

IDI – Universal Design Principles & Perception Laws

Professors IDI – Dept. Computer
Science – UPC

Design Principles & Usability

- Usability: Defined in ISO 9241 standard as
 - The ability in which a product may be used by **specific** users in order to carry out **specific** tasks *effectively, efficiently, and with satisfaction* in a **specific** use environment.
 - Usability is always referred to a **concrete user group** and a **concrete user application**
 - *Efficacy* is the ability of correctly and completely achieving a certain goal.
 - *Efficiency* is the relation of used resources and the completeness and correctness of achieved goals.
 - *Satisfaction* is the comfort and acceptance of a system by the users and other people that are affected by its use.

Usability Principles (Bruce Tognazzini)

- Fashion should never trump usability (**Aesthetics**)
- Bring to the user all the information and tools needed for each step of the process (**Anticipation**)
- Computer interface, and task environment all “belong” to the user (**Autonomy**):
 - Customized interfaces,
 - Keep user informed: status, errors, progress indicators,...
- When using color to convey information in the interface, also use clear, secondary cues (**Color**)
- **Consistency** : levels of consistency, induced inconsistency, continuity, with user expectations
- **Default Values**: easy to blow away, not everything default,
- **Discoverability**: Any attempt to hide complexity will serve to increase it, if user cannot find it, it does not exist:
 - Controls should be visible, communicate the gestural vocabulary, use active discovery,...
- Look at the user’s productivity, not the computer’s (**Efficiency**):
 - formularies, error messages, latency reduction
- **Explorable interfaces**: Actions reversible
 - always allow undo, back to home page, visible navigation
- **Good Metaphors**
- **Protect Users’ work**: Ensure that users never lose their work

Universal Principles & Perception Laws in Design

- **Principle concepts of Design**

From the “Universal Principles of Design” book
by William Lidwell, Kritina Holden, Jill Butler

- Perception Laws in Design: Gestalt Laws
- Color perception

Universal Principles of Design

- Aesthetic-Usability Effect

- Aesthetics play an important role in the way designs are used
- Aesthetic designs look easier to use, and encourage its use more than non aesthetic designs
- This effect produces the perception that an aesthetic design is easier to use than a non-aesthetic design

We must devote important efforts to improving our designs.

Universal Principles of Design

- Correct alignment

- Elements must be aligned, this creates a sense of unity and cohesion, as well as facilitates reading.
- More later..

Confusion over Palm Beach County ballot

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform Party.

(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT	3 ➡	(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT	4 ➡
(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT	5 ➡	(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT	6 ➡
(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVER - VICE PRESIDENT	7 ➡	(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT	8 ➡
(GREEN) RALPH NADER - PRESIDENT WINONA LA DUKE - VICE PRESIDENT	9 ➡	(WORKERS WORLD) MONICA MOOREHEAD - PRESIDENT GLORIA La RIVA - VICE PRESIDENT	10 ➡
(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT	11 ➡	WRITE-IN CANDIDATE To vote for a write in candidate, follow the directions on the long stub of your ballot card.	
(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT	13 ➡		

1

OFFICIAL BALLOT, GENERAL ELECTION
PALM BEACH COUNTY, FLORIDA
NOVEMBER 7, 2000

A

REPUBLICAN GEORGE W. BUSH - PRESIDENT AND DICK CHENEY - VICE PRESIDENT	3 ➡
DEMOCRATIC AL GORE - PRESIDENT AND JOE LIEBERMAN - VICE PRESIDENT	4 ➡
LIBERTARIAN HARRY BROWNE - PRESIDENT AND ART OLIVER - VICE PRESIDENT	5 ➡
GREEN RALPH NADER - PRESIDENT AND WINONA LA DUKE - VICE PRESIDENT	6 ➡
SOCIALIST WORKERS JAMES HARRIS - PRESIDENT AND MARGARET TROWE - VICE PRESIDENT	7 ➡
NATURAL LAW JOHN HAGELIN - PRESIDENT AND NAT GOLDHABER - VICE PRESIDENT	8 ➡
REFORM PAT BUCHANAN - PRESIDENT AND EZOLA FOSTER - VICE PRESIDENT	9 ➡
SOCIALIST DAVID McREYNOLDS - PRESIDENT AND MARY CAL HOLLIS - VICE PRESIDENT	10 ➡
CONSTITUTION HOWARD PHILLIPS - PRESIDENT AND J. CURTIS FRAZIER - VICE PRESIDENT	11 ➡
WORKERS WORLD MONICA MOOREHEAD - PRESIDENT AND GLORIA La RIVA - VICE PRESIDENT	12 ➡
WRITE-IN CANDIDATE To vote for a write in candidate, follow the directions on the long stub of your ballot card.	

1-8

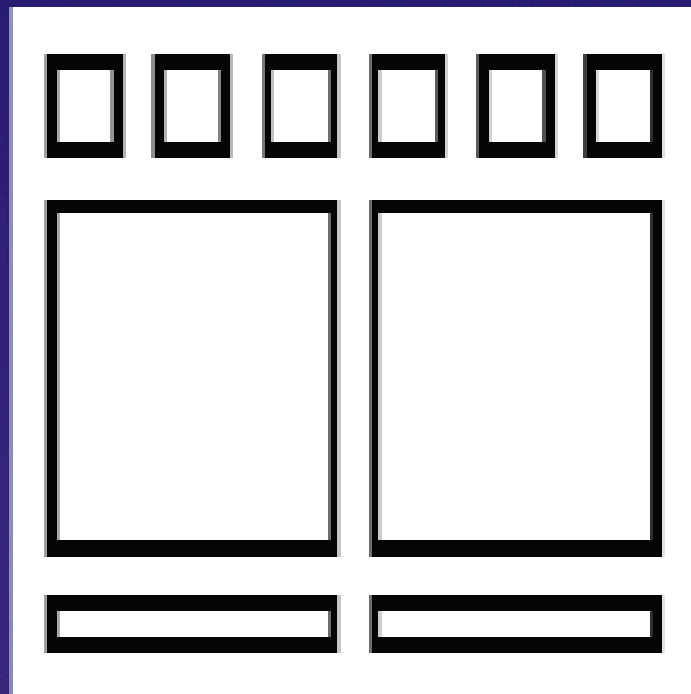
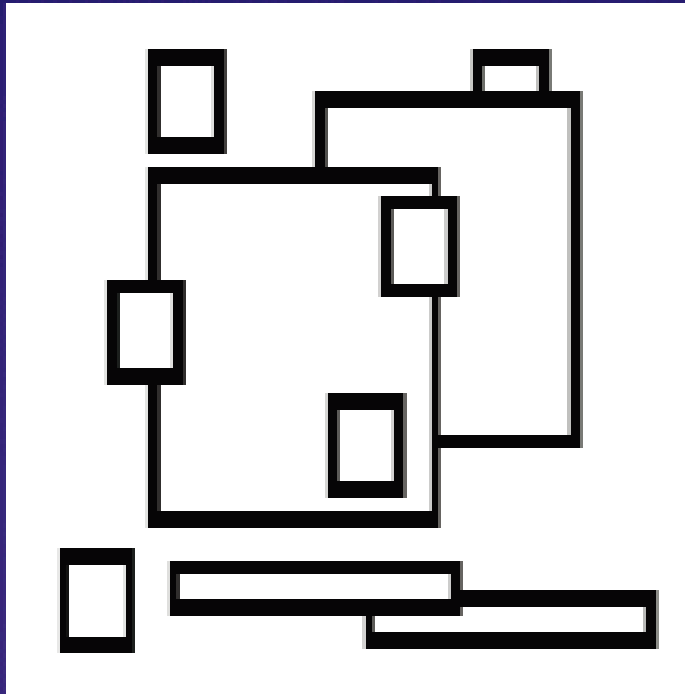
OFFICIAL BALLOT, GENERAL ELECTION
PALM BEACH COUNTY, FLORIDA
NOVEMBER 7, 2000

ELECTORS
FOR PRESIDENT
AND
VICE PRESIDENT

(A vote for the candidates will
actually be a vote for their electors.)

(Vote for Group)

Universal Principles of Design



Universal Principles of Design

- **Chunking**

- A *chunk* is a unit of information in short-term memory
- Chunking is a technique that seeks to place the information in a way that accommodates to the limits the humans have to process bits of information.
 - **Smaller chunks are easier to remember than larger lists**
Most people can remember a list of 5 words for 30 seconds,
but few can remember a list of 10 words for 30 seconds.
 - **Magical number: 7 ± 2 (contemporary estimation 4 ± 1)**
- It refers to elements that must be memorize:
 - *Menu items, telephone numbers...*
- But it is not required to divide all the elements in a screen or page in groups of 5 or so
 - *Elements such a dictionary pages must not be chunked.*

Universal Principles of Design

- Colour
 - It is an important feature that can make a design *more visually pleasing and aesthetic*
 - Can be used to *reinforce layout design* and the *meaning of elements*

Universal Principles of Design

- Colour: Aspects to consider:
 - Number of colours:
 - Keep it low, **up to five** and **Use a second cue.**
 - Colour combinations (more later):
 - Analogous (neighbours), complementary, or combinations of colours found in nature
 - Saturation: Attracts attention
 - When performance and efficiency are important, the use of **desaturated colours may help, perceived as more professional**
 - **Saturated colours attract attention** and are perceived as **more exciting and dynamic** (but may increase eye fatigue)
 - Symbolism:
 - The meanings of colours may vary among cultures

Perception Laws in Design. Universal Principles of Design

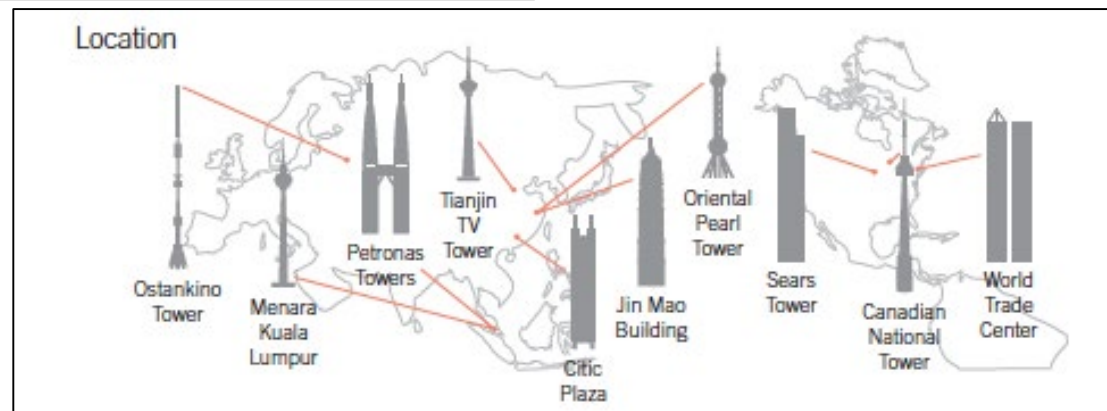
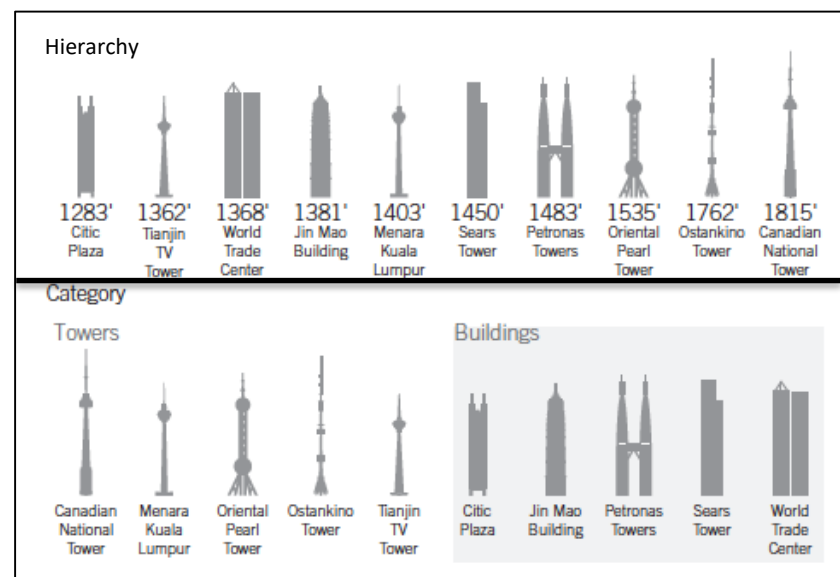
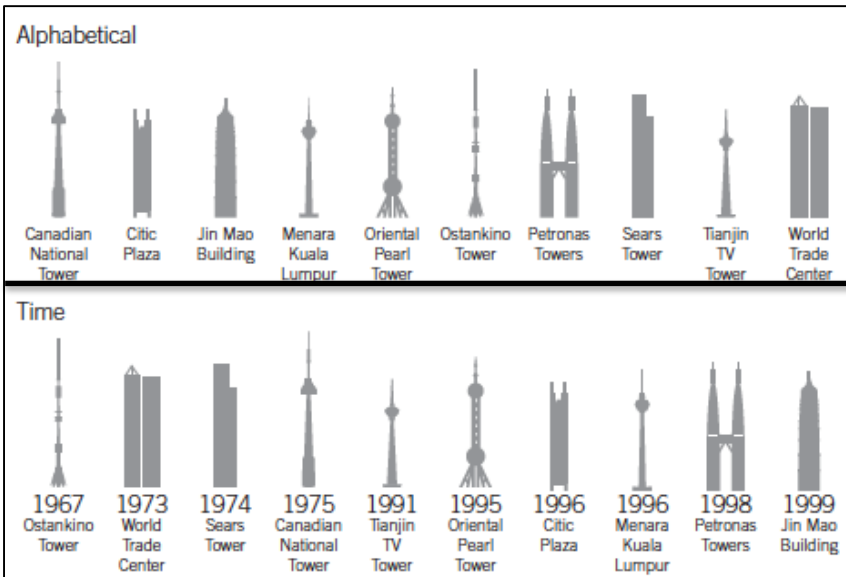
- Colour



Perception Laws in Design.

Universal Principles of Design

- *LATCH principle*. Information is organized according to:
 - **Location:** Information comes from different places (medicine: location of the body,).
 - **Alphabet:** Usually for large amounts of data (words in dictionary...)
 - **Time:** Events with fixed durations. (meeting schedules).
 - **Category:** To classify goods/elements of similar importance. Suitable for shops...
 - **Hierarchy:** By magnitude, order of importance



Perception Laws in Design.

Universal Principles of Design

- Garbage-in garbage-out (GIGO):

Computer scientists have long known that

inadequate input information often generates bad results

- **Type error:** The input is provided in an incorrect type (*mistakes*).

If undetected, it may generate large amounts of garbage.

Ex.: Numerical fields filled with a phone number or credit card number...

Type checks, input formatting, default values, example of inputs

- **Quality error:** The input has the correct type but has some defects (*slips*).

Ex.: Amounts of money.

May be alleviated with confirmations and previews.

Original Form

Order Form: Billing and Shipping Information page 2 of 2

Shipping Address:

Billing Address:

Credit Card Information:

Shipping Method:

Date to Ship:

○ Unconstrained fields increase the probability of garbage input.

Redesigned Form

Order Form: Billing and Shipping Information page 2 of 2

☐ [click here to use the information saved with your account](#)

Shipping Address:

First Name Last Name

Street Address

City State Zip Code

Billing Address

☐ [click here if Billing Address is the same as Shipping Address](#)

First Name Last Name

Street Address

City State Zip Code

Credit Card Information:

Name on Card Type of Card Month Year

Credit Card Number Expiration Date

Shipping Method: Standard Shipping \$7.00

Date to Ship: Month Day Year

[continue >>](#)

○ Allow users to automate input by accessing stored information.

○ Constrain input when a specific amount of information is required.

○ Constrain input using menus of options.

Your order will not be placed until you review the information you entered and click the "submit order" button.

March 21, 2003

1 dozen
chocolate chip cookies

Ship to:
Randy Williams
101 Main Street
Houston, TX 90990

Ship on:
March 30, 2003

Bill to:
Kristen Johnson
211 Elm Blvd.
Columbus, OH 44356

VISA: **** * 3041
Exp. Date 5/2006
Name on Card: Kristen J. Johnson





[make changes](#) [submit order](#)

○ Allow users to preview information before they complete transactions.

Universal Principles of Design

- **Iconic representation:** Images try to represent objects or actions.

Four types:

- **Similarity:** The icon is visually similar to the action/object to be represented. Adequate for simple objects (turn right) 
- **Example:** Elements can be related to the image (plane for airport) 
- **Symbolic:** High level of abstraction (unlock icon) 
- **Arbitrary:** No relationship with element or action (nuclear symbol) 

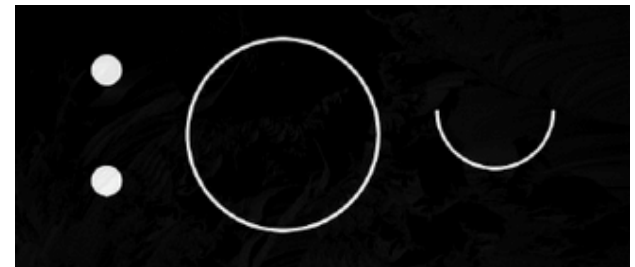
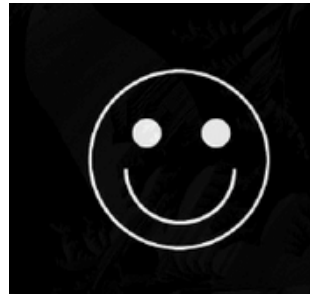
Universal Principles & Perception Laws in Design

- Principle concepts of Design
From the “Universal Principles of Design” book
*by William Lidwell, Kritina Holden, Jill **Butler***
- **Perception Laws in Design: Gestalt Laws and more**
- Color perception

Perception Laws in Design.

Gestalt Laws

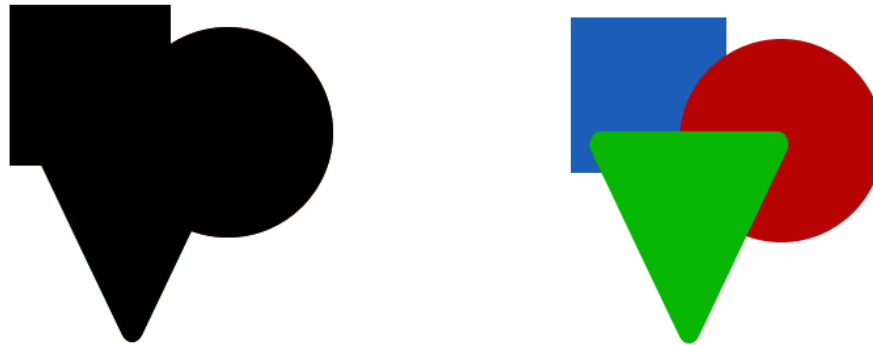
- Gestalt Laws relevant for visual design are:
 - Prägnanz Law
 - The law of closure
 - The law of similarity
 - The law of proximity
 - The law of symmetry
 - The law of continuity
 - The law of common fate



Perception Laws in Design.

Gestalt Laws

- **Pragnänz Law:** Law of good figure, simplicity.
We tend to perceive simpler shapes



Perception Laws in Design.

Gestalt Laws

- **The law of closure:**

The mind may experience elements it does not perceive through sensation, in order to complete a regular figure



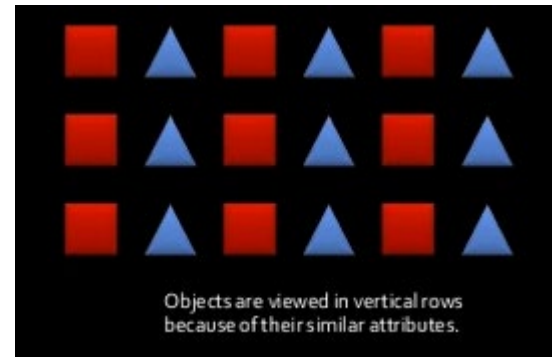
Perception Laws in Design.

Gestalt Laws

- **The law of similarity:**

The mind groups similar elements into collective entities or totalities.

This similarity might depend on relationships of form, colour, size, or brightness.

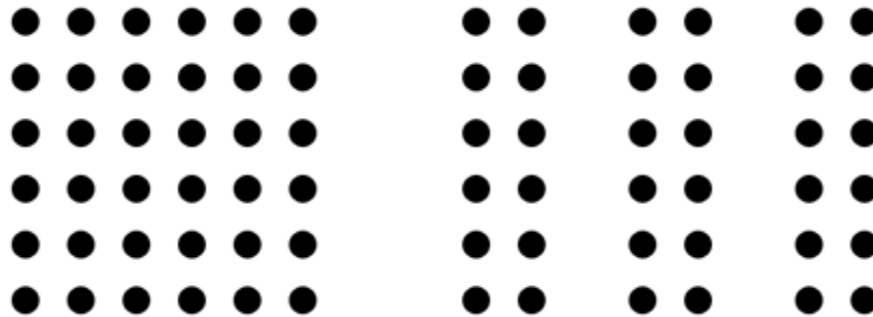


Perception Laws in Design.

Gestalt Laws

- **The law of proximity:**

Spatial or temporal proximity of elements may induce the mind to perceive a collective or totality.



Perception Laws in Design.

Gestalt Laws

- **The law of symmetry:**

Symmetrical images are perceived collectively, even in spite of distance.



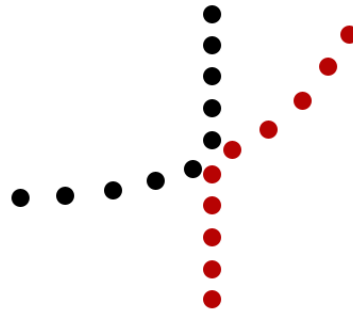
Perception Laws in Design.

Gestalt Laws

- **The law of continuity:**

The mind continues visual, auditory, and kinetic patterns.

Elements on a line/curve may be perceived as more related than elements not on the line/curve.



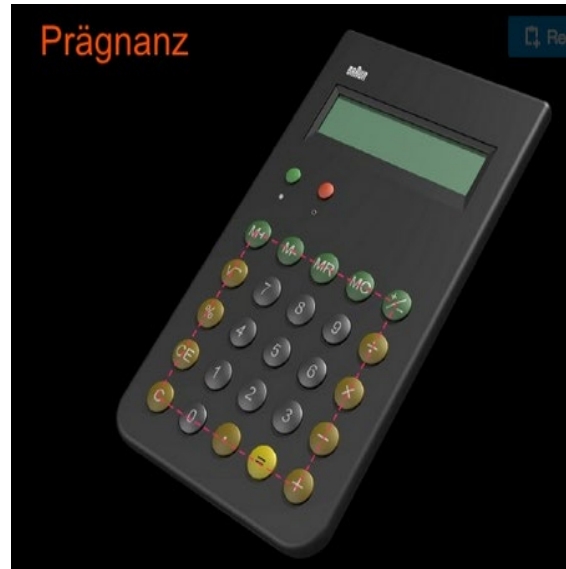
Perception Laws in Design.

Gestalt Laws

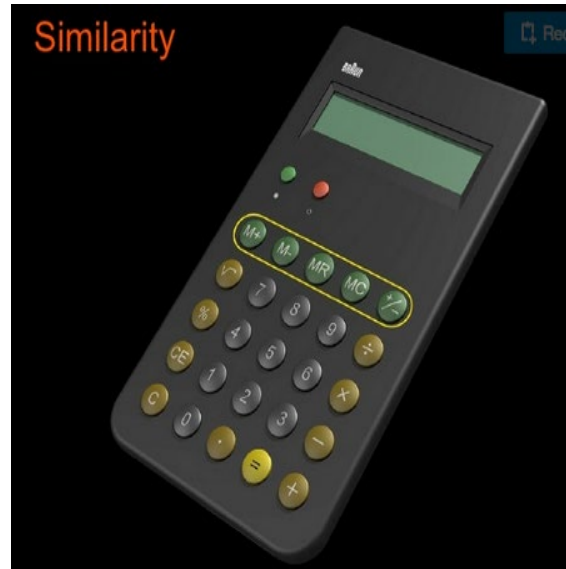
- **The law of common fate:** Elements with the same moving direction are perceived as a collective or unit.



Example

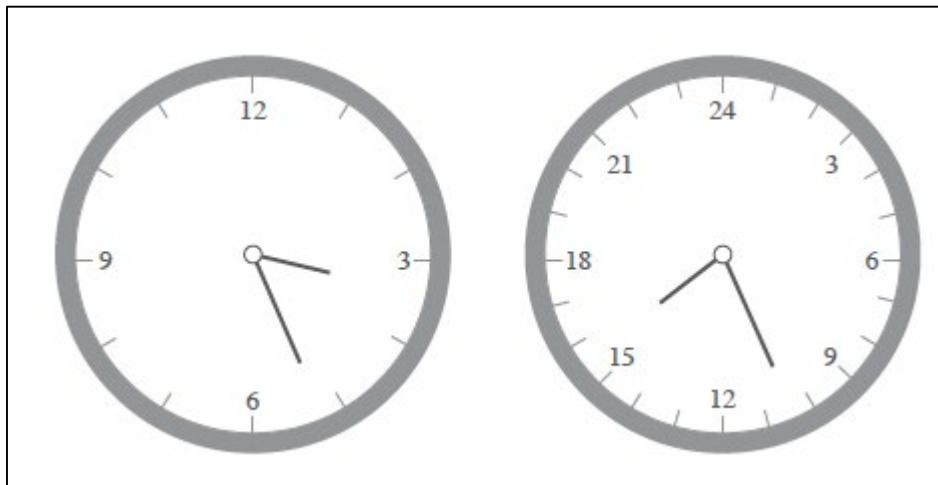
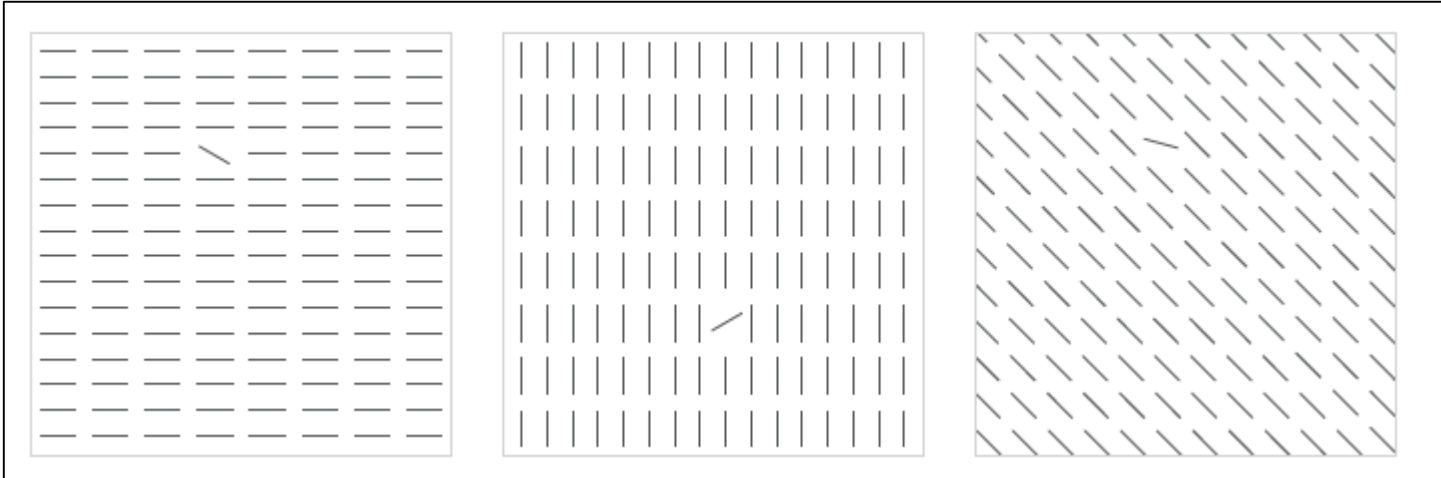


Example



Perception Laws in Design.

- **Orientation Sensitivity:** *Efficient perception of line orientation is highly limited.*
 - Vertical or horizontal orientations are ok, while oblique orientations are more difficult to distinguish (30° is the minimum recommended).
 - Due to two main phenomena in visual perception:
 - **Oblique effect:** The relative deficiency in perceptual performance of our neurons for oblique contours as compared to the performance for horizontal or vertical contours.
 - **Pop-out effect:** It is the tendency of certain elements in a display to pop out as figure elements, and therefore be easily detectable. Better if they differ minimum 30°



Perception Laws in Design.

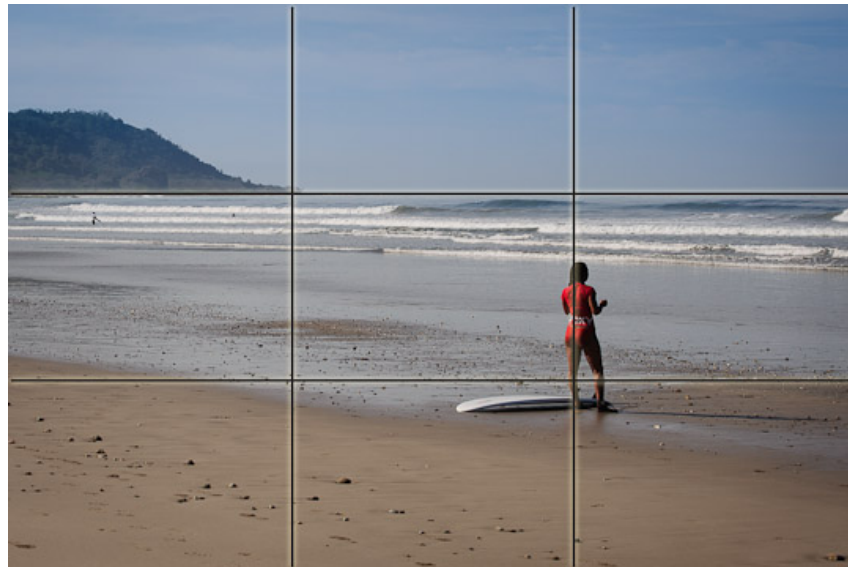
- Pictorial superiority effect:

Concepts are much more likely to be remembered experientially if they are presented as pictures rather than as words.

- After 30 seconds
- Before 30 seconds, the same amount of information can be recalled in text than in pictures

Perception Laws in Design.

- Rule of thirds



Perception Laws in Design.

- Signal to noise ratio:

Measure used in science and engineering that compares the level of a desired signal to the level of background noise.

- A ratio higher than 1:1 indicates more signal than noise.
- *The goal of communication is maximizing signal and minimizing noise.*

Keep de design simple => enhance perception

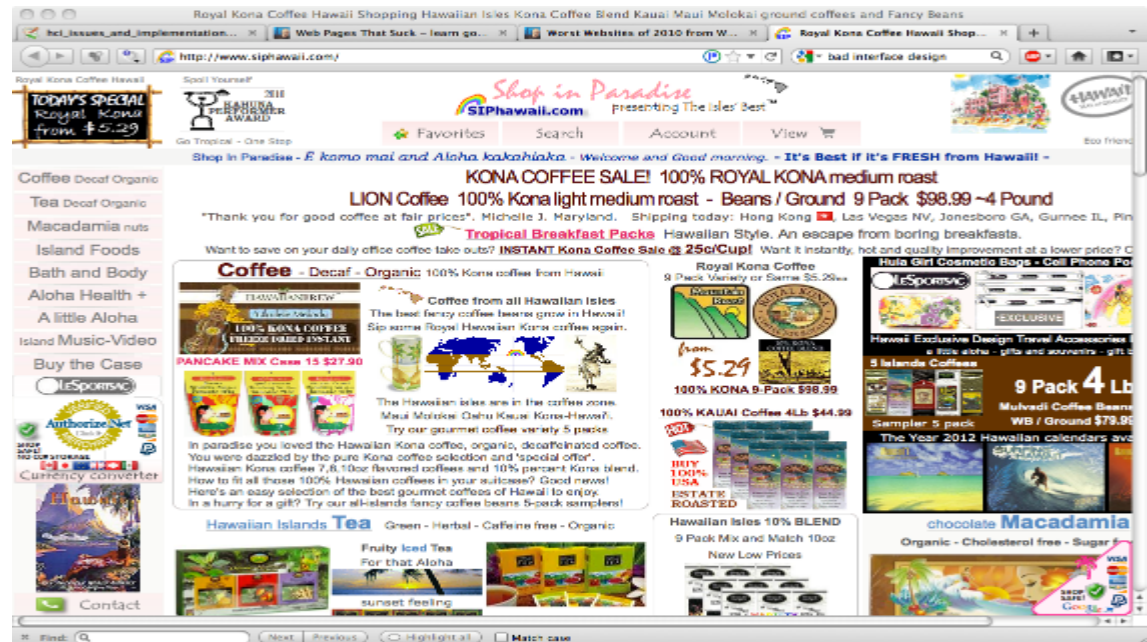
We can enhance information by using redundant coding and highlighting.

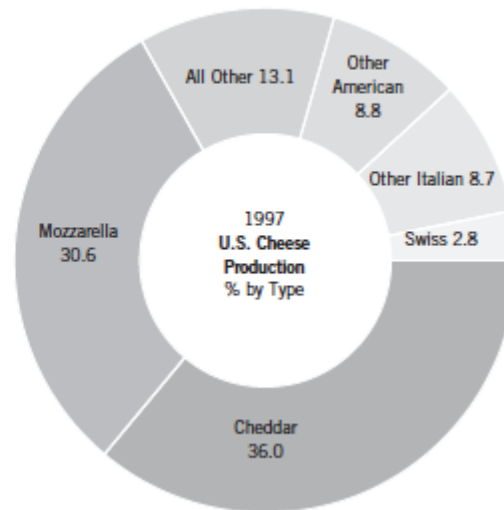
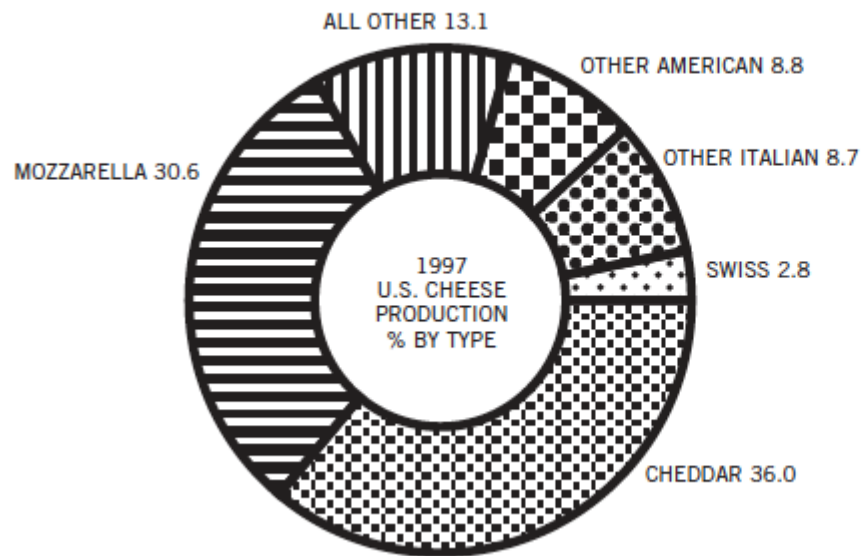
Remove noise by eliminating unnecessary elements.

Design Mistakes. Web pages

Problems

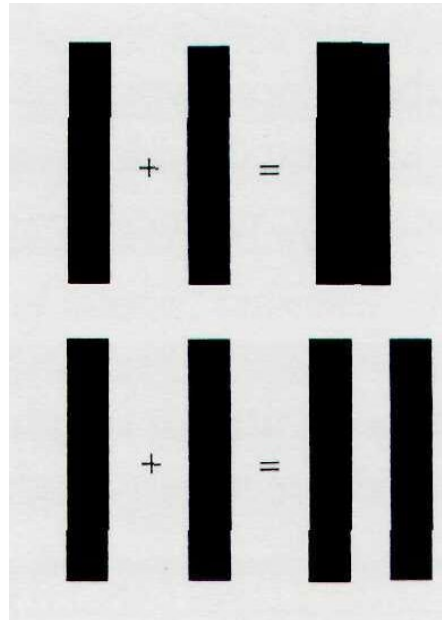
- White space?





Universal Principles of Design

- $1+1=3$



Universal Principles & Perception Laws in Design

- Principle concepts of Design
From the “Universal Principles of Design” book
by William Lidwell, Kritina Holden, Jill Butler
- Perception Laws in Design: Gestalt Laws & more
- Color perception

Universal Principles & Perception Laws in Design

Usability

- Usability: Defined in ISO 9241 standard as
 - The ability in which a product may be used by **specific** users in order to carry out **specific** tasks *effectively, efficiently, and with satisfaction* in a **specific** use environment.
 - Usability is always referred to a **concrete user group** and a **concrete user application**