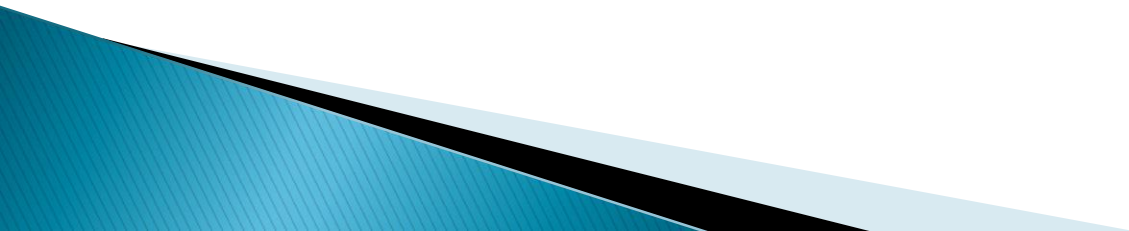


Professors d'IDI - UPC

# IDI – Universal Design Principles & Perception Laws



# 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 Design Principles & Perception Laws

- ▶ **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 of Design

## ▶ Aesthetic–Usability Effect

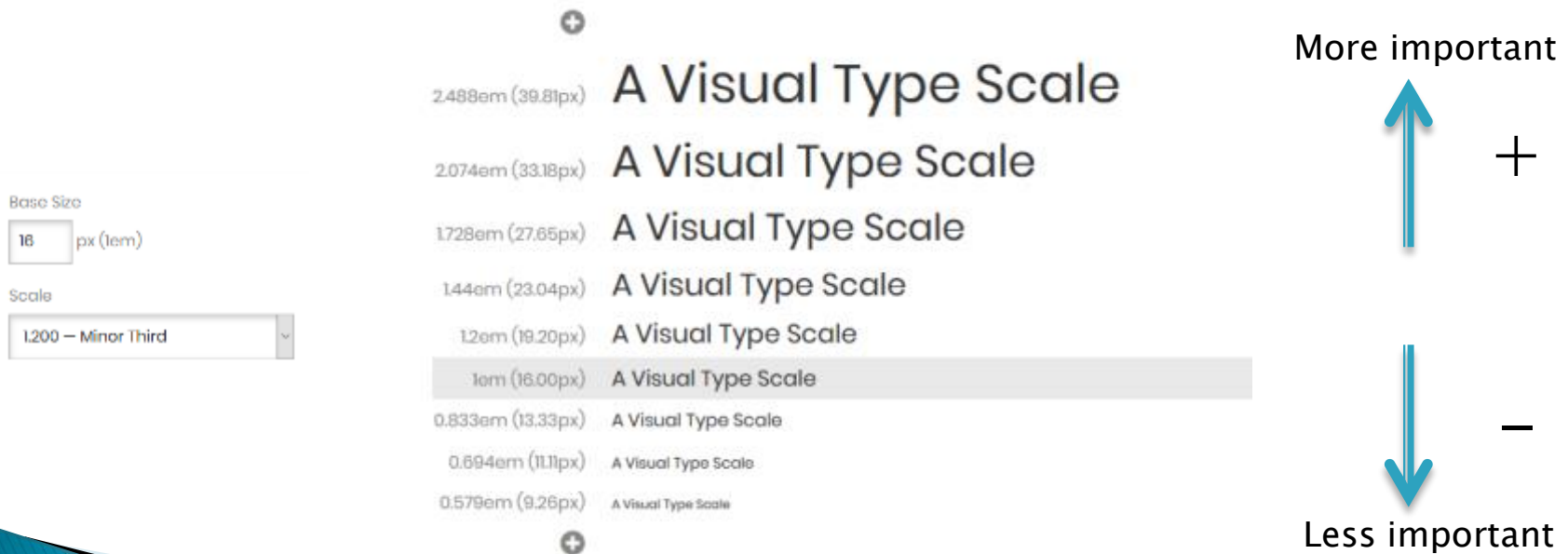
- Aesthetics play an important role in the way designs are used
- Aesthetic designs look easier to use, and encourage its use more than non aesthetic designs
- This effect produces the perception that an aesthetic design is easier to use than a non-aesthetic design

We must devote important efforts to improve our designs.



# Universal Principles of Design

- ▶ Fix a visual hierarchy.
- ▶ Modular scale guarantees harmonious proportions. How to make a modular scale:
  - Choose a ratio (for example, the golden ratio, 1:1.618)
  - Choose a base size (i.e. 10), then multiply and divide to get many resonant numbers:



Captured from a font scale generator: <https://type-scale.com/>

# 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.

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

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

1-8

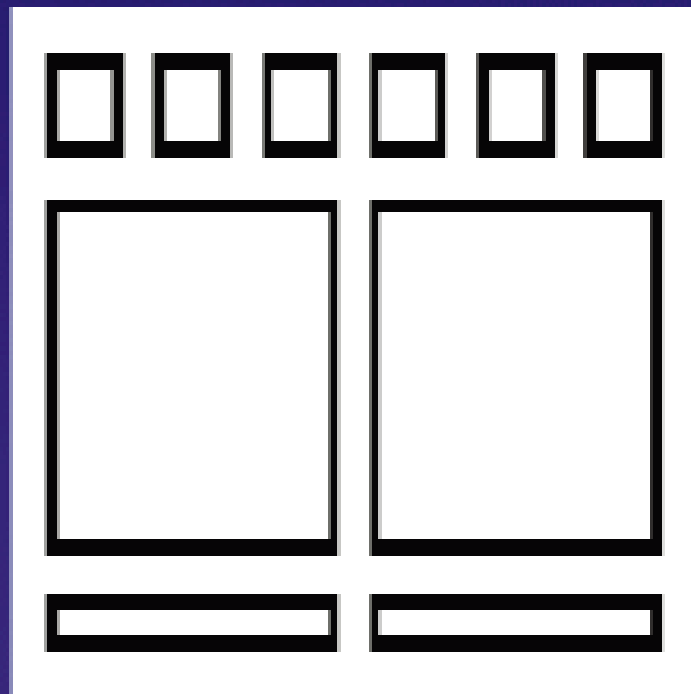
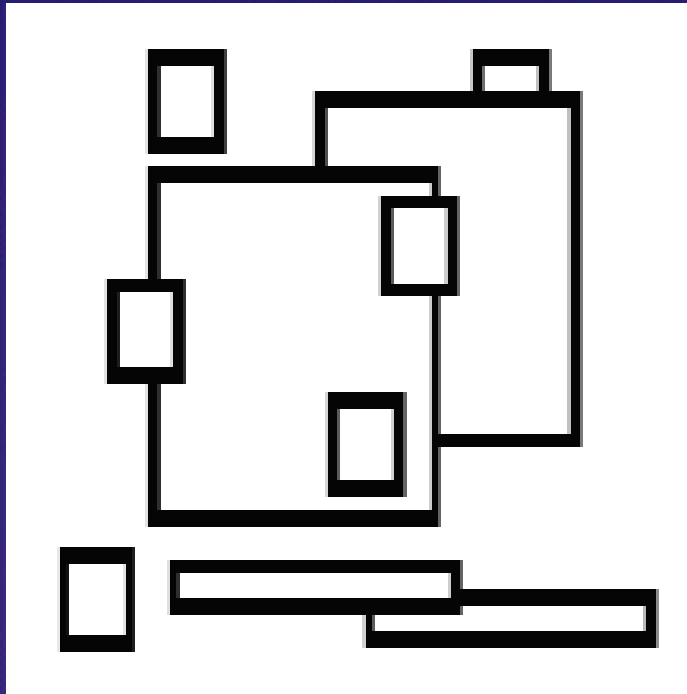
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WORKERS WORLD	MONICA MOOREHEAD - PRESIDENT AND GLORIA LA RIVA - VICE PRESIDENT	12
WRITE-IN CANDIDATE	To vote for a write in candidate, follow the directions on the long stub of your ballot card.	

ELECTORS FOR PRESIDENT AND VICE PRESIDENT

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

(Vote for Group)

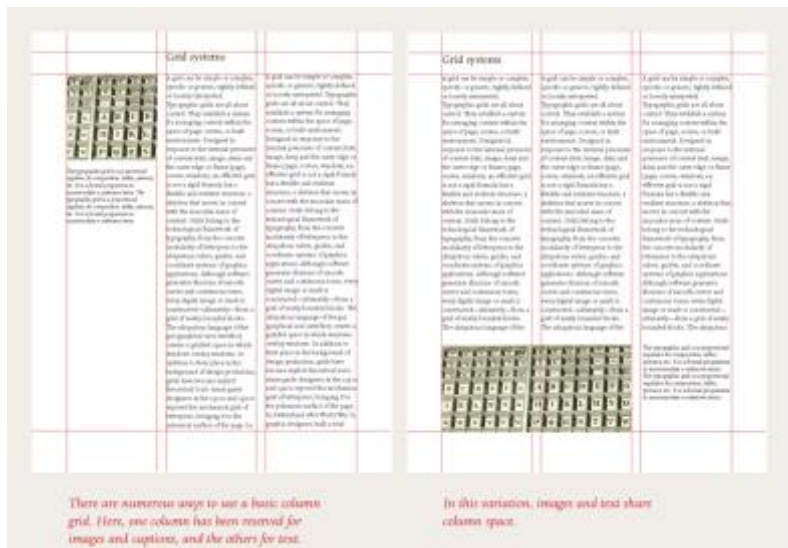
# Universal Principles of Design





# Universal Principles of Design

## ► Define a grid. There are infinite options:



Column grid.

Hang Line (top area reserved for images and captions).

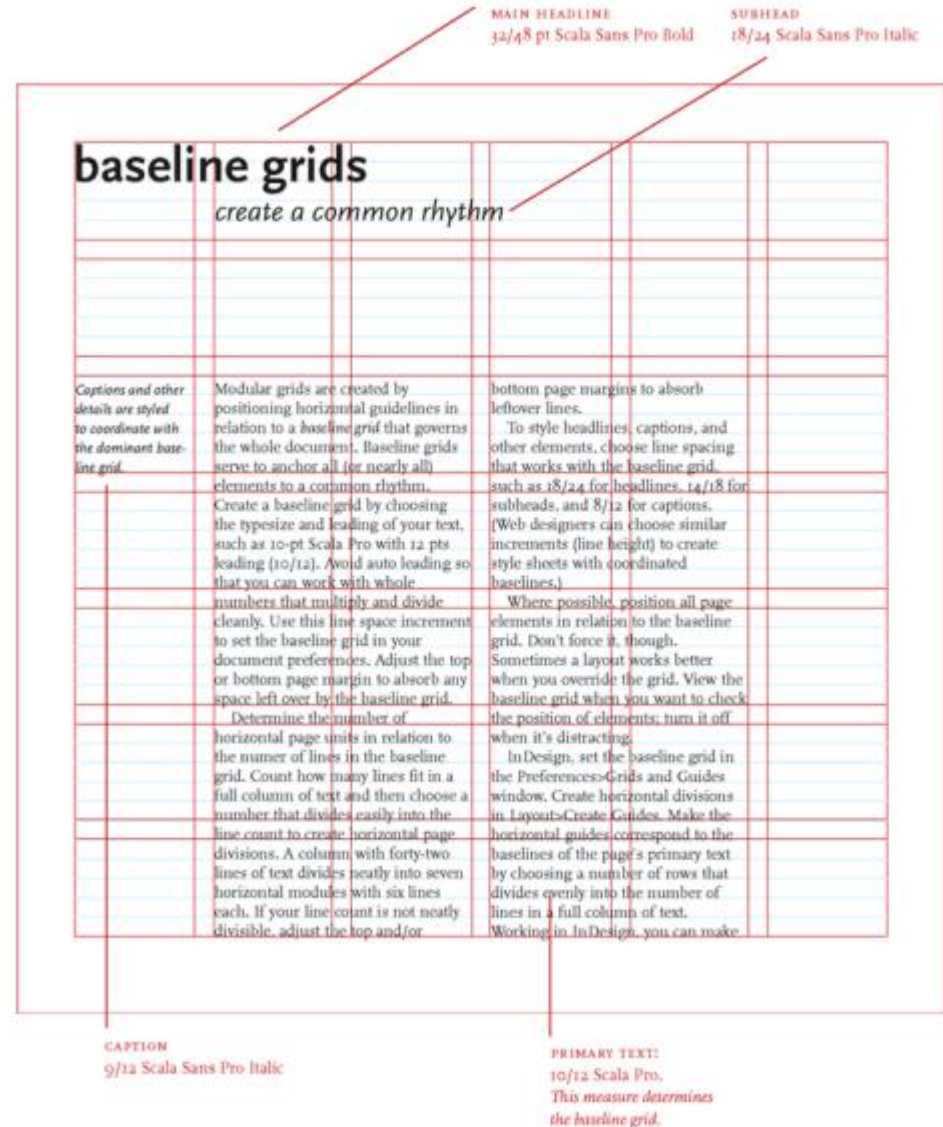
Josef Muller-Brockmann's *Grid Systems in Graphic Design*, 1961.  
(Image credit: <http://thinkingwithtype.com/grid/> )

# Universal Principles of Design

- ▶ Modular grid. One element can occupy several neighboring cells.

# Universal Principles of Design

- ▶ Base line grids ensure the vertical rhythm between columns.
- ▶ The font sizes, line heights and margins are fixed to fit in a base grid of fixed height.
- ▶ Try gridlover for grid generation!





# DON'T



**www.ARNNGREN.net**

23 Butikker

Teknologi & Gadgets

el-biler til barn

Index

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el-retur

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Løfteevne: 8kg

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Star Wars

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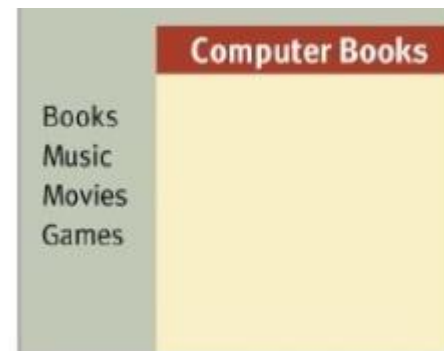
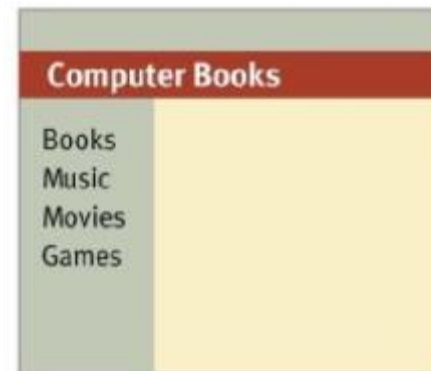
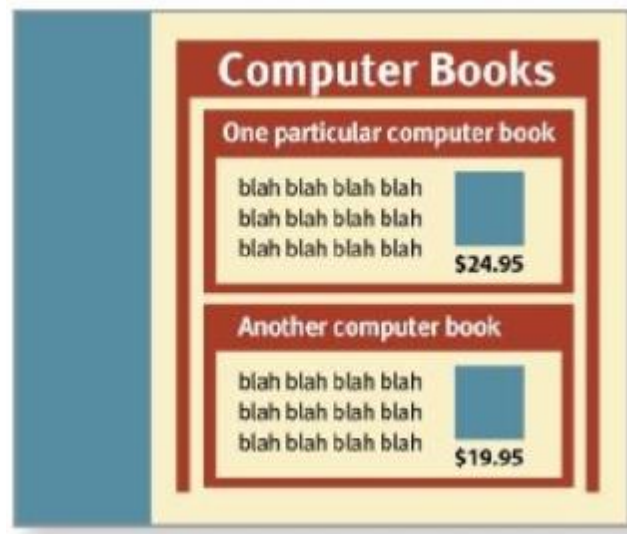
**Se alle våre el-Kjøretøy til Barn og Ungdom, Norges største utvalg**

# Universal Principles of Design

## ► Nesting

Nesting is also a visual queue of the hierarchy of the information shown.

We need to be careful when designing the visual nesting dependences.





# Universal Principles of Design

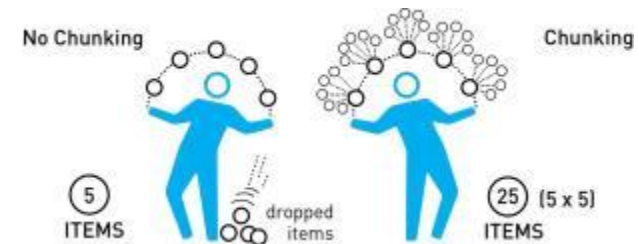
## ▶ Chunking

- 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.

654563465  
654 – 56 – 34 – 65



### ➤ Magical number: $7 \pm 2$ (contemporary estimation $4 \pm 1 \rightarrow 5$ )

- 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, just the information to be memorized.
  - *Elements such a dictionary pages must not be chunked.*

# Universal Principles of Design

## ► Color

- 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

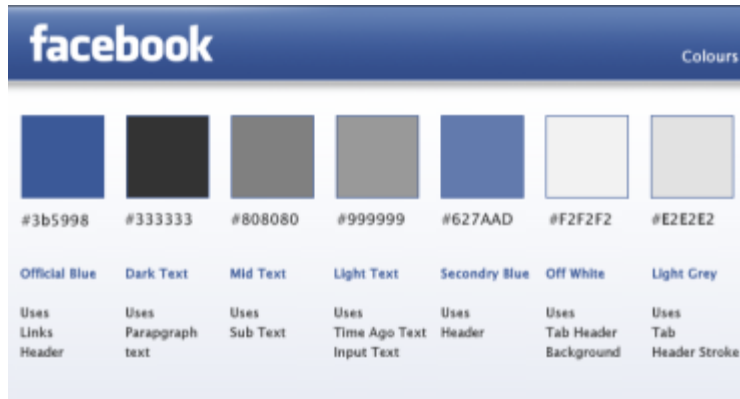
## ► Color: Aspects to consider:

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



# Universal Principles of Design

## COLOR PALETTE



## CORPORATIVE PALETTE



## COLOR HARMONY

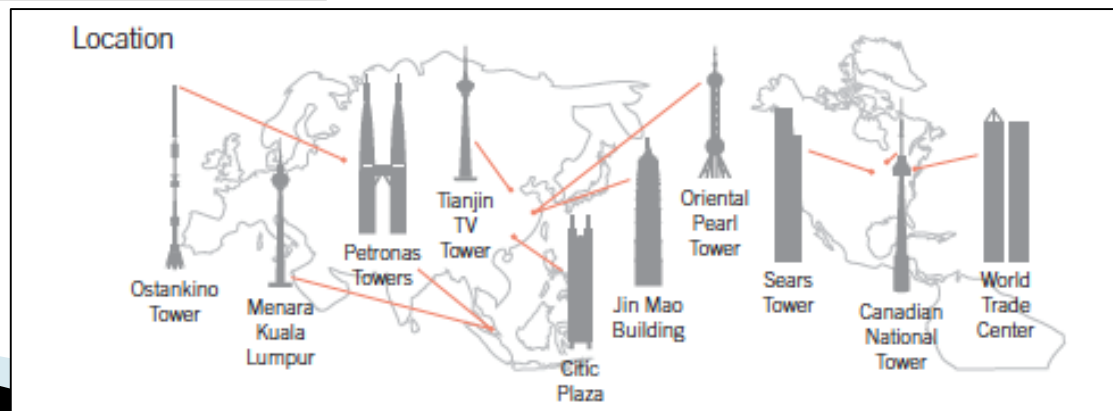
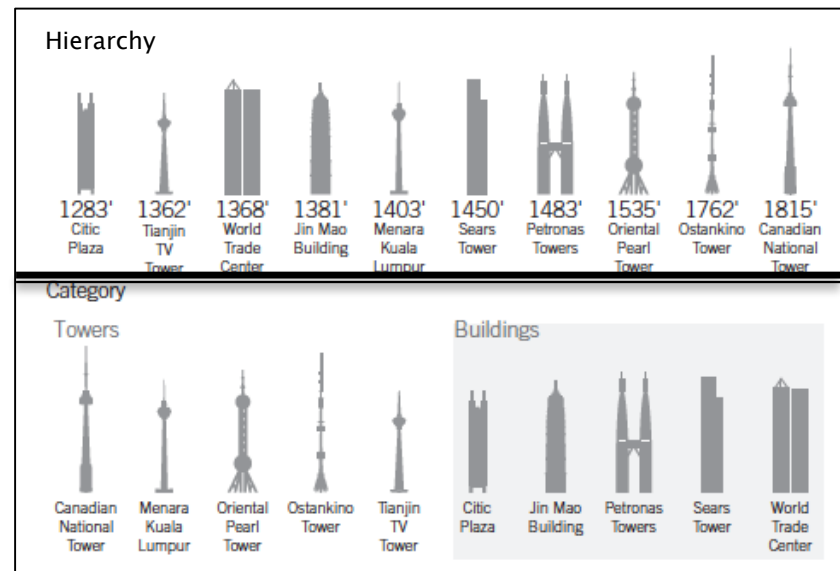
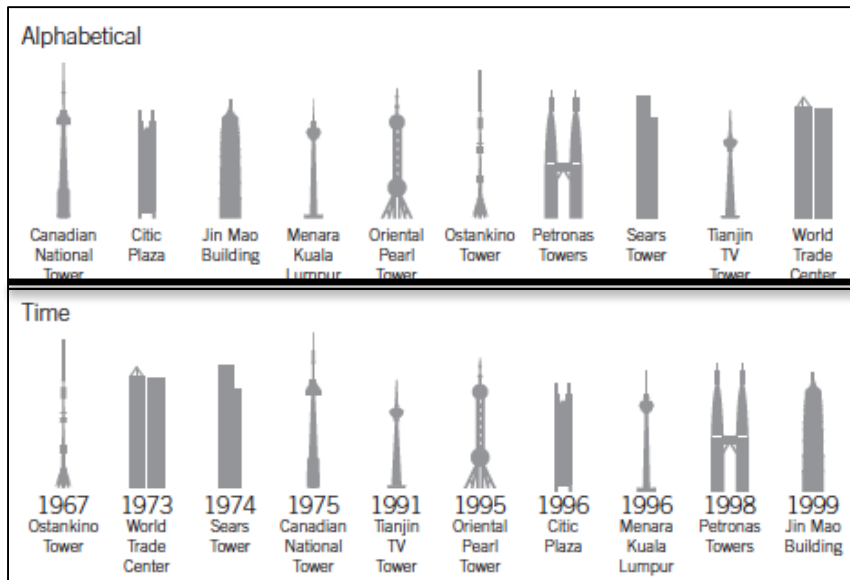


# Universal Principles of Design

- ▶ *LATCH principle.* Information is organized according to:
  - **Location:** Information comes from different places  
(cities in a map, 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

# Universal Principles of Design

## *LATCH principle.*



# 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 in a money transfer.

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

Credit Card Number

Month Year

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.

# Input control: avoid errors

- ▶ Choose the appropriate input for each field:

What's your favorite fruit?

Don't

What's your favorite fruit?

Apple Banana Orange

Do

Price Range

From To

\$10 \$1,000

Don't

Price Range

\$10 \$1 000

Range slider

Do

- ▶ Masked textboxes are a great option:

Phone Number

Card

Expiry

Order Code

- ▶ Use location services

STREET ADDRESS \*

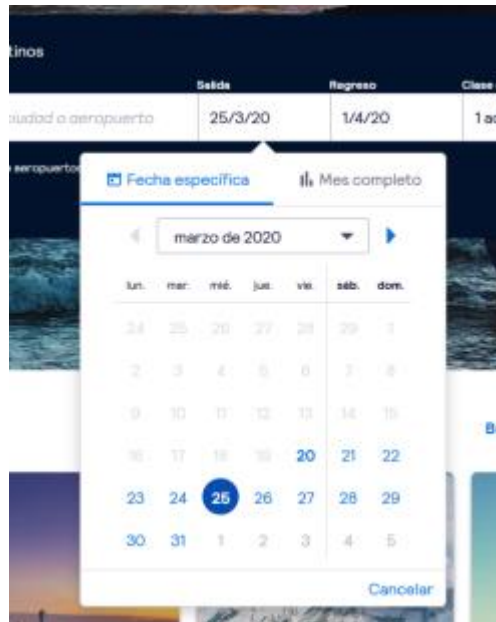
APARTMENT/SUITE #

CITY \*

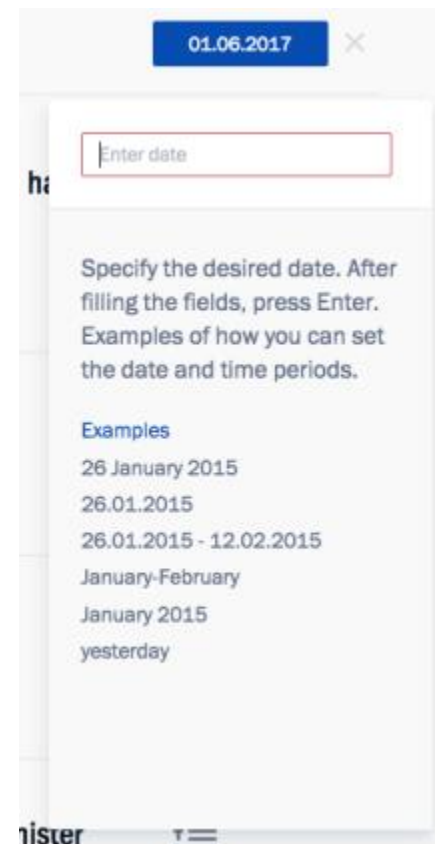
STATE \*

ZIP \*

# Input control: avoid errors



<http://en.kremlin.ru/>



April	29	2014
May	30	2015
June	31	2016
July	1	2017
August	2	2018
September	3	2019
October	4	2020



# Input control: avoid errors

- ▶ Use placeholders to inform of the correct format of the inputs.
- ▶ Activate the proper keyboard for each field.

Tracking Number

Don't

Tracking Number

Do

User Name

Phone Number

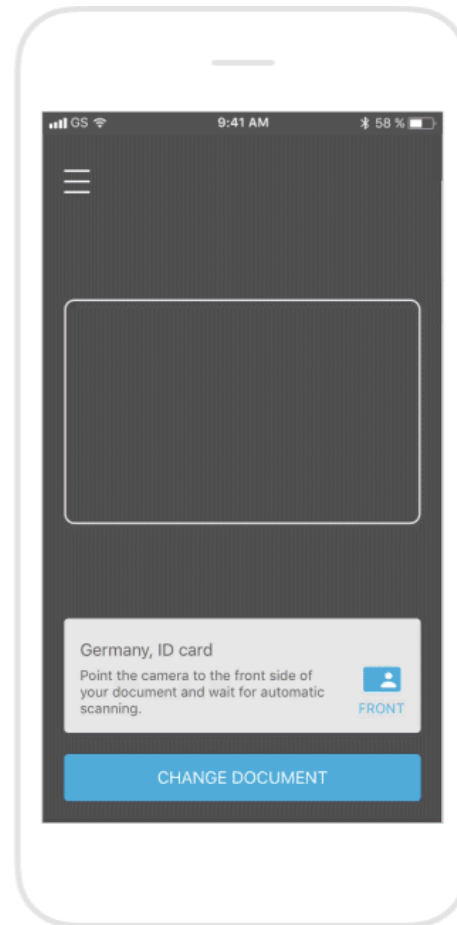
Don't

User Name

Phone Number

Do





► And.....use the camera!



# Universal Principles of Design

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

Four types:

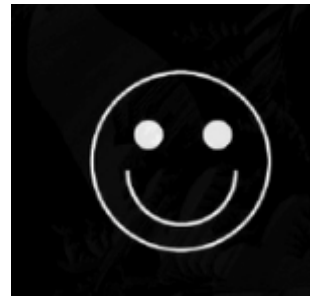
- **Similarity:** The icon is visually similar to the action/object to be represented. Adequate for simple objects (turn right) 
- **Example:** Elements can be related to the image (plane for airport) 
- **Symbolic:** High level of abstraction (unlock icon) 
- **Arbitrary:** No relationship with element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

# Universal Design Principles & Perception Laws

- ▶ 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
- 

# Perception Laws. Gestalt Laws

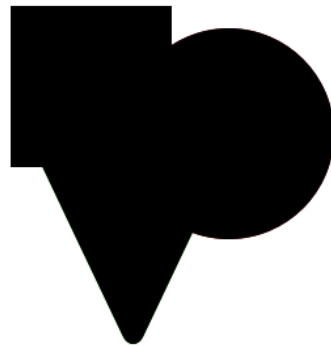
- ▶ **Gestalt Laws** relevant for visual design.
- ▶ Gestalt: Psychology term – people tend to organize visual elements into groups when certain principles are applied.
- ▶ **Gestalt Laws are:**
  - Prägnanz Law
  - The law of closure
  - The law of similarity
  - The law of proximity
  - The law of symmetry
  - The law of continuity
  - The law of common fate



# Perception Laws. Gestalt Laws

- ▶ **Pragnänz Law:** Law of good figure, simplicity.

We tend to perceive simpler shapes because it is the interpretation that requires the least cognitive effort to us.





TOGETHER WE SUCCEED

the creator of  
the world's leading  
snowboarders  
since 1967



# Perception Laws. Gestalt Laws

- ▶ The law of closure:

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



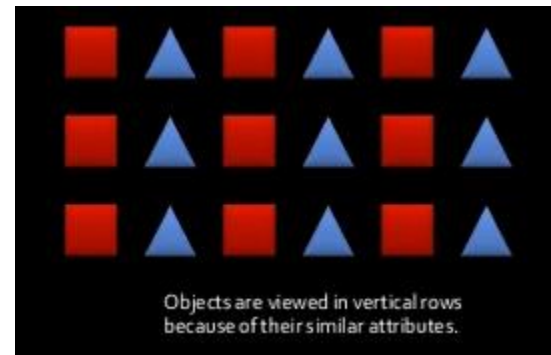


# Perception Laws. Gestalt Laws

- ▶ The law of similarity:

The mind groups similar elements into collective entities or totalities.

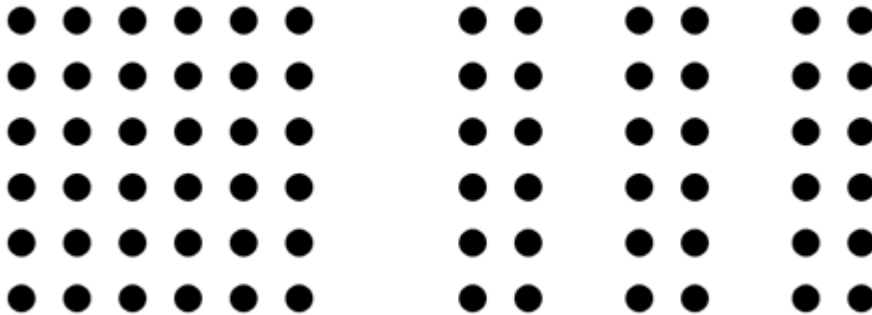
This similarity might depend on relationships of form, color, size, or brightness.



# Perception Laws. Gestalt Laws

- ▶ The law of proximity:

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



# Perception Laws. Gestalt Laws

- ▶ The law of symmetry:

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

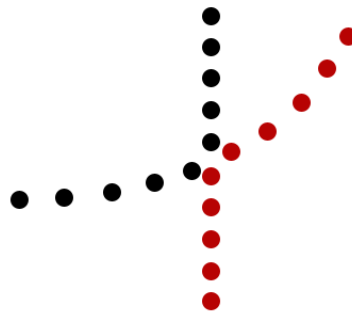


# Perception Laws. Gestalt Laws

- ▶ 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. Gestalt Laws

- ▶ The law of common fate:

Elements with the same moving direction are perceived as a collective or unit.



# Perception Laws. Gestalt Laws

## Example



# Perception Laws. Gestalt Laws

## Example

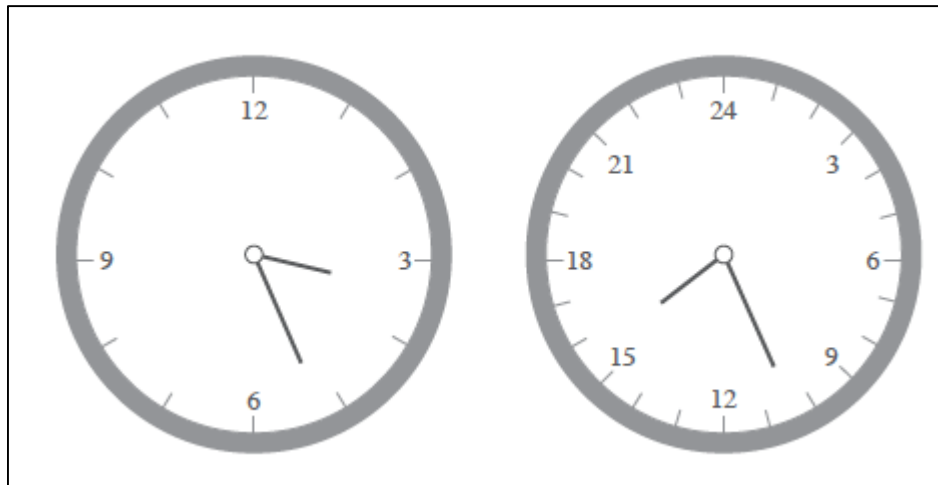
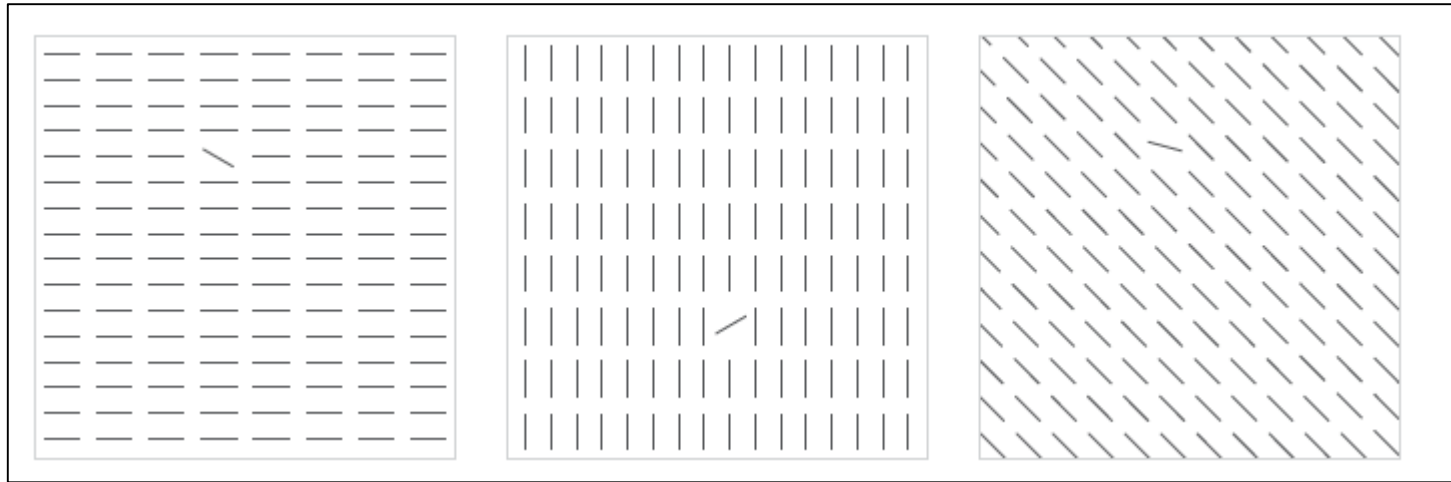


# Perception Laws

- ▶ **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 de 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



# Perception Laws

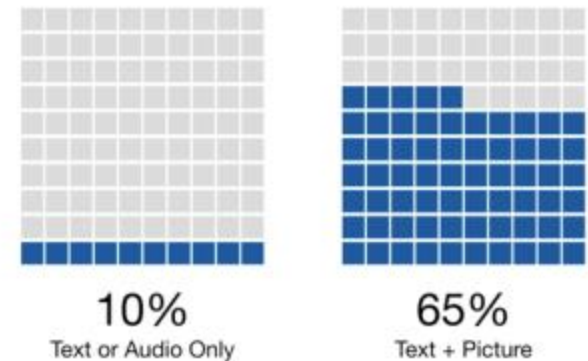
## ► Pictorial superiority effect:

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

## Picture Superiority Effect

Memory retention after 3 days



From Chapter 1: The Science of Infographics

**Cool Infographics**

Effective Communication with Data Visualization and Design

By Randy Krum

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of its components down to the weight distribution, which is another reason that only a STIHL cuts like a STIHL. And those are just the things you can see. There are a bevy of technological advancements that reinforce this machine's leadership position in the industry.

And such attention to detail has resulted in the company earning ISO 9001 and ISO 14001 certifications. Which means it meets rigid international manufacturing, environmental and quality standards. On another gratifying level, STIHL products win quality and engineering design awards regularly.

For instance, the introduction of the new MS 171 chain saw marks the debut of a new generation of cutting machine. The MS 171 features a greener, reduced-emission engine and utilizes an advanced anti-vibration system plus convenience features like toolless fuel and spark plug access.

were taken in the construction of a new guide bar assembly plant at the 100-acre campus. STIHL demonstrated its commitment to socially responsible environmental stewardship when the company built this 40,000-square-foot facility. The plant's roof boasts the largest privately funded "green roof" in Virginia. The more than 56,000 sedum plants on the roof cool the building in the warmer months and help it retain heat in the cooler months, lowering energy usage.

How many chain saw manufacturers have their own lumberjack competitions? Each year, athletes from around the world compete in time-honored events such as the STIHL TIMBERSPORTS® Series and the STIHL® TIMBERSPORTS®. Collectively, these events

real benefits 100%

It's this kind of formula that will create product concepts. Products like handy gasoline-powered drilling machines, coffee harvesters, olive harvesters and plows—all of which already exist among STIHL's offerings.



## Made for professional loggers, landscapers, homeowners, construction workers, farmers, firefighters. . . and long-winded writers.

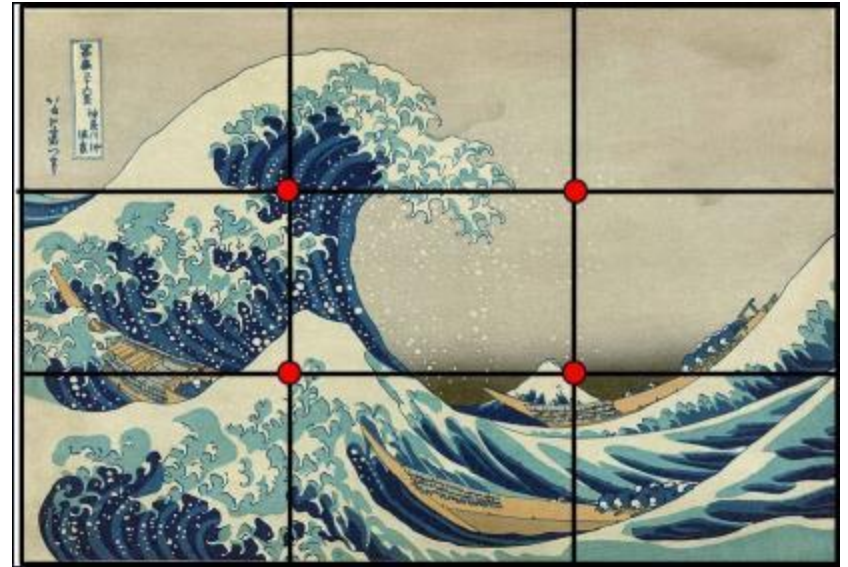
What can you expect from the number one selling brand of chain saws worldwide? Start with legendary design, reliable performance and long-lasting value. Plus innovations like reduced-emission engine technology and the toolless Quick Chain Adjuster. Best of all there's the nationwide network of 8,000 independent STIHL dealers who service what they sell to help you do more—no matter what it is you do for a living.

To find a dealer:  
STIHLUSA.com  
STIHLUSA.mobi  
1-800-GO-STIHL

Number 1 Worldwide **STIHL®**

# Perception Laws

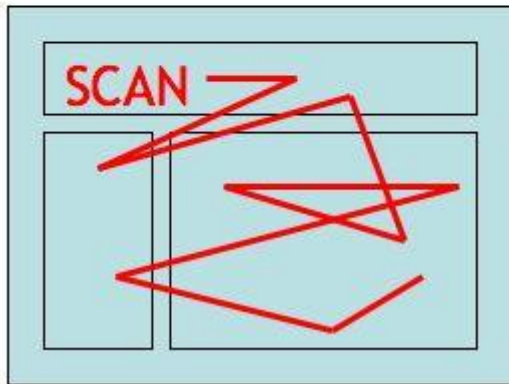
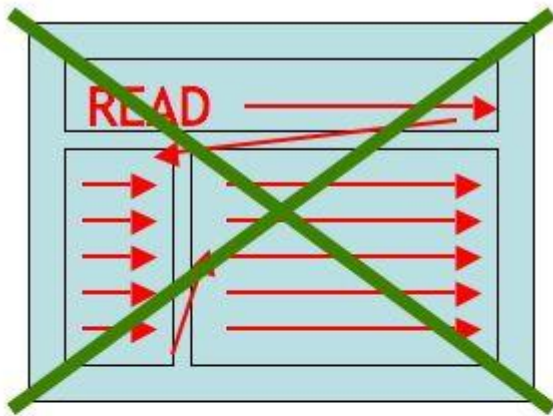
- ▶ Rule of thirds





# Perception Laws

- ▶ We do not read, we scan.



- People start reading from upper left corner of a page (unless the content is written in a right-to-left language).
- Navigation elements work better on the top.
- Users "read" a page diagonally, from upper left corner to lower right one, or in Z or F scan.
- Users pay attention to menu and navigation buttons.
- They commit to headlines.
- They ignore huge blocks of text while scanning.
- Lists hold attention for a longer time.
- Short paragraphs are easier to perceive.
- Users pay attention to subheadings only if they are interesting.

# Perception Laws



www.uselt.com

*F-shaped pattern: how people scan texts online*

# Perception Laws

## ► 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?





# Design mistakes. Web pages

Are you kidding?



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- 

Professors d'IDI - UPC

# IDI – Universal Design Principles & Perception Laws

