NUR: Visual perception and design
Designing Interactive System

USER NEEDS & BEHAVIOR
- Interview transcriptions
- Scenarios & Use-cases
- Storyboards
- User models
- HTA

IDEAS & CONCEPTS
- Sketching
- Design studio

PROTOTYPING
- Lo-Fi prototyping
- Hi-Fi prototyping
- Information architecture

MODELING
- STN, CTT, PN

Design

Engineering

Sales

Source: Buxton 2007
Visual design in UI

- emotional aspects
  - positive impression
  - aesthetics (nice is better)
  - trust
  - forms the opinion in less than 1s

- usability aspects
  - facilitates visual perception
    - information organization
  - simplifies the overall UI design
  - helps to understand the mental model
  - supports interaction sequences

- good visual design is about details
- sense for visual design is essential
  - following visual design rules is not sufficient
  - no algorithm
  - it is about breaking the rules
  - influenced by fashion
Visual design in UI - Apple system settings
Visual design in UI - Apple system settings
NetBeans IDE: improving download

NetBeans IDE 6.7 Connects Developers

The only IDE you need! Runs on Windows, Linux, Mac OS X and Solaris.
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![NetBeans IDE](image)

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- A/B test performed

<table>
<thead>
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<th>Version</th>
<th>Download improvement</th>
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<tr>
<td>Download NetBeans IDE for FREE</td>
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<td>Download NetBeans IDE for FREE</td>
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Visual perception
Perception – bottom-up

Features 1,000,000

Patterns

Objects 1-3
cognition bottleneck

bottom-up information drives pattern building
Perception – top-down

Features
1.000.000

Patterns

bottom-up information drives pattern building

top-down attentional processes reinforce relevant information

Objects
DOG friendly pet

1-3
cognition bottleneck

NUR – Visual perception and design
Perception – top-down

- **attention**
  - we perceive what is needed only
- **driven by need to accomplish a goal**
  - goals: actions (close window), cognitive goals (understand idea in a figure)
  - close link perception-action
- **constant priming of action plans**
  - just-in-time strategy: information are perceived when needed
- **causes a bias in signals we are looking for**
  - e.g., if looking for red icons the red spot detector will signal louder

top-down attentional processes reinforce relevant information
Perception – top-down: Standards

Pro stažení DEMO instalaci našich produktů je nutné přihlásit se přiděleným přihlašovacím kódem. Tento kód vám bude zaslan e-mailem na základě vyplnění registračního formuláře.

Kód pro přihlášení:

Přihlásit

POZOR!
Pro stažení PLNÝCH VERZÍ našich produktů jdete prosím do Podpora - Zákaznická služba.
Perception – top-down: Consistency
Perception – top-down: Attraction
Implication for design

- support just-in-time visual queries for every important cognitive task

1. identify cognitive tasks
2. identify visual queries involved in visual perception process
Example: London underground map
Example: London underground map

- Goal: Get from the hotel to the pub
- Cognitive tasks
  - combination of lines
  - shortest route
  - names of stations where train changes
  - how long will it take
  - distance between the pub and the station
- Visual queries
  - locate the station nearest our hotel
  - locate a station near the pub
  - find the route connection

How well are these queries supported?
Example: London underground map

- Visual perception processes
  - find the hotel station (label search)
  - find the pub station (label search)
  - tracing the path of the "hotel" line
    - building the contour (several fixations)
  - tracing the path of the "pub" line + finding intersection with the "hotel" line
  - most of the information of the contour of the hotel line will be lost => tracing must be repeated
  - rough estimate of the number of stations
    - no counting
    - judgment based on distance and previous experience
Example: London underground map
### Example: London underground map

Which cognitive tasks are well supported?

<table>
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<tr>
<th>Cognitive Task</th>
<th>Support</th>
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<tbody>
<tr>
<td>station near hotel finding</td>
<td>😞</td>
</tr>
<tr>
<td>route finding</td>
<td>😊</td>
</tr>
<tr>
<td>station near pub finding</td>
<td>😞</td>
</tr>
<tr>
<td>estimating journey time</td>
<td>😞</td>
</tr>
</tbody>
</table>
Low level feature analysis

- primary features analyzed
  - form (orientation, size)
  - color
  - motion
- all in parallel
- provides information to "Where pathway"
  - planning the eye movement to search where the object is located
- PROBLEM: How can we direct eyes to an object if we do not know where it is?
  - biased feature competition
    - based on the knowledge of the object features we are looking for
  - pop-out effect
    - object is sufficiently distinct in primary feature from all the other objects
Low level feature analysis

Combination of features

Similarity of the feature
Visual design consequences

- pop-out important objects
  - use primary features (orientation, size, color, motion)
  - difference in the feature must be significant
    - about 3 different steps for each feature
    - visibility enhancement is not symmetric (size or contrast increase; add extra part)
  - do not combine more features

- more than 8-10 independently searchable symbols impossible

- stylistic consistency => visual search will take longer

- avoiding objects to be invisible
  - do not use unexpected features (biased competition)
    - button which does not look like button
Gestalt principles of visual form perception
Gestalt psychology

- 1930-40 applied into visual perception
  - Max Wertheimer, Wolfgang Köhler, and Kurt Koffka

- does not answer the question WHY?
Gestalt principles

- Proximity
- Similarity
- Symmetry
- Closure
- Continuity
Gestalt principles

- Proximity + Similarity

- Proximity + Different space
Information vs. color
Information coding by color

- Text, shape, color coding
  - visual search is 37% better if color and icon is used compared to text
  - shape vs. color: visual search better for icon compared than color
    - this may be context dependent

- Problem with interference of various cognitive processes
  - perceiving colors
  - reading text
Experiment I

- Name COLORS of the boxes – as fast as possible
- Say "END" when finished
- We will measure the time elapsed
Experiment II

- Name COLORS of words on the next slide – as fast as possible
- Say "END" when finished
- We will measure the time elapsed
Žlutá
Zelená
Bílá
Černá
Červená
Modrá
Experiment III

- Again the same task as in previous experiment
- Name COLORS of words on the next slide – as fast as possible
- Say "END" when finished
- We will measure the time elapsed
Modrá
Černá
Bílá
Červená
Žlutá
Zelená
Influence of interference

- Conclusion
  - Experiments are slower and slower

- Interference of two cognitive processes
  - automatic processing is disturbed and slowed down
Color perception and visual design
Color Perception

- **Rods**
  - gray scale
  - much more than cones

- **Cones**
  - red, green, blue
  - less sensitive than rods
Central and peripheral colors

- cones in the center of retina
- less blue cones and fewer in center of retina
Central and peripheral colors

This is a text.

This is a text.

This is a text.

This is a text.
Colors in design

- use maximum of 4 colors
  - short-term memory limit
- colors invoke associations (cultural dependent)
  - black => funeral, wedding (Japan)
  - red => alert, danger, hot, love, death (Celtic)
  - green => nature, money
  - yellow => weakness, courage (Japan)
  - blue => depression, sadness, wealth (Japan)
- different sensitivity on color variations
  - low: red, purple, green
  - high: yellow, blue-green
  - do not change one component only
- elderly users need brighter colors
Color usage in design

- Use color to label or show hierarchy
- Use color to represent or imitate reality
- Use color to unify, separate, or emphasize
- Use color to decorate
- Use color consistently

- DO NOT code information into color only
Information coded NOT in color only

Title: Mr
First name: Graham
Last name: Charlton
Phone number: 02072691450
Confirm phone number: 0207691540
Alternative phone number: 
Email address: 

Finish booking

Those phone numbers don't match. Please check and try again.
Please give us a valid email address.
Icon design

- Findability
- Recognition
- Information scent
- Attractiveness
Flat design

- week vs. strong signifiers
- time spent
- number of fixations
- When it can work?
Literature

- Nielsen Norman Group: https://www.nngroup.com/topic/visual-design/

Example question for examination

- What is it pop-out effect? How does it work?
- What is the cognition bottleneck of visual perception process? How it is solved?
- What should be taken into account in icon design process?
- How can be Gestalt principles applied to UI design?
- What should be considered when coding information into color?
Thank you for attention