

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 acceptation 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’s 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

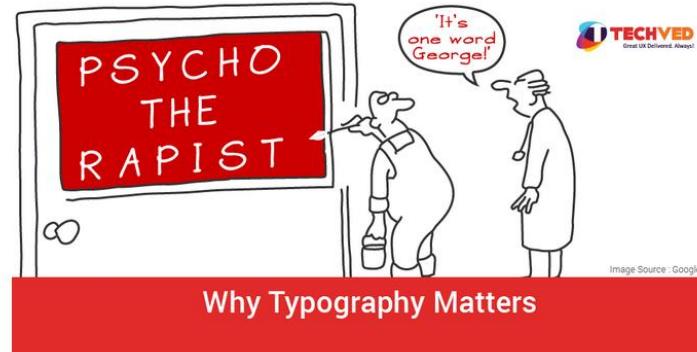
- Aesthetic-Usability Effect
 - Aesthetics play an important role in the way designs are used
 - Aesthetic designs look easier to use, and encourage its use more than non aesthetic designs
 - This effect produces the perception that an aesthetic design is easier to use than a non-aesthetic design

We must devote important efforts to improving our designs.

Typography matters

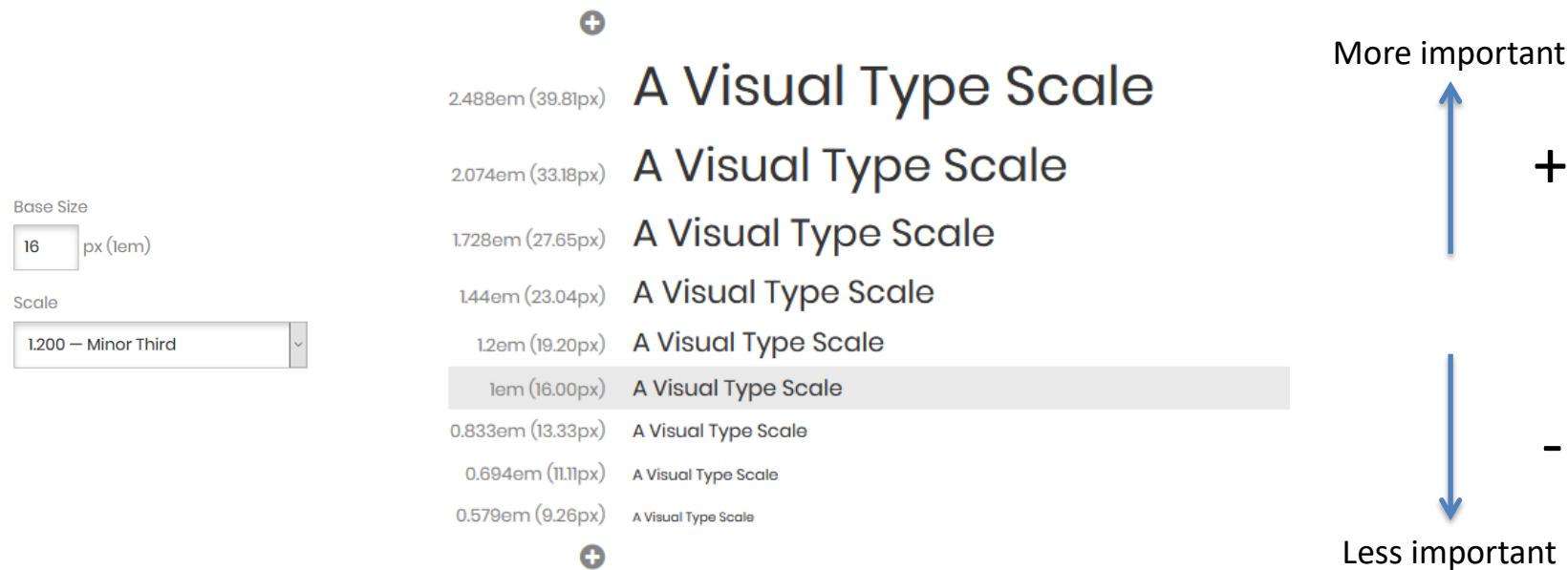
Hi, I'm here to test your readability skills.

Are you able to read this? - Fancy right? AND THIS? What about this? Are you having fun? We could do this all day you know. NOW, THIS IS DEFINITELY READABLE! I'm Certainly Having Fun, What About You? OkAy, NoW iT's geTtiNg SliGhtLy aNnoYinG. Let's just stop here.



Typography matters

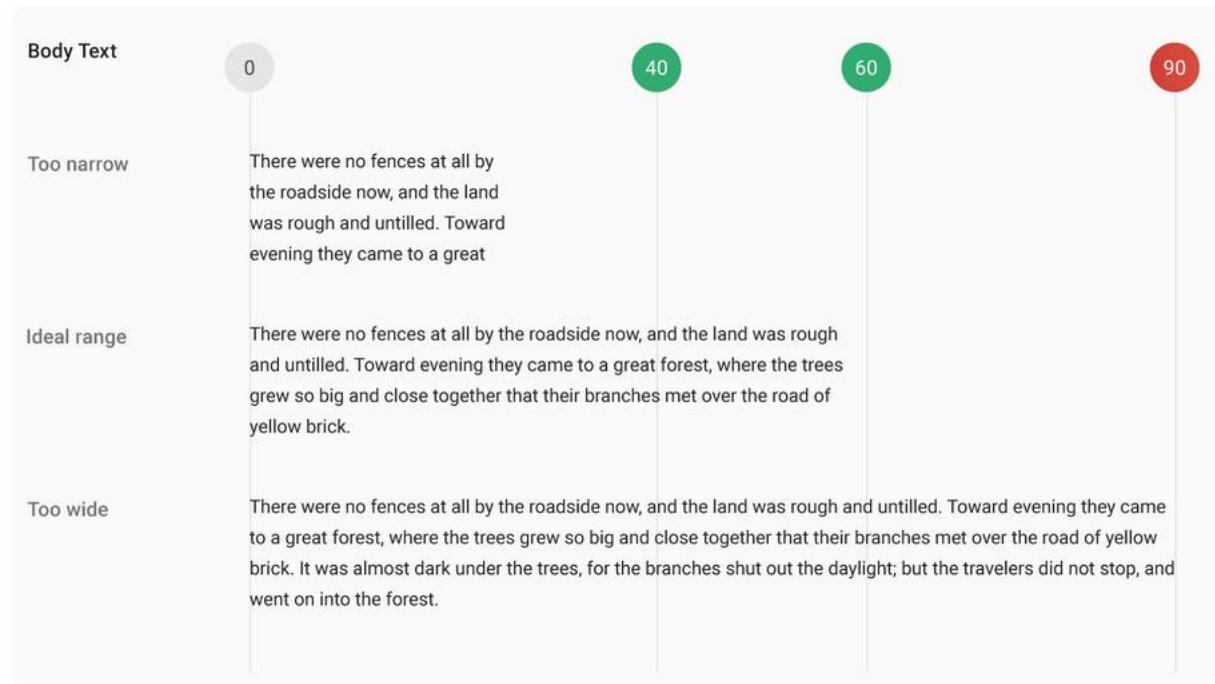
- Fix a visual hierarchy.
 - A **Modular scale** guarantees harmonious proportions. [How to](#) make a modular scale:
 - Choose a ratio (for example, the golden ratio, 1:1.618)
 - Choose a base size (i.e. 10), then multiply and divide to get many resonant numbers:



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

Typography matters

Line length



Recommended line length in Google's Material Design Guidelines (Source: [material.io](#))

The Equilateral Triangle of a Perfect Paragraph - [Matej Latin](#) on Jun 9, 2017 - <https://css-tricks.com/equilateral-triangle-perfect-paragraph/>

Typography matters

Line height

Georgia, #202020, 16/23

Garamond worked as an engraver of punches, the masters used to stamp matrices, the moulds used to cast metal type. He worked in the tradition of what is now called old-style serif letter design, that produced letters with a relatively organic structure resembling handwriting with a pen but with a slightly more structured and upright design. Although Garamond himself remains considered an eminent figure in French printing of the sixteenth century, historical research over the last century has increasingly placed him in context as one artisan among several active at a time of rapid production of new typefaces in sixteenth-century France, operating within a

Georgia, #646464, 16/21

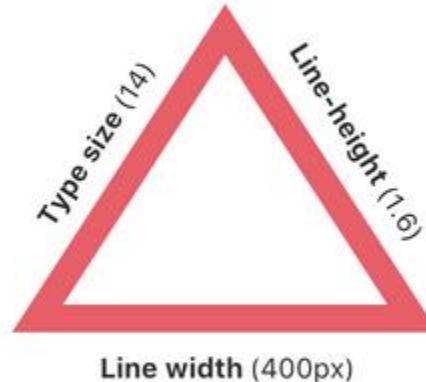
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The Equilateral Triangle of a Perfect Paragraph - [Matej Latin](#) on Jun 9, 2017 - <https://css-tricks.com/equilateral-triangle-perfect-paragraph/>

Typography matters

Merriweather, 14/24, 400px (55 characters)

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The Equilateral Triangle of a Perfect Paragraph - [Matej Latin](#) on Jun 9, 2017 - <https://css-tricks.com/equilateral-triangle-perfect-paragraph/>

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..

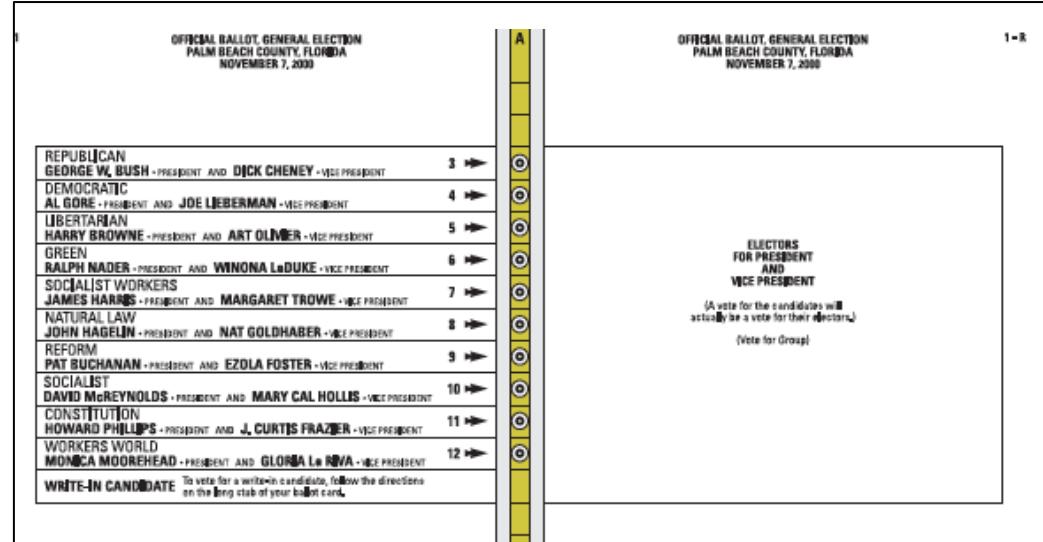
Confusion over Palm Beach County ballot

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

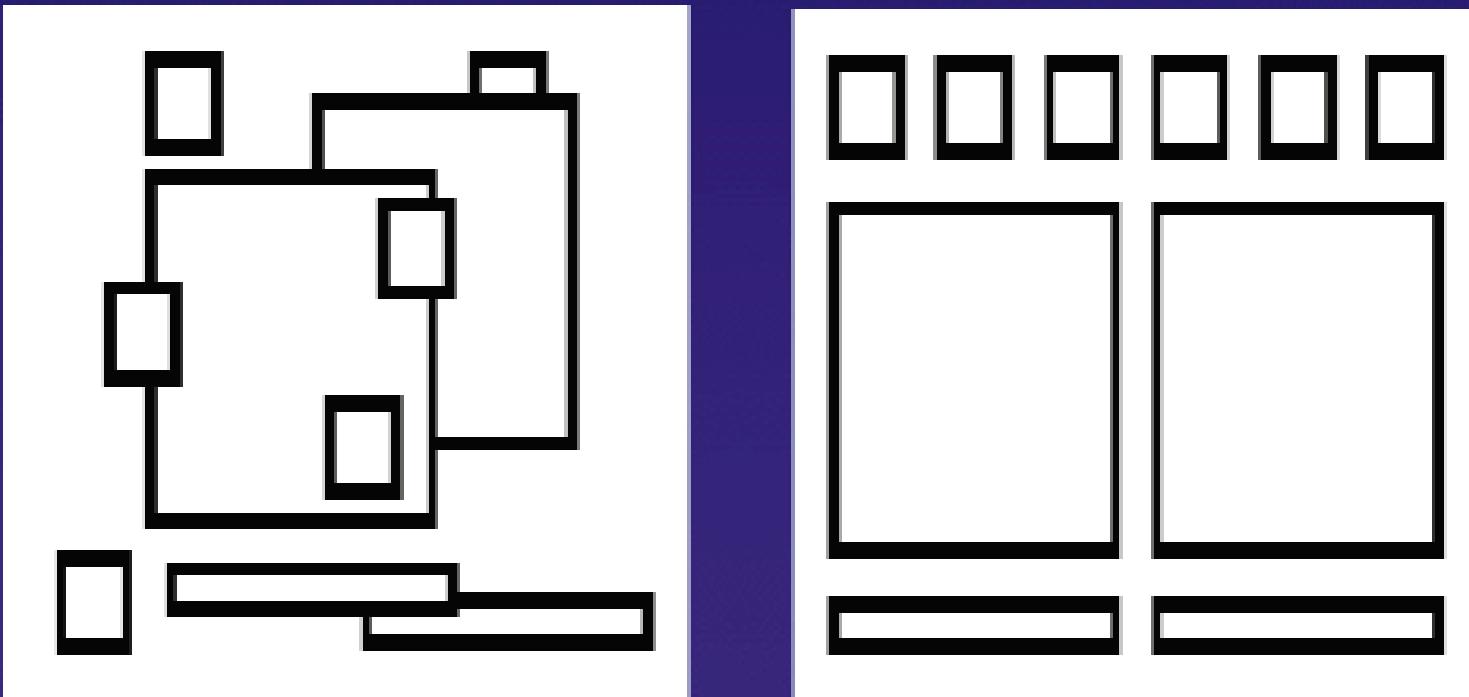
(REPUBLICAN)	GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT	3 →
(DEMOCRATIC)	AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT	5 →
(LIBERTARIAN)	HARRY BROWNE - PRESIDENT ART OLIVIER - VICE PRESIDENT	7 →
(GREEN)	RALPH NADER - PRESIDENT WINONA LaDUKE - VICE PRESIDENT	9 →
(SOCIALIST WORKERS)	JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT	11 →
(NATURAL LAW)	JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT	13 →

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

(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.	



Universal Principles of Design



Universal Principles of Design

- Define a grid. There are infinite options:

	<p>Grid systems</p> <p>A grid can be simple or complex, specific or generic, tightly defined or loosely interpreted. Typographic grids are all about control. They establish a system for arranging content within the space of page, screen, or built environment. Designed in response to the internal pressure of content (text, image, data) and for some edge or frame (page, screen, window), an effective grid is not a rigid formula but a flexible and intelligent structure that moves in concert with the modular mass of content. Grids belong to the technical framework of typography, from the concern with the modular mass of content, rules, guides, and coordinate systems of graphic design, to the modular mass of images and continuous tone, every digital image or mark is constructed—ultimately—from a grid of pixels. The ubiquitous language of the grid, graphical user interface, creates a consistent visual language across windows. In addition to their place in the background of design, grids have become explicit tools. Grids guide designers in the space of page, screen, or built environment, bringing it to the foreground. After World War II, graphic designers built a modular grid on the potential surface of the page. It</p> <p>The typographic grid is a proportional regularise for composition, sales, value, presentation, etc. It is a formal progression of a modular grid, designed to accommodate a column one.</p>
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There are numerous ways to use a basic column grid. Here, one column has been reserved for images and captions, and the others for text.

In this variation, images and text share column space.

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A horizontal band divides a text zone from an image zone. Elements gravitate toward this line, which provides an internal structure for the page.

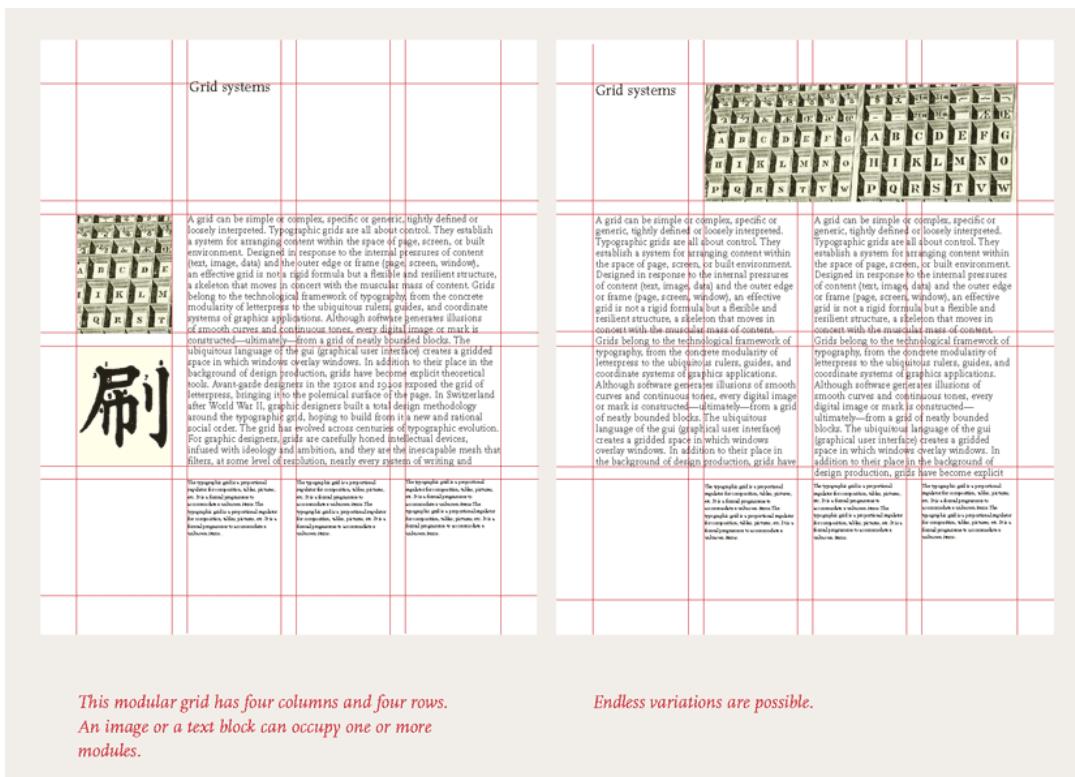
Column grid.

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/>)

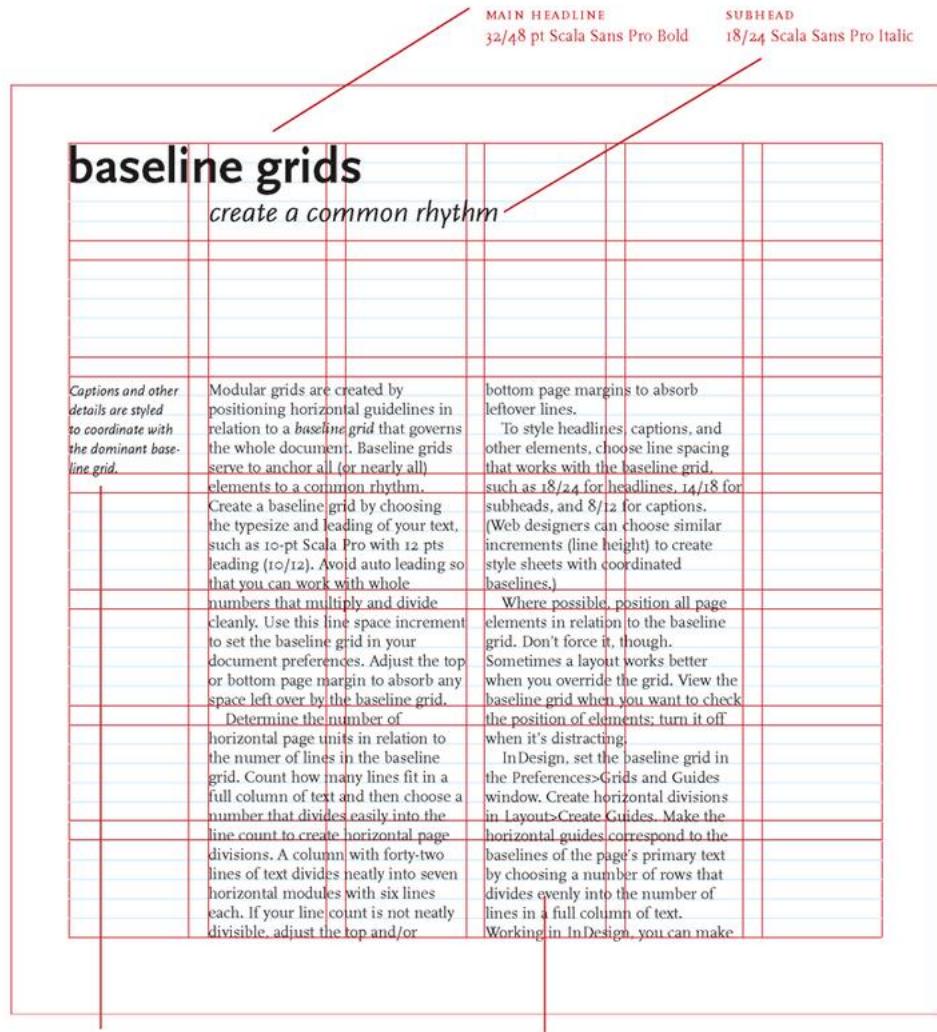
Universal Principles of Design

- 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!



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Figurer

Hobby

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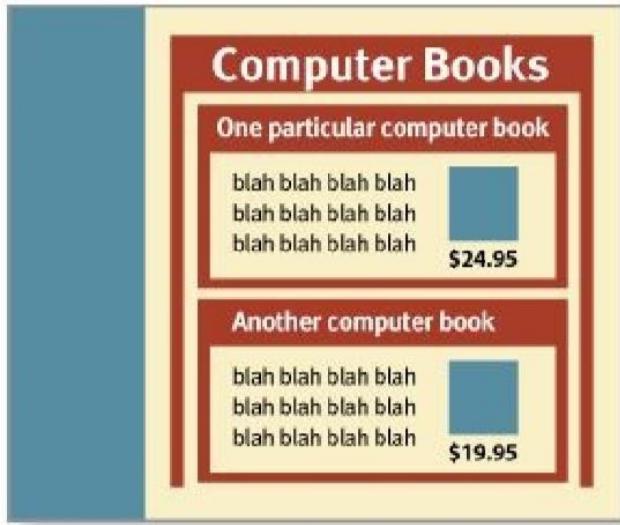
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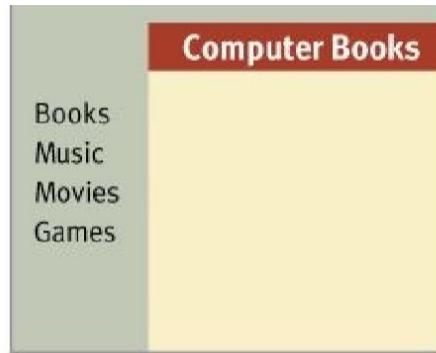
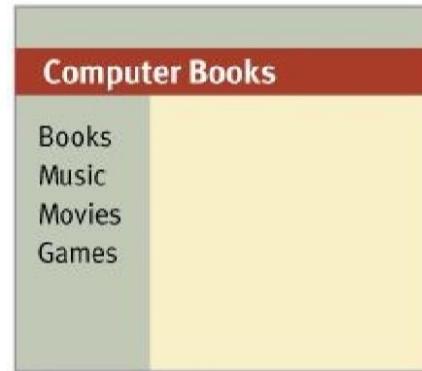
Universal Principles of Design

- 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.



Images: *Don't Make Me Think, Revisited*, 3rd Edition

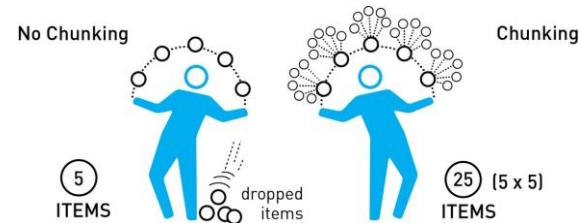
Universal Principles of Design

- **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: $7+/-2$ (contemporary estimation $4+/-1 \rightarrow 5$)

- 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

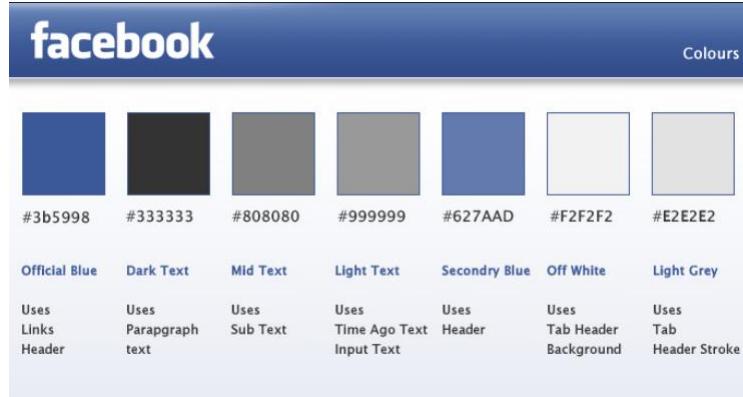
- Colour
 - It is an important feature that can make a design *more visually pleasing and aesthetic*
 - Can be used to *reinforce layout design and the meaning of elements*

Universal Principles of Design

- Colour: Aspects to consider:
 - Number of colours:
 - Keep it low, up to five. Define a COLOR PALETTE.
 - 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

COLOR PALETTE



CORPORATIVE PALETTE



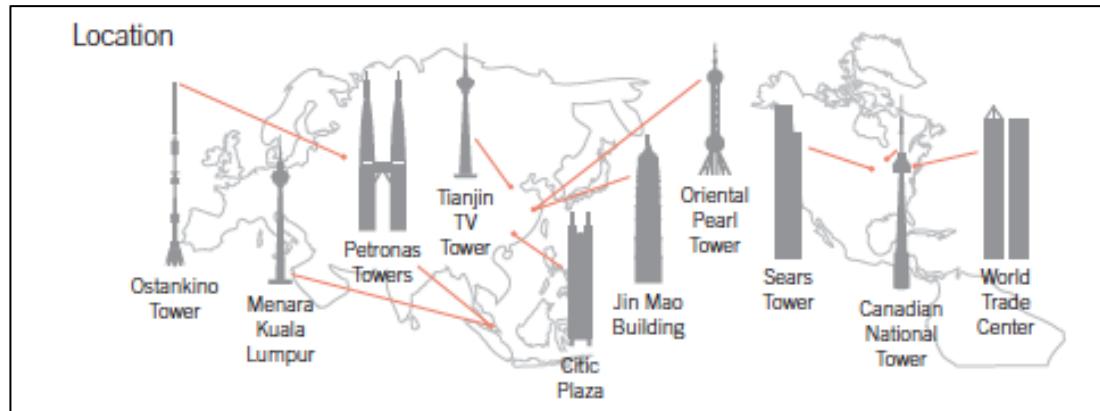
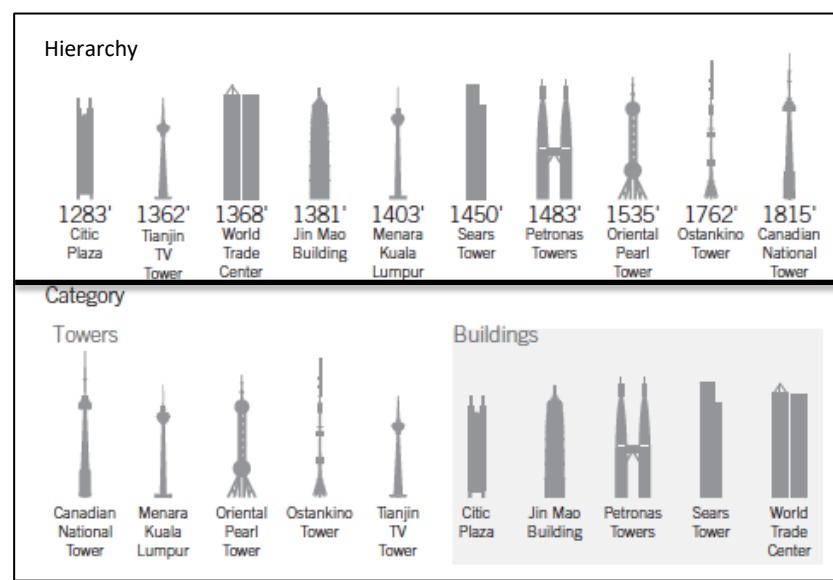
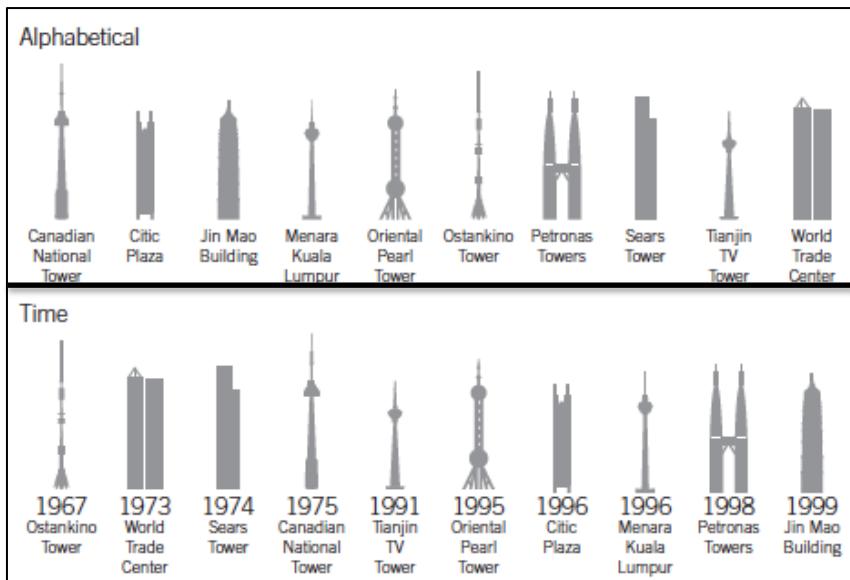
COLOR HARMONY



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

LATCH principle.



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 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:

Name
Street Address
Street Address
City, State and Zip Code

Billing Address:

Name	<input type="radio"/>
Street Address	
Street Address	
City, State and Zip Code	

- Unconstrained fields increase the probability of garbage input.

Credit Card Information:

Name on Credit Card	Type of Credit Card	Credit Card Number	Exp. Date
---------------------	---------------------	--------------------	-----------

Shipping Method:

--

Date to Ship:

--

[continue >>](#)

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

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
-------	-----	------

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

continue >>

make changes **submit order**

- 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.
- 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?

Select

Don't

What's your favorite fruit?

Apple Banana Orange

Do

Price Range

From \$10 To \$1,000

Don't

Price Range

\$10 \$1 000

Do

- Masked textboxes are a great option:

Phone Number

|

Card

Expiry

Order Code

Order Code

- Use location services

STREET ADDRESS *

Enter a location

APARTMENT/SUITE #

CITY *

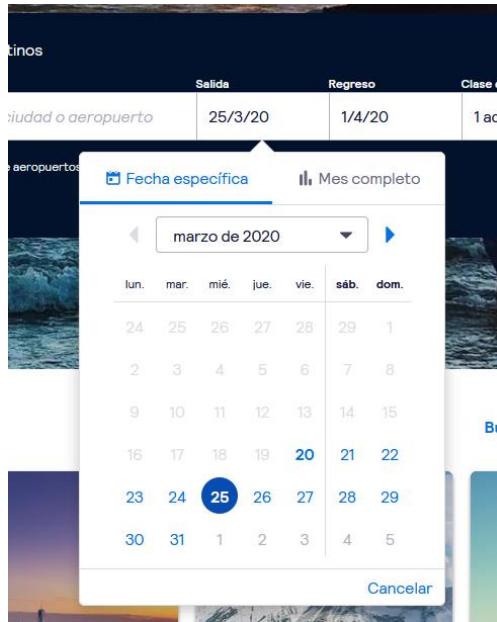
STATE *

ZIP *

STATE *

ZIP *

Input control: avoid errors



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

Specify the desired date. After filling the fields, press Enter.
Examples of how you can set the date and time periods.

Examples

26 January 2015
26.01.2015
26.01.2015 - 12.02.2015
January-February
January 2015
yesterday

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

e.g. EZ987654321XX

Do

User Name

Phone Number

I The I'm

q w e r t y u i o p	a s d f g h j k l	z x c v b n m
123	space	return
4 GHI	5 JKL	6 MNO
7 PQRS	8 TUV	9 WXYZ
+ * #	0	✖

Don't

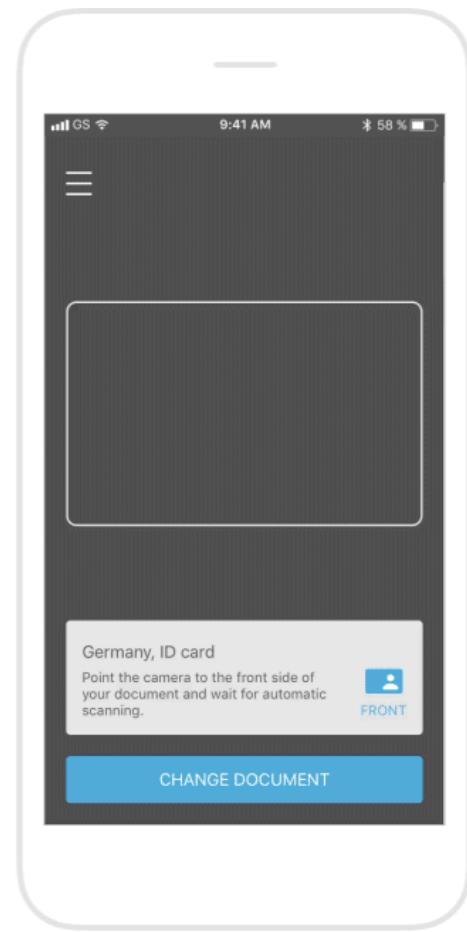
User Name

Phone Number

1 2 3
4 5 6
7 8 9
+ * # 0

Do

- And....use the camera!



Universal Principles of Design

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

Four types:

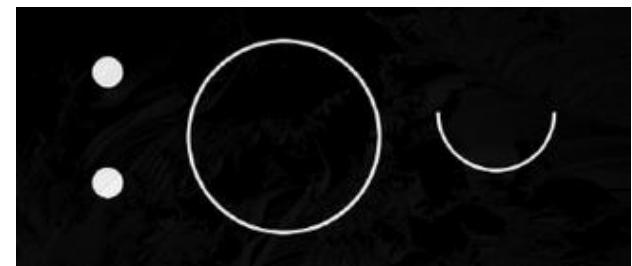
- **Similarity:** The icon is visually similar to the action/object to be represented. Adequate for simple objects (turn right) 
- **Example:** Elements can be related to the image (plane for airport) 
- **Symbolic:** High level of abstraction (unlock icon) 
- **Arbitrary:** No relationship with element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

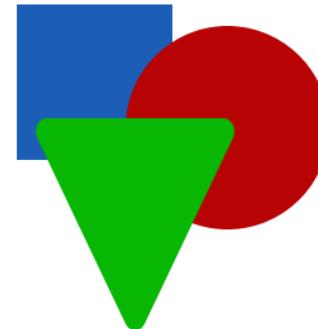
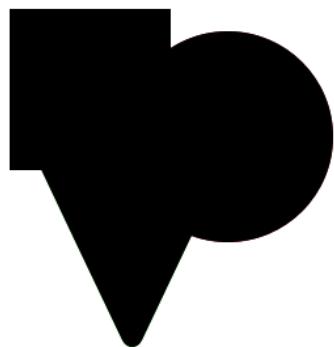
- Gestalt Laws relevant for visual design.
- Gestalt is a Psychology term, it hypothesises that people tend to organize visual elements into groups when certain principles are applied.
- Gestalt Laws are:
 - Präganz Law
 - The law of closure
 - The law of similarity
 - The law of proximity
 - The law 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 because it is the interpretation that requires the least cognitive effort to us.





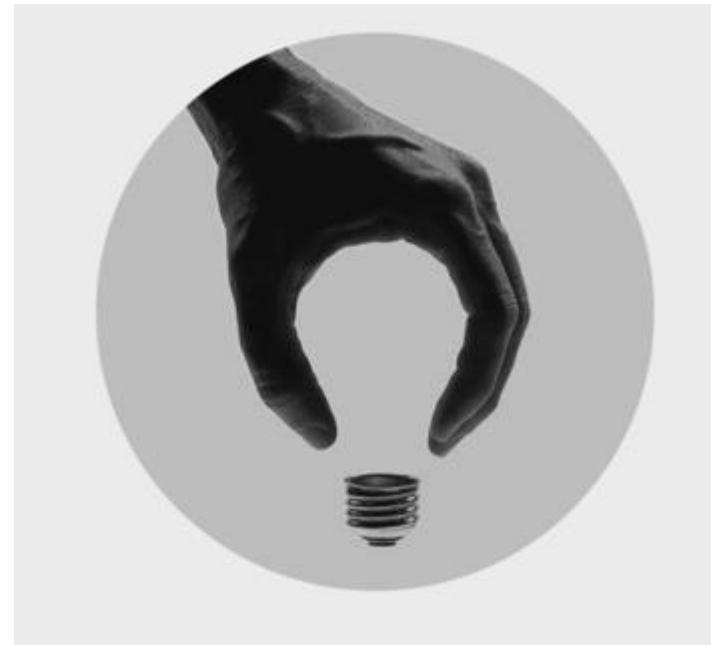
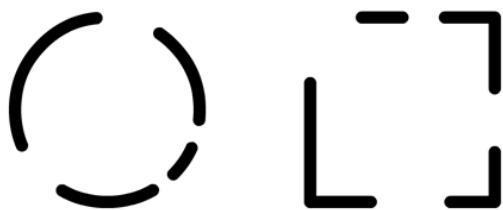
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The creator of
the world's leading
snowboards
S3®

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

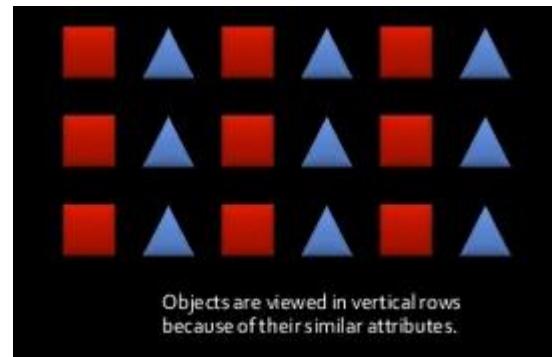
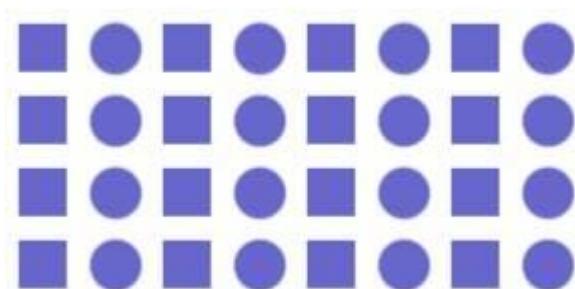


Perception Laws in Design. Gestalt Laws

- **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.

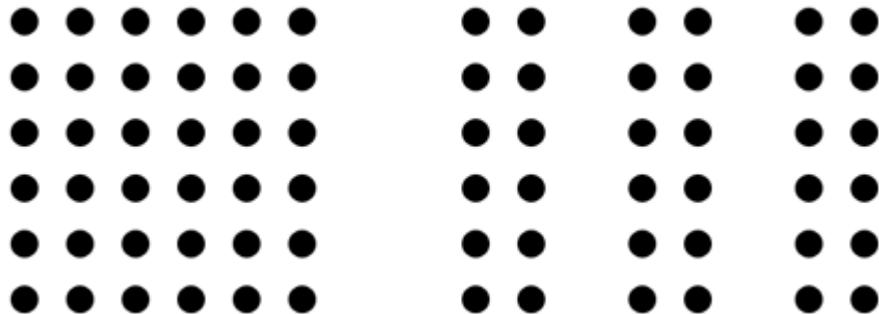


Objects are viewed in vertical rows because of their similar attributes.

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.

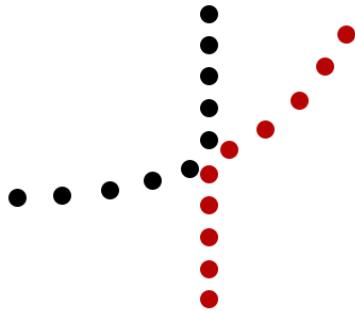


Perception Laws in Design. Gestalt Laws

- **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.



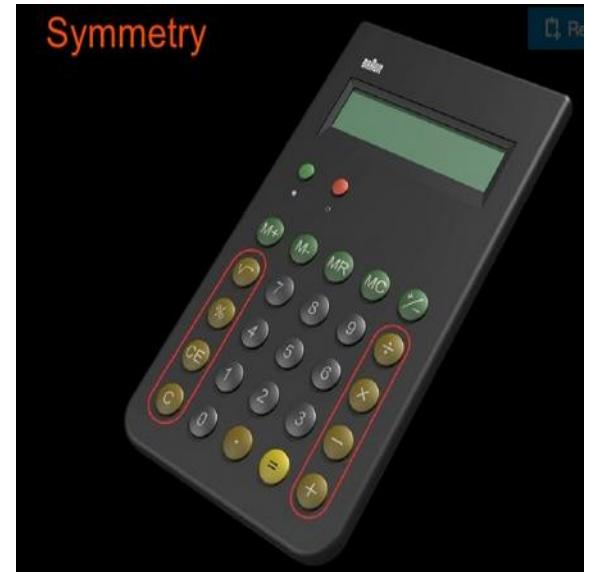
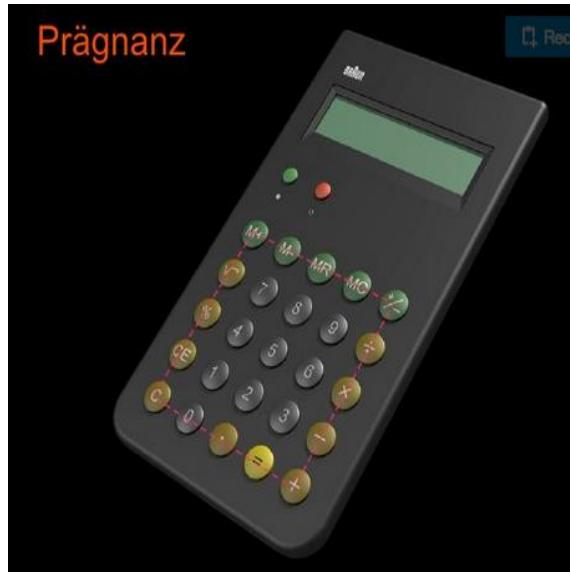
Perception Laws in Design. Gestalt Laws

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

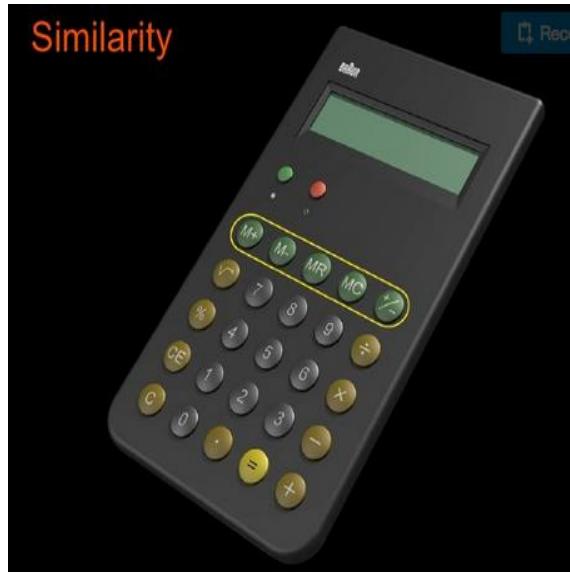
<https://vimeo.com/151103562>



Example

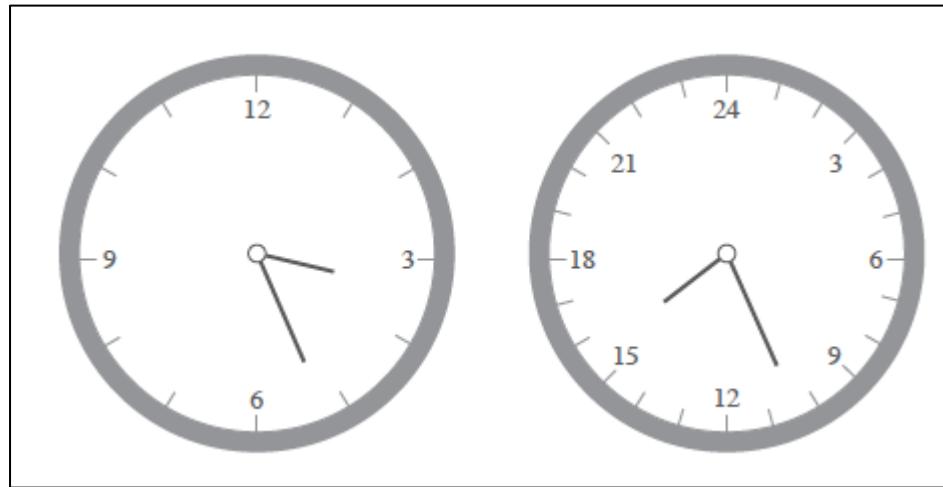
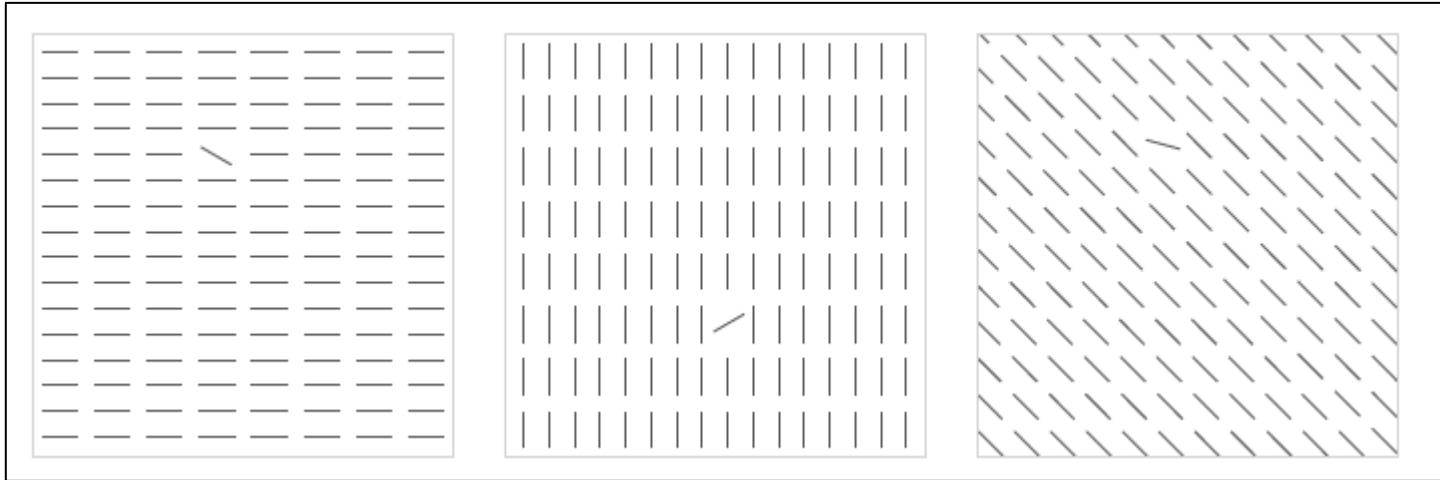


Example



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 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 in Design.

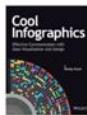
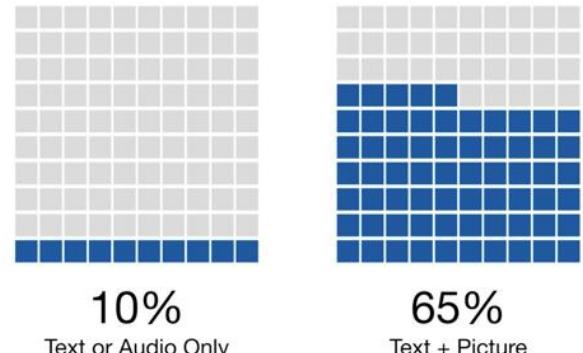
- Pictorial superiority effect:

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

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 début of a new generation of cutting machine. The MS 171 features a greener, reduced-emission engine and utilizes an advanced anti-vibration system.

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 60,000-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®

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Alternative and complementary

It's this kind of formula that will create new product concepts. Products like our handy gasoline-powered drilling machines, coffee harvesters that shorten harvesting times, and olive harvesters and plow breakers—all of which already add among STIHL's offerings.

卷之三

organization and that a global sales organization will help position French, as it becomes more competitive, to delight its customers with innovative products.

... our line had a unique
marketing function.
A worldwide network is under
the production director there.

—The following day an increase in sales by 87% will be held at the new store.

dealers through whom
importers rather than
American mass merchandisers

...you poor wretches! You breed us
and cultivate us, and property
has been adroitly,
its master's

use. As soon as the money is used as starting material for manufacturing engines, the network of STIHL is the web of dealers. Whatever service is required, STIHL service centers know just how to dispense assistance. Our dependability, experience and knowledge come from people who understand them better than anyone else. That's why



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

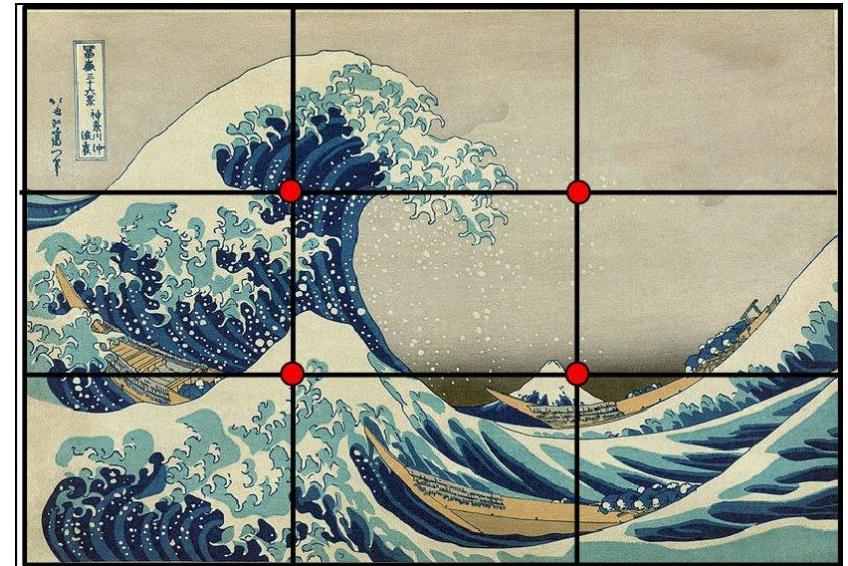
What can you expect from the number one selling brand of chain saws worldwide? Start with legendary design, reliable performance and long-lasting value. Plus innovations like reduced-emission engine technology and the toolless Quick Chain Adjuster. Best of all there's the nationwide network of 8,000 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
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Perception Laws in Design.

- Rule of thirds





www.uselt.com

F-shaped pattern: how people scan texts online

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

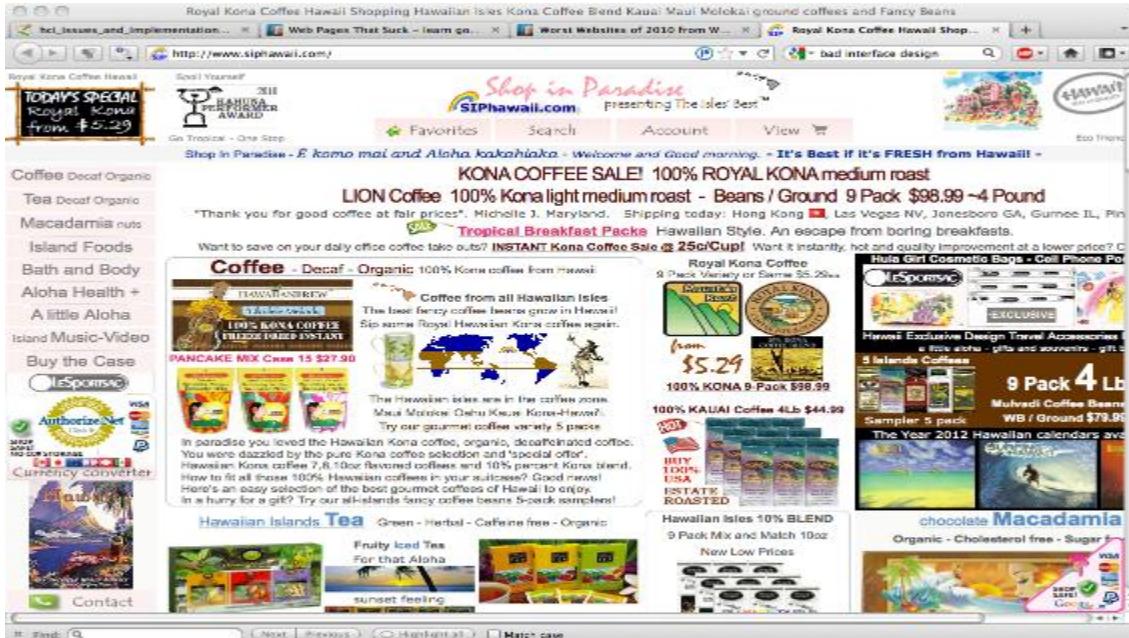
We can enhance information by using redundant coding and highlighting.

Remove noise by eliminating unnecessary elements.

Design Mistakes. Web pages

Problems

- White space?



Are you kidding?

I live inside my car leasing website all day Monday to Friday 9am-8pm. Lease the cheapest HGV and contract hire cars in the UK! - I am Ling, accept no substitutes.

LINGS CARS.com

Leader of the Pack - The UK's favorite car leasing website!

Contract hire cars from Ling Valentine, LINGS CARS is the UK's favourite car leasing website - On 2016 I leased over £85 million in cars!

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If the Virus means you need to cancel, I'll fully support you. ***

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...OR I'LL SNEEZE ON YOU!

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Menu

Home
Cars
Vans
Customers
About Ling
Fun stuff
Free stuff
Live staff

ABARTH
124 Spider
Convertible
595 Convertible

3 DELIVERIES TODAY

Seat Tarraco Estate
To Loz
KINGS LANGLEY, WD4

Peugeot 208
To Darren
GLASGOW, G71

Audi A4 Saloon
To Surj
BEDFORD, MK41

15 DELIVERIES IN LAST WEEK

Seat Arona
To Rich
SUENDERLAND, SR40

Mercedes GLA Class
To Sabrina
ENFIELD, EN2

Citroen C5 Aircross
To Martin
ABERGAVENNY, NP7

Peugeot 5008 Estate
To Andy
STEVENAGE, SG12

Ford Mondeo Estate
To Michael
KIDLINGTON, OX51

Peugeot 208
To EII
STANFORD-LE-VAUX, ES1

Car Leasing

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- 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****