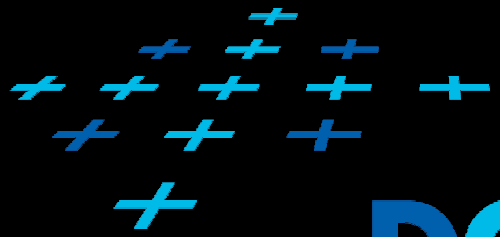
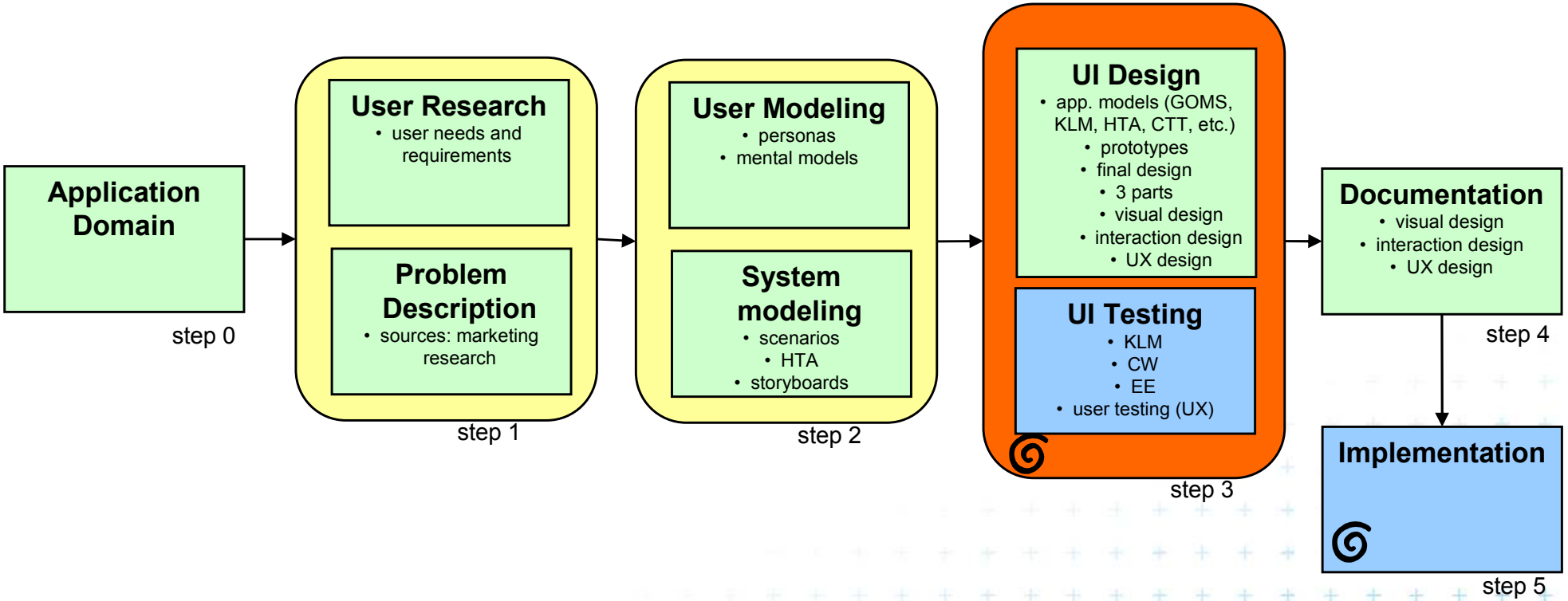


DCGI

DEPARTMENT OF COMPUTER GRAPHICS AND INTERACTION

NUR - Visual perception and design

User interface design - big picture



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 are 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: improving download

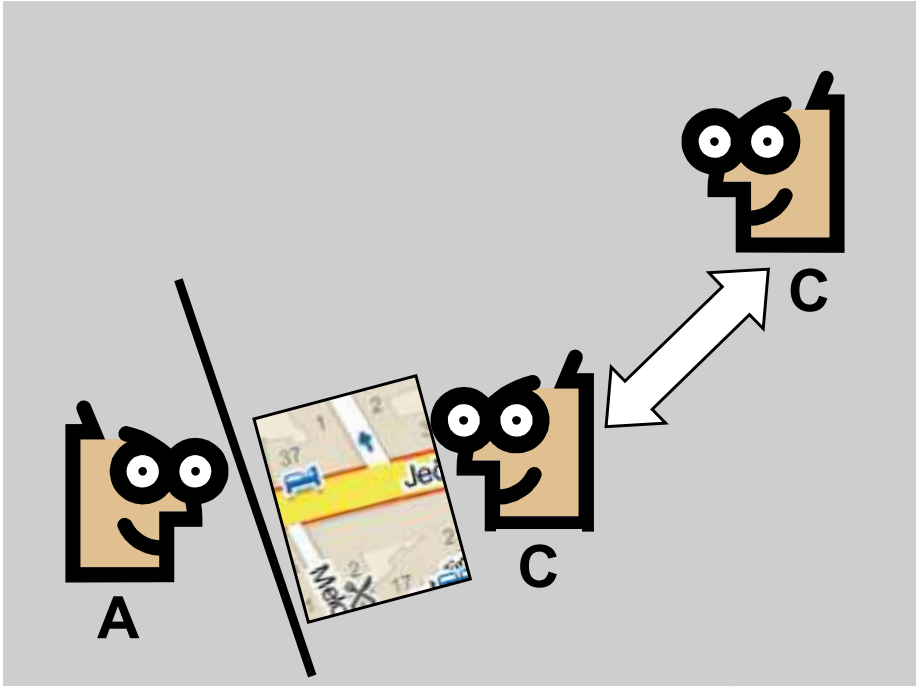
NetBeans IDE: improving download

NetBeans IDE: improving download

- A/B test performed

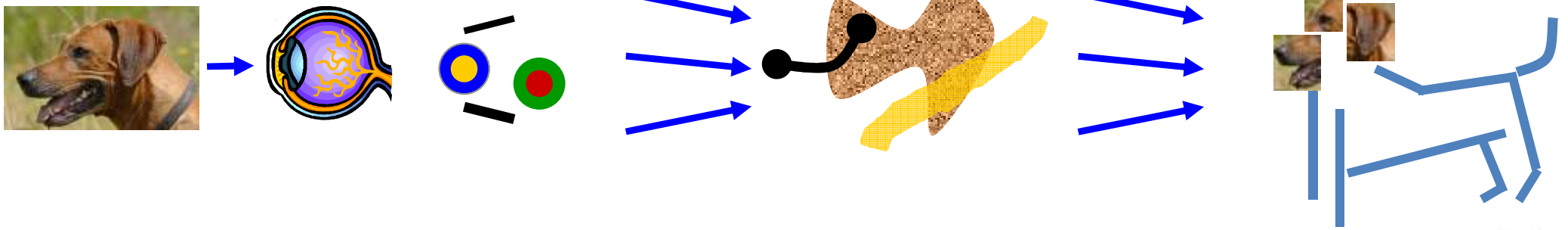
Version	Download improvement
	3.15%
	1.6%

Visual perception



DCGI

Perception – bottom-up



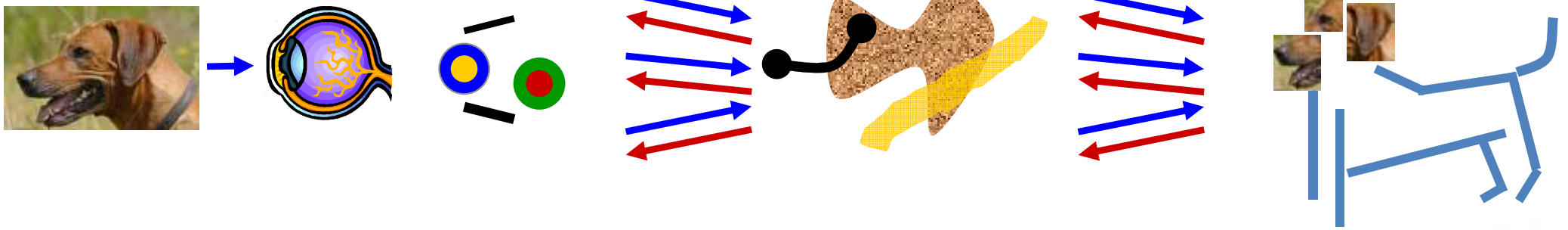
Features
1.000.000

Patterns

Objects
1-3
cognition bottleneck

bottom-up information drives pattern building

Perception – top-down



bottom-up information drives pattern building

top-down attentional processes reinforce relevant information

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

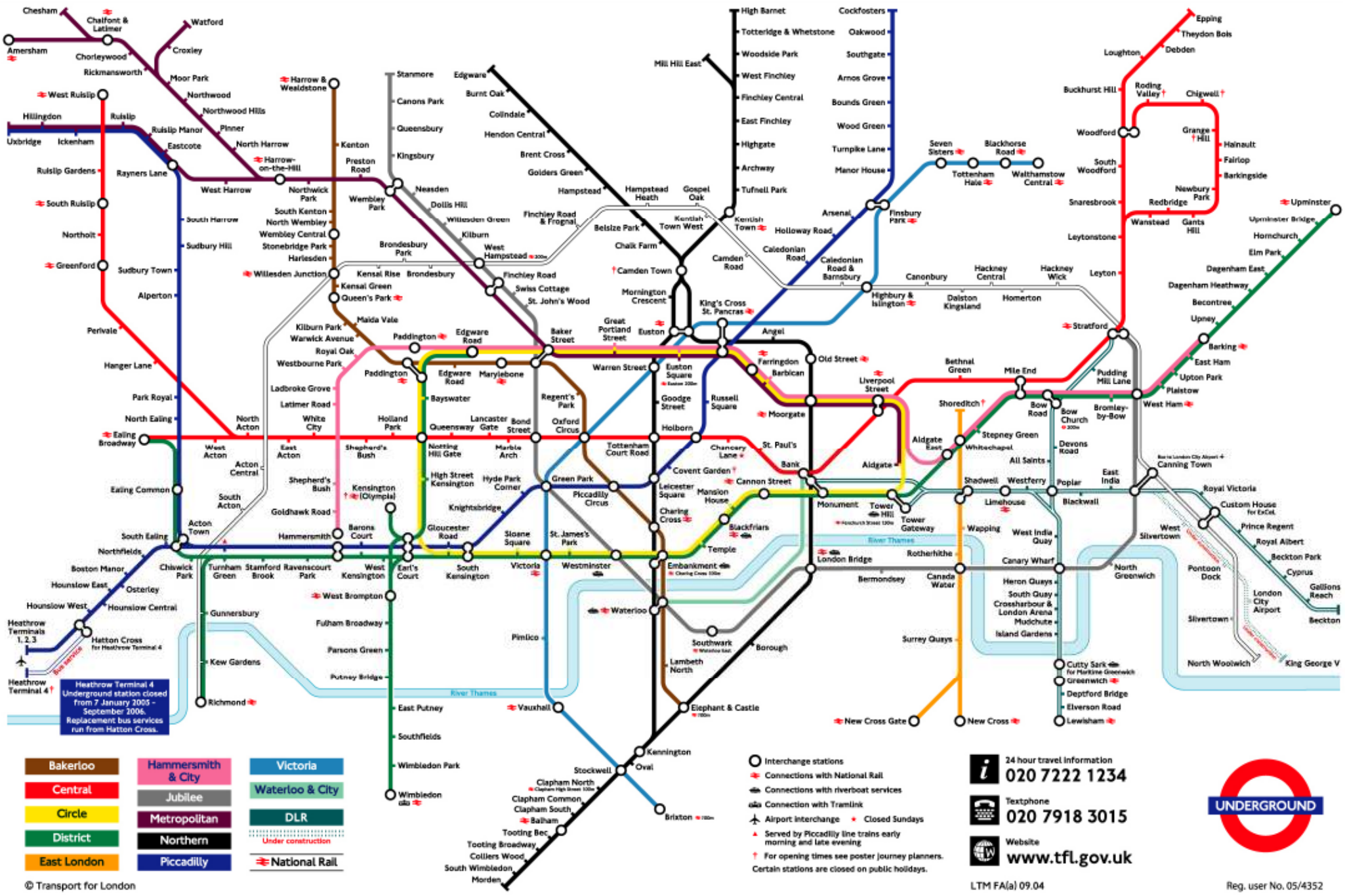
top-down attentional processes reinforce relevant information

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

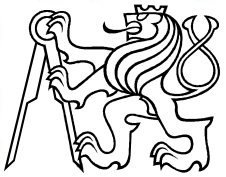
Example: London underground map



Example: London undergorund 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

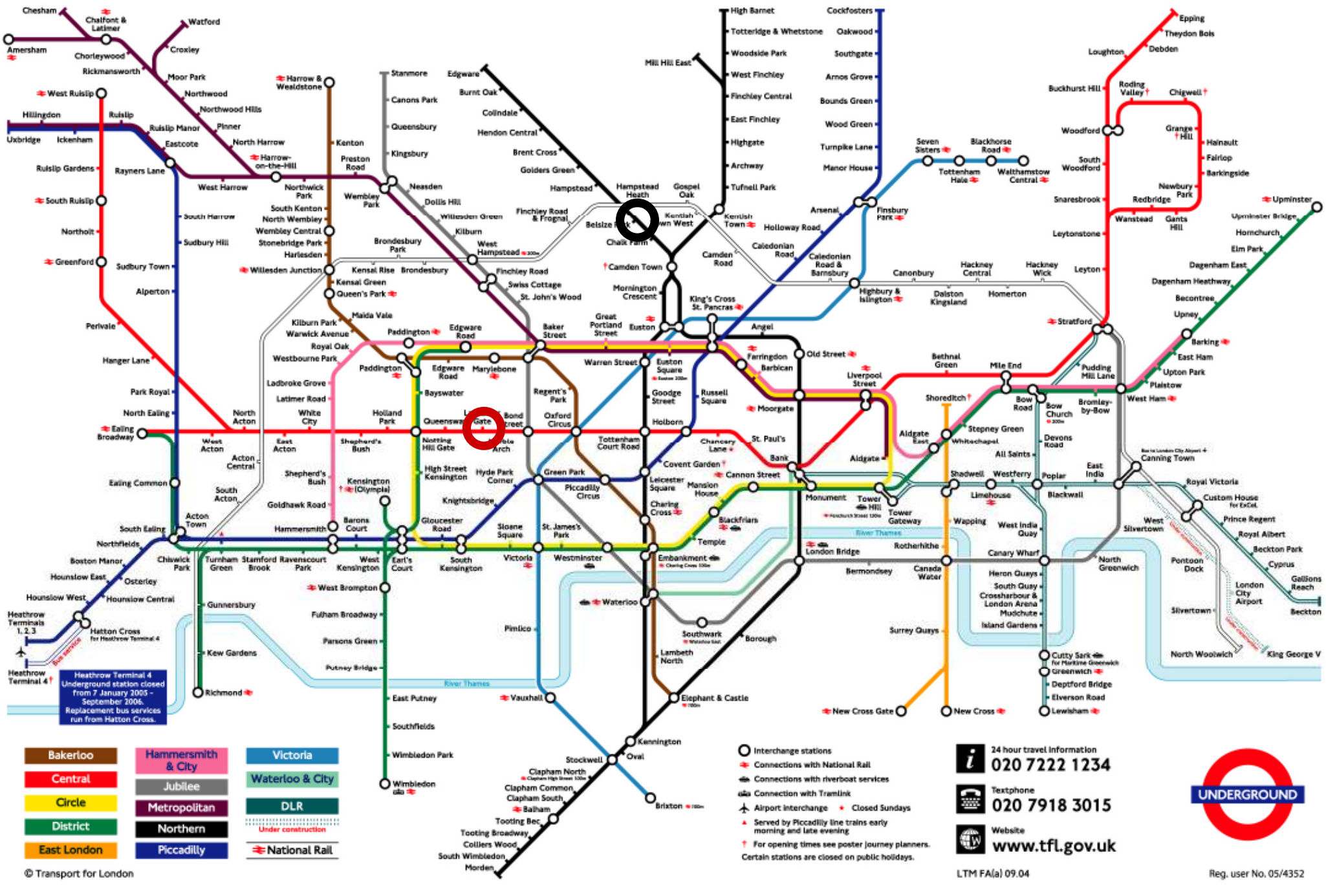
How well are these queries supported?



Example: London undergorund 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 undergorund map

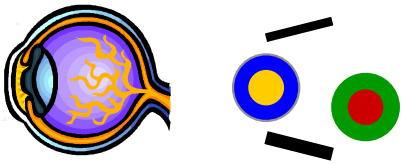


Example: London undergorund map

- Which cognitive tasks are well supported?

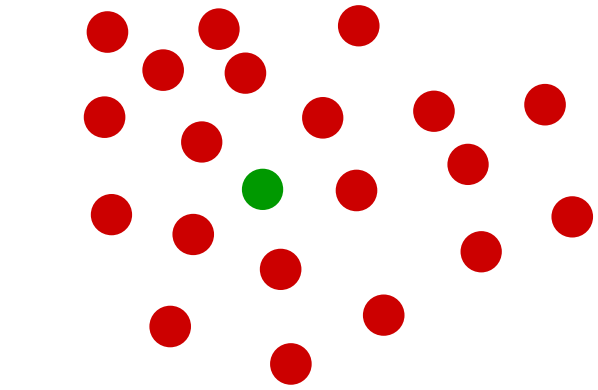
cognitive task	support
station near hotel finding	
route finding	
station near pub finding	
estimating journey time	

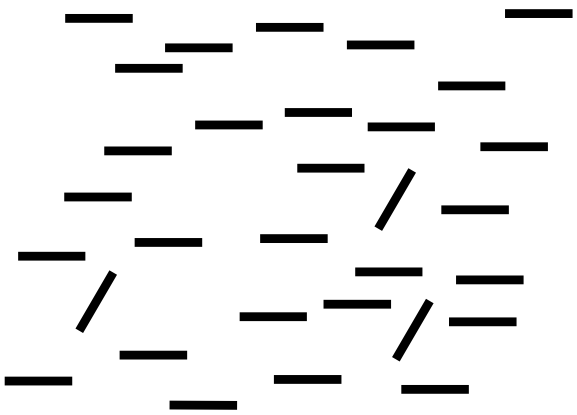
Low level feature analysis

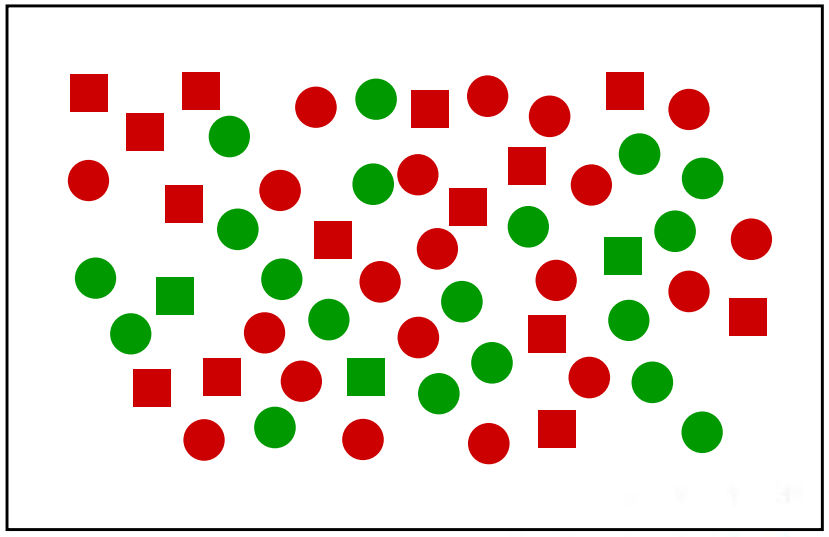


- primary features analyzed
  - form (orientation, size)
  - color
  - motion
- all in parallel
- provides information to "Where pathway"
  - planning the eye movement to search where the object is located
- PROBLEM: How can we direct eyes to an object if we do not know where it is?
  - biased feature 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

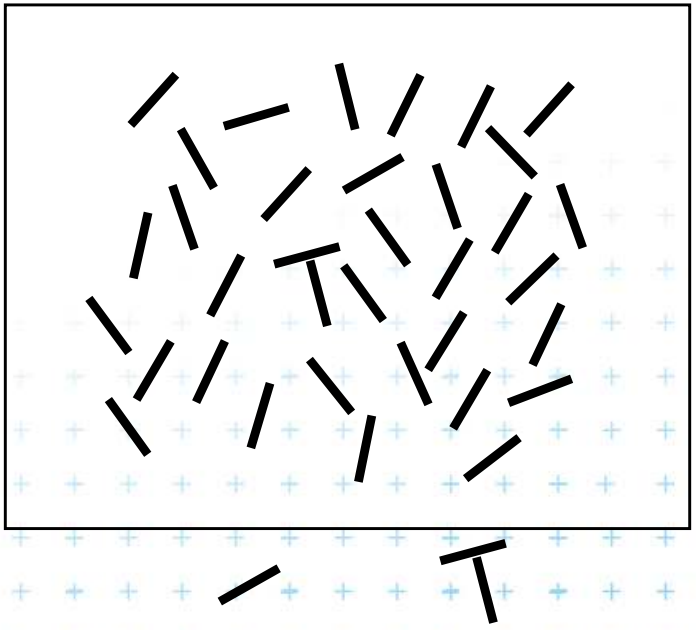
Low level feature analysis







combination of features

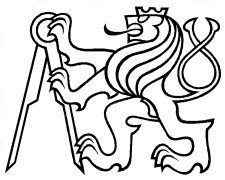


similarity of the feature

Visual design consequences

- pop-up important objects
  - use primary features (color, orientation, size, 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)
  - 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 as button

Information vs. color

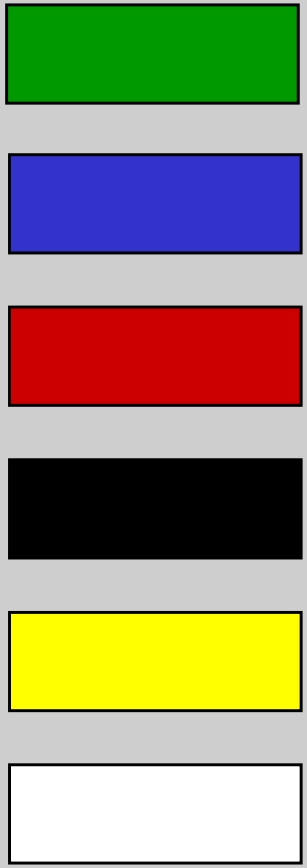


Information coding by color

- 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

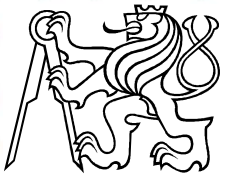
Zelená

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

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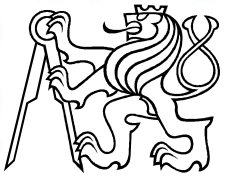
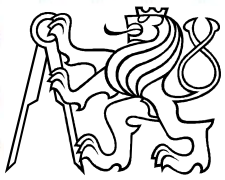


Influence of interference

- Conclusion
  - Experiments are slower and slower

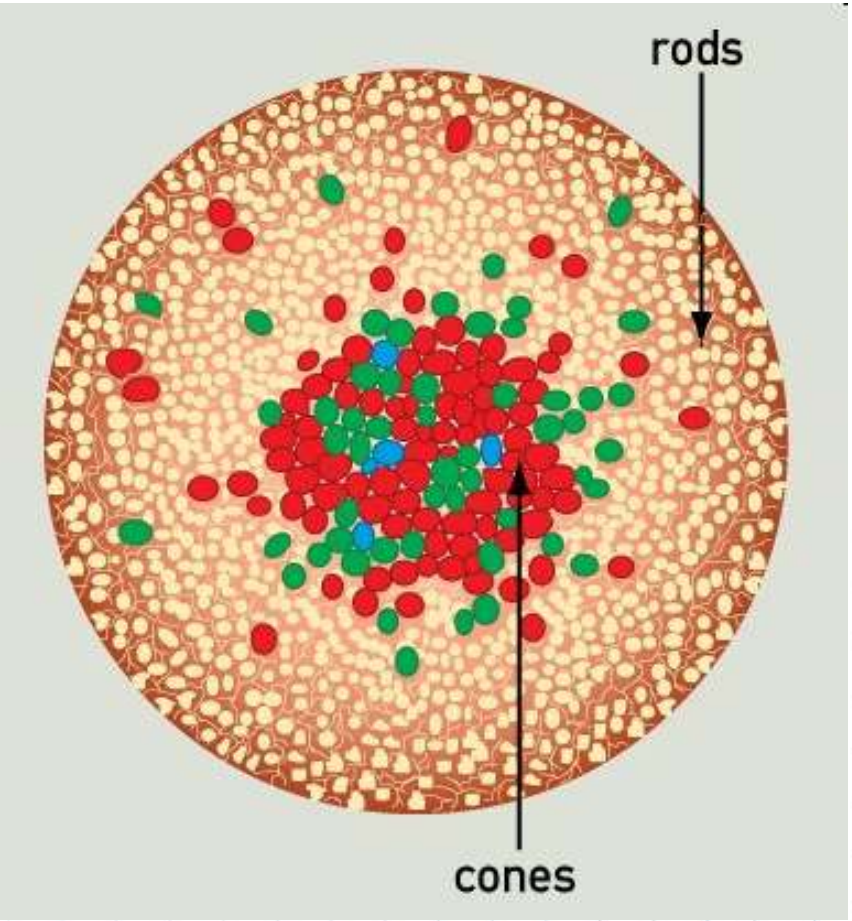
- Interference of two cognitive processes
  - automatic processing is disturbed and slowed down

Color perception and visual design



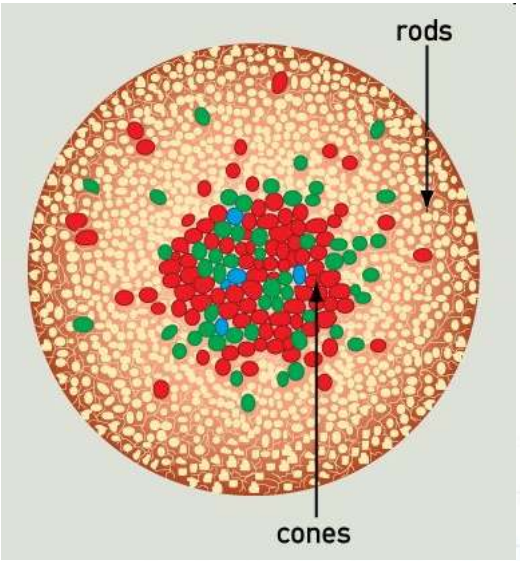
Color Perception

- Rods
  - gray scale
  - much more than cones
- Cones
  - red, green, blue
  - less sensitive than rods

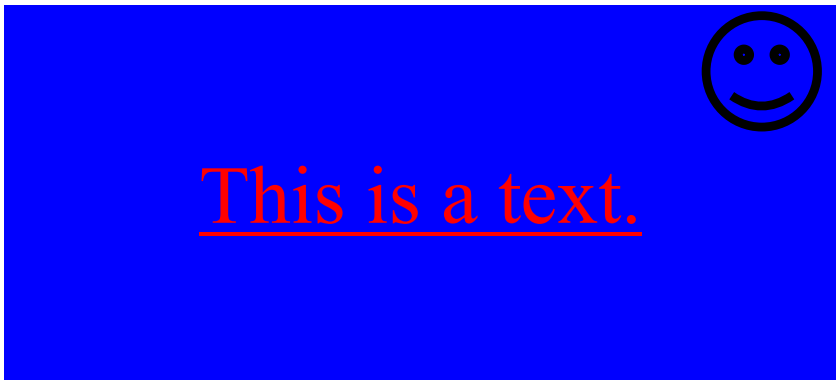


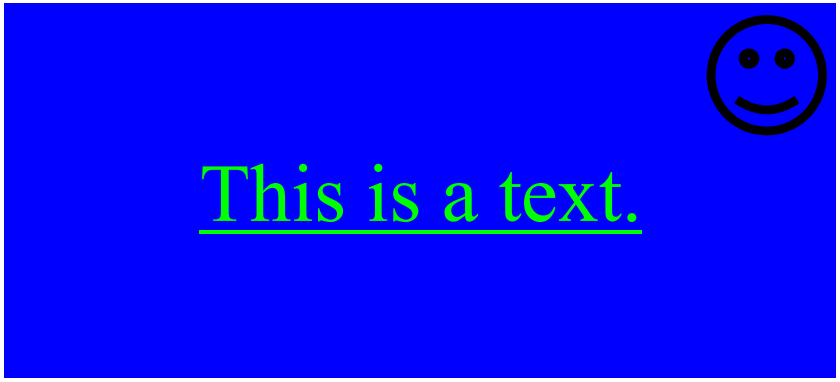
Central and peripheral colors

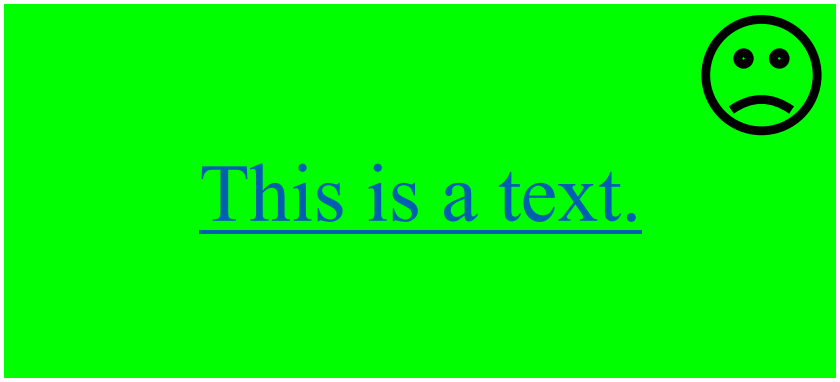
- cones in the center of retina
- less blue cones and fewer in center of retina

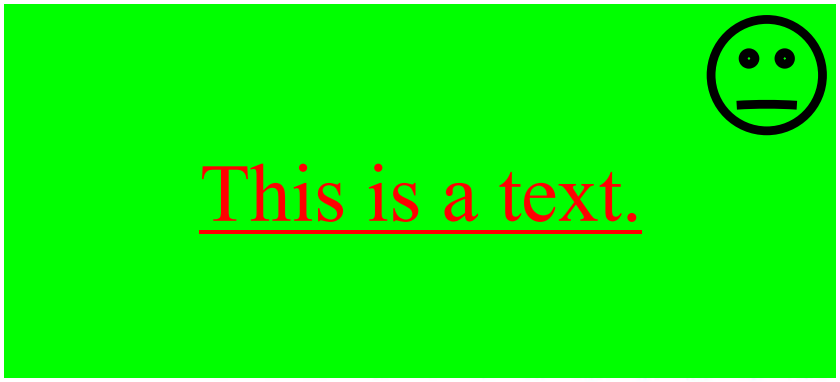


Central and peripheral colors

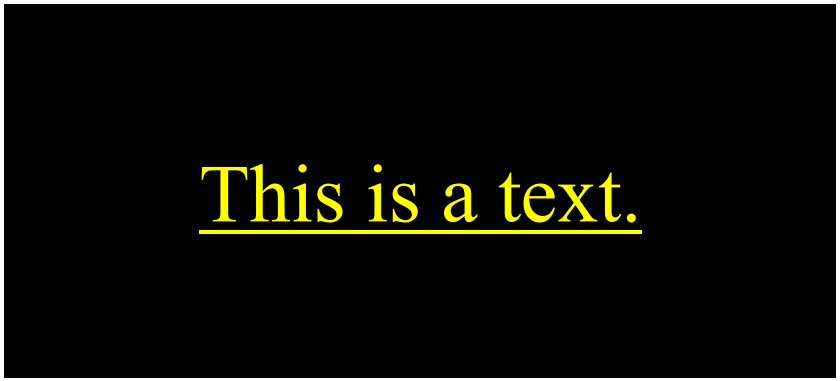




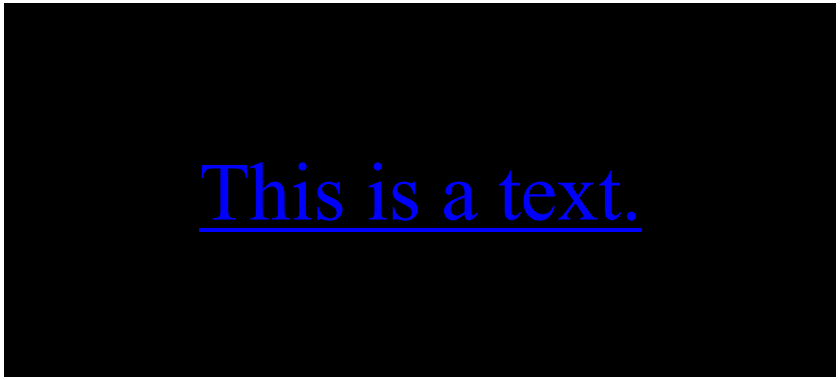




Central and peripheral colors



This is a text.



This is a text.

Colors in design

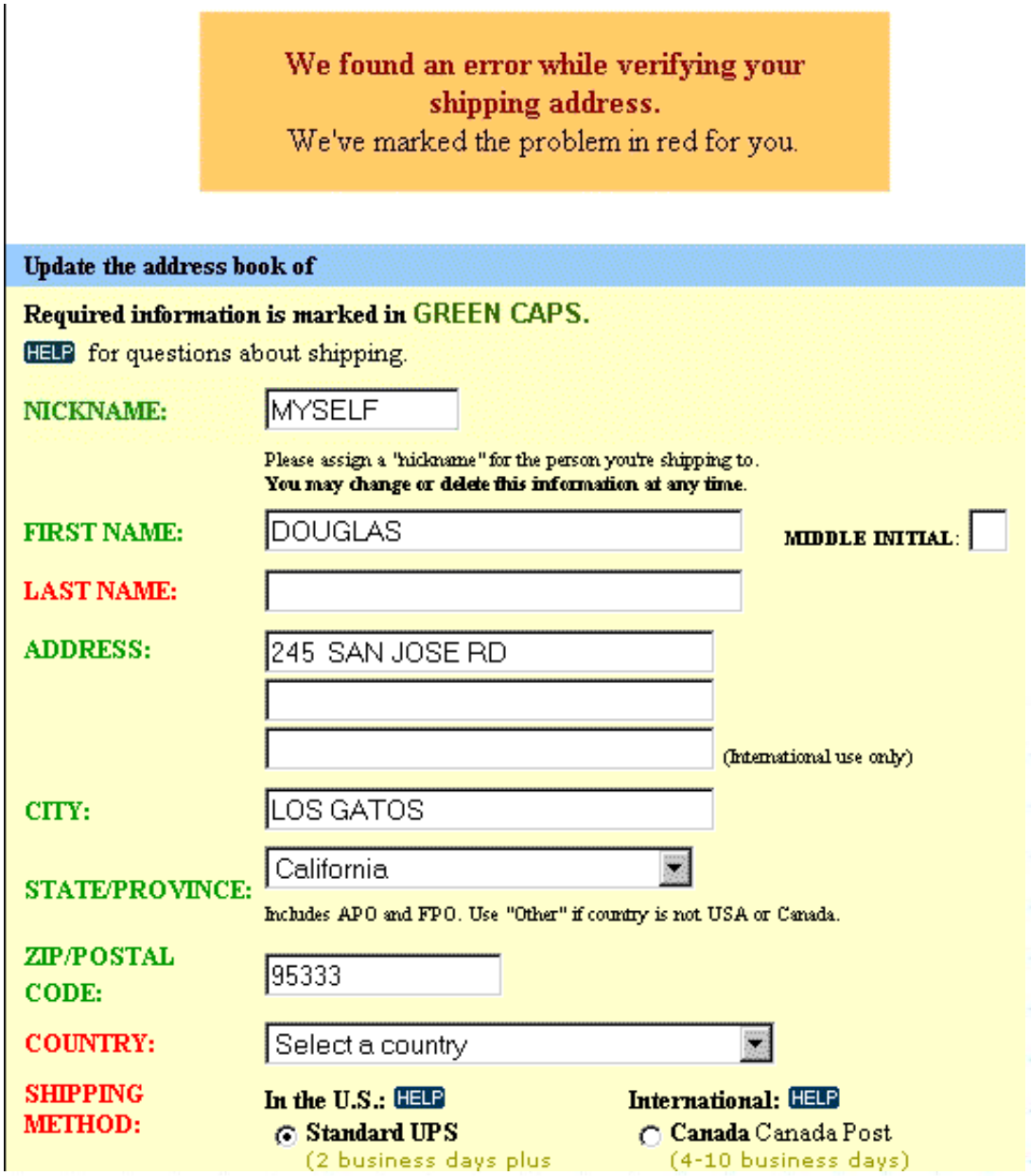
- use maximum of 4 colors
  - short-term memory limit
- colors invoke associations (cultural dependent)
  - black => funeral, wedding (Japan)
  - red => alert, danger, hot, love, death (Celtic)
  - green => nature, money
  - yellow => weakness, courage (Japan)
  - blue => depression, sadness, wealth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

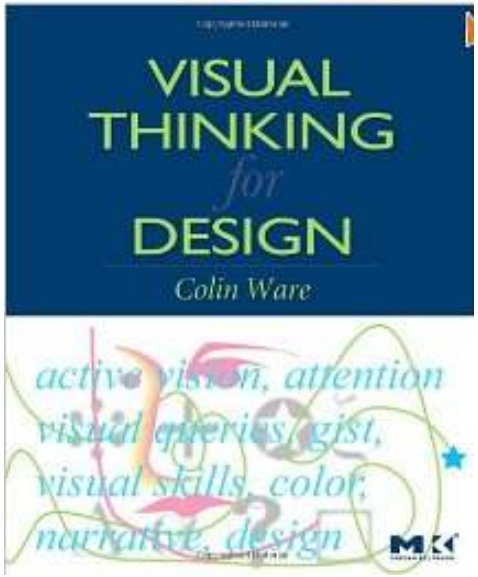
- DO NOT code information into color only

Information coded into color only



Literature

- Colin Ware: Visual Thinking for Design. Morgan Kaufman, 2008, ISBN: 978-0-12-370896-0



Thank for your attention