

Introduction to Design

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Learning Goals

- Understanding what design is about
- Understanding the complexity of design
- Discussing design from different perspectives

Definition: Design

- A **design** is

Die Gestaltung

- **a plan** for the construction of an object or system or for the implementation of an activity or process,

Die Gestalt

- **or the result of that plan** or specification in the form of a prototype, product or process.

Design Disciplines

- Architektur
- Corporate Design
- Datenbankdesign
- Fotodesign
- Game Design
- Grafikdesign
- Kommunikationsdesign
- Interaktionsdesign
- Interface Design
- Lichtdesign
- Mediendesign
- Modedesign, Bekleidungsdesign
- Produktdesign
- Schmuckdesign
- Service Design
- Sound Design
- Textildesign
- Orientierungsdesign
- Webdesign



form follows function

Louis Sullivan 1896

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Disfunctional design

- Alessi's Juicy Salif by Philippe Starck (1990)
- Gold plated special edition comes with a little paper saying:

*“Don't use this juicer to make juice.
The acid will ruine the gold plating”*

Don Norman: https://www.ted.com/talks/don_norman_3_ways_good_design_makes_you_happy?language=de#t-49049

Image Source [https://de.wikipedia.org/wiki/Alessi_\(Design\)](https://de.wikipedia.org/wiki/Alessi_(Design)) by Niklas Morberg

Design milestones



- A portable typewriter Olivetti Valentine (1969)
- For use “anyplace *but* an office
- Used by David Bowie & Dieter Rahms

Image <https://www.flickr.com/photos/bibliodyssey/2459300706> by Paul K
Image https://de.wikipedia.org/wiki/Olivetti_Valentine by Davide Casali

Design milestones



- Braun T3 Pocket portable transistor radio by Dieter Rams (1958)
- Apple's iPod by Jonathan Ive: homage to the T3 design

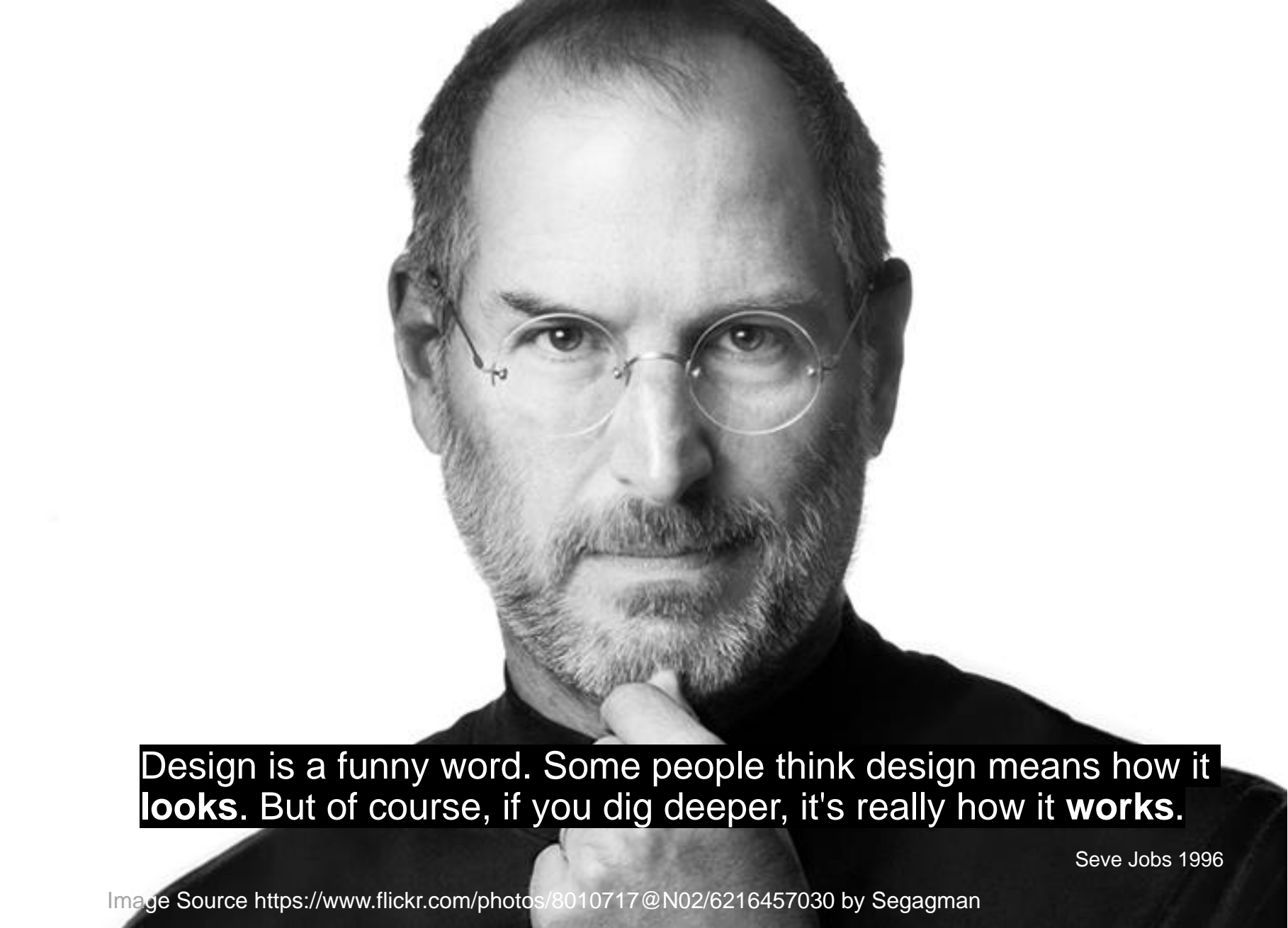
Image Source https://commons.wikimedia.org/wiki/File:Jon_Ive_and_Dieter_Rams_works.jpg by ArenysDep

Design milestones



- iPod portable music player (2001)
- Jonathan Ive: Red Dot Design Award
- More than an aesthetic design: entire ecosystem including an online shop

Image Source https://commons.wikimedia.org/wiki/File:Jon_Ive_and_Dieter_Rams_works.jpg by ArenysDep



Design is a funny word. Some people think design means how it **looks**. But of course, if you dig deeper, it's really how it **works**.

Seve Jobs 1996

Image Source <https://www.flickr.com/photos/8010717@N02/6216457030> by Segagman

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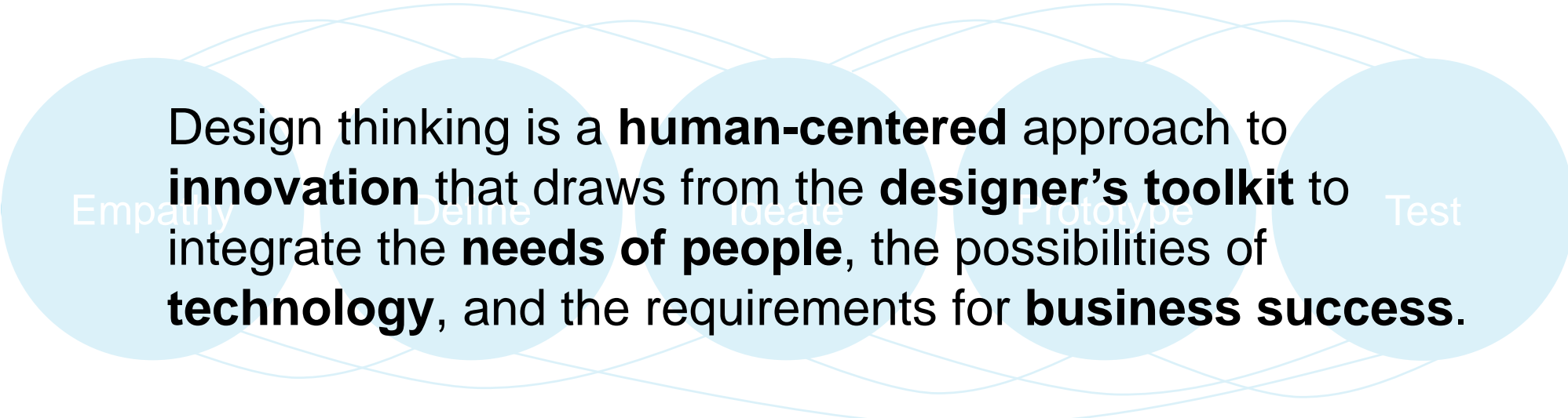


Design Methods

Learning Goals

- Being familiar with design thinking
- Knowing a set of creativity methods

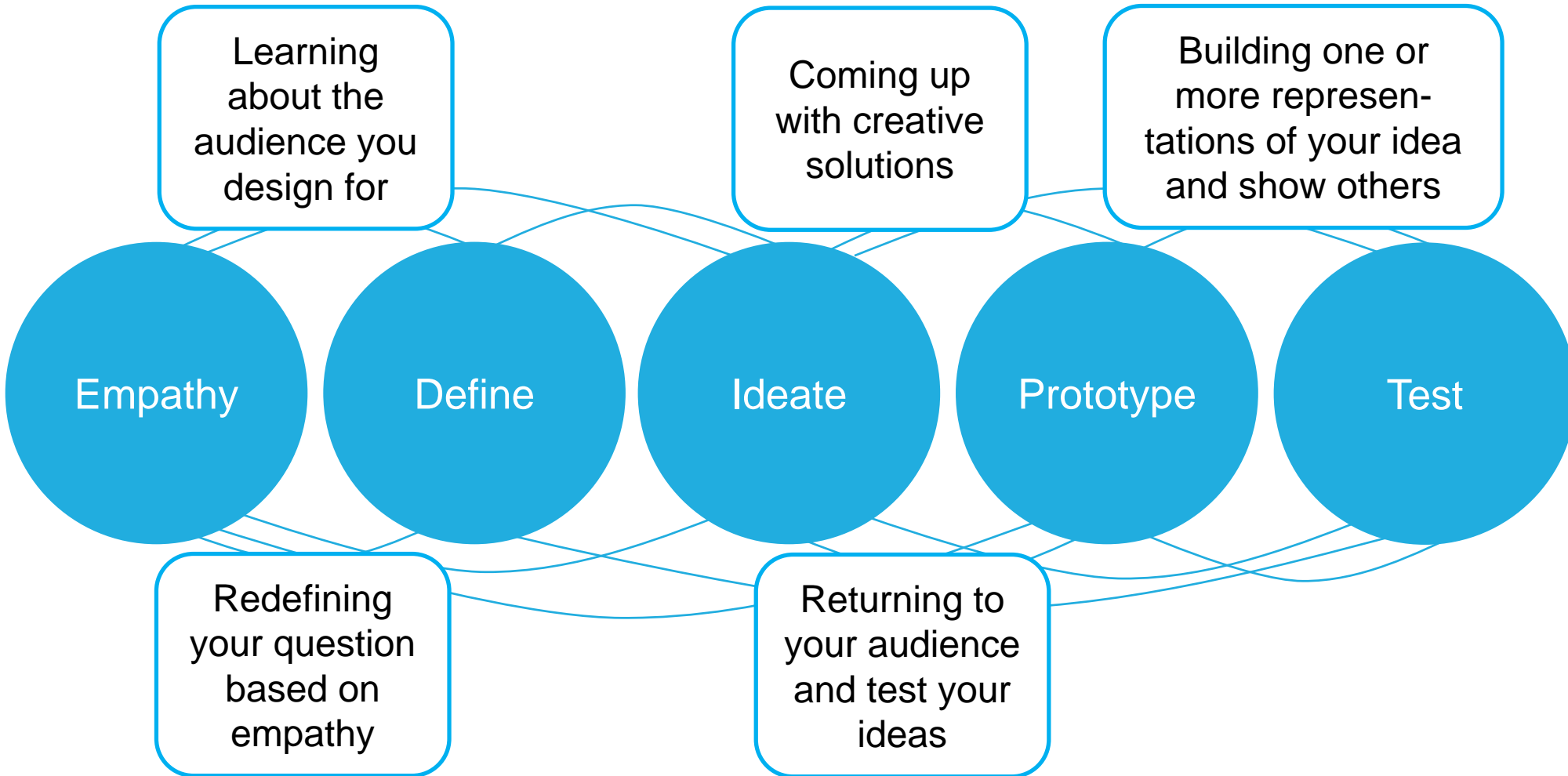
Design Thinking



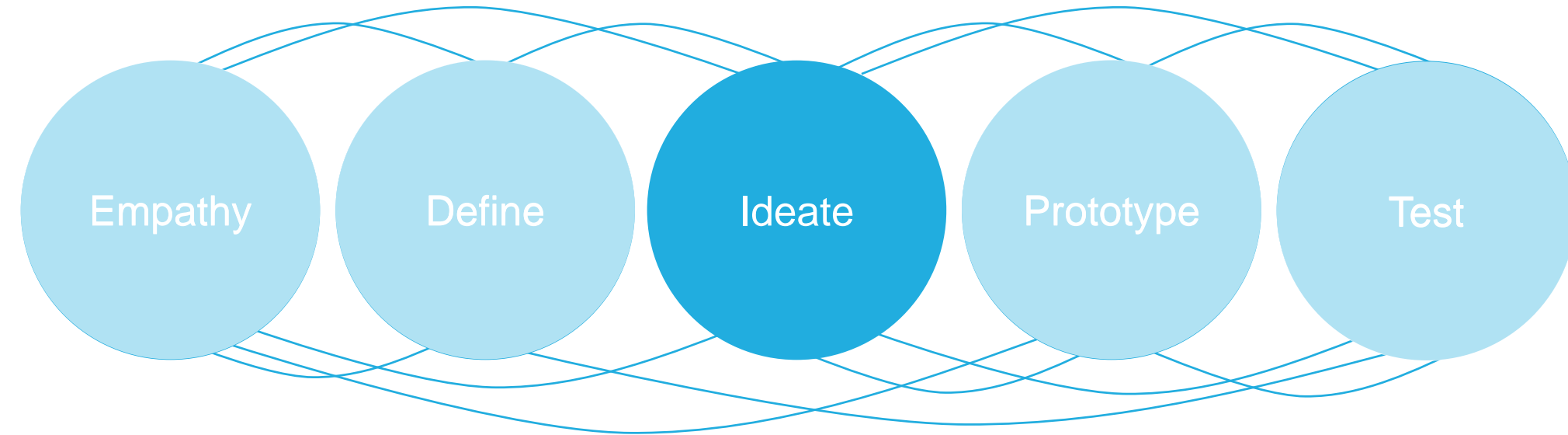
Design thinking is a **human-centered** approach to **innovation** that draws from the **designer's toolkit** to integrate the **needs of people**, the possibilities of **technology**, and the requirements for **business success**.

M. I. T. World: Innovation Through Design Thinking, Tim Brown (IDEA) at MIT, 26. März 2006.

Design Thinking



Design Thinking



How do come up with ideas?

Ideation



Influence is borrowed.
Inspiration is earned.

Cameron Moll

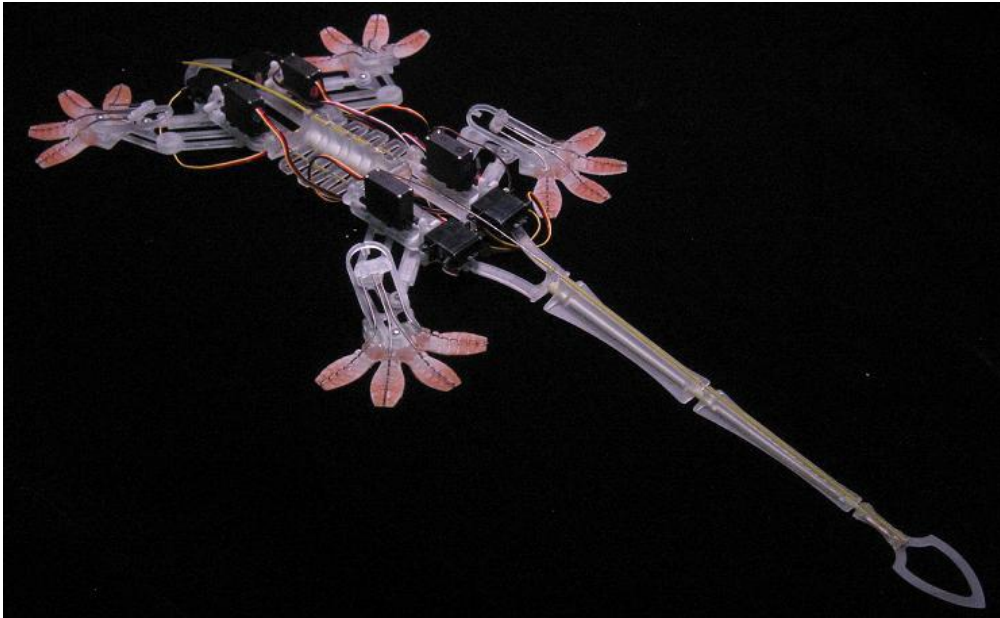
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Influence versus Inspiration



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Influence versus Inspiration



Images: https://en.wikipedia.org/wiki/Bio-inspired_robotics

<https://pxhere.com/en/photo/833087> by annegordon

Influence versus Inspiration



- Think of products that seem to be designed through
 - Influence
 - Inspiration

Image Source <https://www.flickr.com/photos/sanjoselibrary/27965668390> by San José Public Library

Inspiration sources

Reduce distraction



<https://www.wallpaperflare.com/opened-black-shower-head-douche-bathroom-clean-water-washing-wallpaper-wqxgk>

Inspiration sources

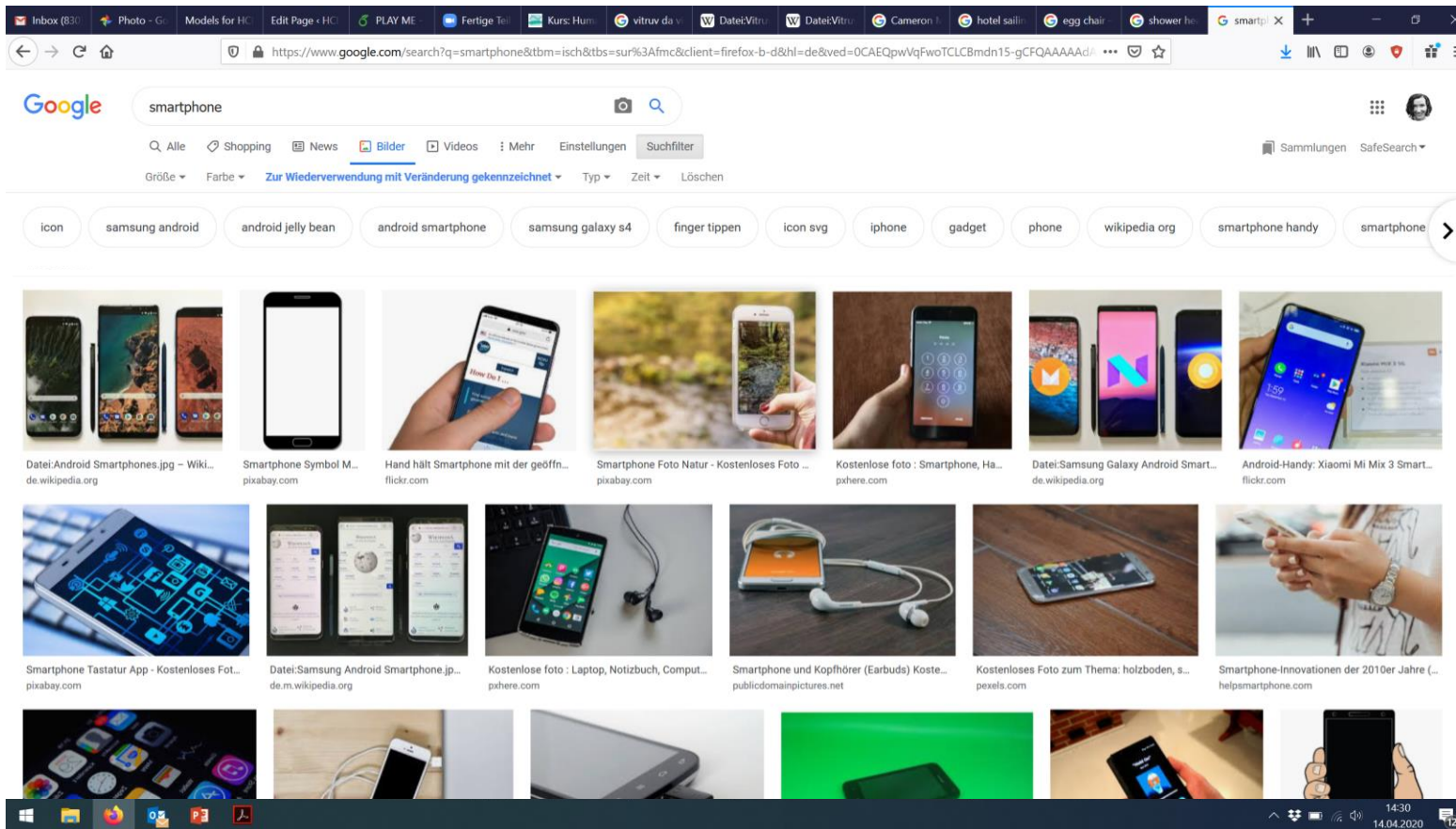
Go for distraction



Image Source <https://www.flickr.com/photos/kotomi-jewelry/12274531886> by Kotomi_

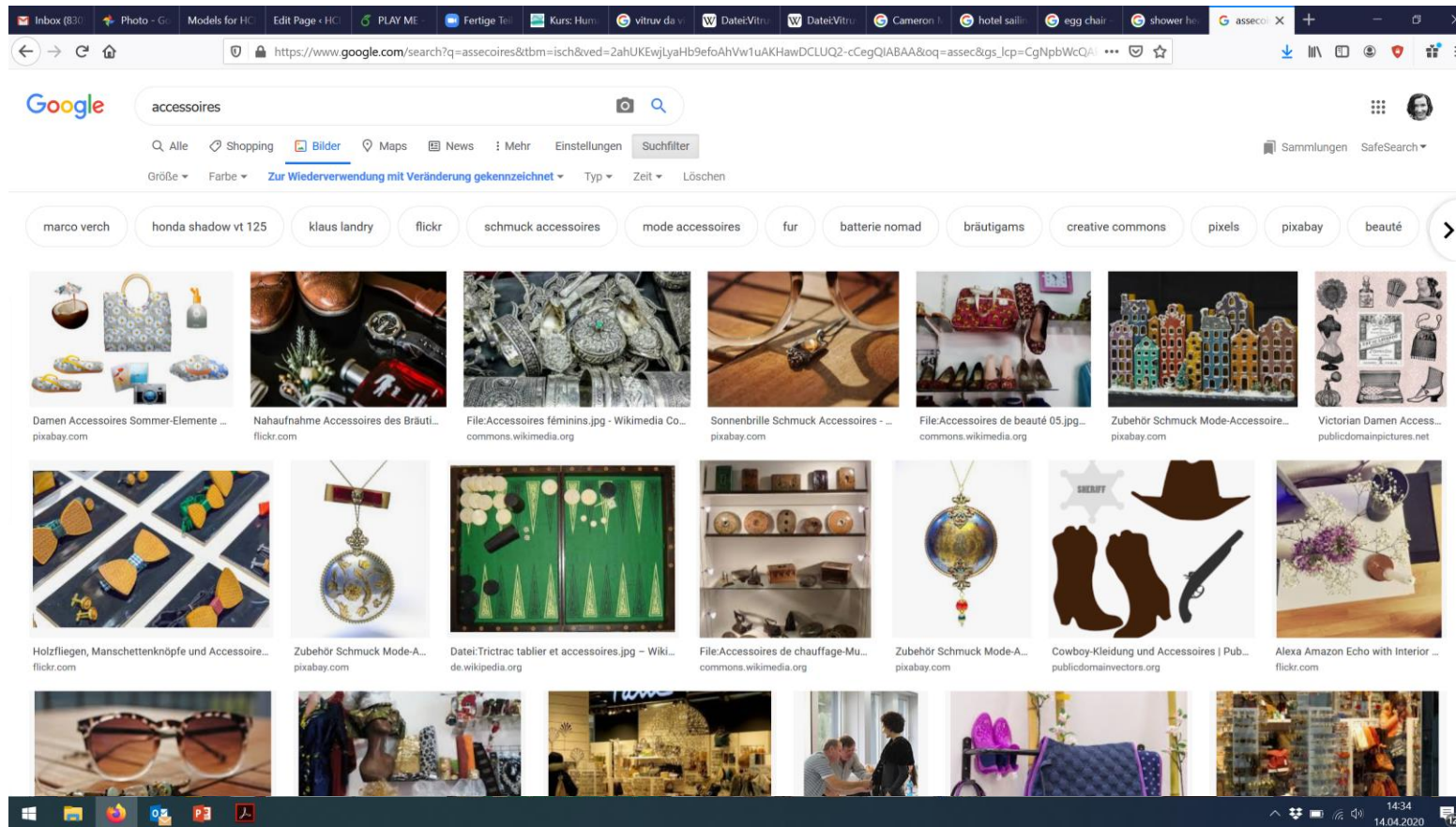
Inspiration search

Do not look at the obvious



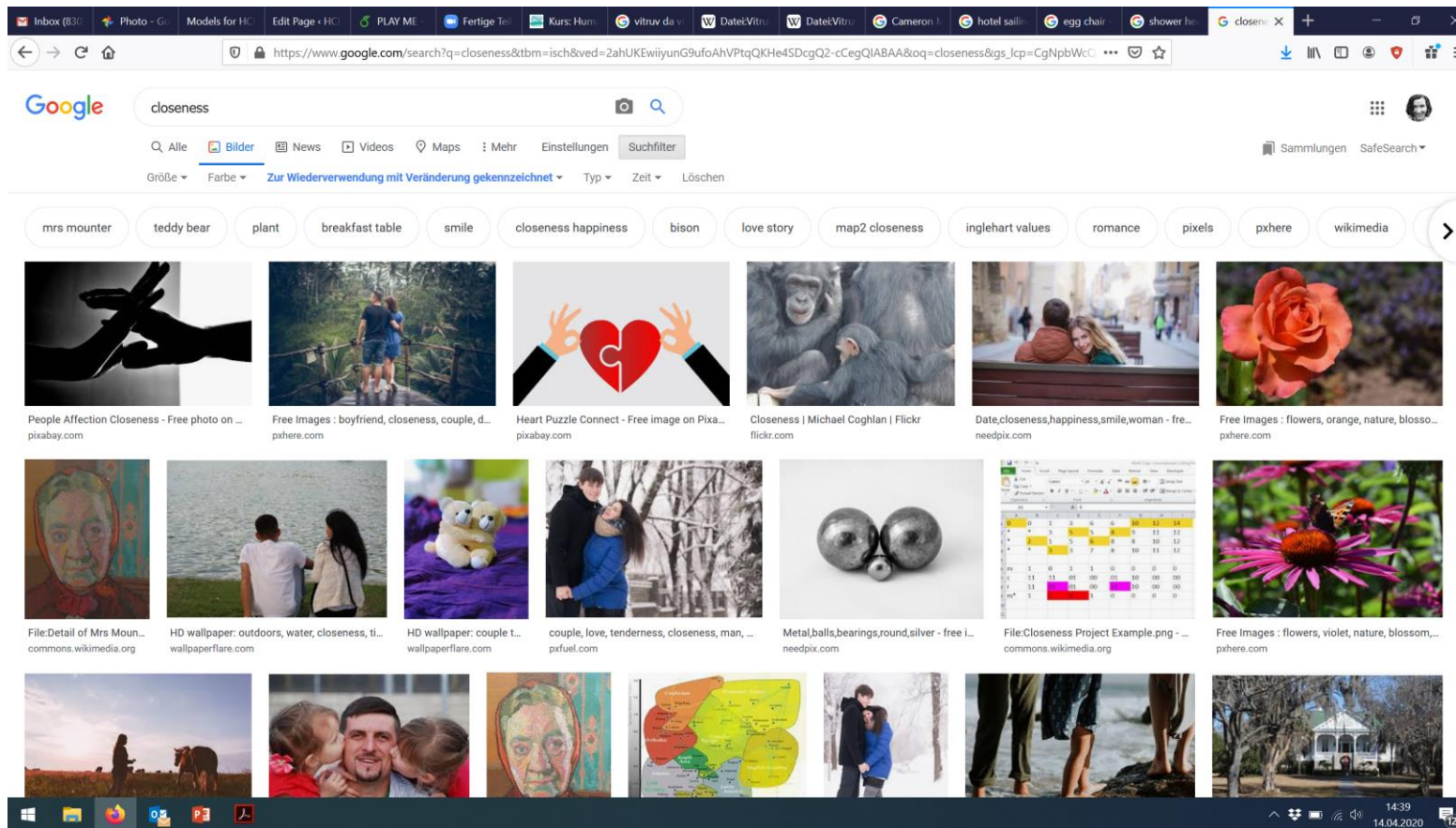
Inspiration search

Search further away



Inspiration search

Think of concepts and metaphors



Inspiration search

Think together

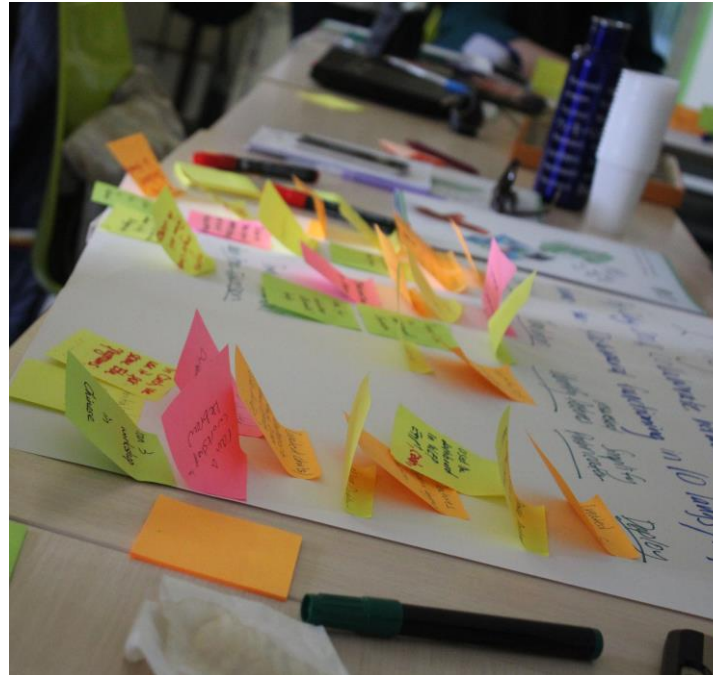


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Brainstorming I

Collecting Ideas

- Start with a well-phrased question, e.g. “How might we help [group] to [benefit]?”
- Share the 7 rules:
 1. Defer judgement
 2. Encourage wild ideas
 3. Build on others’ ideas
 4. Stay on topic
 5. One conversation at a time
 6. Be visual
 7. Go for quantity.



<https://www.extraordinaryteam.com/ideos-design-thinking-the-7-rules-for-brainstorming/> https://upload.wikimedia.org/wikipedia/commons/5/5e/Wikipedia_Education_Collaborative_Meeting_in_Yerevan_2017_33.jpg by David Saroyan

Brainstorming II

Selecting Ideas

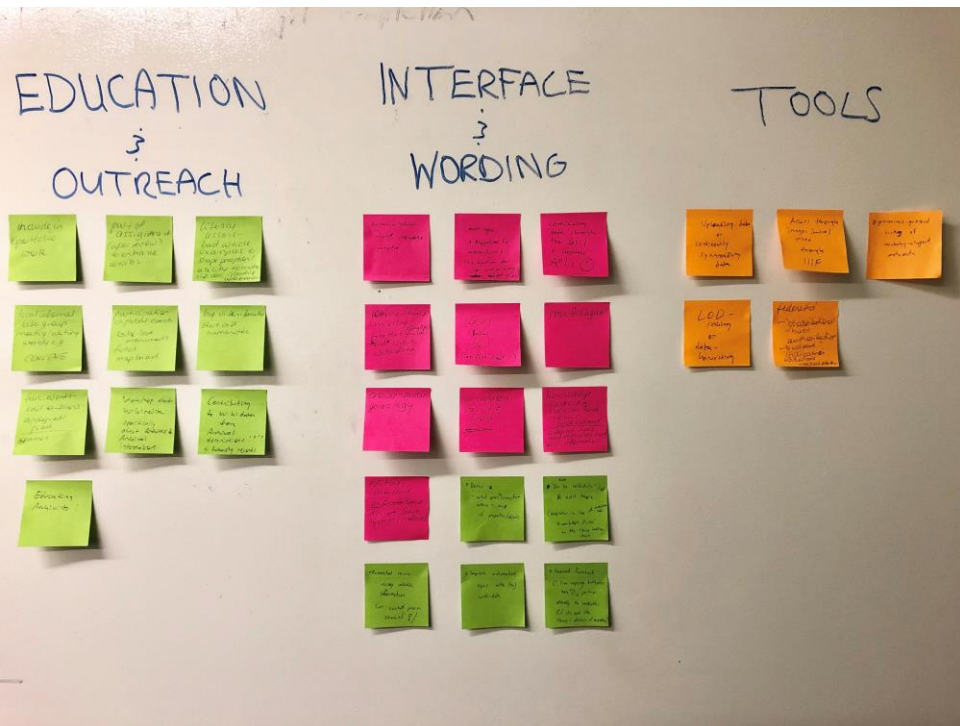


- Interdisciplinary teams
- Make a selection out of the ideas
- Allow crazy ideas
- Use simple tools, such as post-its

Photo Source <https://pxhere.com/en/photo/1553749> by 795663

Brainstorming III

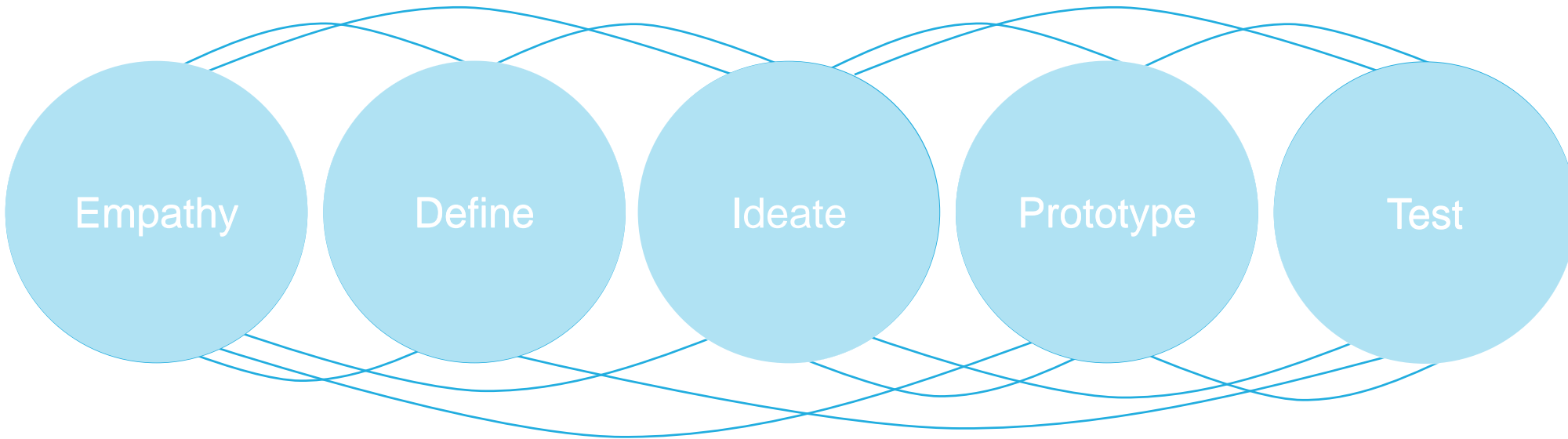
Organizing & Documenting Ideas



- Identify similar ideas
- Identify concepts and themes
- Group the ideas accordingly
- Conclude design & implementation concepts
- Record the process (take a picture of the grouping result)

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Design Thinking



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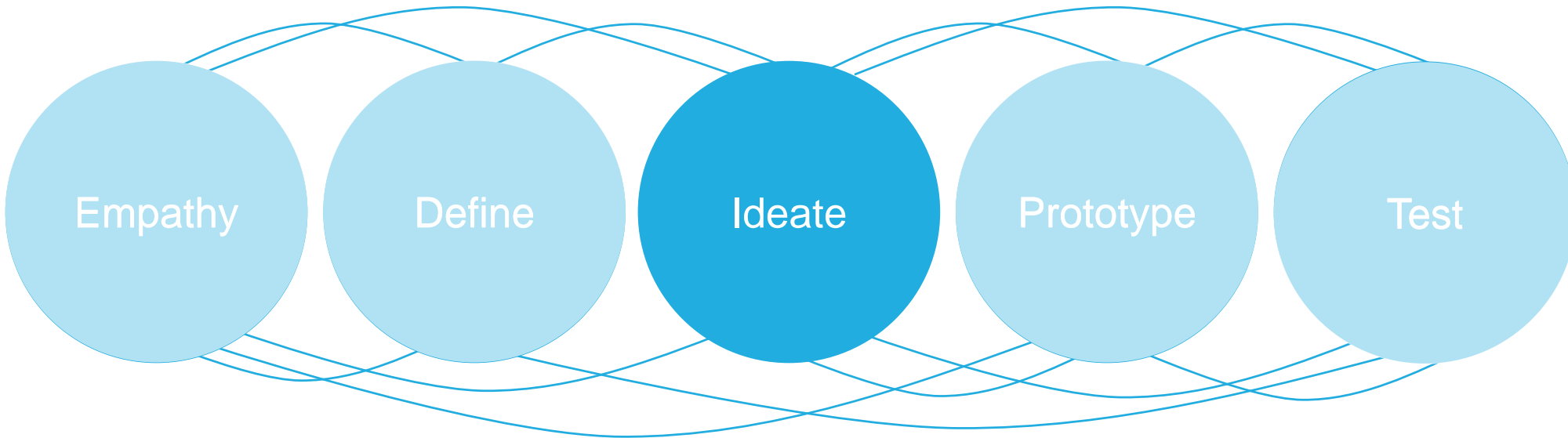
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Design Methods 2

Design Thinking



Hasso Plattners: <https://www.tele-task.de/archive/video/flash/17778/>

Learning Goals

- Lotus Flower method
- Overview of Ideation Techniques
- Choosing the right tool

Lotus Flower method

aka Lotus Blossom technique

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 4 | 1 | 5 | 4 | 2 | 5 | 4 | 3 | 5 |
| 6 | 7 | 8 | 6 | 7 | 8 | 6 | 7 | 8 |
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 4 | 4 | 5 | 4 | ? | 5 | 4 | 5 | 5 |
| 6 | 7 | 8 | 6 | 7 | 8 | 6 | 7 | 8 |
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 4 | 6 | 5 | 4 | 7 | 5 | 4 | 8 | 5 |
| 6 | 7 | 8 | 6 | 7 | 8 | 6 | 7 | 8 |






- Adds structure & focus to brainstorming
- Walk through:
 - Write the problem / question at a card
 - Write 8 solutions on cards placed around the 1st card
 - Give the ideas more space
 - Find 8 more specific or modified descriptions around each of the 8 solution idea cards








Image Source <https://pixnio.com/flora-plants/flowers/water-lily-lotus-flower/horticulture-flora-green-leaf-lotus-flower-pink-petal-blossom-plant>

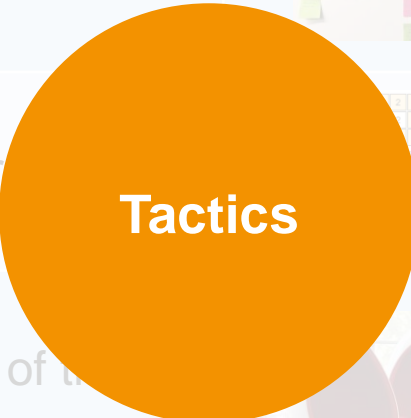


Marion Koelle, Katrin Wolf, and Susanne Boll. Beyond LED Status Lights - Design Requirements of Privacy Notices for Body-worn Cameras. TEI '18

| Technique | Device | Description | Example |
|----------------|-------------------|---|---|
| Brainstorming | Group interaction | Verbalize thoughts in a group so one person's idea prompts others |  |
| Lotus Blossom | Goal setting | Set goals/limits and provide structure |  |
| Input-Output | Translation | Conceptually convert one kind of thing into another |  |
| Focused-Object | Association | Mentally follow associative links among ideas in memory |  |
| Bionics | Analogy | Look for things similar to parts of the problem situation |  |

After G. F. Smith: Idea-Generation Techniques: A Formulary of Active Ingredients. 1998, The Journal of creative behavior 32(2)

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After G. F. Smith: Idea-Generation Techniques: A Formulary of Active Ingredients. 1998, The Journal of creative behavior 32(2)

Strategies

- The most common and significant type of ideation techniques.
- Active means for generating ideas.
- Refer to identifiable mental activities.

Tactics

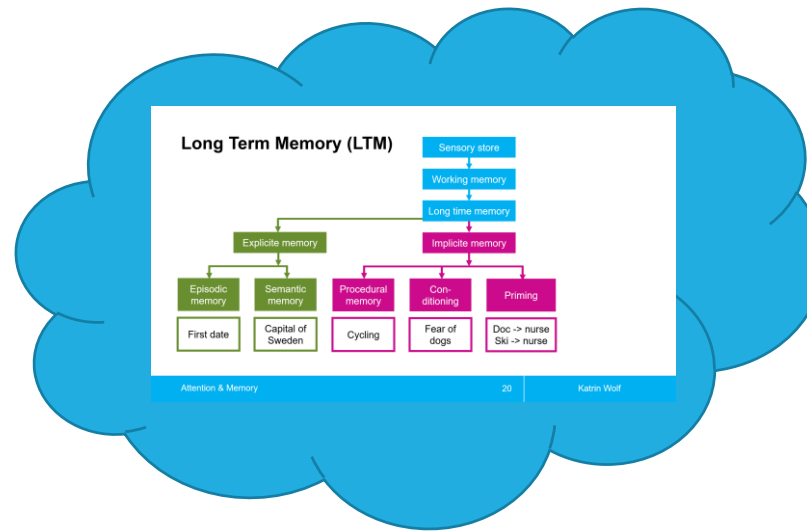
- The least common type.
- Simulatory tools that support strategies.

Enablers

- Passive means of promoting idea generation.
- Rather than directly inspiring creative output, enablers foster conditions within which ideas are more likely to appear

After G. F. Smith: Idea-Generation Techniques: A Formulary of Active Ingredients. 1998, The Journal of creative behavior 32(2)

Priming tools ● ● ●



- Tools affect the outcome in both, cognitive and enabling manner
- Pen & paper foster words & drawings
- A brush fosters visuals
- A camera fosters use cases and scenarios
- A recorder fosters auditory designs and storyboards
- IDEO Tech Box or a material box foster physical artifacts



Marion Koelle, Katrin Wolf, and Susanne Boll. Beyond LED Status Lights - Design Requirements of Privacy Notices for Body-worn Cameras. TEI '18

Choosing the Right Tool

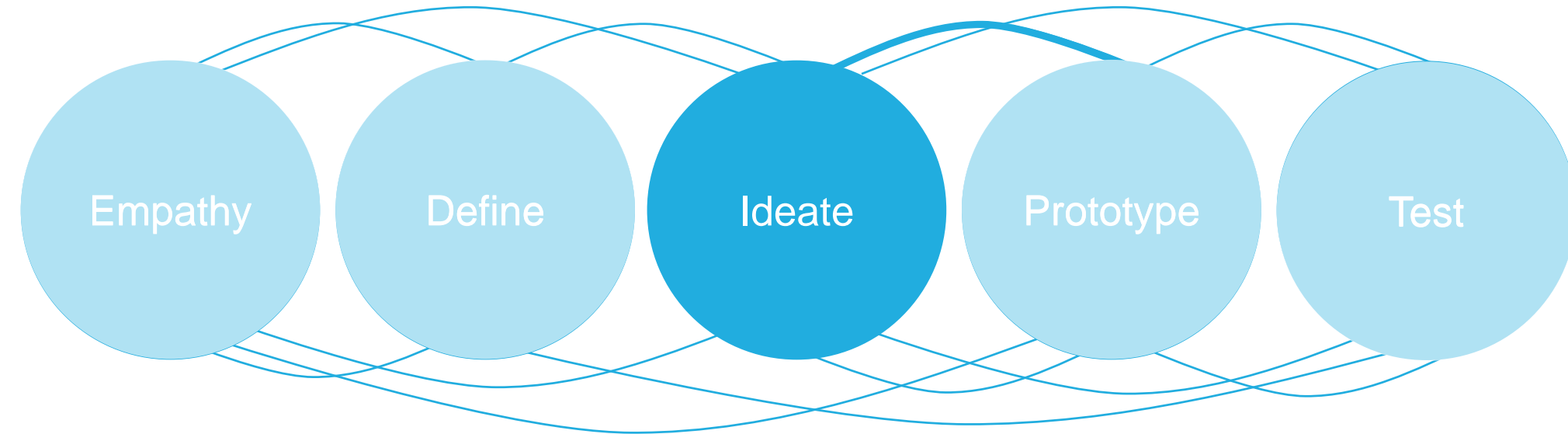
- Ideation technique choices depend on:
 - Problem / question
 - Ideation goal
 - Users' needs, abilities, preferences, personalities
 - Ideation group size
 - Team dynamics
 - Team background & skills
 - Team member's self-confidence or perceived lack of creativity

Ideation Outcome

- Thoughts
- Rough ideas
- Concepts
- Design strategies
- Artifacts
- Devices & material determine outcome

- **Neither a finished product design nor consistent UI / UX design.**

Design Thinking



Hasso Plattners: <https://www.tele-task.de/archive/video/flash/17778/>

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Color



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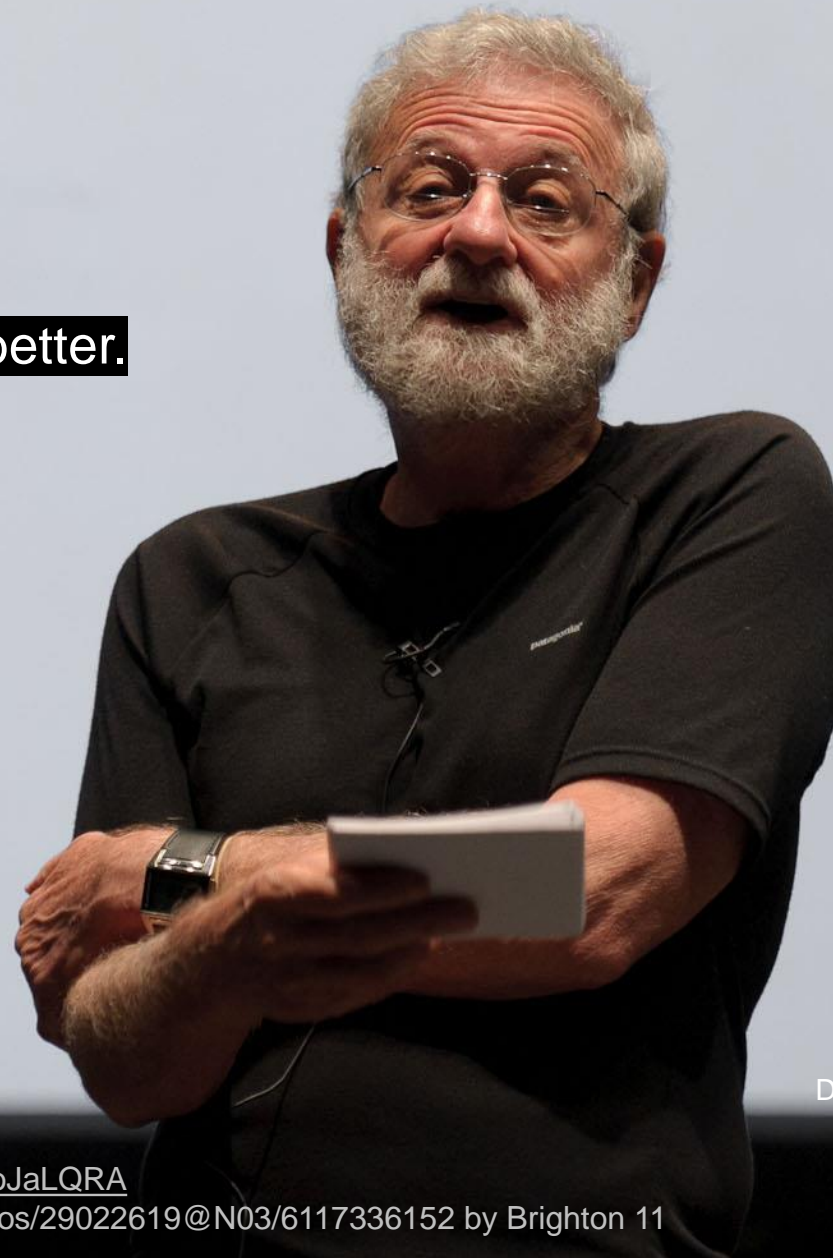


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Everyday Product Design

- No manuals & no time investment to understand UIs
- Lifestyle & design artifacts instead of pure tech devices

Attractive things work better.



Don Norman 2001

<https://www.youtube.com/watch?v=RIQEoJaLQRA>

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Learning Goals

- Influence of color on perception and cognition
- Affects of color
- Symbolic meaning of color
- Interplay of complementary colors

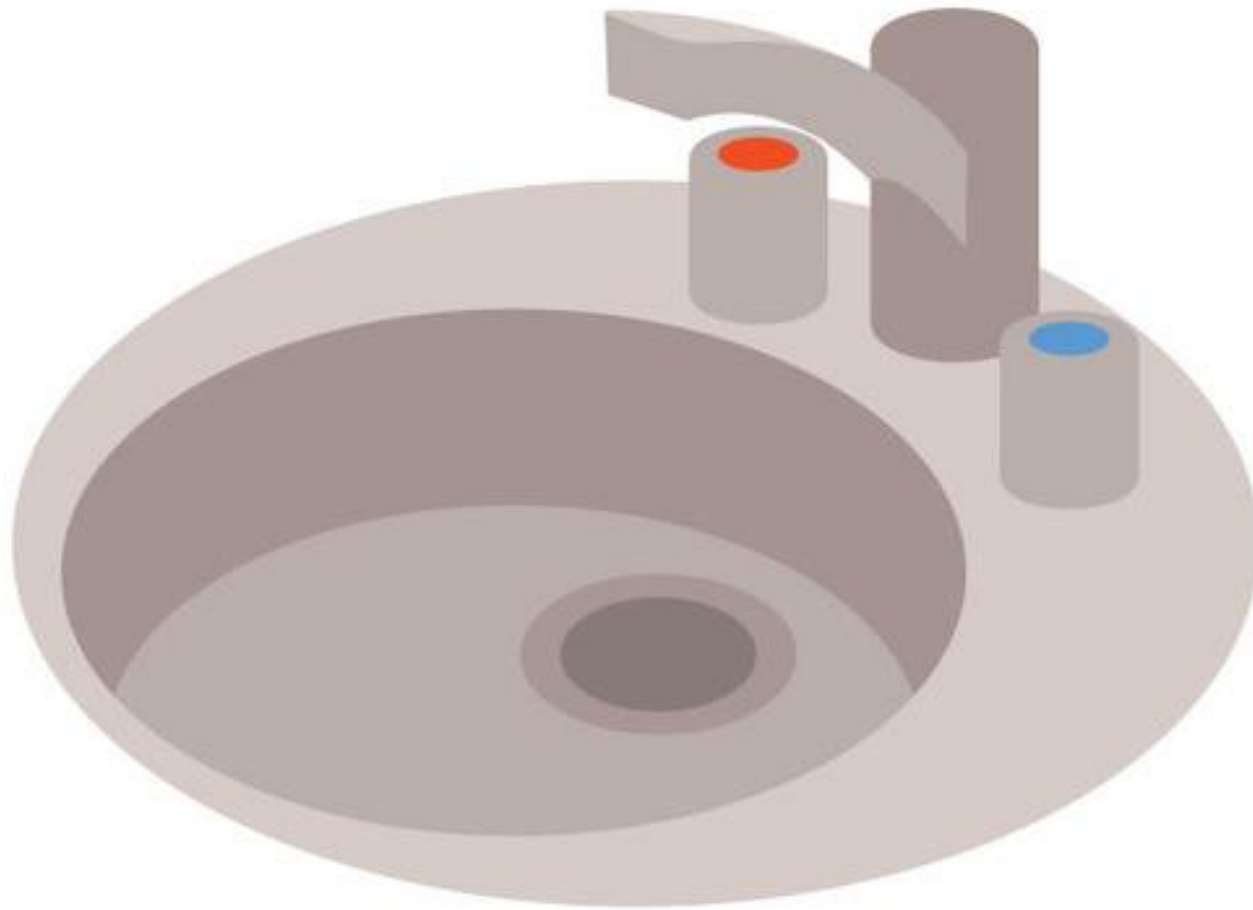


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Paper on color affects: Ho, Hsin-Ni. (2015). Color-temperature correspondence and its impact on object temperature perception.



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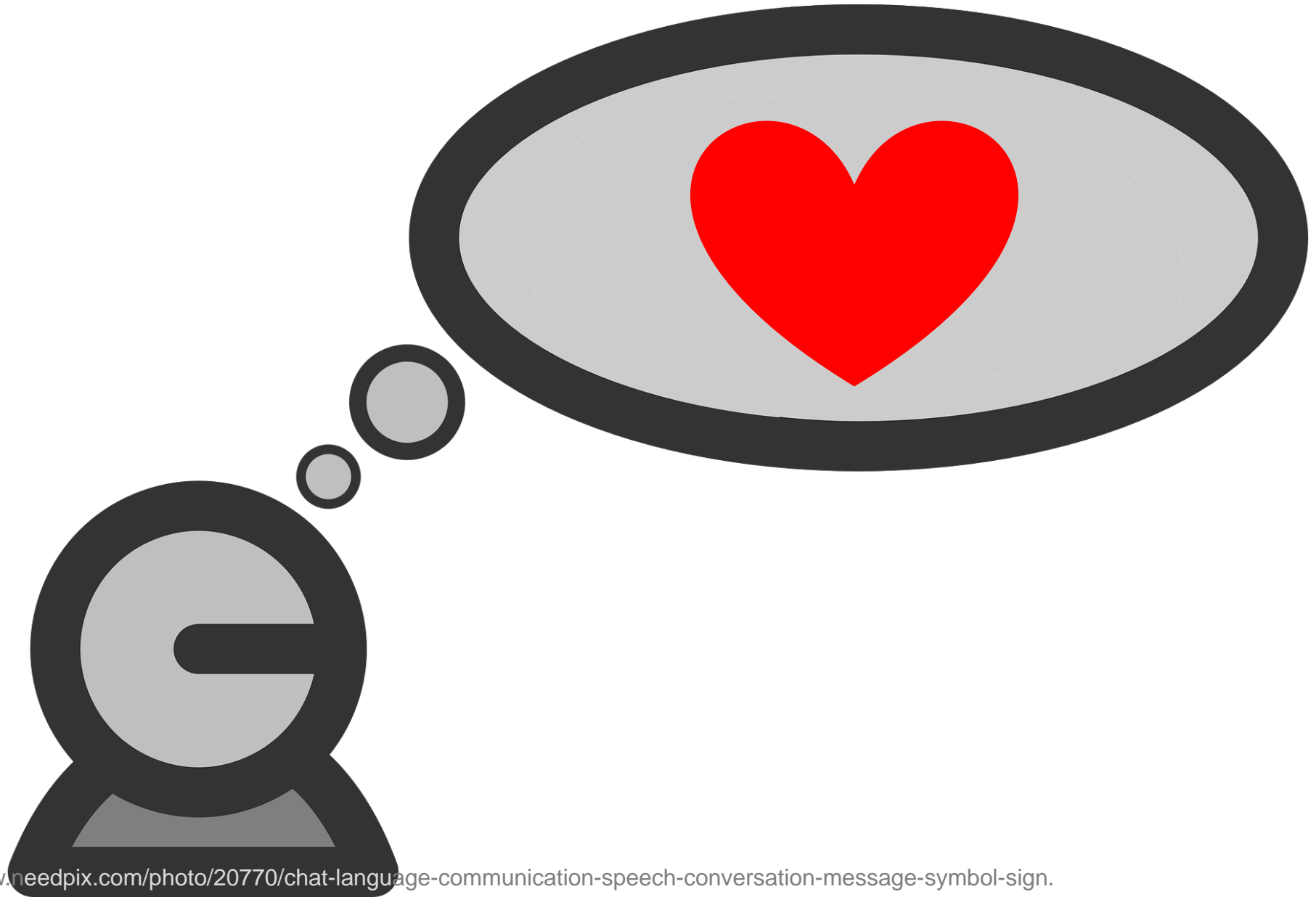


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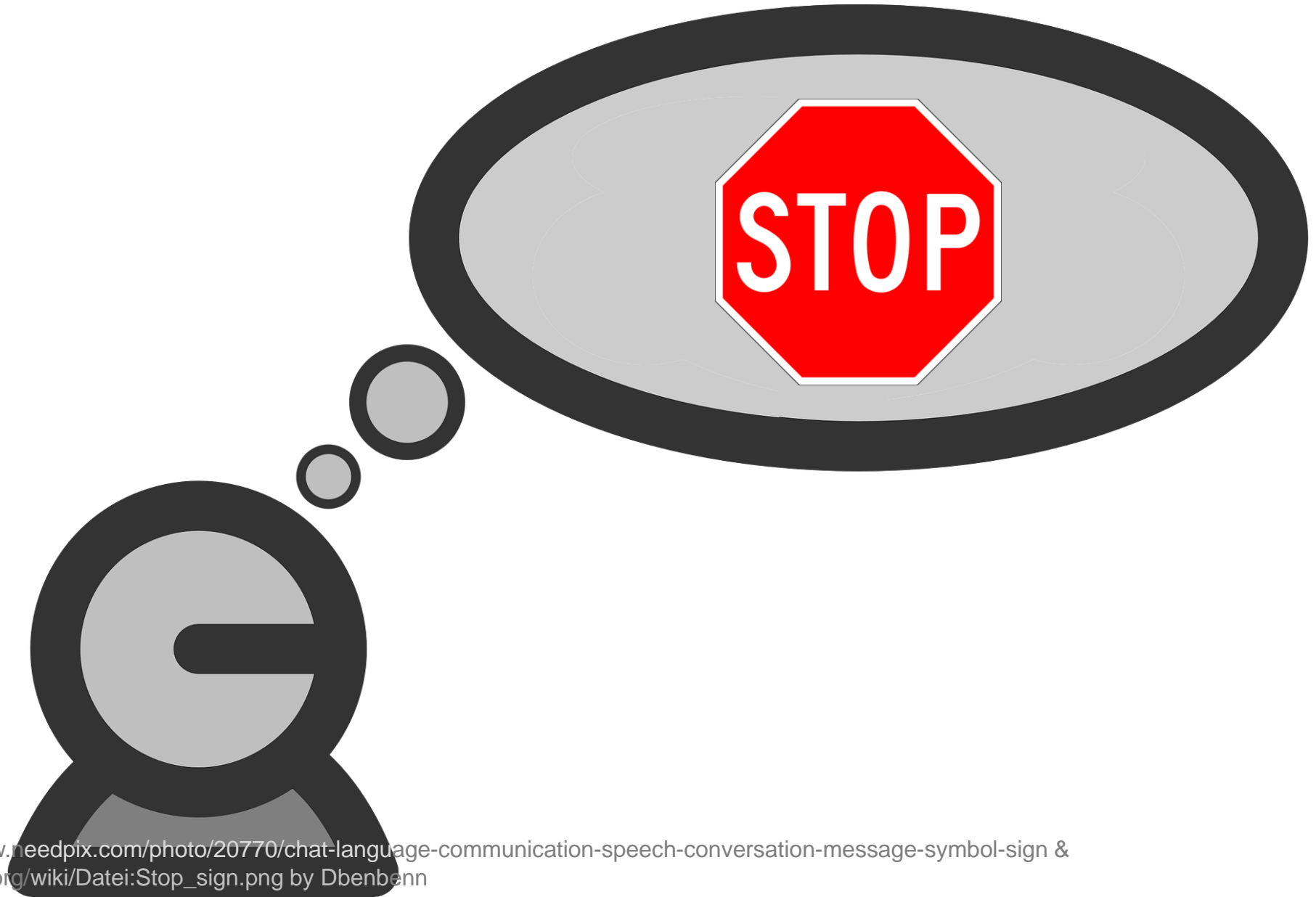


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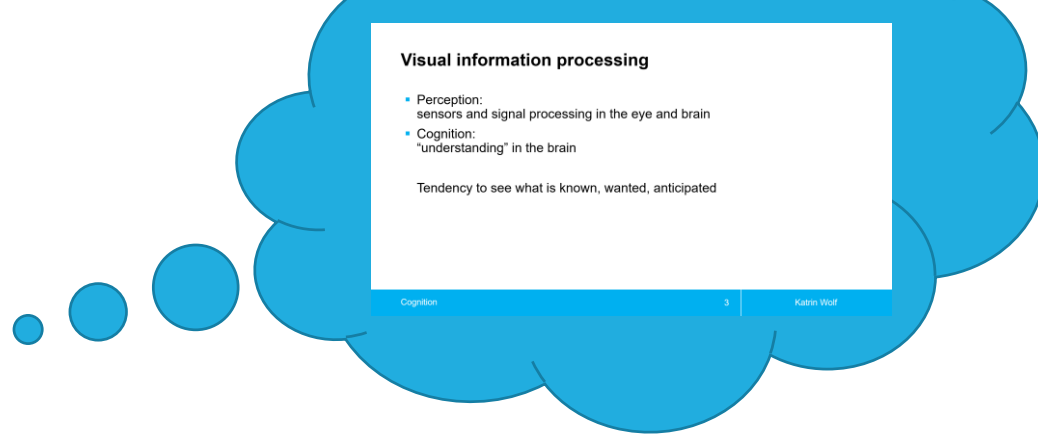


Image After <https://www.flickr.com/photos/160866001@N07/48913239888> by Marco Verch
Paper on color affect S. Bayarri, C. Calvo, E. Costell, and L. Duran, "Influence of color on perception of sweetness and fruit flavor of fruit drinks," Food Science and Technology International, vol. 7, pp. 399–404, 2001..

- The brain integrates visual biasing multimodal perception toward expectations¹
- Color biases perception of
 - Temperature
 - Taste
 - Smell

¹ M. O. Ernst and M. S. Banks, "Humans integrate visual and haptic information in a statistically optimal fashion," 2002.

What we have learnt

- The brain stores memory in association with emotions (conditioning)
 - Color (also) biases cognition of cultural meanings as symbols
 - Black -> dead (in West Europe)
 - White -> dead (in Japan)
- In pre-attentive processing, some colors are harder to filter (red)
 - attention of some colors (red) is higher
- Colors serve as depth cues
 - blue -> far away

| | Attention | Depth perception | Affection | Symbolic meaning |
|--|-------------------------------------|----------------------------------|------------------|--|
| | Salient in contrast to dark | Objects appear larger & higher | Neutral | Innocence (Western world), mourning (JP, CN), purity (Catholicism) |
| | Very salient | Objects appear closer | Warm, arousing | Passion, love, fire, blood, power (Renaissance) |
| | Salient | Obj. closer | Activating | |
| | Very salient | Obj. larger | Exhilarating | Sun, light, envy |
| | Little salient | Obj. further away | Calming | Spring, hope, paradise, ecology (lately) |
| | Very little salient | Obj. appear far away | Cool, depressing | Truth, air, water, loyalty, poverty (Renaissance) |
| | Little salient | Obj. smaller | Ceremonial | Magic, wealth (antiquity) |
| | Not salient | | | Earth, autumn, humbleness (Cath.) |
| | Salient in contrast to light colors | Objects appear smaller & heavier | Scaring | Mourning (West. W.), night, death, damnation, contempt for the world |

Size & Weight



Size and Weight

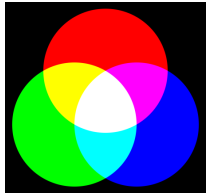




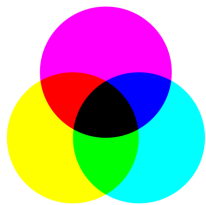
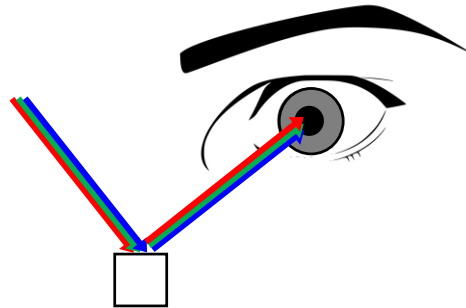
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Complementary Colors

- Increase their perceived saturation in proximity



Add up to white in the additive color system



Add up to black in the subtractive color system

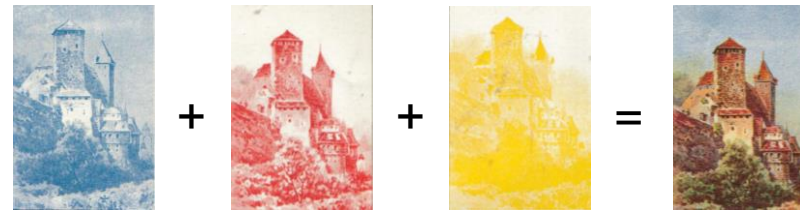


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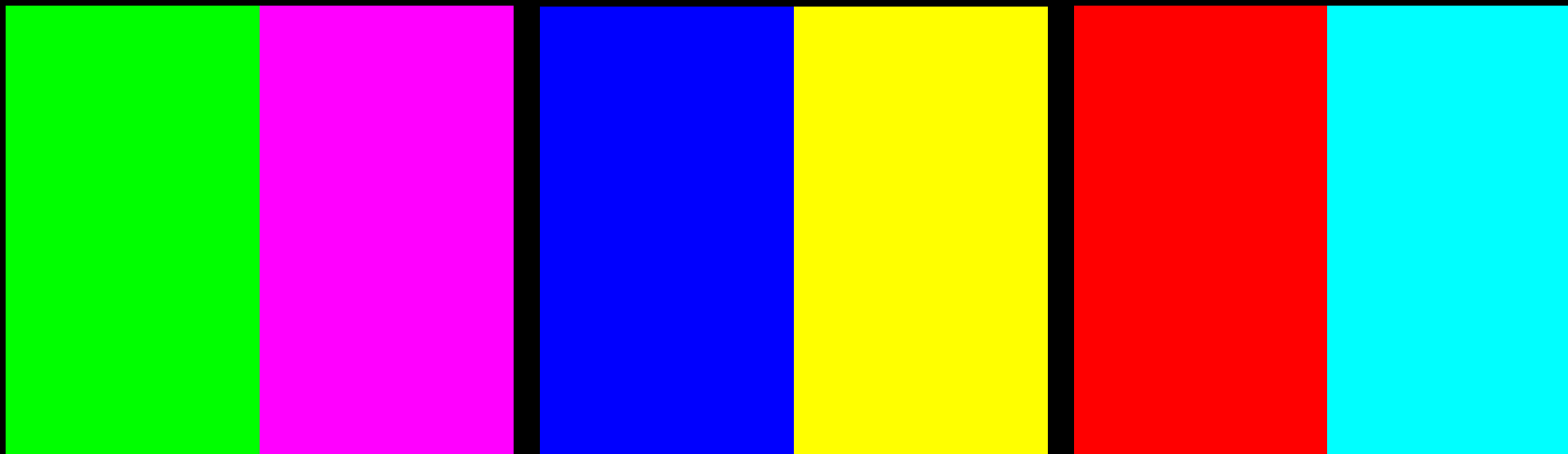
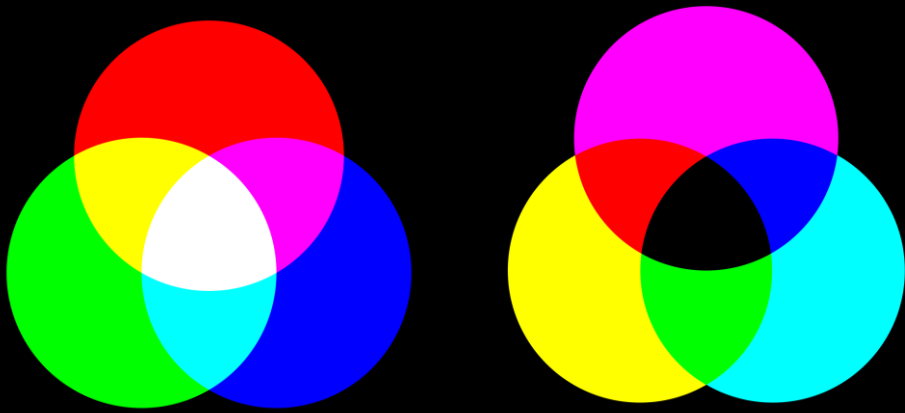


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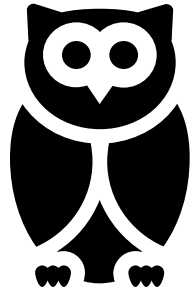
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Composition

Learning Goals

- Balanced composition
- Golden cut
- Examples in UI design

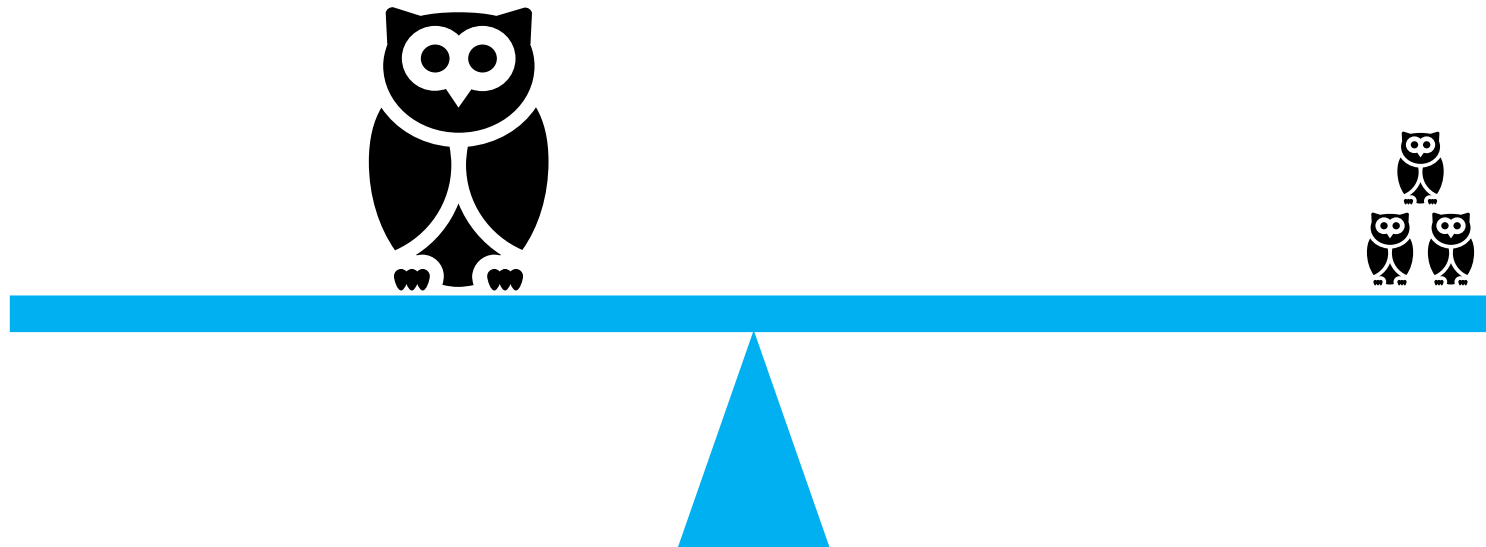
Influence of Composition



Influence of Composition



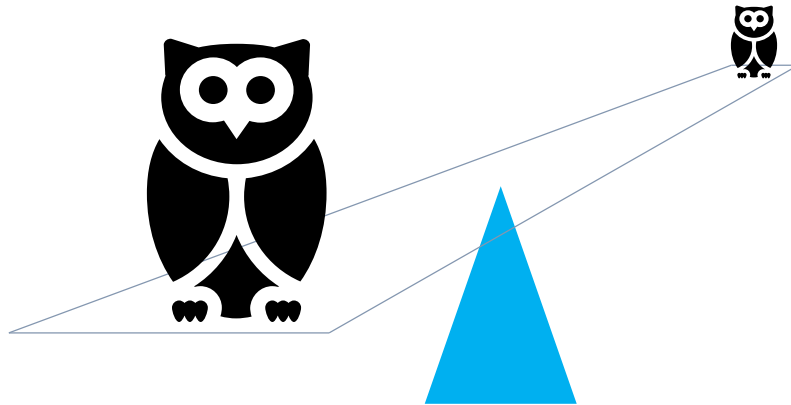
Influence of Composition



Influence of Composition



Influence of Composition



Influence of Composition

- Balance -> harmony
- Unbalanced composition -> discomfort



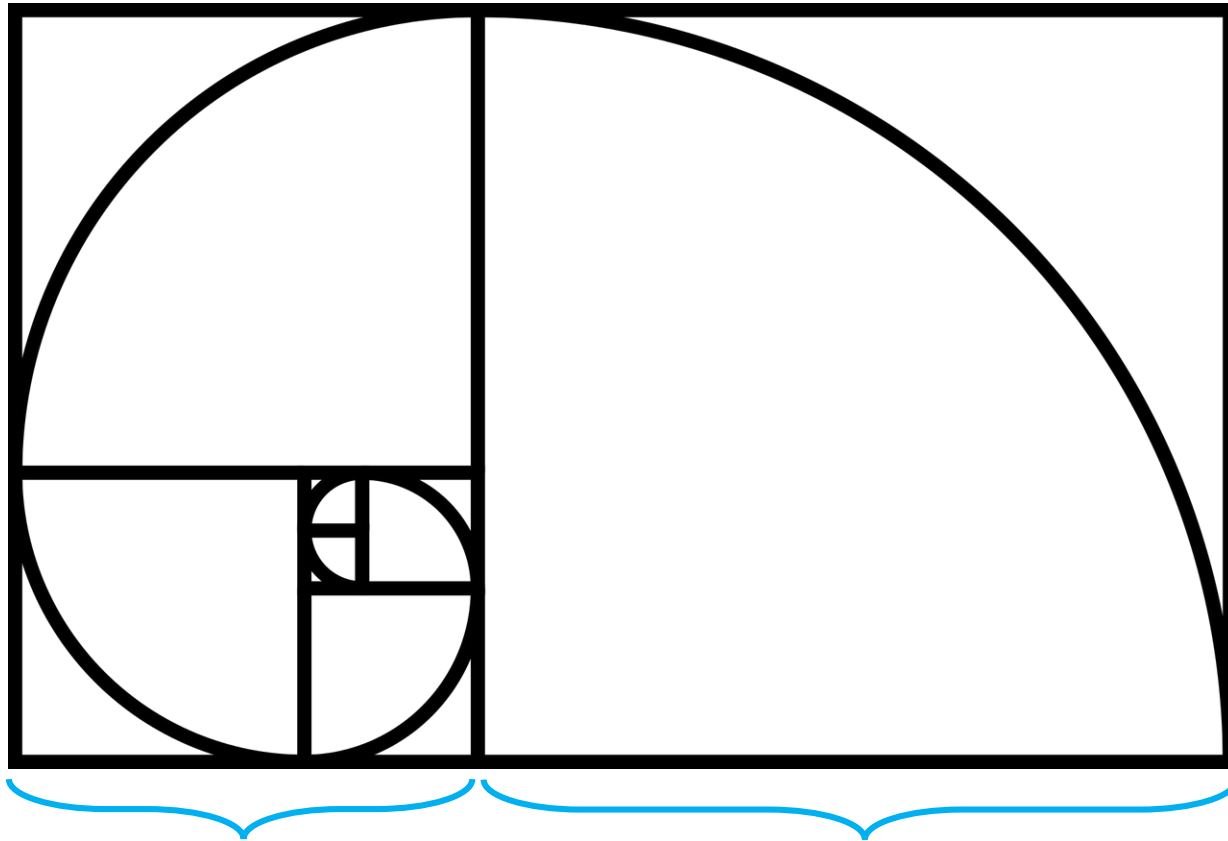
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Influence of Composition



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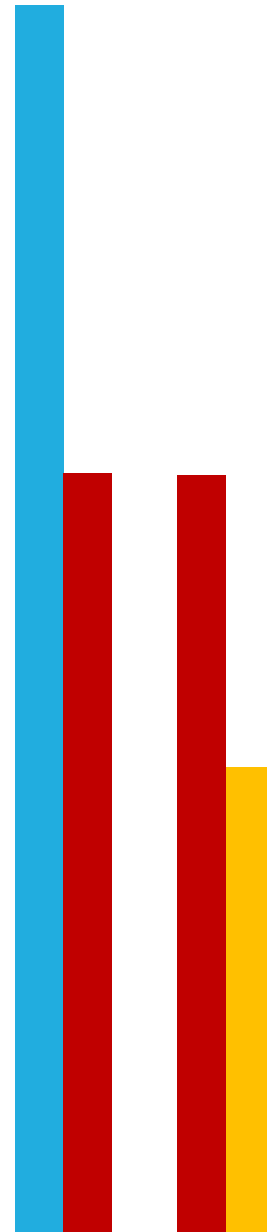
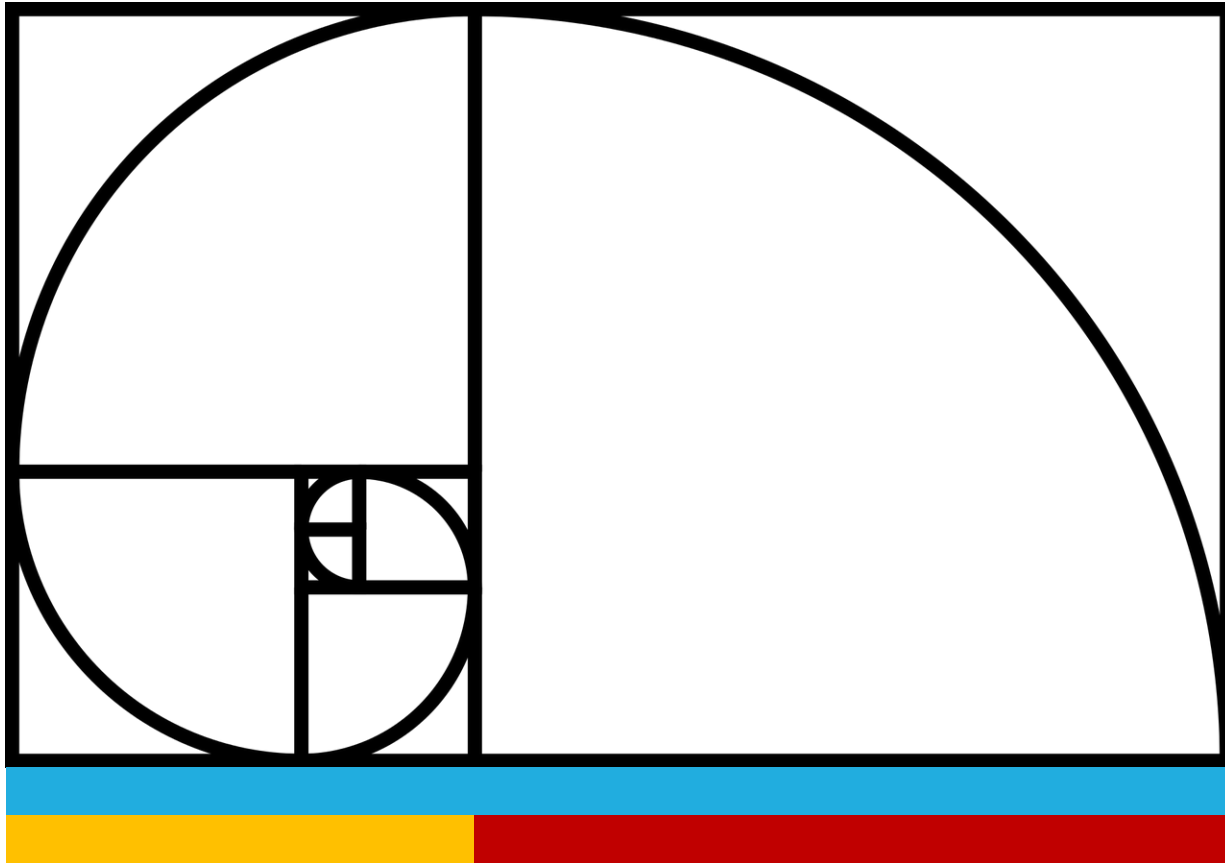


ca. 38.2%

ca. 61.8%

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Influence of Composition





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Influence of Composition



Image <https://www.pikrepo.com/friuy/white-and-red-family-computer-console-and-two-gamepads>

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Form



form follows function

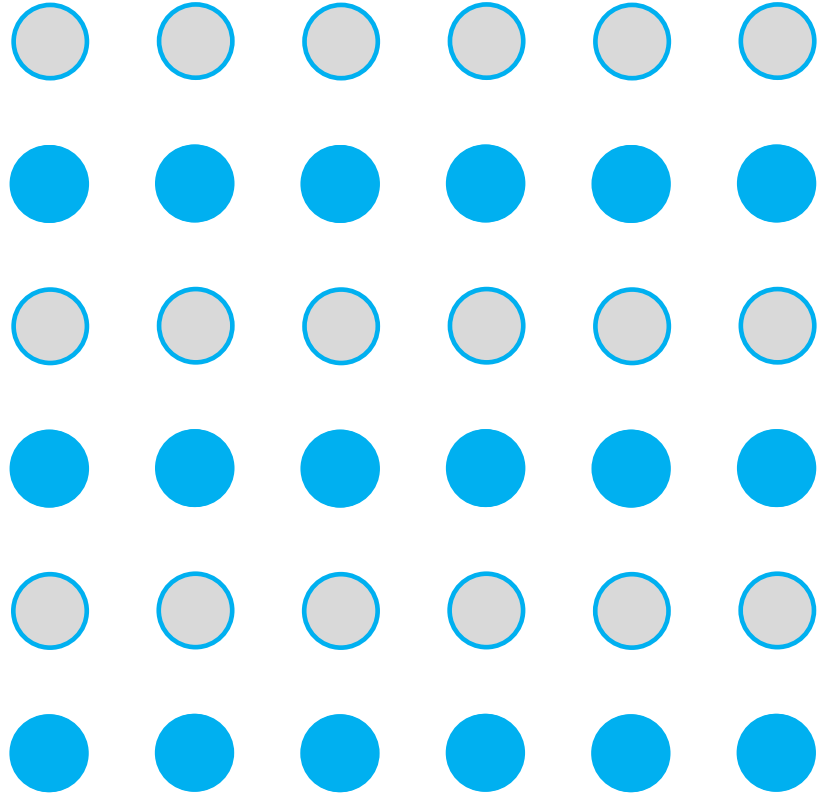
Louis Sullivan 1896

Image Source https://commons.wikimedia.org/wiki/File:Louis_Sullivan_-_Wainwright_Building,_Seventh_%2B_Chestnut_Streets,_Saint_Louis,_St._Louis_City_County,_MO.jpg by Paul Piaget

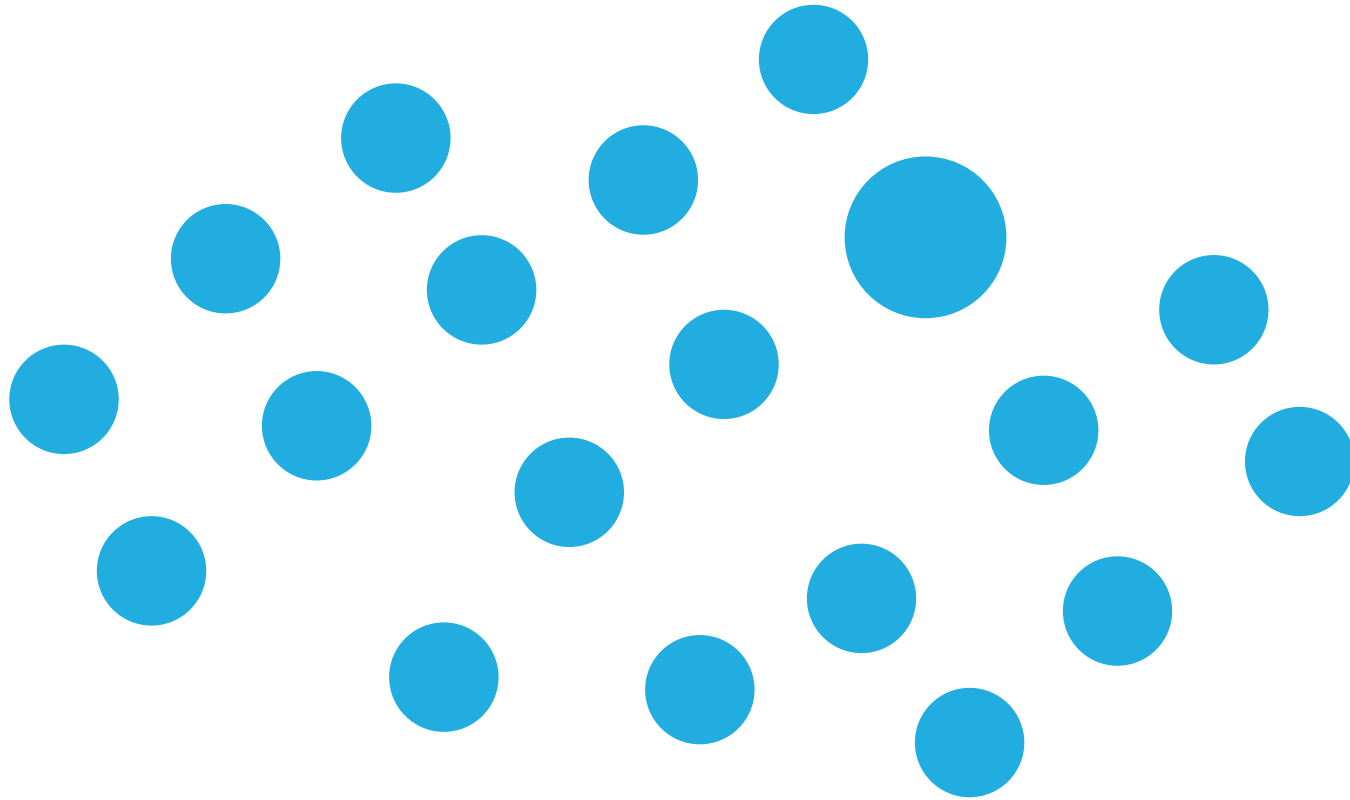
Learning Goals

- Form perception
- Understanding form
- Semiotics
- Ergonomics of form factors
- Form in UIs

Remember: Gestalt Law Similarity



Perception

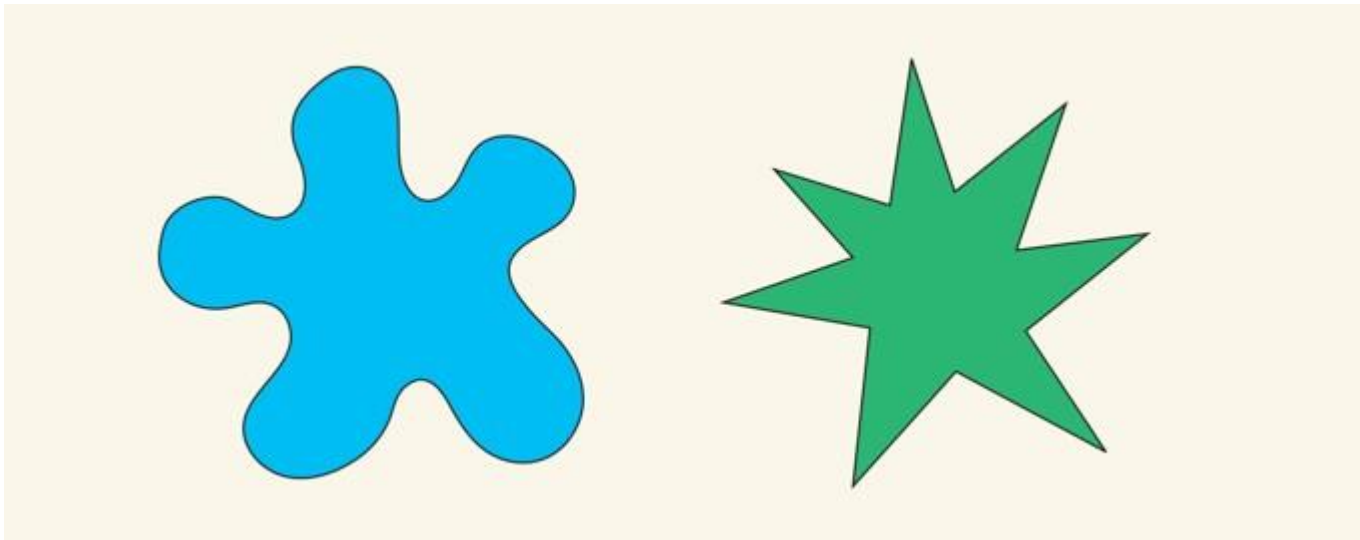


Perception



Perception

- Bouba–kiki phenomenon:



- Link between the consonants 'b' and 'k' and round and sharp shapes: consistently found in different languages

Fitch, W. Sound and meaning in the world's languages. *Nature* **539**, 39–40 (2016). <https://doi.org/10.1038/nature20474>

Understanding form

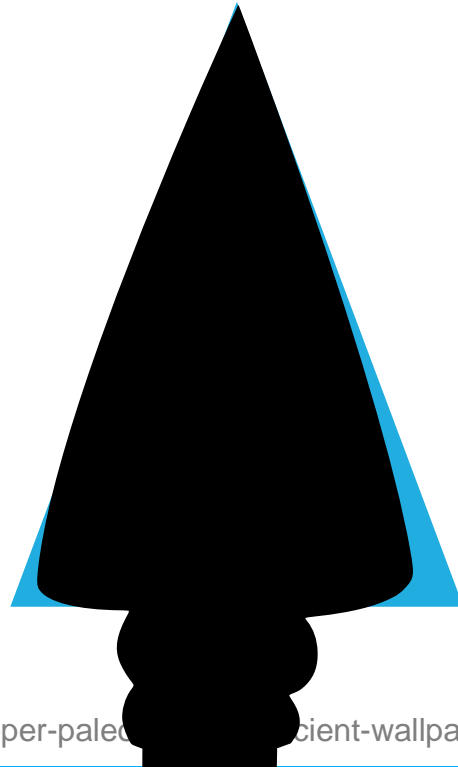


Image <https://svgsilh.com/de/image/152248.html> &
<https://www.wallpaperflare.com/venus-of-willendorf-european-upper-paleolithic-artwork-ancient-wallpaper-aaykt>

Understanding form



Image <https://publicdomainvectors.org/en/free-clipart/Christmas-tree-with-ornaments-vector-drawing/17028.html> & <https://commons.wikimedia.org/wiki/File:Cannonball.png> by GifTagger

Semiotics

- is the science of signs and symbols
- Signs such as words, gestures, and odours communicate information of all kinds in time and space
- Without semiosis, cognition, communication, and cultural meanings would not be possible



<http://www.semiotik.eu/what-is-semiotics>

Semiotics

- Signs: a factual connection to their objects

- Icon – similarity
(with an object)



- Indices – cue
(referring to an object)



- Symbol – convention
(to refer to an object)



https://de.wikipedia.org/wiki/Charles_Sanders_Peirce

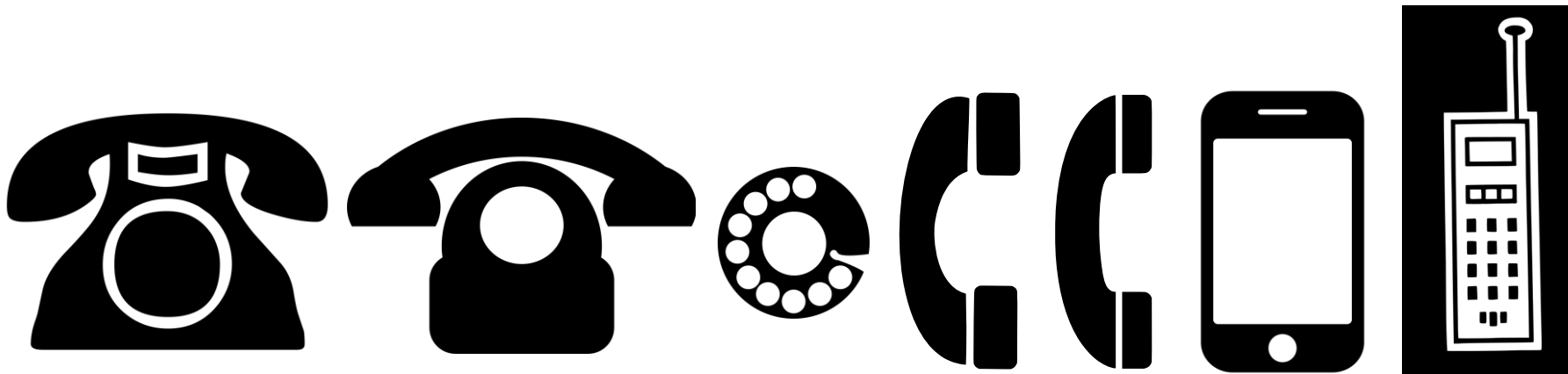




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Image <https://www.pxfuel.com/en/free-photo-osxnr>

Functions of Form

- Physical ergonomics
- Cognitive ergonomics
- Information
- Aesthetics
- Affect

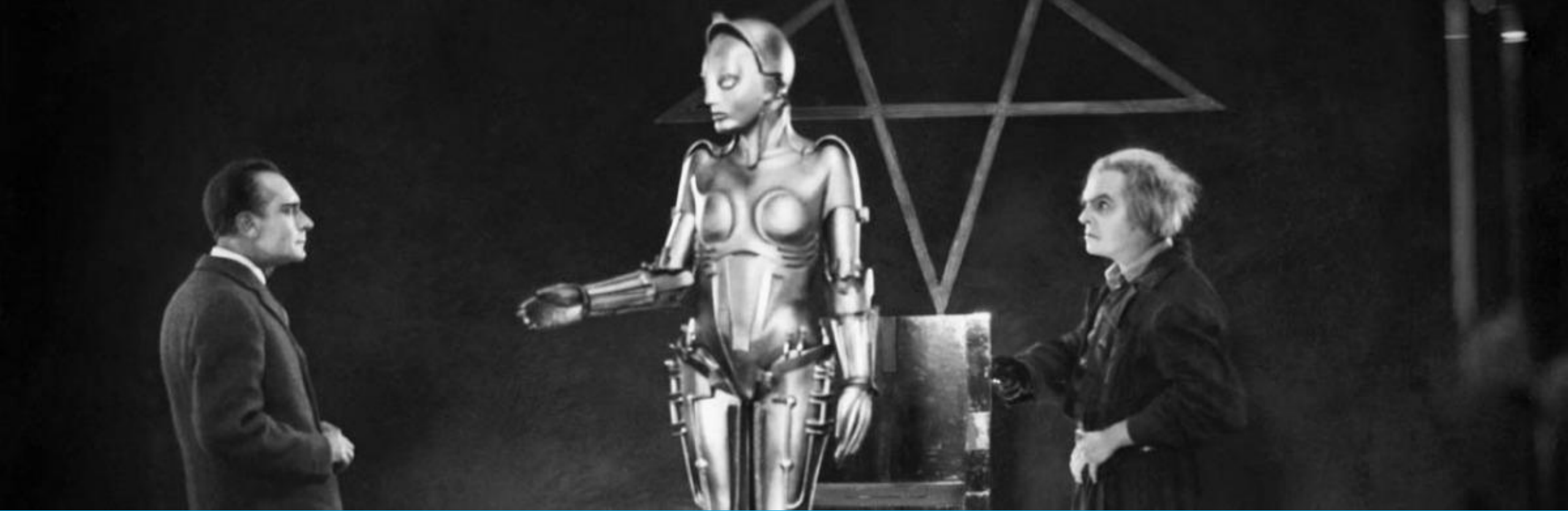
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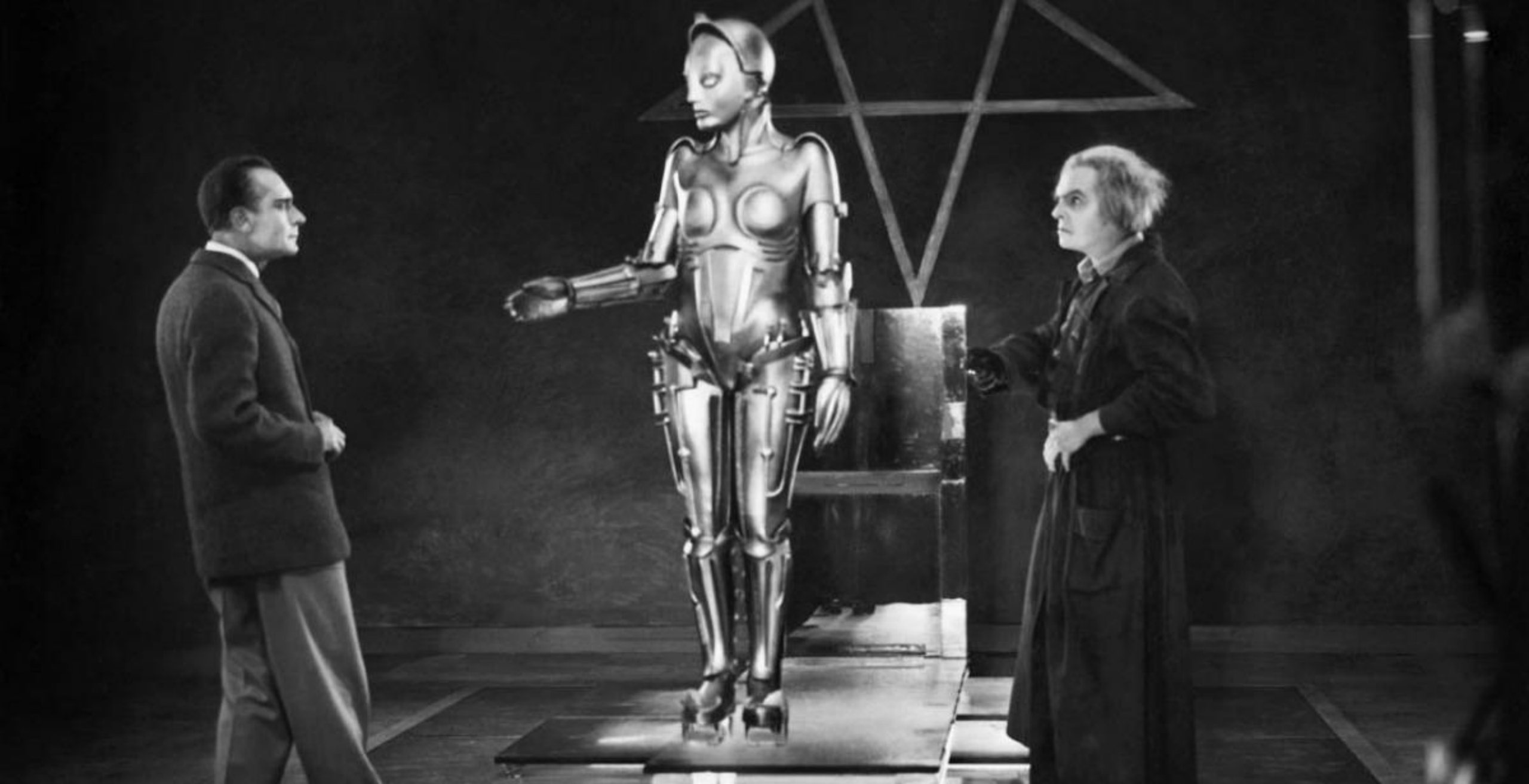
For more content see: <https://hci-lecture.de>





Interaction

Image Source: Screenshot from Metropolis by Fritz Lang



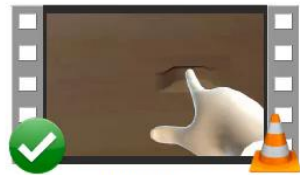
Learning Goals

- Interaction techniques
- Natural interaction

Interaction Techniques



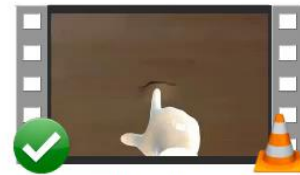
ButtonPlusMinus



ButtonRaw



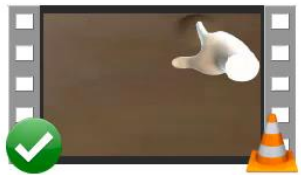
RampPlusMinus



RampRaw



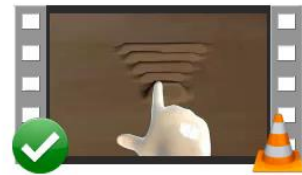
SimpleSliderPlusMinus



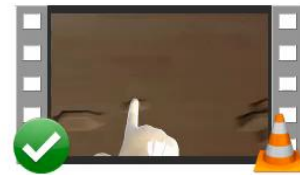
SimpleSliderRaw



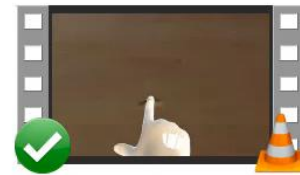
SliderPlusMinus



SliderRaw



VolumePlusMinus



VolumeRaw



x:882
y: 304



Video Source <https://vimeo.com/376900254> by Interactive Architecture Lab



Video Source <https://www.youtube.com/watch?v=RyBEUyEtXQo>
Richard A. Bolt: "Put-that-there": Voice and gesture at the graphics interface. SIGGRAPH 1980

Interaction Techniques

- are a combination of hardware and software elements that provides a way for computer users to accomplish a single task.

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

Interaction Techniques

Can be

- Efficient
- Elegant
- Intuitive
- Fun

Can also be

- Slow
- Clumsy
- Hard to understand
- Frustrating

Natural Interaction

- Natural User Interfaces (NUI) are easy to use that they feel natural.
- Interaction is direct and consistent with our ‘natural’ behavior.
- Bill Buxton:
 - NUIs exploit **skills** that **we have** acquired through a lifetime of living in the world
 - should always be designed with the use **context in mind**, such as voice input for automotive control but not in public environments

<https://www.interaction-design.org/literature/article/natural-user-interfaces-what-are-they-and-how-do-you-design-user-interfaces-that-feel-natural>

NUI Design Guidelines

By Joshua Blake

- Instant expertise
- Progressive learning
- Direct interaction
- Cognitive load (primarily use innate abilities and simple skills)

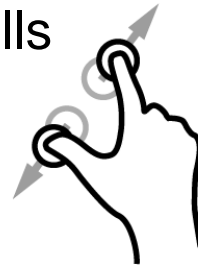
Joshua Blake, Natural User Interfaces in .Net, 2011

NUI Design Guidelines

By Joshua Blake

Instant expertise

- Take advantage of the users' existing skills
 - Reusing common human skills



- Reusing domain-specific skills

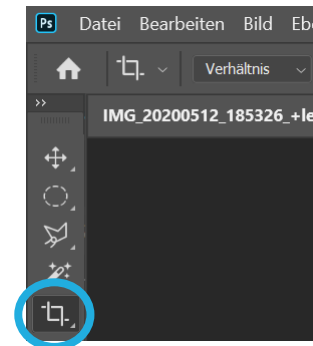
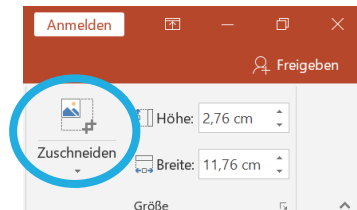
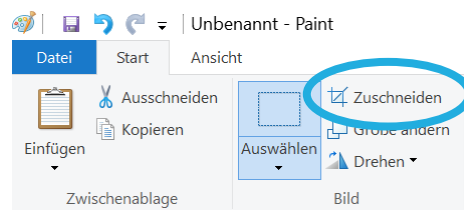


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NUI Design Guidelines

By Joshua Blake

Progressive learning

- Lay out a clear learning path for users to start with basic skills and move on to something more advanced

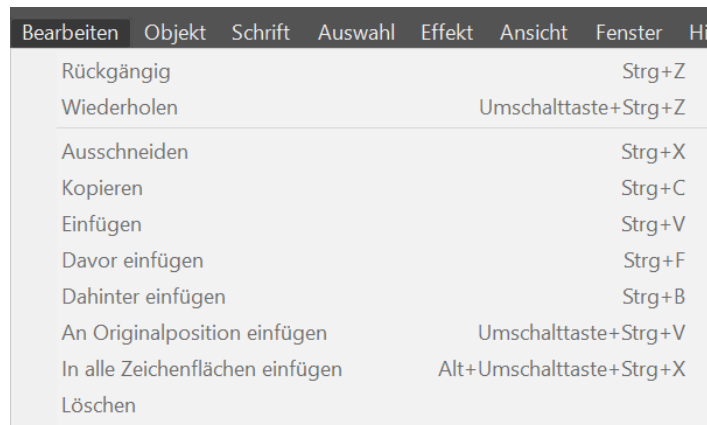


Image Source https://commons.wikimedia.org/wiki/File:Pinch_zoom.png by Rosieate

NUI Design Guidelines

By Joshua Blake

Direct interaction

- Having a **direct correlation between user action and NUI reaction through:**
 - Directness: NUI actions happen at the same time as user actions
 - High-frequency interaction: there is a *constant* flow of action and reaction between the user and the NUI
 - Contextual interaction: to not overwhelm the user, NUI should primarily show information that is relevant to the user's current interaction

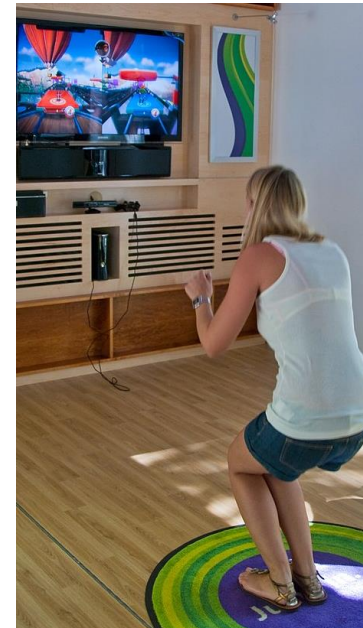


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NUI Design Guidelines

By Joshua Blake

Cognitive load

- Users should not think about the interface but focus on achieving a task
- User should apply basic knowledge and simple skills during the interaction

Keep it simple!

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