colors have lightness 0.5

color Picker:

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Interesting Links

- Introduction to color guidelines and standards (NASA)
http://colorusage.arc.nasa.gov/guidelines_0.php

- Effective Visual Communication for Graphical User Interfaces
http://web.cs.wpi.edu/~matt/courses/cs563/talks/smartin/int_design.html

- Screen Layout and Design
http://pt.scribd.com/doc/14784511/Chap-062-Screen-Layout-and-Design

- Universal Principles of Design, Revised and Updated: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach through Design
http://www.amazon.com/Universal-Principles-Design-Revised-Updated/dp/1592535879/ref=pd_sim_b_15#reader_1592535879

- UI design guidelines for responsive design
http://tympanus.net/codrops/2013/01/21/ui-design-guidelines-for-responsive-design/

- Ergonomic design for human interface design, Cornell University Ergonomics Web
http://ergo.human.cornell.edu/ahtutorials/interface.html

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