SI 388
Perception: Visual, Part 1

WEEK 4-1 (MON 25 SEP) – SEEING AND PERCEIVING

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Today's Agenda

- Odds & Ends
- Feedback from Wednesday's assignment
- Presentations by Teach-A-Chapter Groups
  - Group 1
  - Group 2
- Shorter lecture on Visual Perception

Odds & Ends

Couple of drops and a recent add

2 Teach-A-Chapter groups with 3 people

- Please someone in those groups email me

Feedback from In-class 2

Positives

- Creative, lot of good detail
- Concepts overall solid. Great to see concepts not listed on the prompt, esp. the readings & Anthropometrics
- Some groups used highlighting/underlining.
- A few used corresponding numbering in text+diagrams, or arrows.
- Some short, high-level explainers of app's purpose and features. Need this more.

Negatives

- Several too messy, hard to parse. Allot 10 min to copy neatly
- Instances in multi-page UIs where same concept should have been stated (again)
- One assignment was a full page of undifferentiated text. Not what I suggested last Monday. Hard to parse
- One assignment listed only 4 concepts. Not several.

Feedback from In-class 2: Concepts

- Expected to see **working memory limits, selective attention (**esp. more **effort** and **value**)
- Displaying content grouped by categories != **selective attention**
- **Unitization** != whole interface or screen is recognizable
- **Unitization** = visual target "recognized instantly" – e.g. logo or icon (comb. t/d & b/u processing)
- **User goals** in this context = perceptual apparatus filters out currently low-value elements
- Some explained using “grayed out" to indicate unimportant options in UI. Unconventional
  - “Grayed out” is a strong convention for inactive options

Student Presentations today

Teach A Chapter: Groups 1 & 2

Reminder: Courtesy to presenters – no audience chatter

Student Feedback on Presentations

You can give feedback via on the presentations via Google Forms

These links also are on Canvas/Announcements:

- Group 1 – Feedback survey https://goo.gl/forms/qesEaqhmQXxlrTCC2
- Group 2 – Feedback survey https://goo.gl/forms/5GJV84X4S3vMBzC63

Student feedback does not determine the grades/points. It provides additional info for consideration in the grading process.

Lecture today

VISUAL PERCEPTION PART 1

Learning Objectives

After today's lesson, students should be able to:

- ❑ Understand the very basic elements of human vision
- ❑ Identify key parts of the eye utilized for visual sensation
- ❑ Recognize pop-out effects
- ❑ Identify Gestalt Principles of Visual Grouping
- ❑ Understand and design for visual hierarchy

Visual Perception's Importance

- For sighted people, vision is most powerful sense
- Critical (in some form) for vast majority of interfaces
- HCI's emphasis primarily on perceptual processes
  - Far less on **biology** of sensation
- Today: Principles involved in visual perception

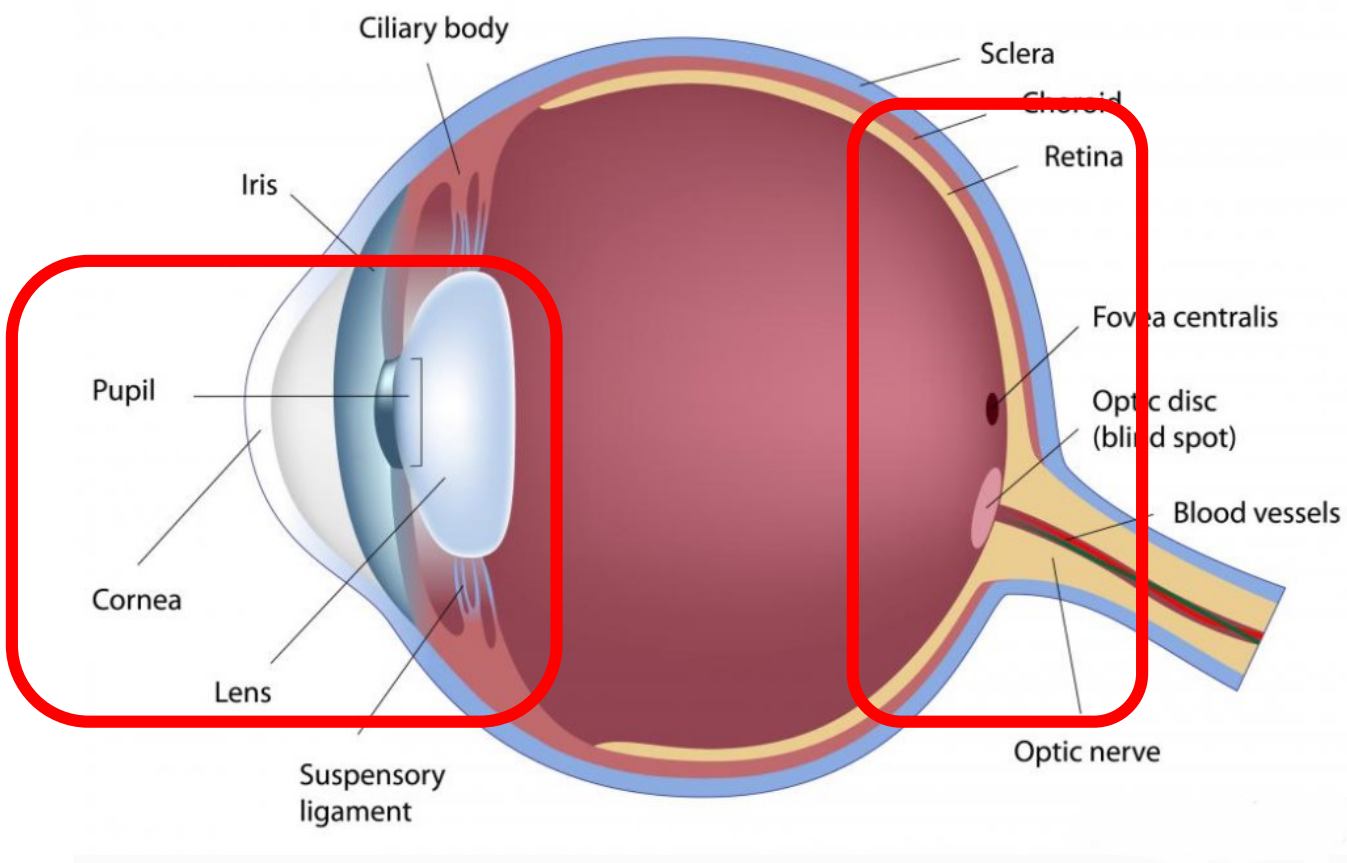
What Eyes Do

- Filter out gamma rays, X-rays, ultraviolet light (wavelengths <400 nanometers and >700 nanometers)
- Allows humans to focus on “window of visibile light”
- Minimum *sensory threshold*:
  - Candle flame seen from 30 miles away on clear night
  - JND’s: Just Noticeable Differences

Parts of the Eye: An Overview

Cornea and lens

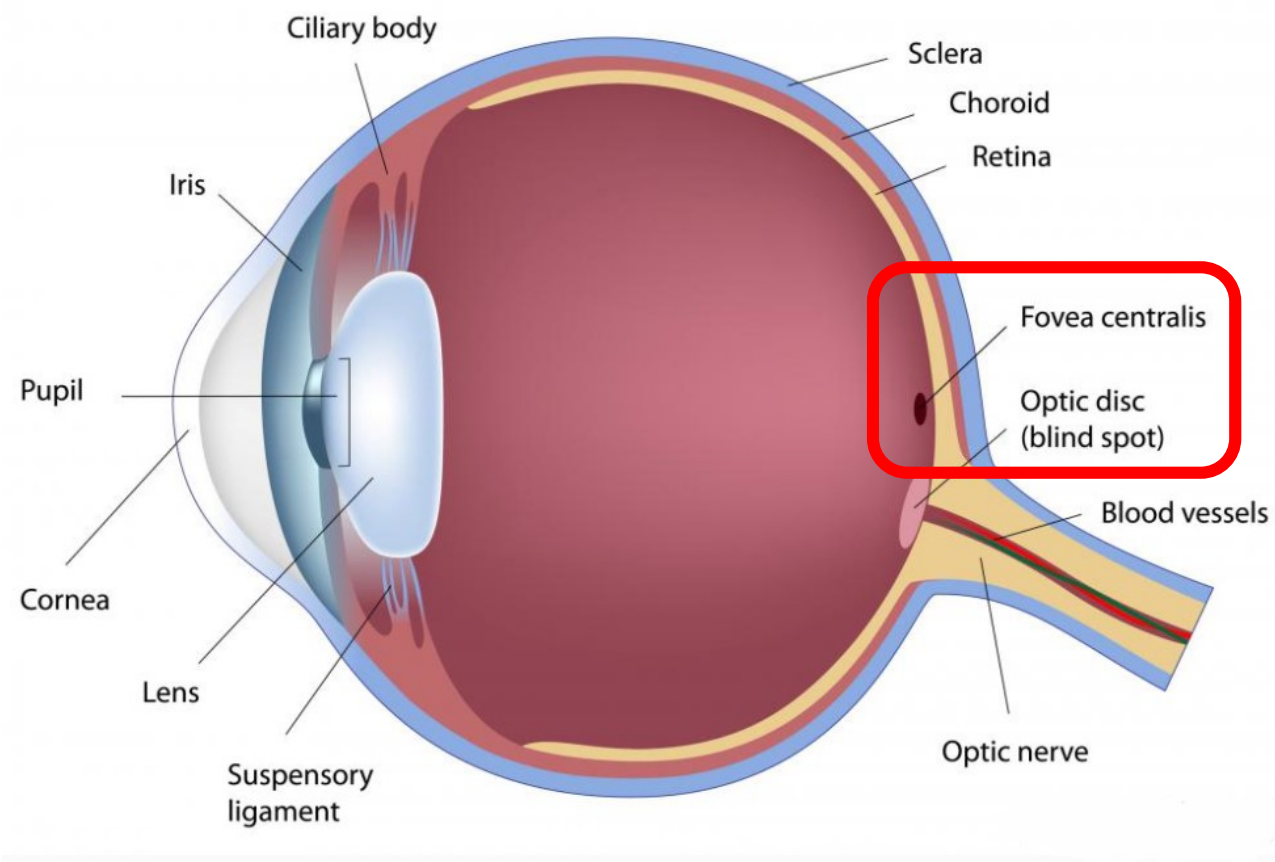
- Light passes through cornea and lens into the eye
- Muscles attached to lens contract to help it focus; this ability decreases with age



Parts of the Eye: An Overview

Fovea

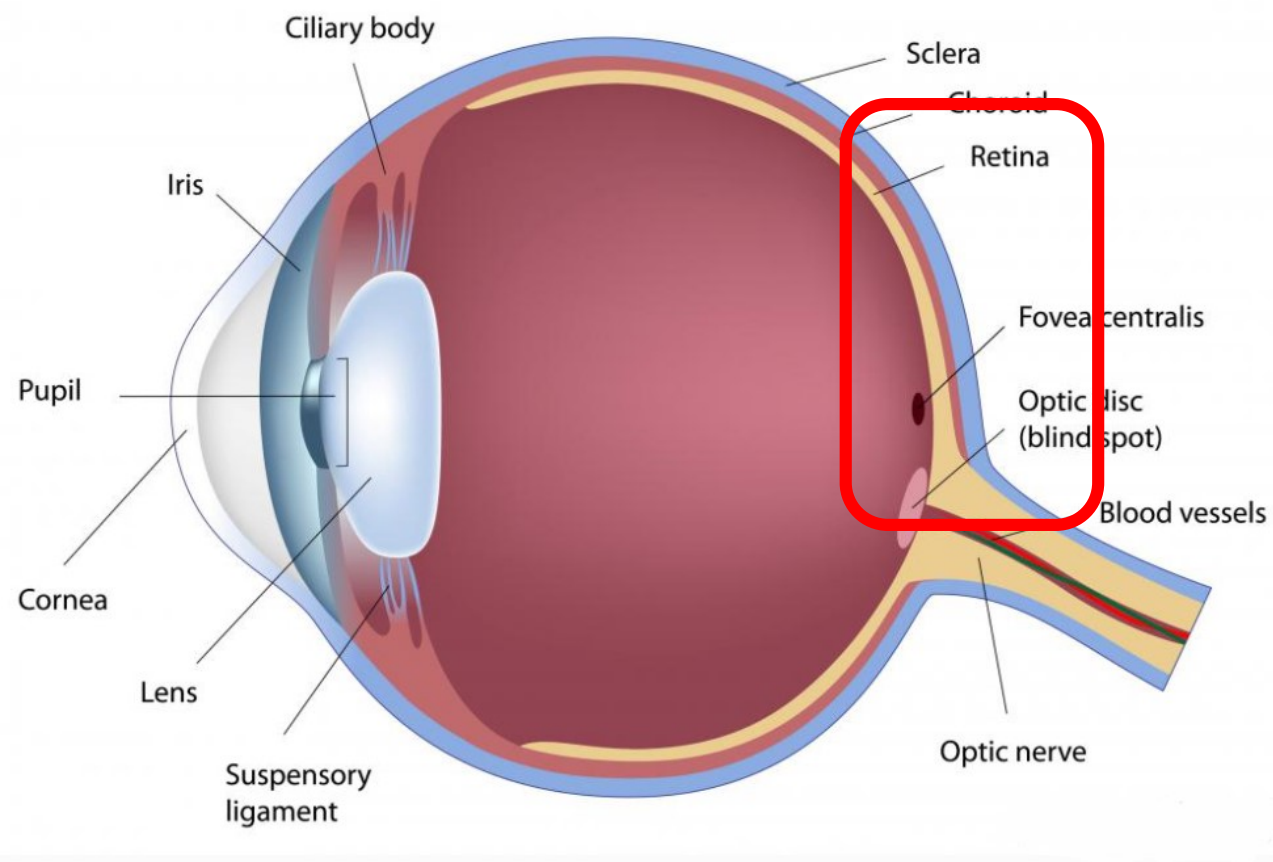
- Small area on retina, receives light
- "Foveal vision" is fine detail
- What's outside fovea is periphery, less detailed



Parts of the Eye: An Overview

Retina

- Has cells that respond to incoming light:
  - **Rods**
    - Outside fovea. 120 million.
    - Active in dark conditions, so enables black-and-white vision.
    - Generally poor resolution.
  - **Cones**
    - Within fovea. 6 million.
    - Responsible for color vision.
    - Higher resolution.
    - Function poorly in low light.



Cues for Perceiving Depth and Surfaces

Information on the retina is two-dimensional, like a photograph—and most screens.

What cues allow perception of depth?

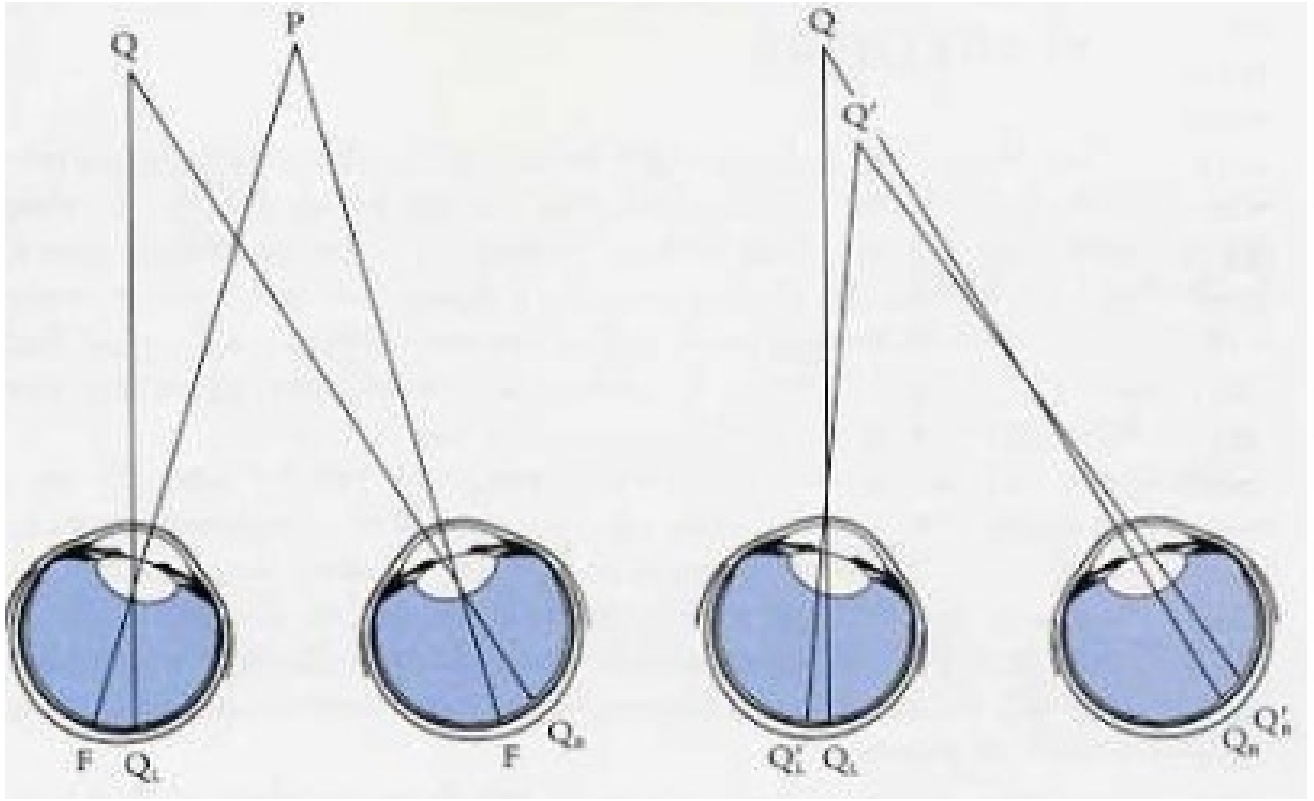
- ❑Texture
- ❑Stereopsis
- ❑Motion parallax
- ❑Size
- ❑Interposition
- ❑Contrast, clarity, brightness
- ❑Shadows
- ❑Texture

Perceiving Depth and Surfaces

Steropsis

Each eye senses slightly different visual information

The difference between them provides a depth cue

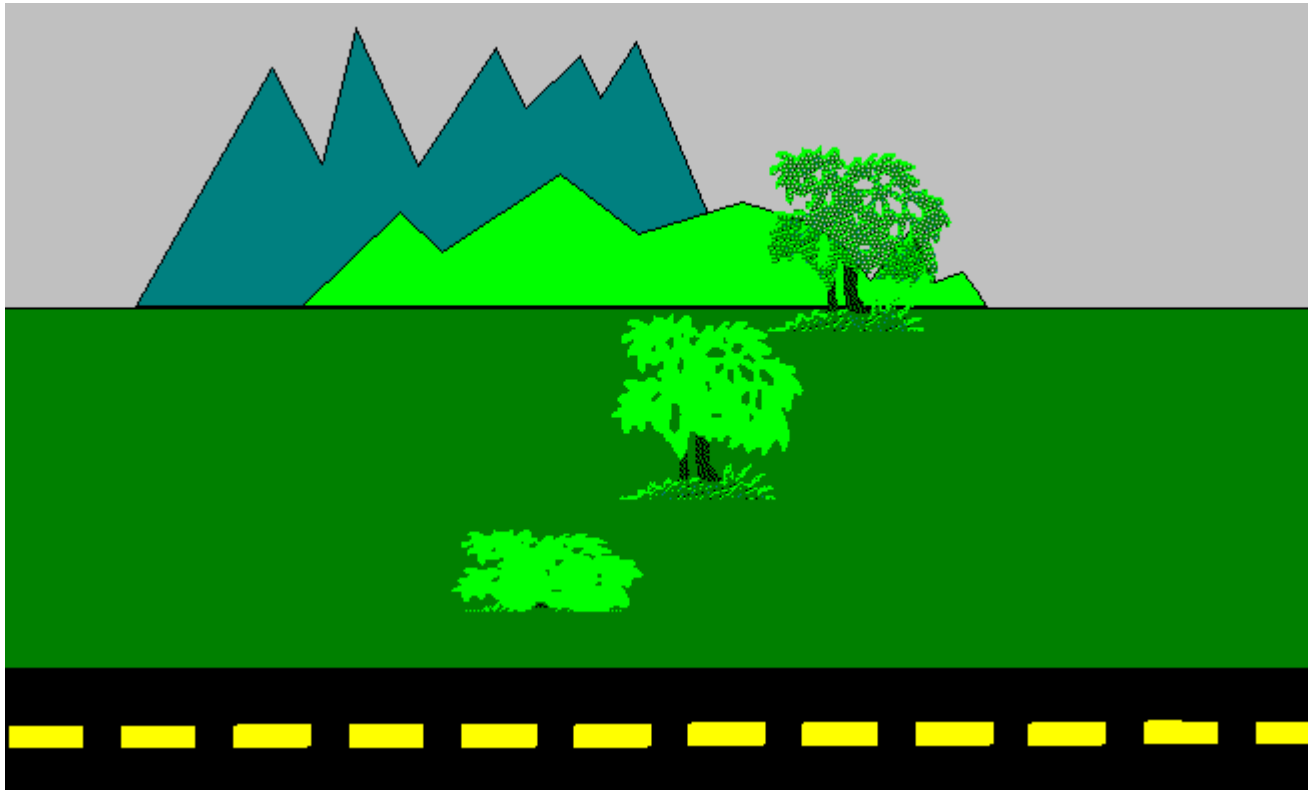


Hubel, D. http://hubel.med.harvard.edu/book/b36.htm

Perceiving Depth and Surfaces

Motion parallax

Distant elements move across the retina more slowly than closer objects



http://psychlab1.hanover.edu/Classes/Sensation/MotionParallax.html

Perceiving Depth and Surfaces

Size

Closer objects can appear larger than distant ones

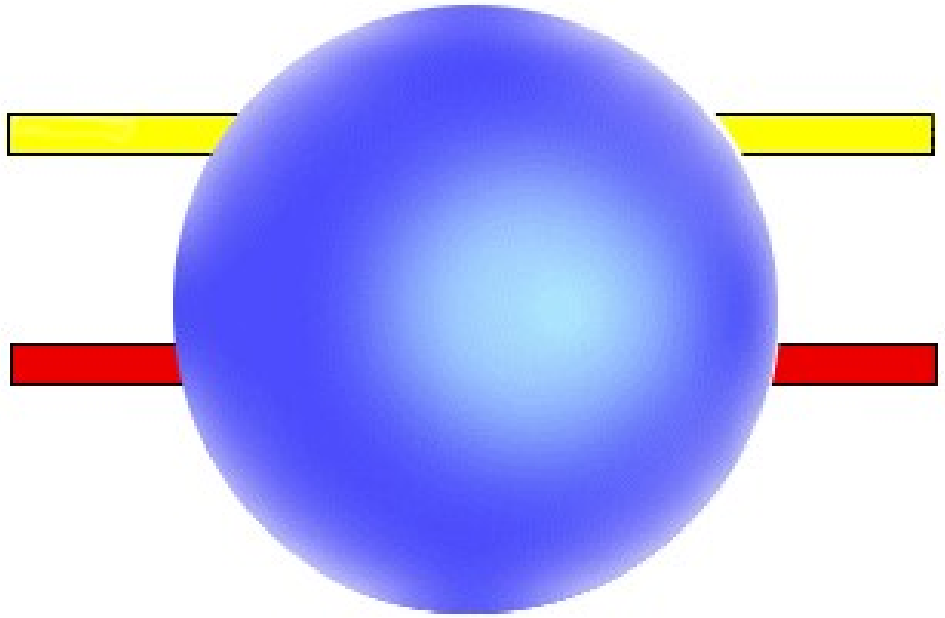
Obviously this young woman isn't as tall as the Eiffel Tower

Visualphotos.com

Perceiving Depth and Surfaces

Interposition

If one object partially seems to obscure a second object, the one doing the obscuring seems to be closer than the obscured one.



Dragon.uml.edu

Perceiving Depth and Surfaces

Contrast, clarity, brightness

In-focus objects look sharper and brighter.

They seem nearer than objects that are fuzzy (such as background)

Perceiving Depth and Surfaces

Shadows

Create an indication of relative positions

Perceiving Depth and Surfaces

Texture

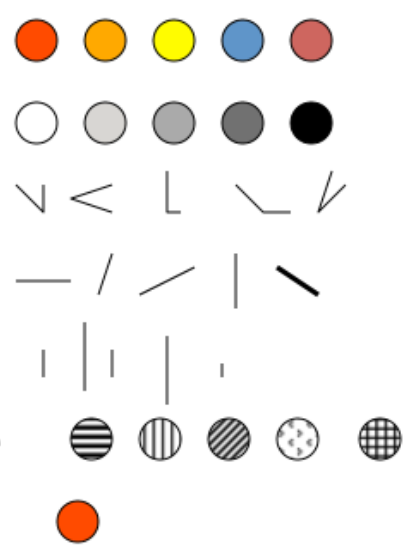
As apparent distance increases, surfaces appear smoother despite having same texture in reality

Pop-out Effects

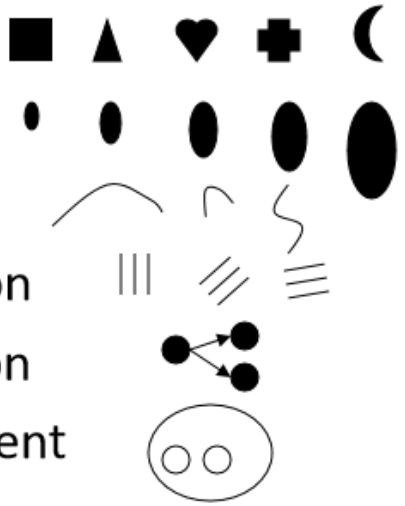
- Certain visual features are rapidly distinguished from each other unconsciously.
- "Feature Integration Theory" (Treisman & Gelade, 1980)
- Also Johnson, Ch. 5 pp. 62-63 next week

Creates "pop-out effect" AKA – preattentive processing

- Detected in parallel
  - Color
  - Value
  - Angle
  - Slope
  - Length
  - Texture
  - Motion



- Detected in serial
  - Shape
  - Area
  - Curvature
  - Orientation
  - Connection
  - Containment

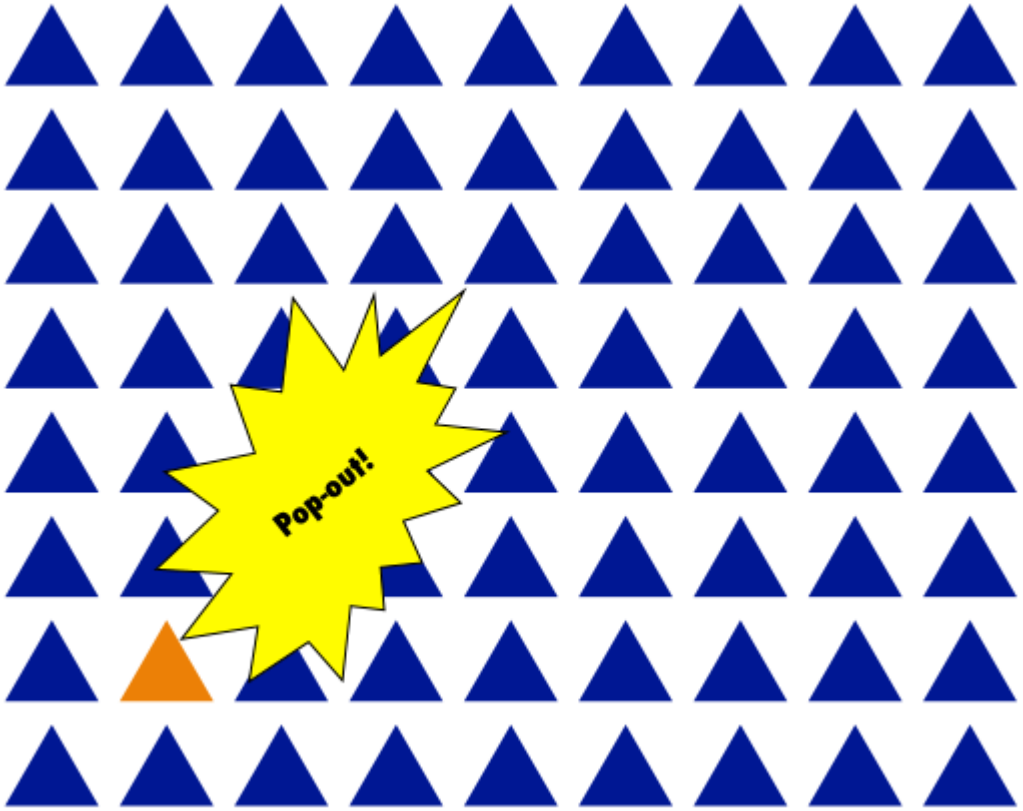


https://www.csc2.ncsu.edu/faculty/healey/PP/index.html

Pop-out Effects

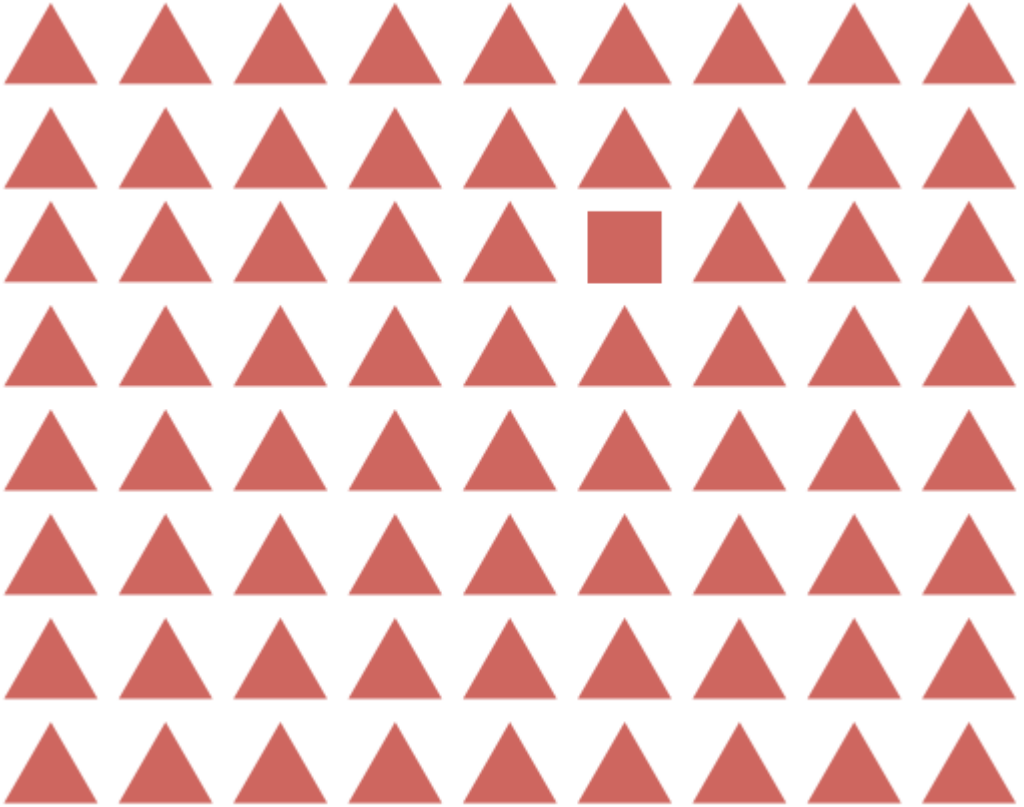
Find the ▲

Strong “pop-out effect”



Pop-out Effect

Find the 



Not a “pop-out effect”

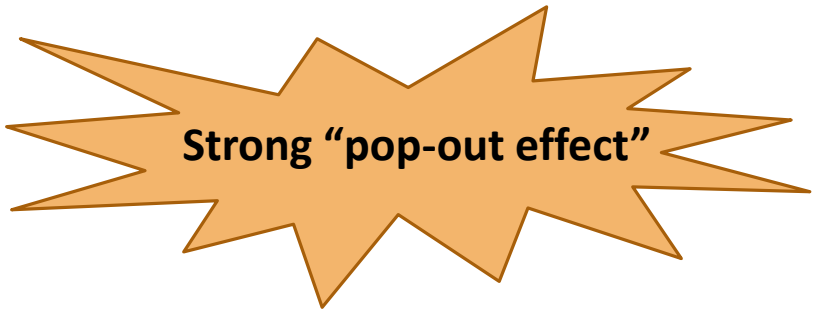
Pop-out Effect

Find the ▶

Mixed “pop-out effect”

Pop-out Effect

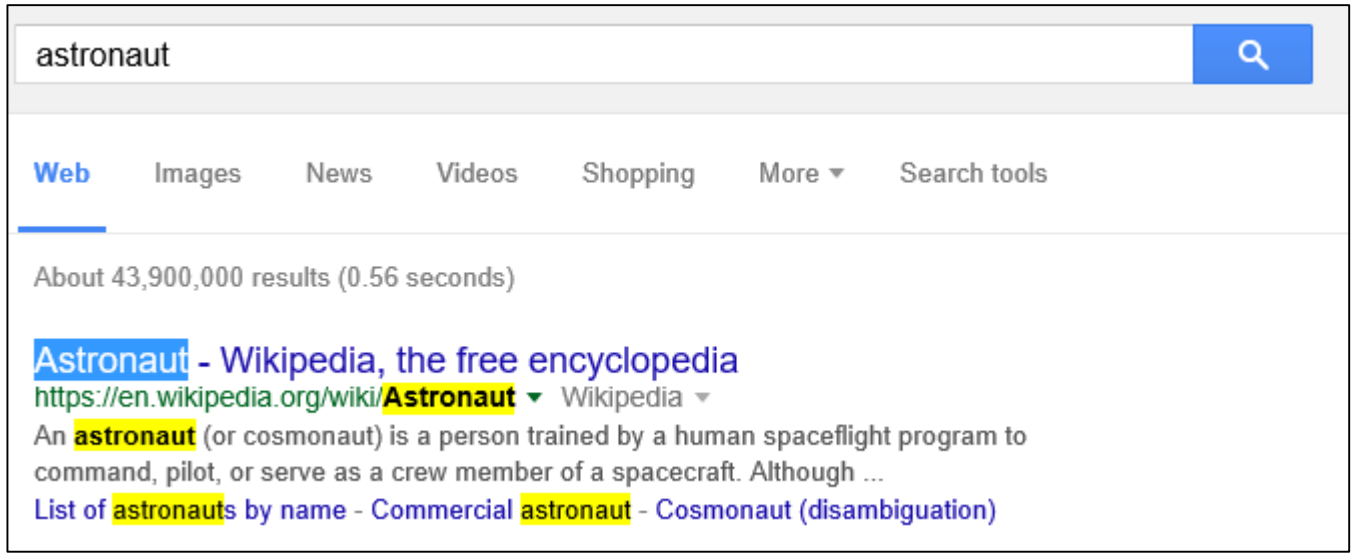
Find the moving triangle

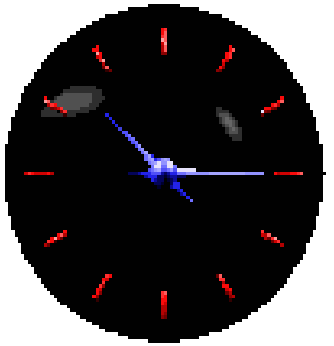


Pop-out Effect

Design implications

- Pop-out effects can be leveraged to help users find elements they are looking for rapidly.
- Dashboards can be made more effective.
- Color variations and motion are particularly effective.





Dashboards and Preattentive Processing

Dashboard

- Shows regularly updated information users must monitor frequently
- Typically presented in single-page view
- At-a-glance, essential info absorbed quickly, without user's concentration
- Metaphor for vehicle dashboards:
  - "Am I speeding? Do I have enough gas?
  - Are sales up?
  - Are more users' devices running out of date operating systems?
  - Are my interest earnings down from last year?

www.nngroup.com/articles/dashboards-preattentive/(next 4 slides)

Dashboards and Preattentive Processing

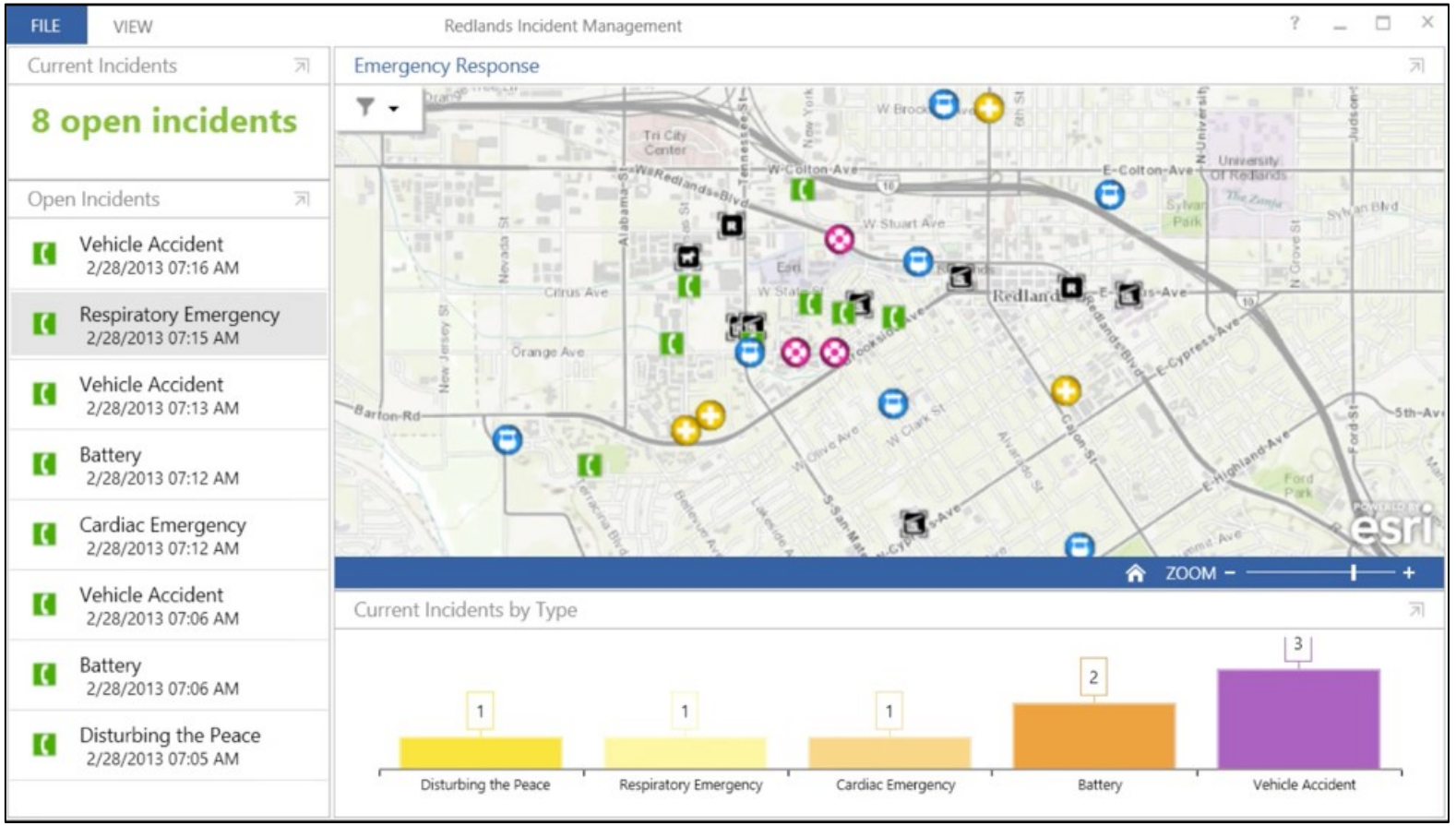
Type

Operational – provide timely data to users

Support rapid decision-making

Examples:

- Flight traffic
- Customer service calls
- Continuous, frequently updated
- Generally indicate deviations from norms
- User lock-outs



Dashboards and Preattentive Processing

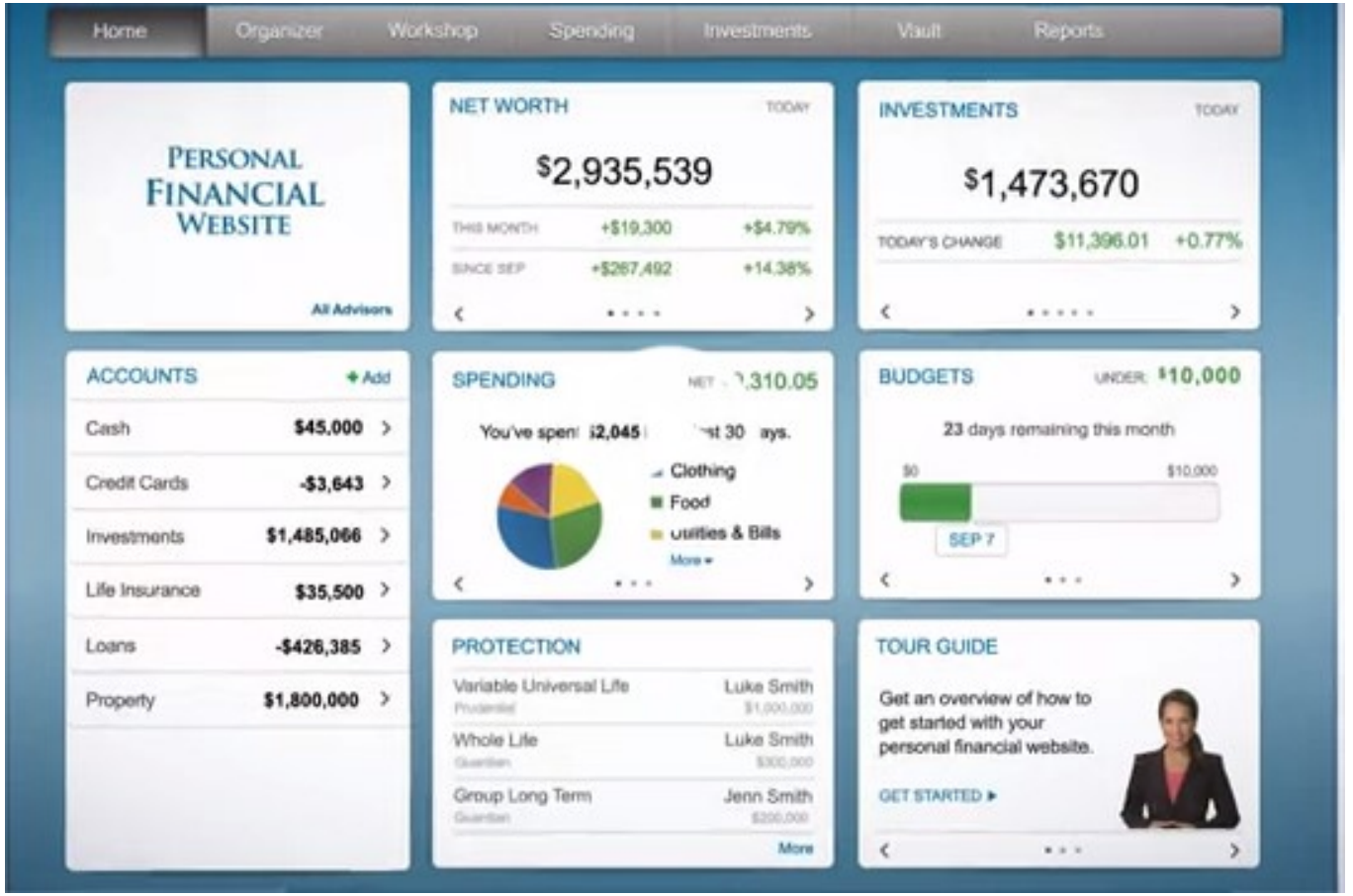
Type

Analytical – provide ability to gauge performance

Typically longer-term data, ratios, percentages, aggregations

Examples:

- Device insights
- Sales performance
- Customer support KPIs
- Quarterly gains/losses



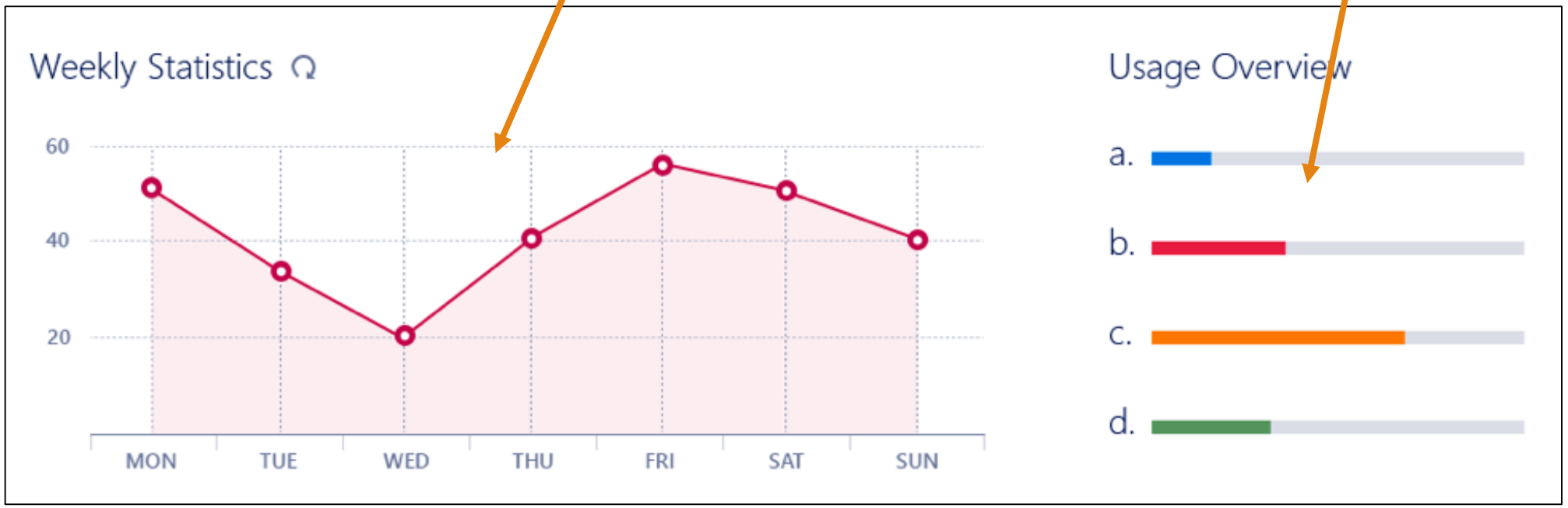
Examples of Preattentive Processing with Dashboard-style Graphs

Slope/angle characteristics = dips/rises

Length to highlight data relationships

Detected in parallel

- Color
- Value
- Angle
- Slope
- Length
- Texture
- Motion



How about this?

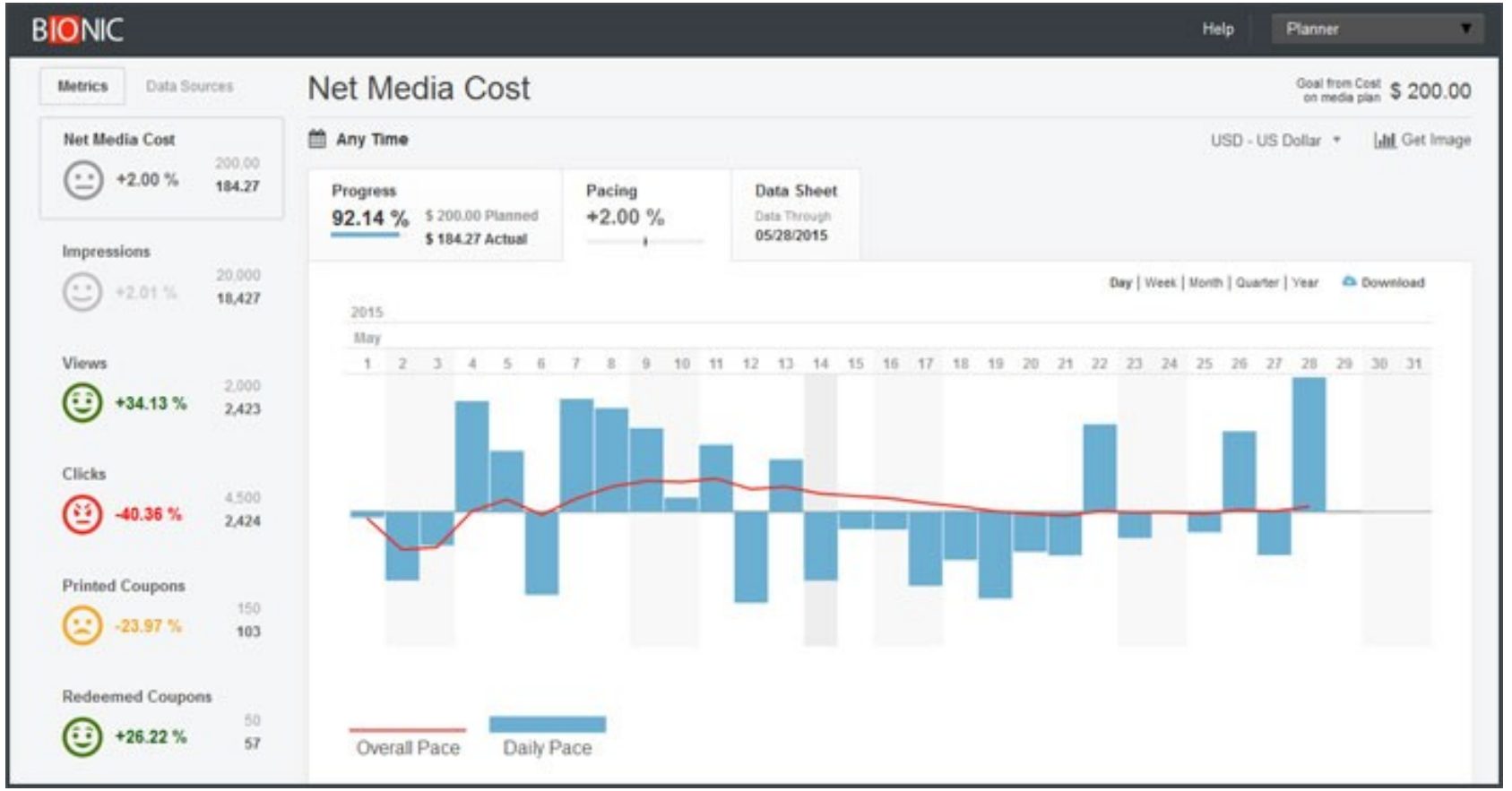
Detected in parallel

- Color
- Value
- Angle
- Slope
- Length
- Texture
- Motion

How about this?

Detected in parallel

- Color
- Value
- Angle
- Slope
- Length
- Texture
- Motion



How about this?

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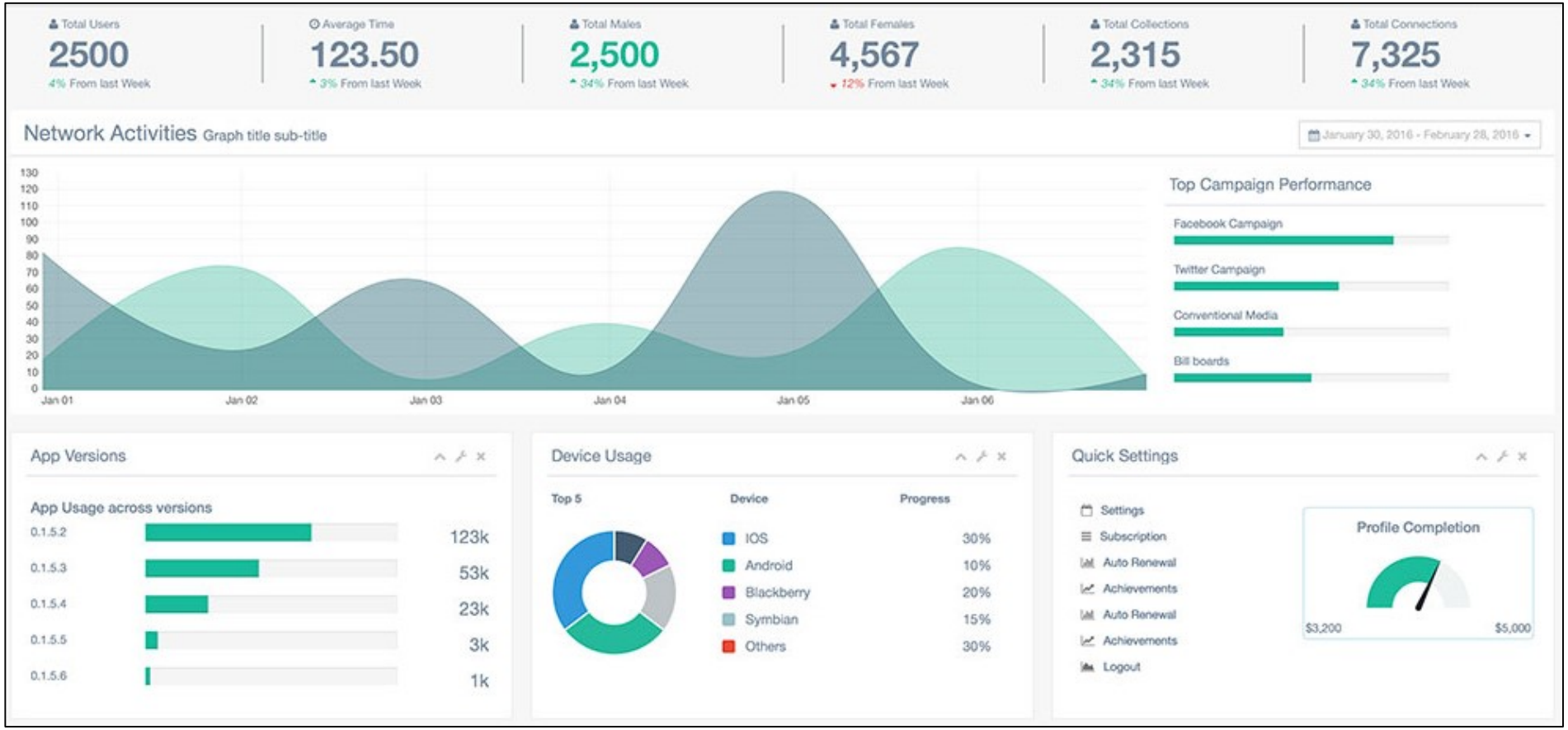
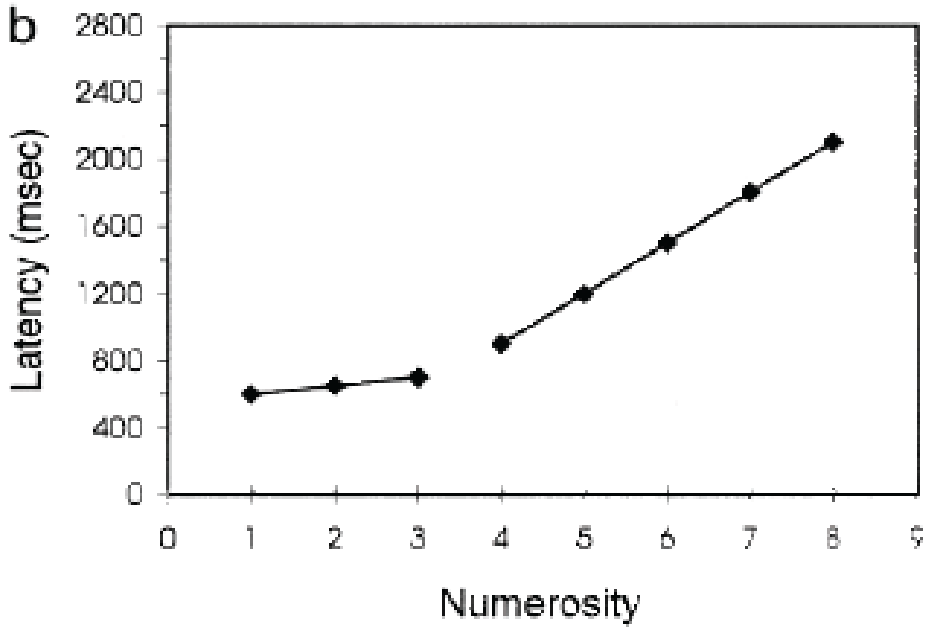


Subitizing

Perceiving number of objects

- Up to 3 objects, they're recognized rapidly (50 ms difference per object)
- 4+ recognition time increases to 250-300 ms per object



Importance for design: 1-3 objects are significantly faster to perceive and count than 4+.

Gestalt Principles of Visual Grouping

A set of principles in psychology proposed by Gestalt psychologists to account for the observation that humans naturally perceive objects as organized patterns and objects.

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

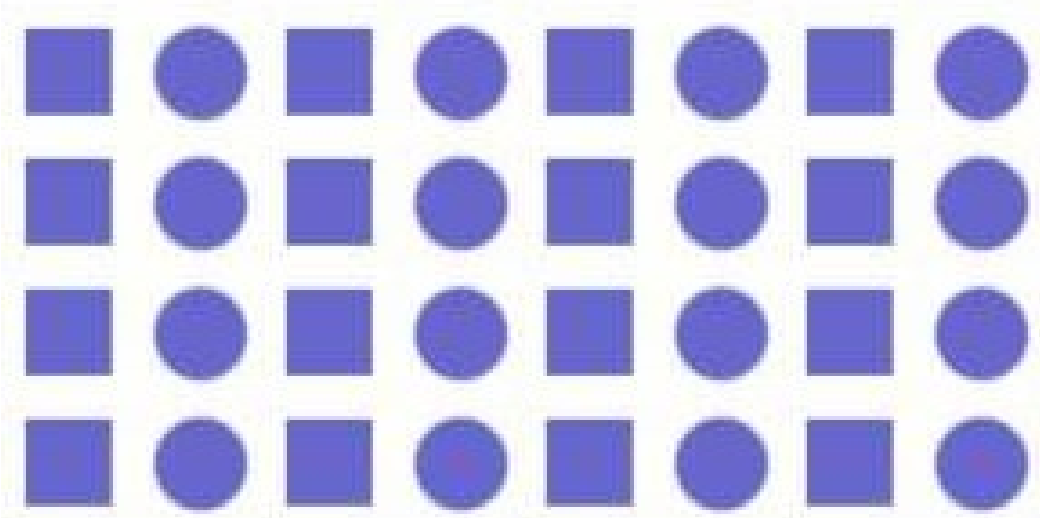
- Useful for describing visual pattern identification
- Not highly predictive, but …
- Often helpful in diagnosing usability problems

Gestalt Principles: Proximity

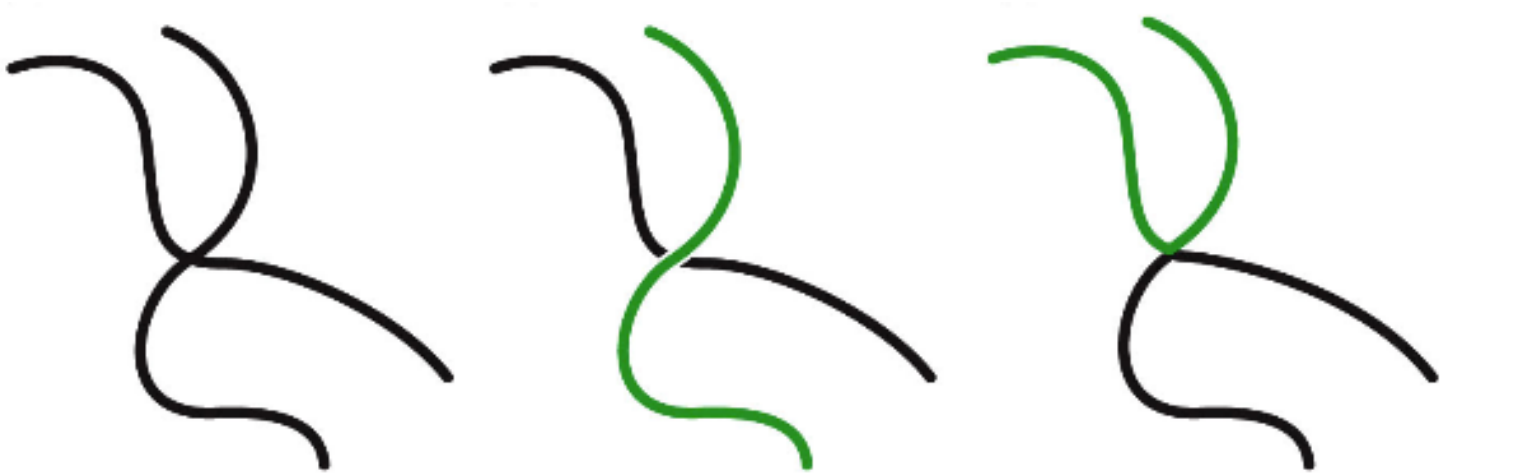
What's located together is perceived as related

Gestalt Principles: Similarity

Most people see columns, not rows



Gestalt Principles: Continuity



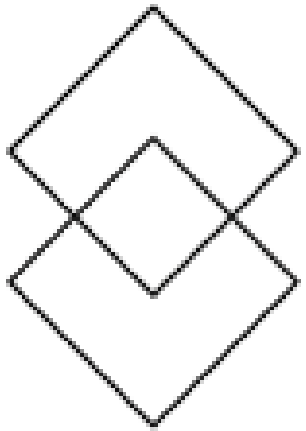
This looks like this… not like this

Gestalt Principles: Closure

What is this?

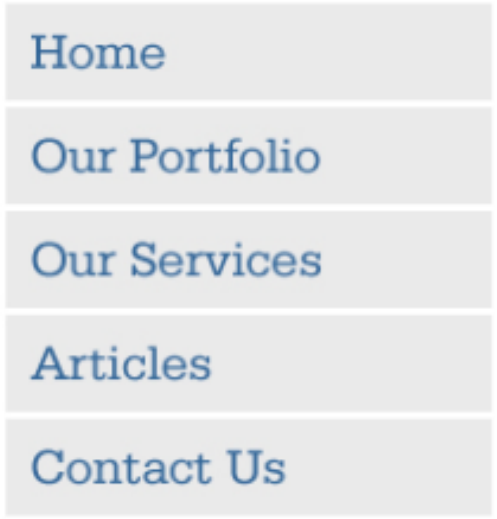
Gestalt Principles: Symmetry

Complex figures are parsed as symmetrical shapes, perceived as **simpler**

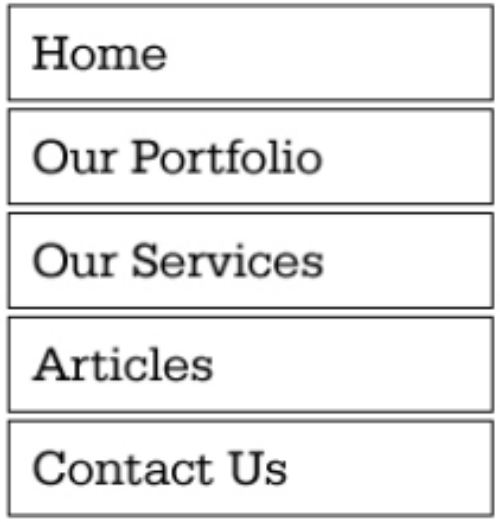


Gestalt Principles: Figure-ground

Whatever is perceived as most prominent is considered most important and unified as foreground “figure”. Everything else is background.



Text perceived as figure resting on inconsequential background.

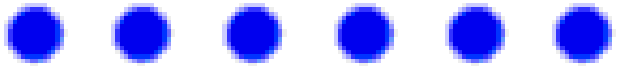


Text competes with black lines, as both are perceived as figure resting on white background.

http://andyrutledge.com/gestalt-principles-1-figure-ground-relationship.php

Gestalt Principles: Common fate

Objects with common motion are perceived as related



Gestalt Principles

Implications for design

- Perceptions of relatedness and unrelatedness are critical to orientation, navigation, information architecture
- **Unintended** semantic relationships due to visual groupings = confusing
  - They imply semantic relationships that don't exist. Misleading.
- Johnson's suggestion: Evaluate any design with Gestalt Principles as a precaution

Visual Hierarchy

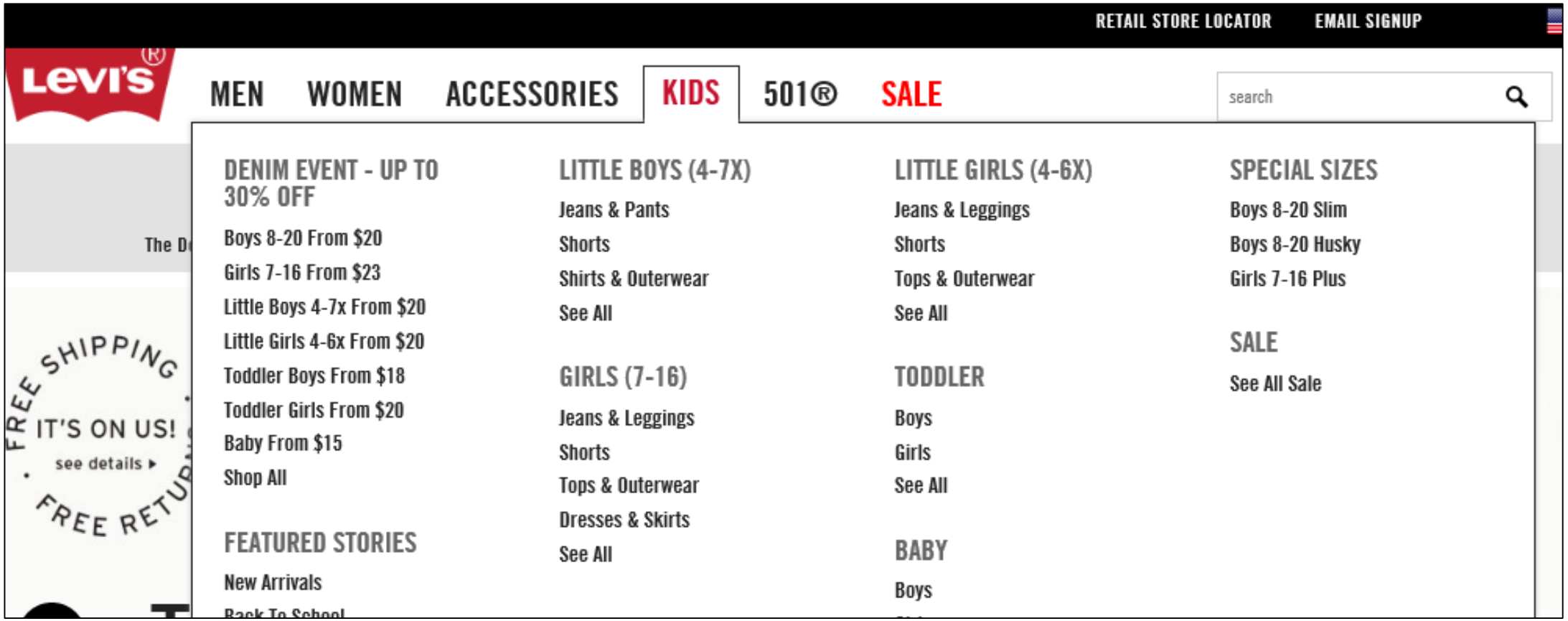
Presents information in semantic "layers"

- Design information as easily "digested" sections
  - Reduces cognitive load
  - Typically groups semantically related content
- Visually format labels to have appropriate prominence
  - Users can evaluate quickly by processing visual layers of info
  - Facilitates visual scanning behavior
  - Read only the sections of interest, based on hierarchy

Visual Hierarchy

Example

Visual Hierarchy



Visual Perception: Summary, part 1

- Theories of vision provide insights into how users use displays
- Eyes are great but have limitations
- The visual system uses many cues to create perception of 3D
- Keep Gestalt Principles in mind with design elements
- Pop-out effects help users quickly find elements
- Design with visual hierarchies to save users time and effort