

Information Visualization – DH2321

Lecture 8-9: data tables, visual mappings, and visual representations

Mario Romero
2014/02/25



Methods and Techniques

Google Maps API
Data APIs – SL for commute times and Booli for ads
Time algorithm

Google maps

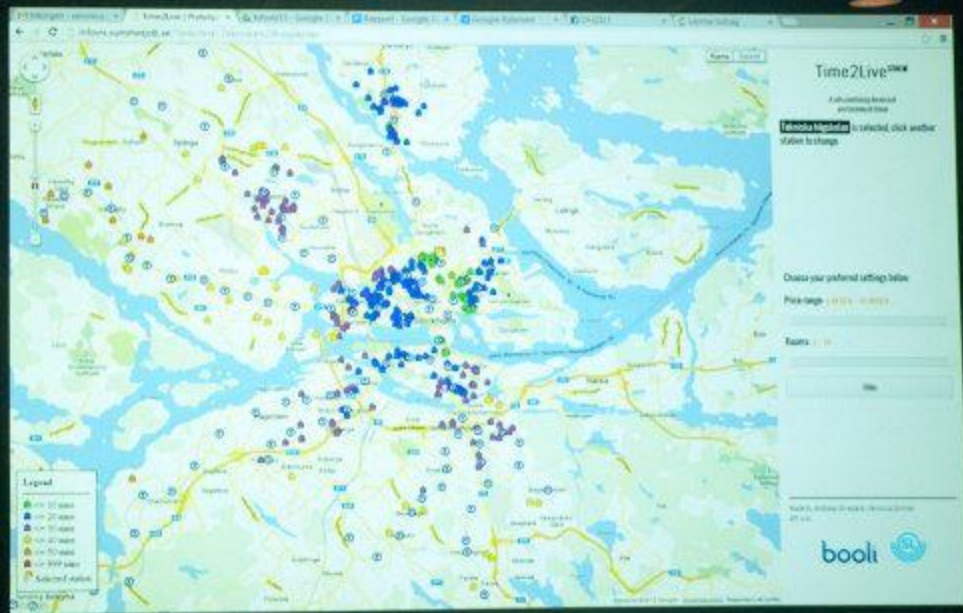
booli



March 4, 2013

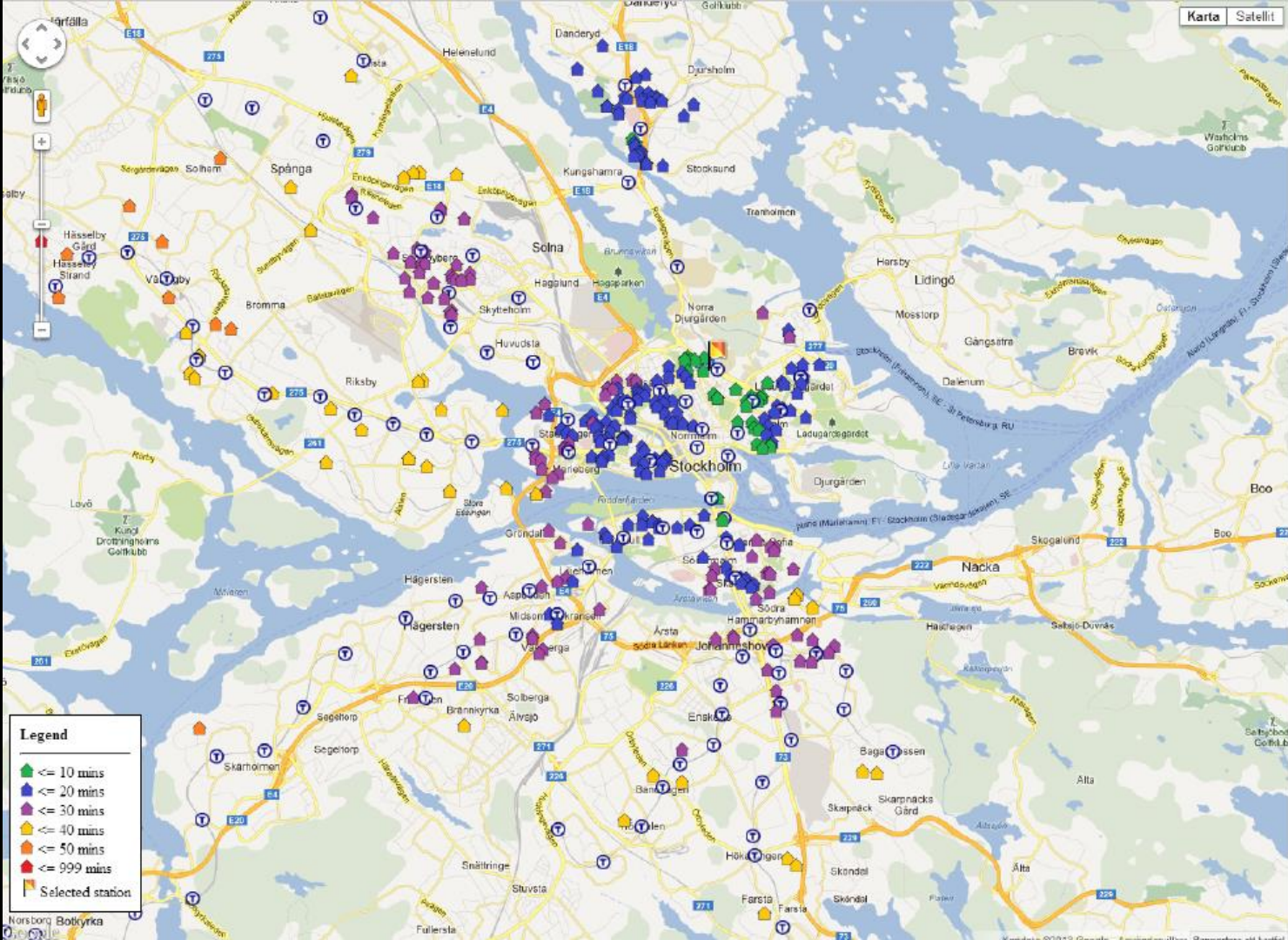
TimeToLive

TimeToLive



March 4, 2013

TimeToLive



Karta Satellit

Time2Live^{STHLM}

A site combining home ads and commute times

Tekniska högskolan is selected, click another station to change

Choose your preferred settings below

Price range: 0 MSEK - 10 MSEK

Rooms: 0 - 10

Filter

Made by Andreas Ulvessand, Veronica Ginman
API's by



Prelude Videos

- CITY SYMPHONIES
 - MARK MCKEAGUE
 - <http://markmckeague.com/work/city-symphonies/>
- **“unnamed soundsculpture”**
 - Project by Daniel Franke & Cedric Kiefer
 - <http://wearechopchop.com/%E2%80%9Cunnamed-soundsculpture%E2%80%9D/>
- Trend and Variation
 - <http://www.youtube.com/watch?v=e0vj-0imOLw>

Outline

1. Discuss Visualizing the [Stock Market](#).
2. Explore [Map of the Market](#).
3. Introduce Data Tables and Data Models
4. **Break.**
5. Update Group 1 and 2.
6. Discuss Ware, C. (2012). Information visualization: perception for design. Elsevier. [Chapter 1](#).
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14. Working groups and one-on-one feedback

Visualizing the Stock Market

Martin Wattenberg

Dow Jones & Co. (SmartMoney Magazine)

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ABSTRACT

We describe a new 2-dimensional visualization algorithm capable of presenting detailed information on hundreds of items while emphasizing overall patterns in the data. This display method, which builds on Shneiderman's treemap technique, makes use of both hierarchy and similarity information. We have implemented this display in the *SmartMoney Map of the Market*, a web page that reports current data on over 500 publicly traded companies.

Keywords

Visualization, interactive graphics, treemap, investing

INTRODUCTION

A key goal of financial journalism is to answer the question, "How is the market doing today?" What makes this question tough is that there are so many possible answers: on a given day, the market as a whole may be up, but technology stocks could be down--but Apple Computer's stock might be up. Summing up the market with one or two index values hides a lot of the action. But if you give all the details, as in the stock price pages of a newspaper, the result is hard to read and there is no way to spot overall trends. This paper describes a new interactive graphical display, related to Shneiderman's treemap diagram [3], that allows a user to track the performance of hundreds of stocks at once without losing sight of the bigger picture.

PROBLEM

Using a treemap to provide a snapshot of stock market

First, the "slice-and-dice" layout method often creates a partition containing rectangles with extremely large aspect ratios. Figure 1, a slice-and-dice layout with two levels of hierarchy, clearly shows this effect.

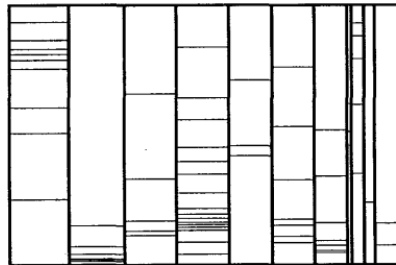


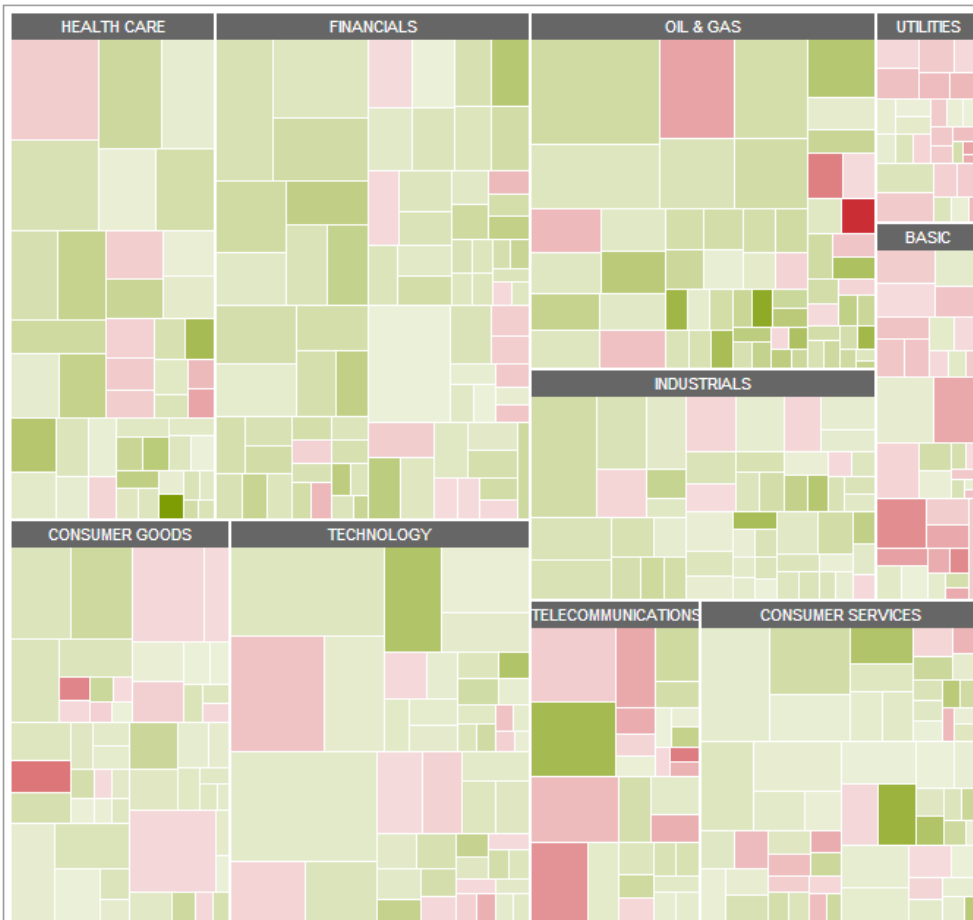
Figure 1: Typical slice-and-dice layout



Figure 2: New layout scheme, described below

All

🔍 Locate Company



DJIA	+0.64%	Nasdaq	+0.69%	S&P 500	+0.62%
103.84	↑	29.56	↑	11.36	↑
16207.14		4292.97		1847.61	

MarketWatch News Viewer

2/24/14 **EBay rises, fires back after Icahn attack** [MARKETWATCH](#)

EBAY INTU MSFT CMCSA

2/24/14 **U.S. stocks rally as S&P 500 hits intraday record** [MARKETWATCH](#)

UNH CMCSA

2/24/14 **Icahn takes aim at eBay corporate governance** [MARKETWATCH](#)

EBAY

2/24/14 **Natural gas rises 1%, oil gains; SolarCity to report** [MARKETWATCH](#)

XOM CVX

2/24/14 **Men's Wearhouse, Jos. A. Bank, Sina gain** [MARKETWATCH](#)

CMCSA

2/24/14 **Nokia unveils Nokia X its first Android phone** [MARKETWATCH](#)

NOK GOOG MSFT

2/24/14 **Pfizer pneumonia vaccine study meets objectives** [MARKETWATCH](#)

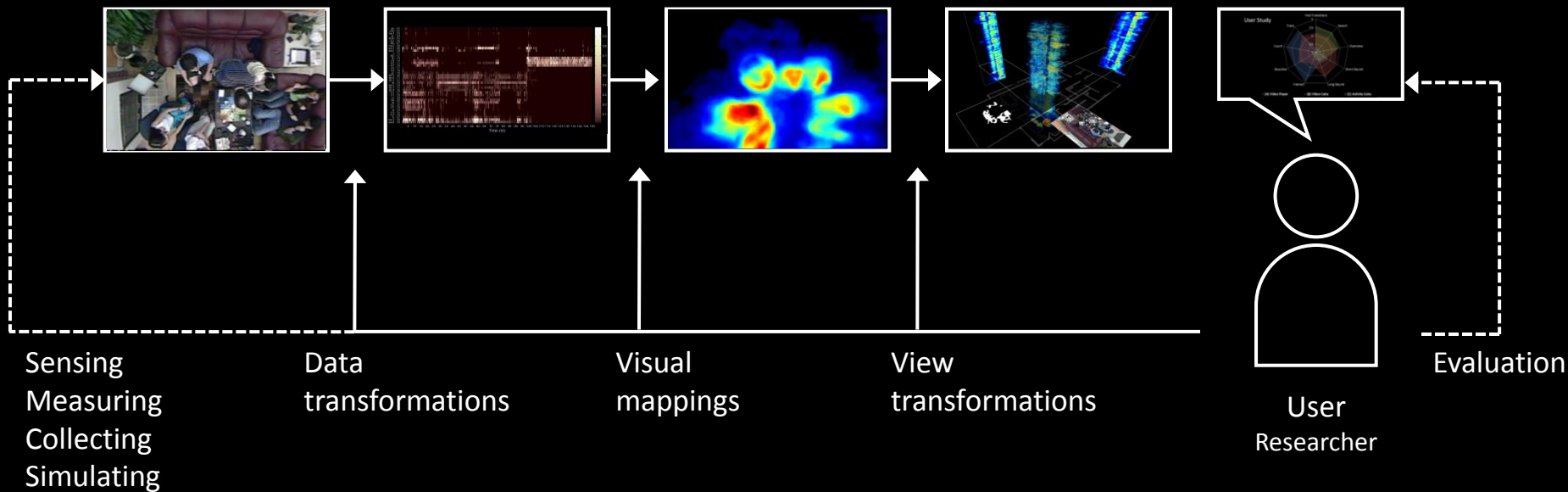
PFE

2/24/14 **WhatsApp aims to add voice service**

Information Visualization Pipeline

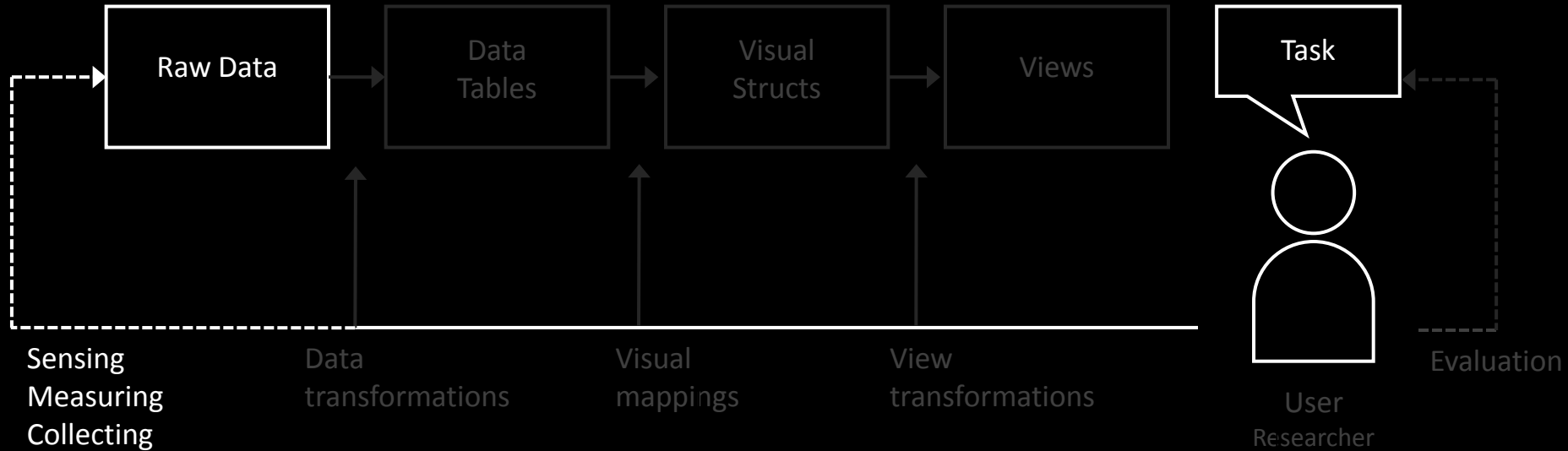
expanded from **Readings in Information Visualization: Using Vision to Think**

By Stuart K. Card, Jock D. Mackinlay, Ben Shneiderman, 1999

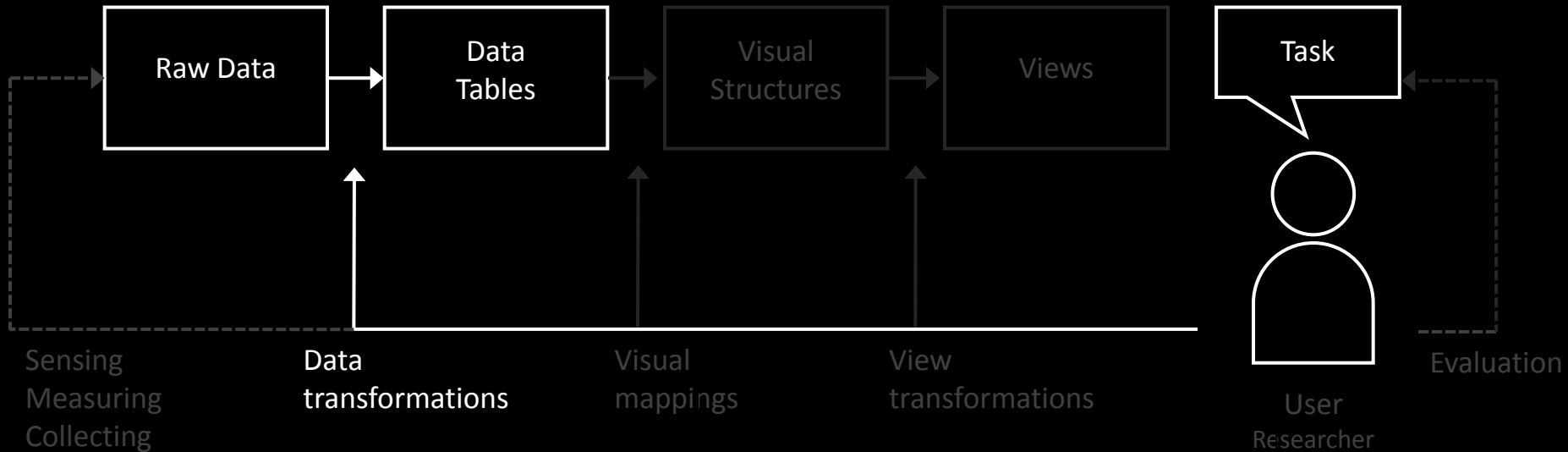


Quick Demo

Data



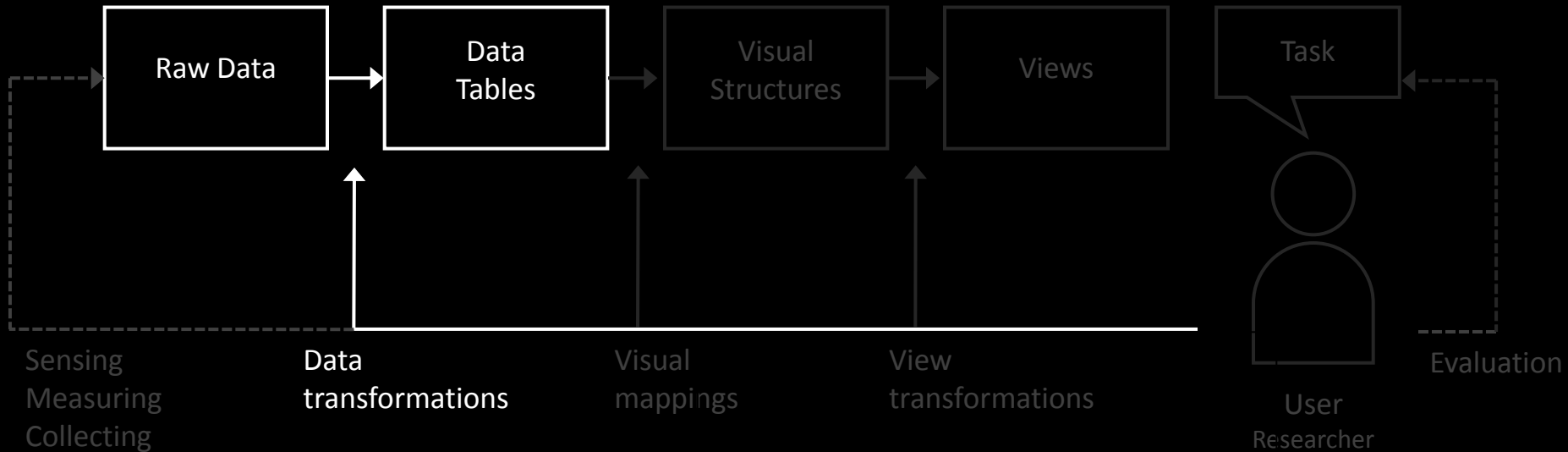
Data Tables and Data Transformations



Data Models

- Objects Items of interest
 - (students, courses, terms, ...)
- Attributes Characteristics or properties of data
 - (name, age, GPA, number, date, ...)
- Relations How two or more objects relate
 - (student takes course, course during term, ...)

Data Tables and Data Transformations



Data Tables

- Raw data → data model (table)
- Individual items are called *cases* (or points)
- Cases have variables (attributes or dimensions)

Data Table Format

	Case ₁	Case ₂	Case ₃	...
Variable ₁	Value ₁₁	Value ₂₁	Value ₃₁	
Variable ₂	Value ₁₂	Value ₂₂	Value ₃₂	
Variable ₃	Value ₁₃	Value ₂₃	Value ₃₃	
...				...

$$f(\text{Case}_1) = \langle \text{Value}_{11}, \text{Value}_{12}, \dots \rangle$$

Example

	Joakim	Veronica	Ulf	...
ID	8802014452	9011133322	9112113331	
Age	24	22	21	
Hair	Brown	Blond	Black	
Height	182	168	176	
...				...



Standings

Rnk	Team	MP	W	D	L	GF	GA	+/-	Pts	
1	Malmö FF	30	19	6	5	56	30	26	63	=
2	AIK	30	17	7	6	54	32	22	58	=
3	IFK Göteborg	30	16	6	8	49	31	18	54	=
4	Kalmar FF	30	14	10	6	35	26	9	52	▲
5	Helsingborgs IF	30	14	7	9	61	41	20	49	▼
6	IF Elfsborg	30	12	10	8	49	34	15	46	=
7	Djurgårdens IF	30	12	8	10	38	44	-6	44	=
8	Åtvidabergs FF	30	11	7	12	37	37	0	40	▲
9	IFK Norrköping	30	11	6	13	45	47	-2	39	▼
10	BK Häcken	30	10	7	13	37	41	-4	37	▲
11	Mjällby AIF	30	10	6	14	46	47	-1	36	▼
12	Gefle IF	30	7	13	10	34	42	-8	34	=
13	IF Brommapojkarna	30	8	8	14	33	54	-21	32	=
14	Halmstads BK	30	7	10	13	32	46	-14	31	=
15	Östers IF	30	6	10	14	27	43	-16	28	=
16	Syrianska FC	30	3	5	22	26	64	-38	14	=



0



0



0



Share

UEFA Champions League Preliminary

UEFA Europa League

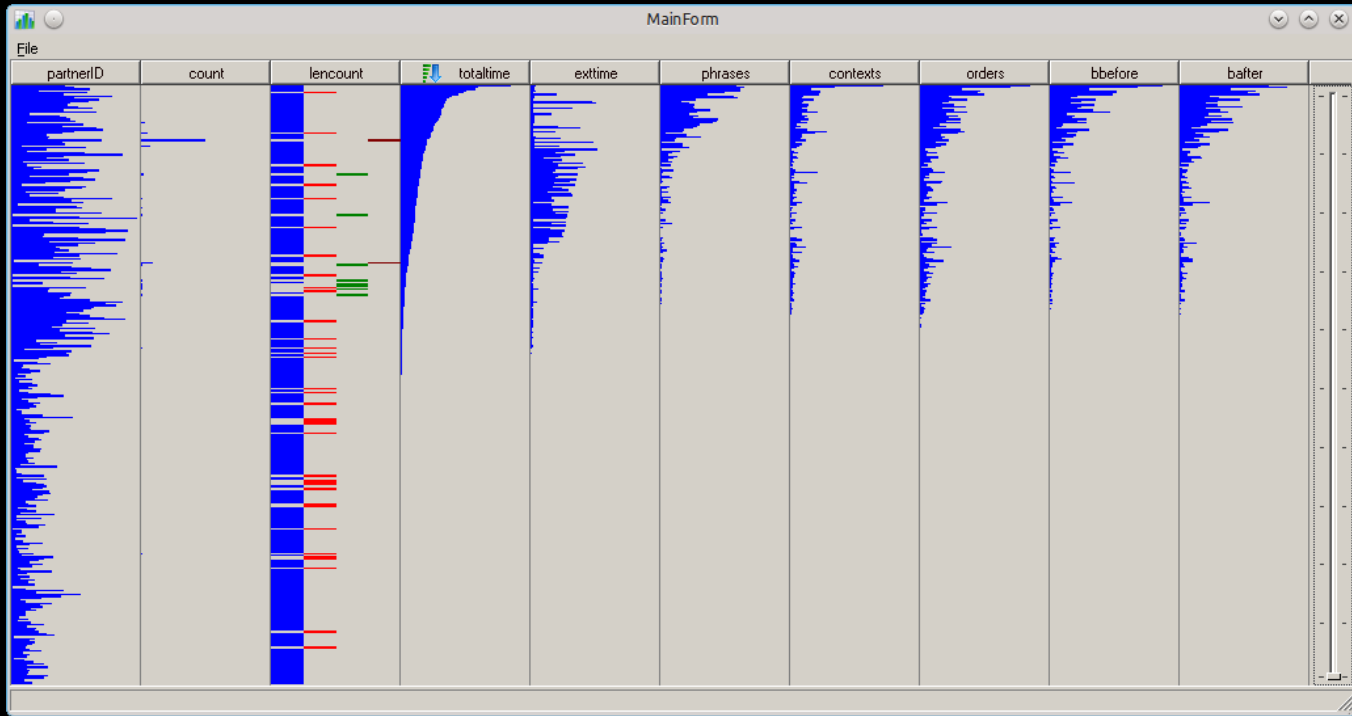
UEFA Europa League depending on domestic cup

Relegation play-off

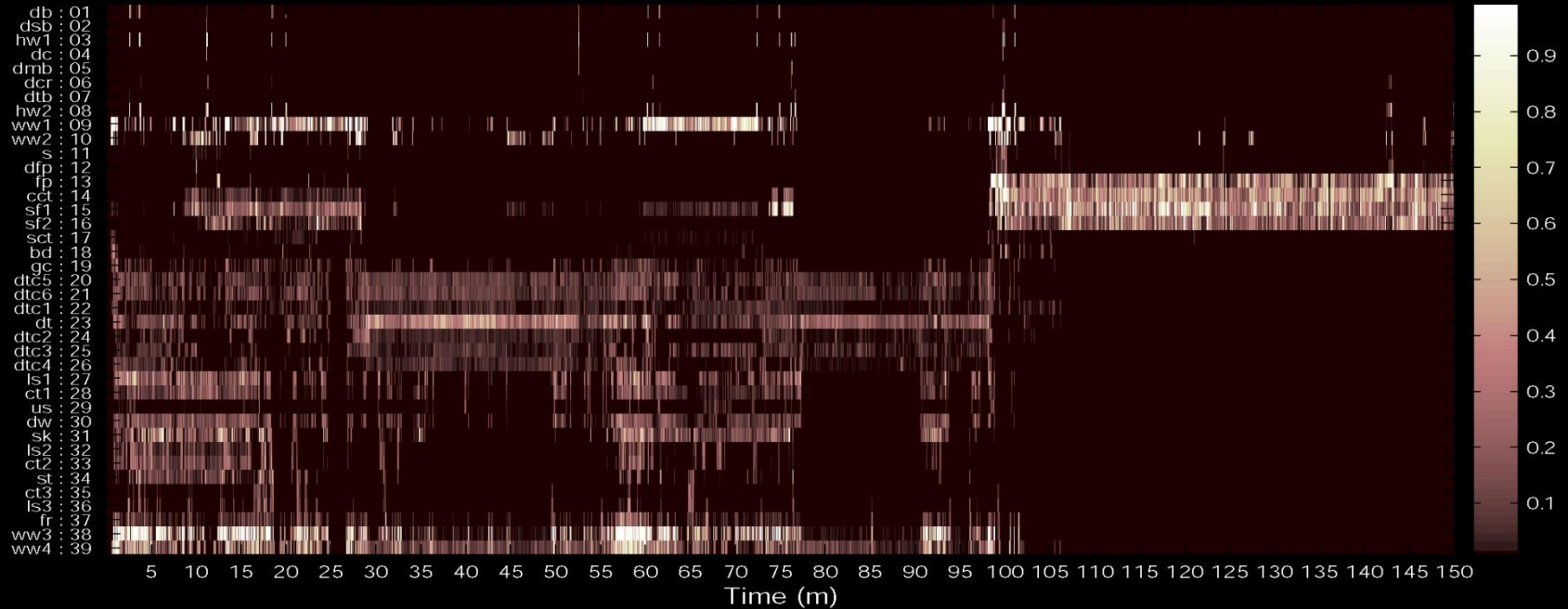
Relegation

Visualizing Tables Directly

table visualizer

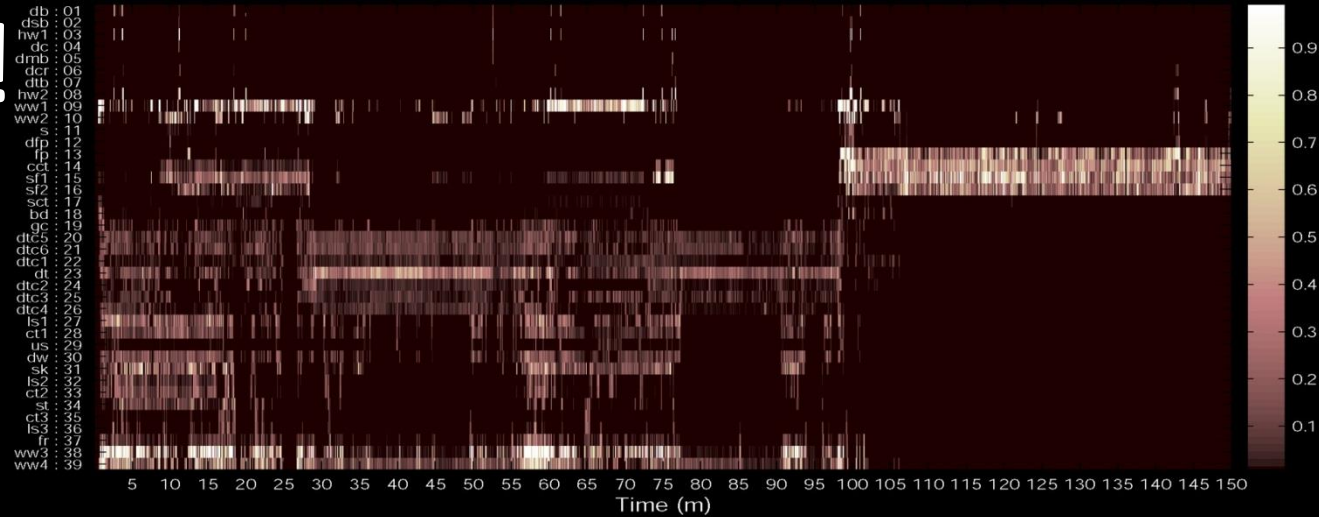


Aggregate Motion over Space



Formalize it!

- Data source
 - Overhead video
- Raw Data type
 - array
- Data transformations
 - Aggregate motion (s,t)
- Visual Representation
 - Cell Brightness (p,t)

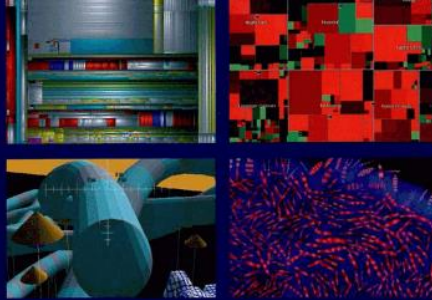


Data Transformations

- Cleaning
 - Remove
 - Modify
 - Interpolate missing values
- Adjust values
 - Use inverse
 - Map nominal to ordinal to numeric
 - Normalize ($0 \leq x \leq 1$)
- Aggregate
- Scale
- Classify
- Signal Processing
- Pattern Recognition
- Machine Learning
- Statistic Analysis

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SECOND EDITION

INFORMATION VISUALIZATION

PERCEPTION FOR DESIGN

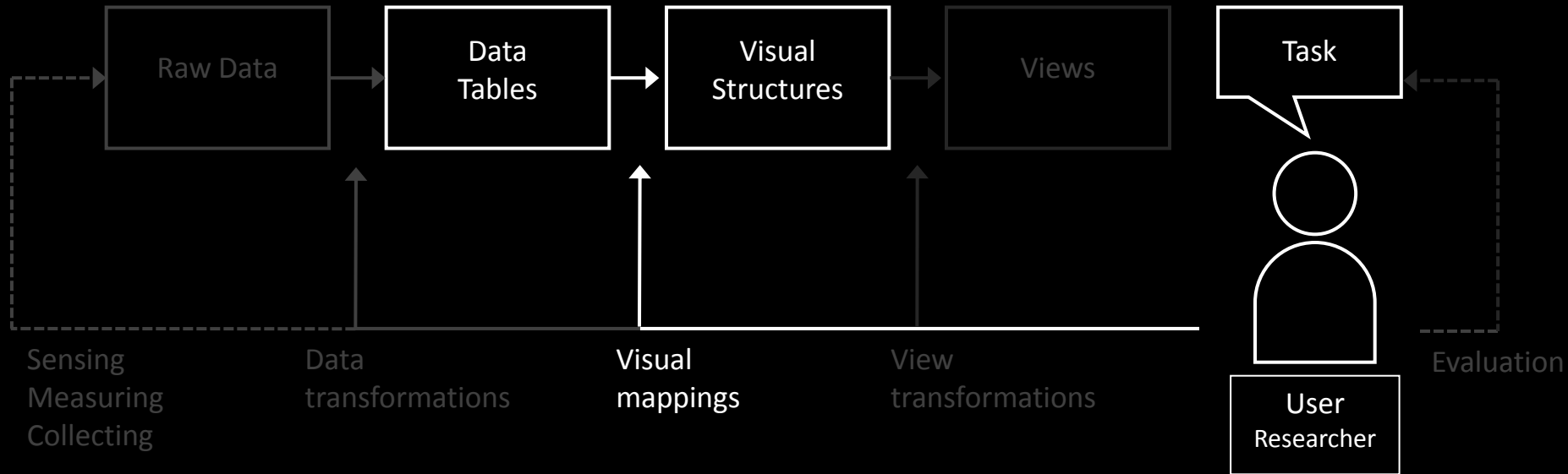


COLIN WARE

Groups of three

- Discuss 15 minutes
- Three most important points from Ware
- Create a slide
- Post it on the Facebook and Social

Visual Perception and Visual Structures



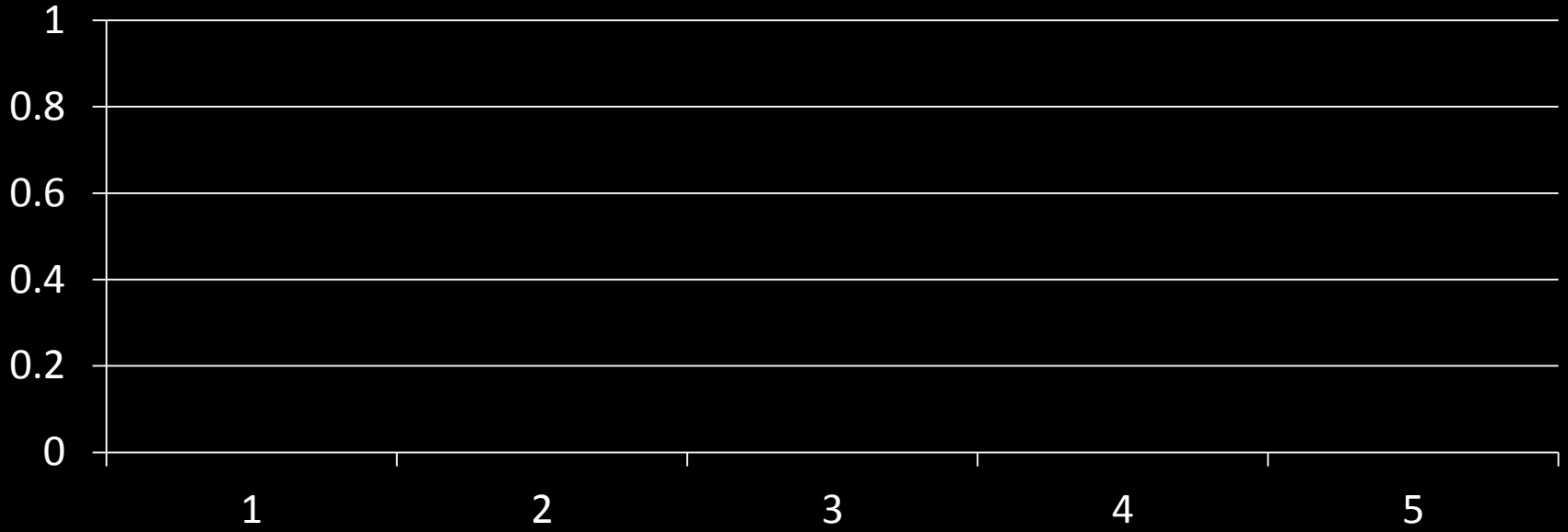
A Question about Human Perception

The human blind spot is:

1. a myth.
2. a metaphor to explain our inability to see everything.
3. the area that is outside your field of vision that is approximately 175°
4. your brain fooling you into thinking you see in an area where you actually can't see.
5. the space between what you see in your rear-view mirror and your peripheral vision when driving.

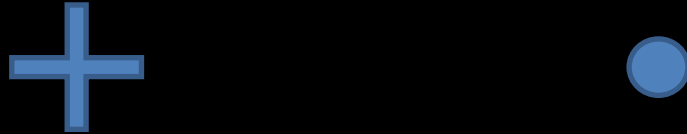
Results

Answers

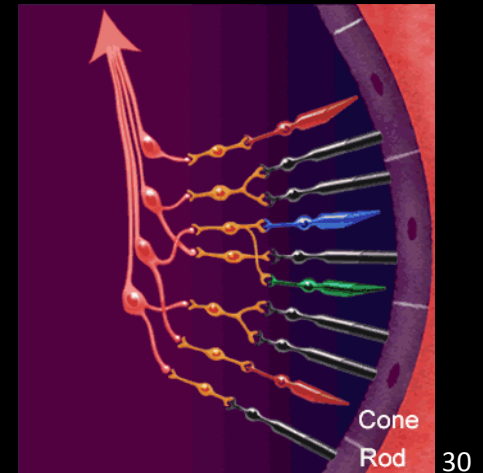
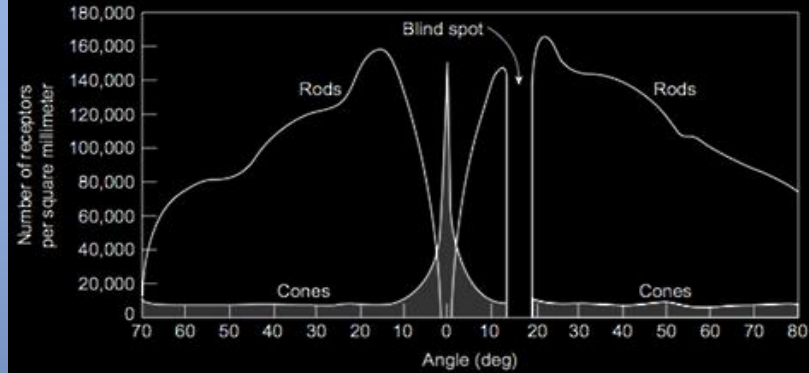
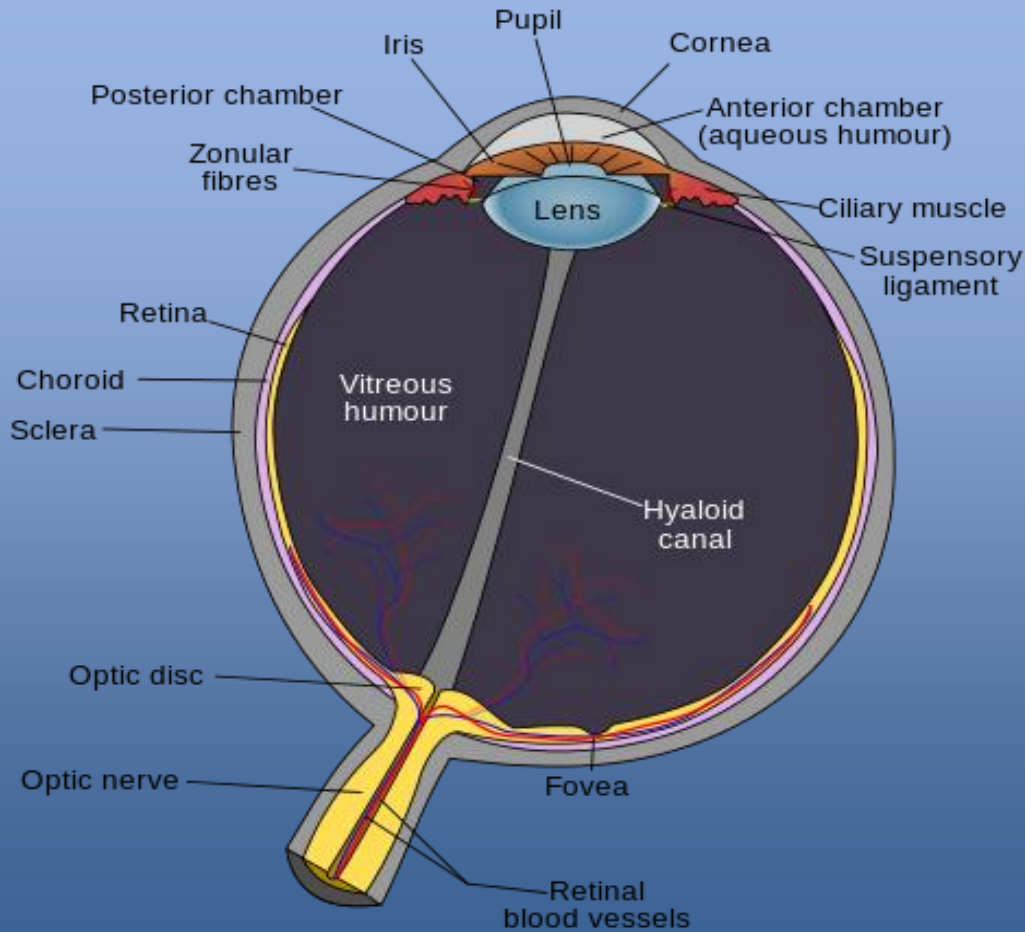


Try this out!

- Draw a cross and a circle about 5 cm apart
- Close left eye and look only at cross
- Place paper about 15 cm from nose



The Human Eye

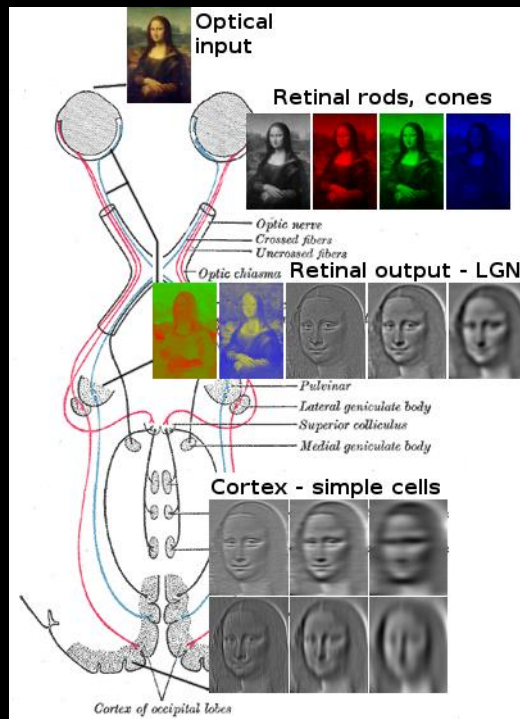


Human Vision

- Highest bandwidth
- Fast, parallel
- Pattern Recognition
- Pre-attentive
- Extends memory and cognitive capacity
- People think visually
- Brain: 30% vision, 8% touch, 3% hearing

Visual Processing

video



Preattentive Processing

- No need for focused attention
- Parallel
- Fast: 200-250 msec

Attentive Processing

How many 3s?

1281768756138976546984506985604982826762
9809858458224509856458945098450980943585
9091030209905959595772564675050678904567
8845789809821677654876364908560912949686

Preattentive Processing

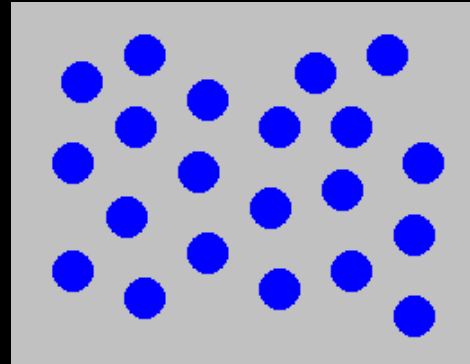
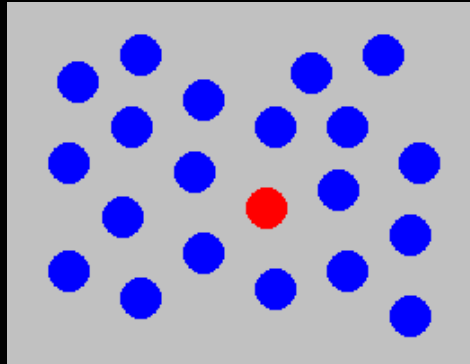
How many 3s?

12817687561**3**8976546984506985604982826762
980985845822450985645894509845098094**3**585
90910**3**0209905959595772564675050678904567
8845789809821677654876**3**64908560912949686

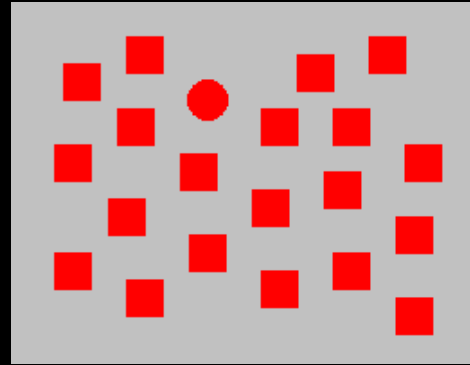
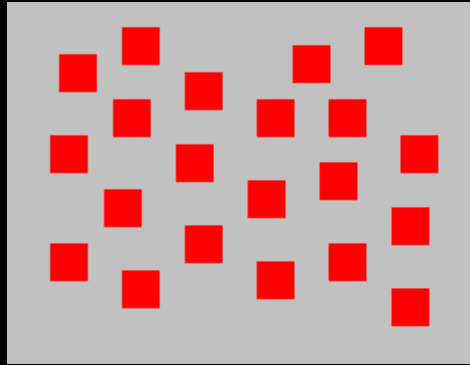
Tasks

- Target detection
 - is something there?
- Boundary detection
 - Can the elements be grouped?
- Counting
 - How many elements of a certain type are present?

Which side has a red circle?

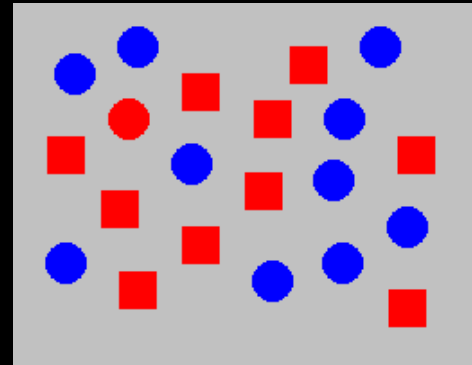
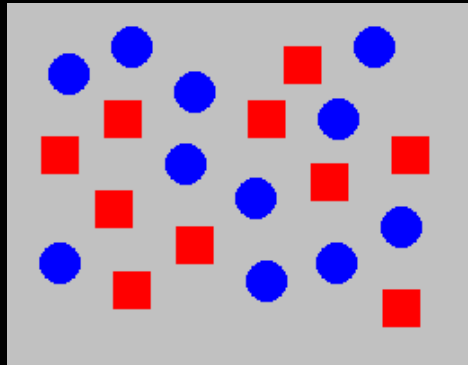


Which side has a red circle?



Which side has a red circle?

link



Potential Pre-attentive Features

Position

length

width

size

curvature

number

terminators

intersection

closure

hue

intensity

flicker

direction of
motion

binocular lustre

Stereoscopic
depth

3-D depth cues

lighting direction

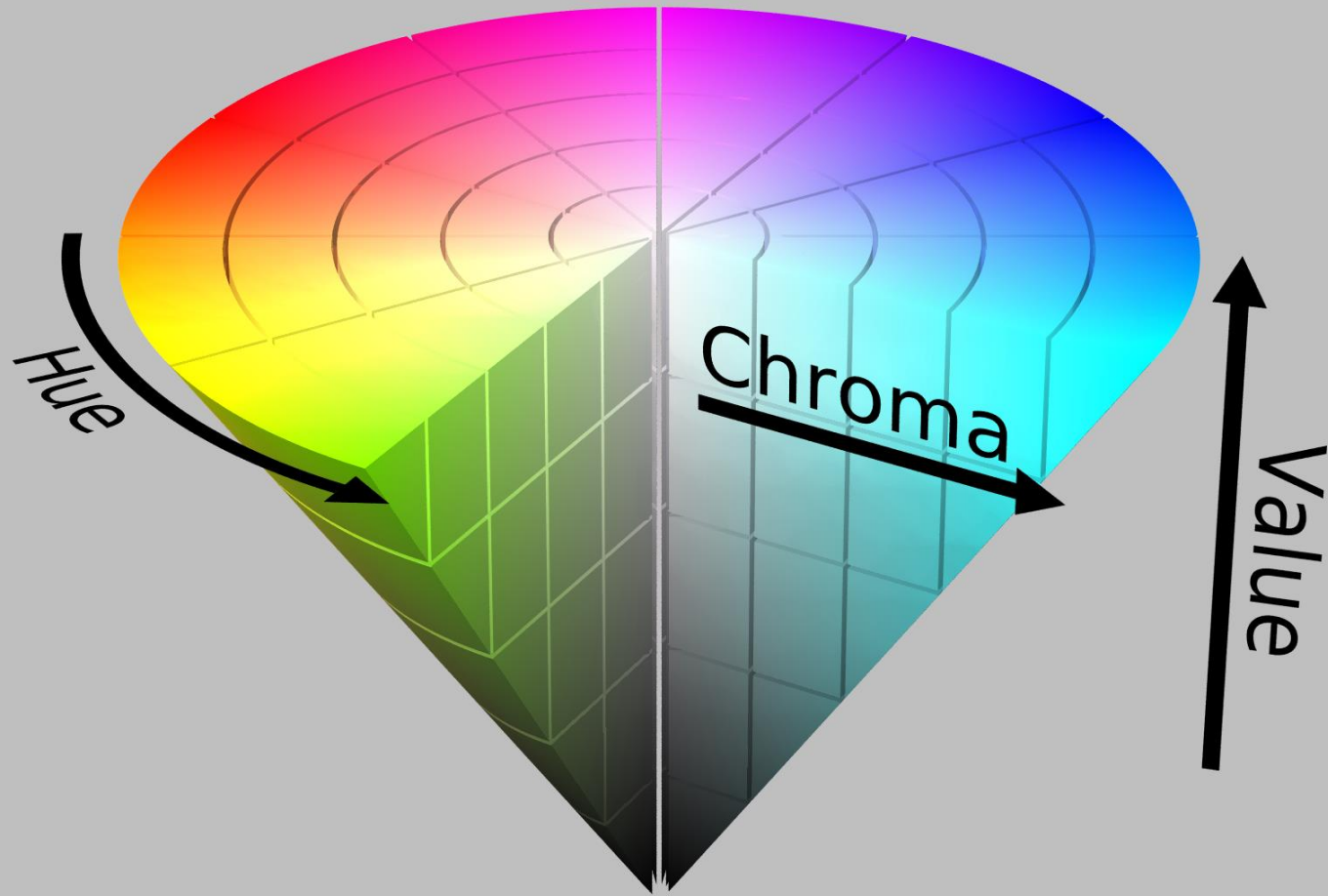
Discussion

- What role does/should pre-attentive processing play in information visualization?

Visual Types

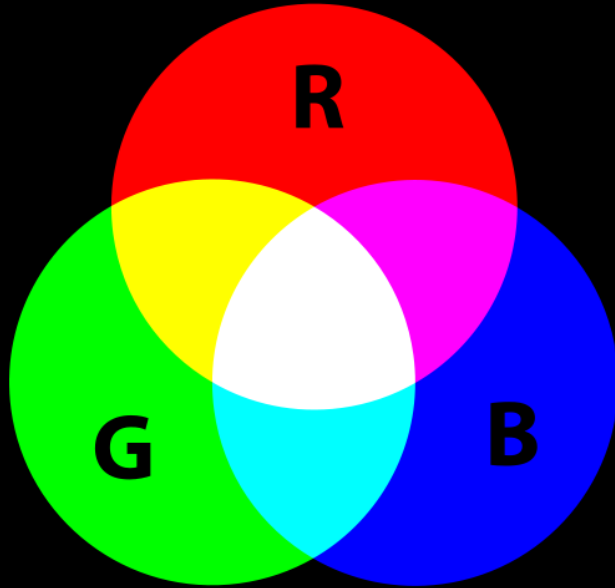
Jacques Bertin, *Sémiologie Graphique*, 1967

	<i>Points</i>	<i>Lines</i>	<i>Areas</i>	<i>Best to show</i>
<i>Shape</i>		<i>possible, but too weird to show</i>	<i>cartogram</i>	<i>qualitative differences</i>
<i>Size</i>			<i>cartogram</i>	<i>quantitative differences</i>
<i>Color Hue</i>				<i>qualitative differences</i>
<i>Color Value</i>				<i>quantitative differences</i>
<i>Color Intensity</i>				<i>qualitative differences</i>
<i>Texture</i>				<i>qualitative & quantitative differences</i>

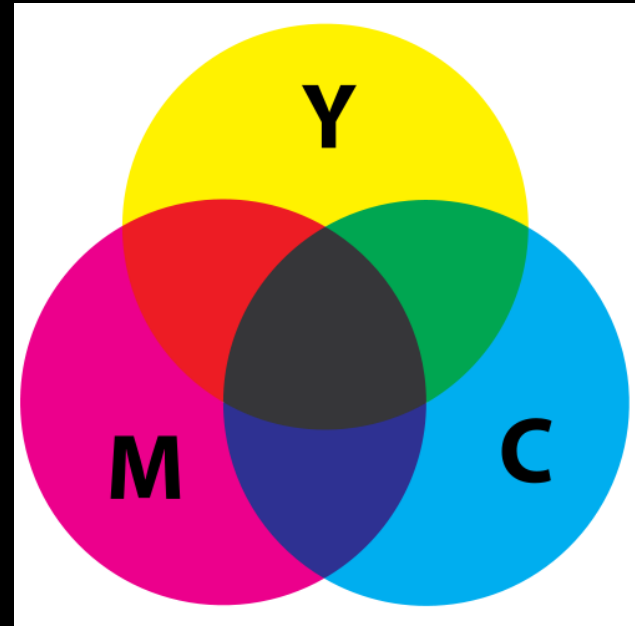


Additive vs. Subtractive Color

Additive



Subtractive



COLOR EMOTION GUIDE

OPTIMISM CLARITY
WARMTH

FRIENDLY CHEERFUL
CONFIDENCE

EXCITEMENT YOUTHFUL
BOLD

CREATIVE IMAGINATIVE
WISE

TRUST DEPENDABLE
STRENGTH

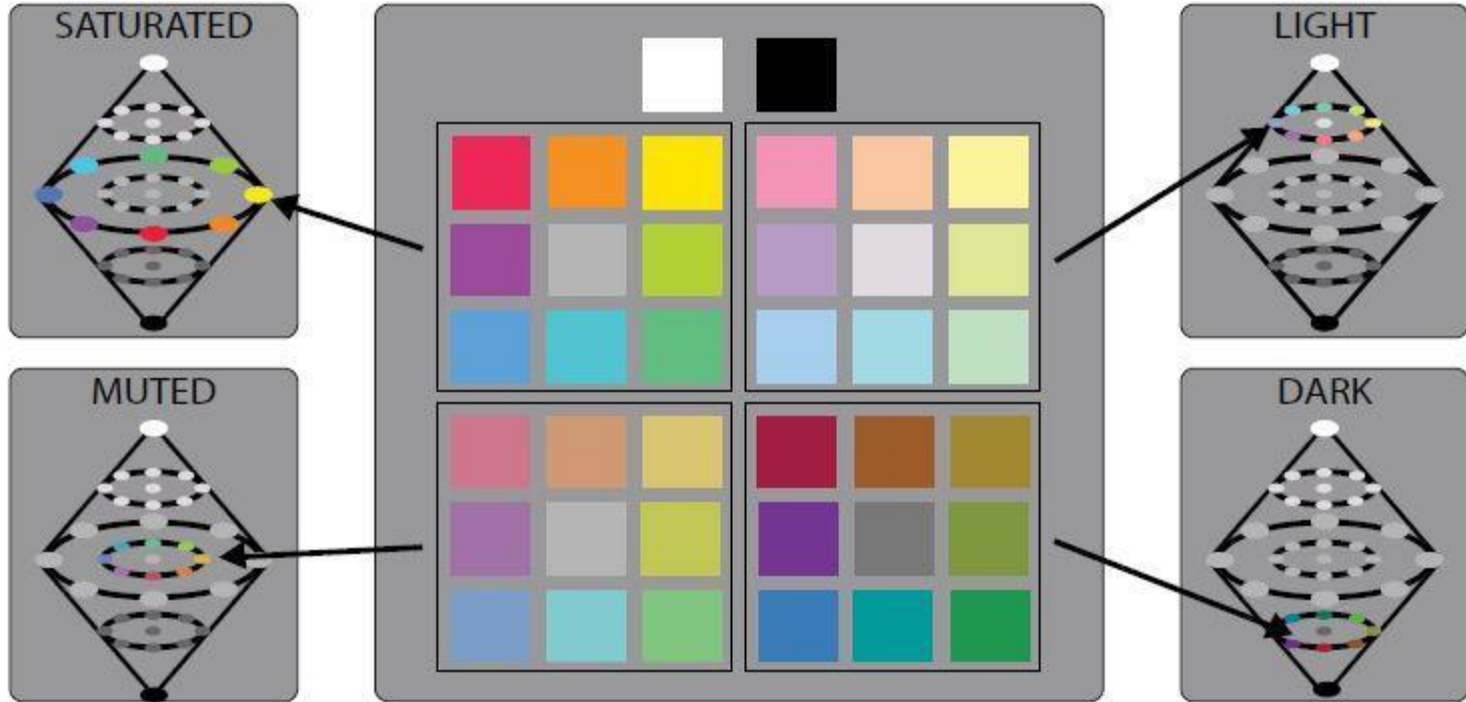
PEACEFUL GROWTH
HEALTH

BALANCE NEUTRAL
CALM

Brand Logos: Nikon, UPS, National Geographic Channel, Denny's, NBC, Google, Nickelodeon, Hooters, Amazon, IMDb, CAT, Chevrolet, Sprint, Pennzoil, Subway, eBay, Kellogg's, Nintendo, Kmart, Oracle, Payless, Shell, Fanta, Best Buy, Syfy, Monster, YouTube, Coca-Cola, CNN, Netflix, Virgin, Exxon, Barbie, ACE, Starz, Dell, JPMorgan, Lowe's, Intel, HP, NASA, Lynx, Lays, Oreo, Welch's, Canon, Frito Lay, Gush, Hertz, Goodyear, Whole Foods, Girl Scouts, American Express, Twitter, Intel, Orkut, Target, Harley-Davidson, DHL, Anis Planet, Spotify, Hess, Starbucks, Facebook, Hallmark, Walmart, Cadbury, Avis, Shutterfly, E, Boost, Sm Chips, Ferrari, Puma, Nike, Oral-B, Pfizer, Vimeo, Taco Bell, Heinz, Gulf, McDonald's.

Emotion Icons: Yin-Yang, Peace Sign, Flexing Arm, Lightbulb, Lightning Bolt, Smiley Face, Thumbs Up.

Berkeley Color Project (BCP) 37 Colors

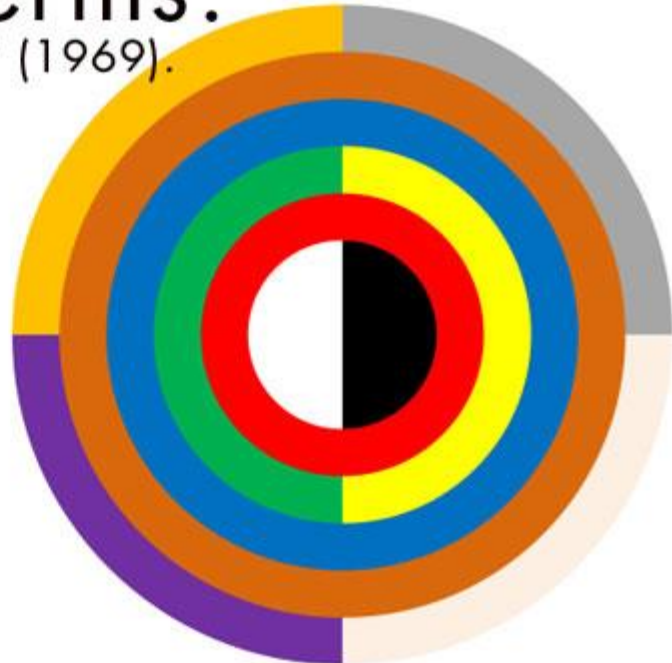


Basic Color Terms:

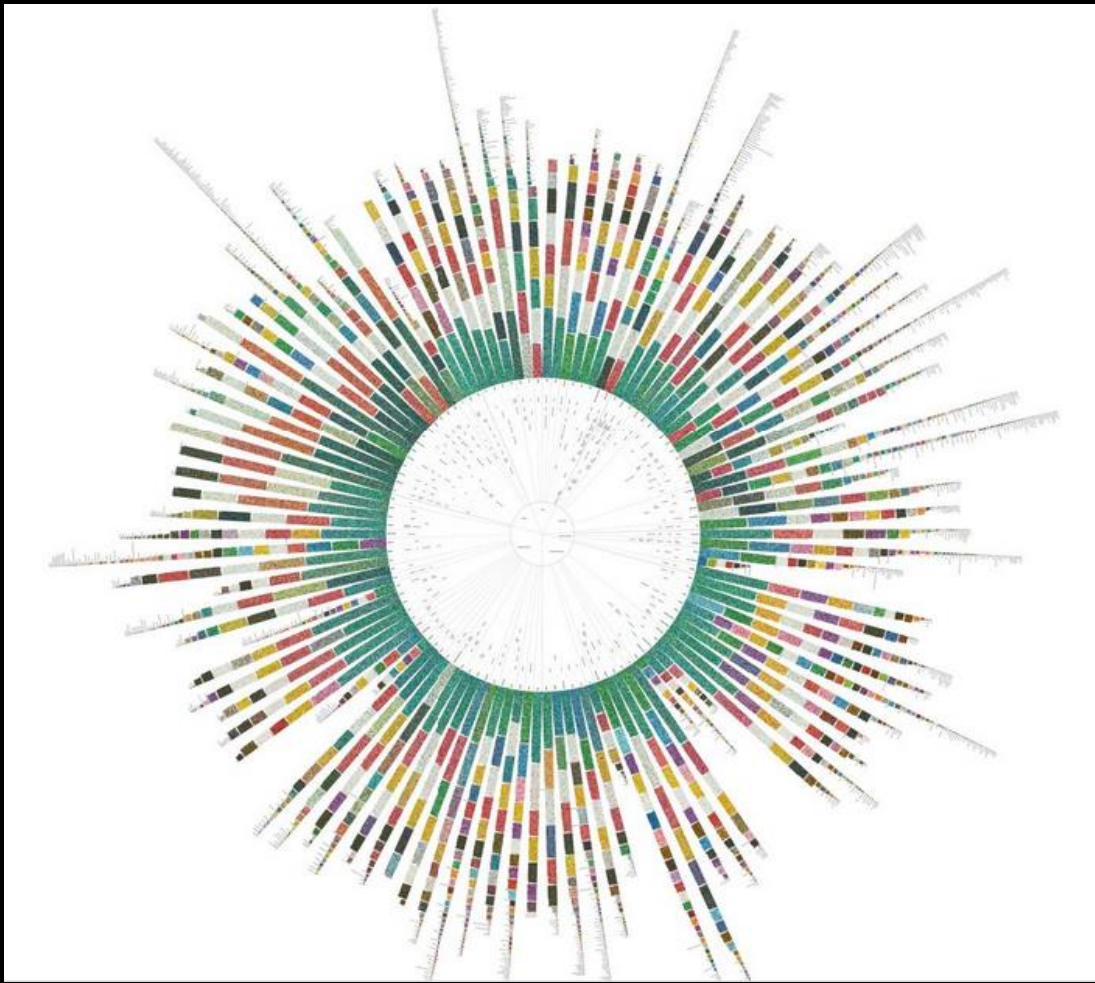
“Their Universality and Evolution” (1969).

LANGUAGE OF COLOR

Berlin and Kay



<http://michaelpetersen.wordpress.com/category/image/>



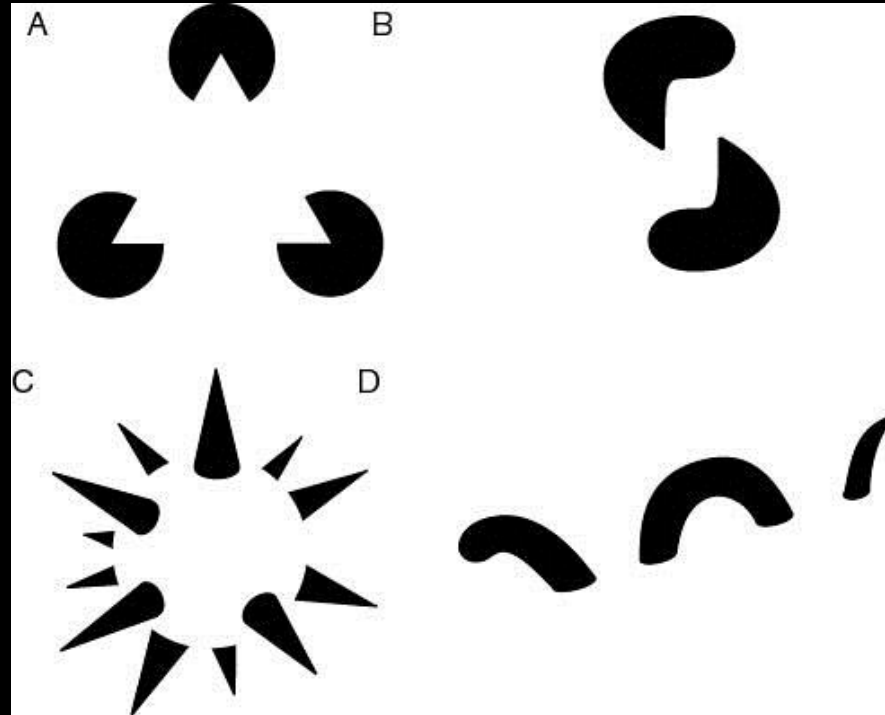
Gestalt Laws of Pattern Perception

- German psychologists 1920s
- Understand perception
- Principles
 - Emergence
 - Reification
 - Multistability
 - Invariance
 - Grouping

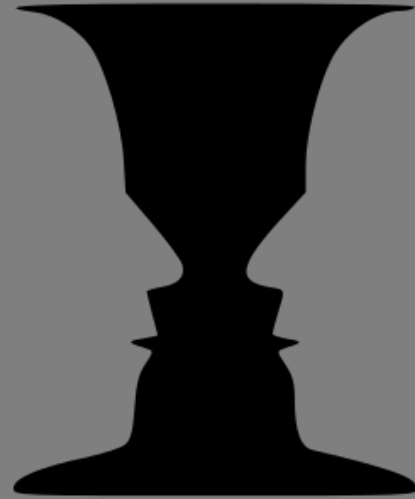
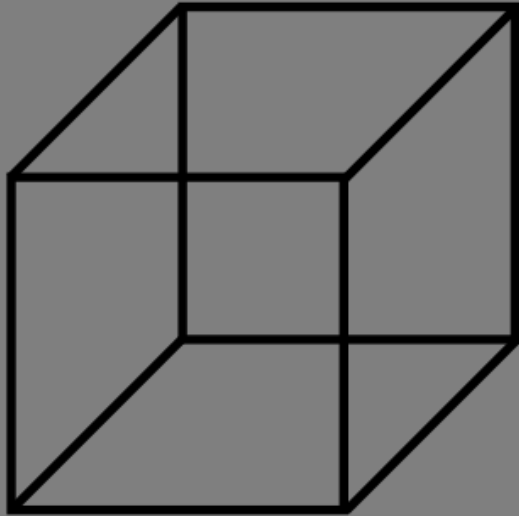
Emergence



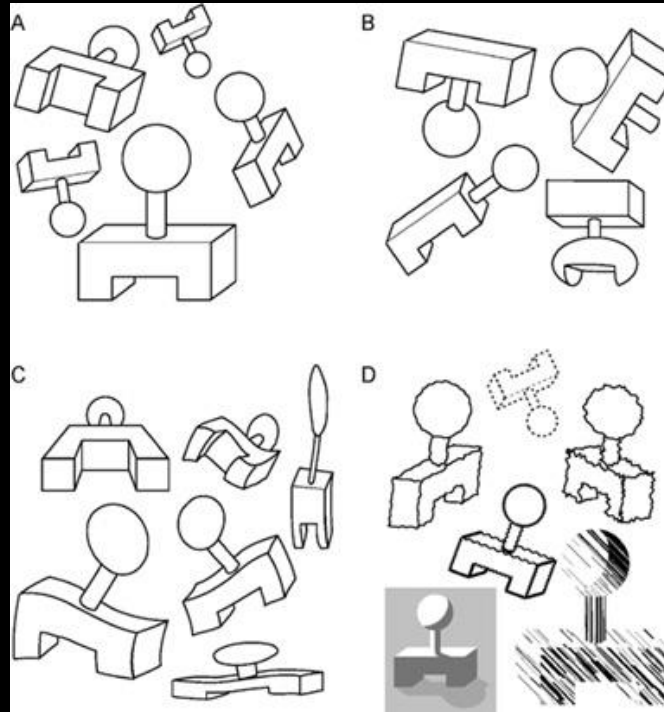
Reification



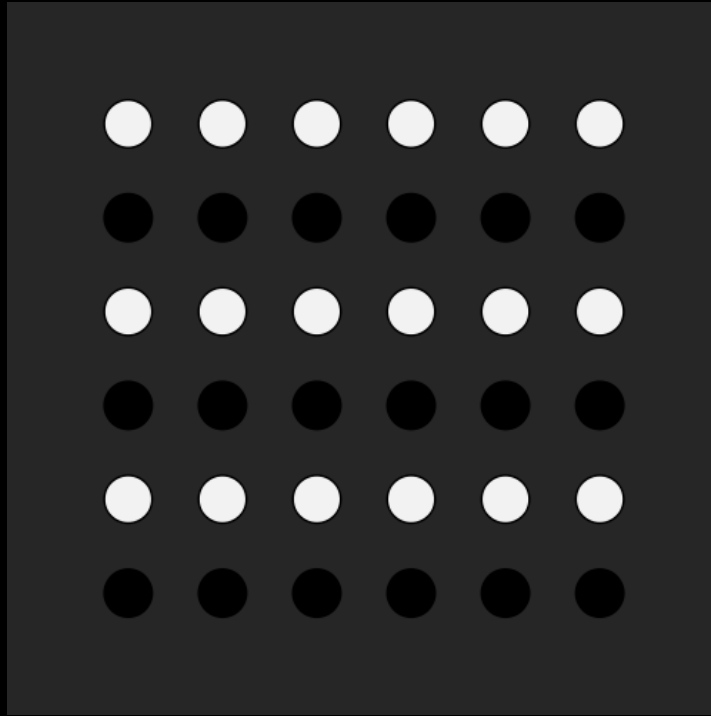
Multistability



Invariance



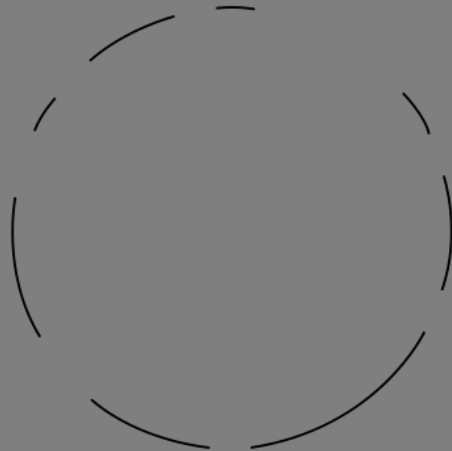
Group: Similarity



Similarity



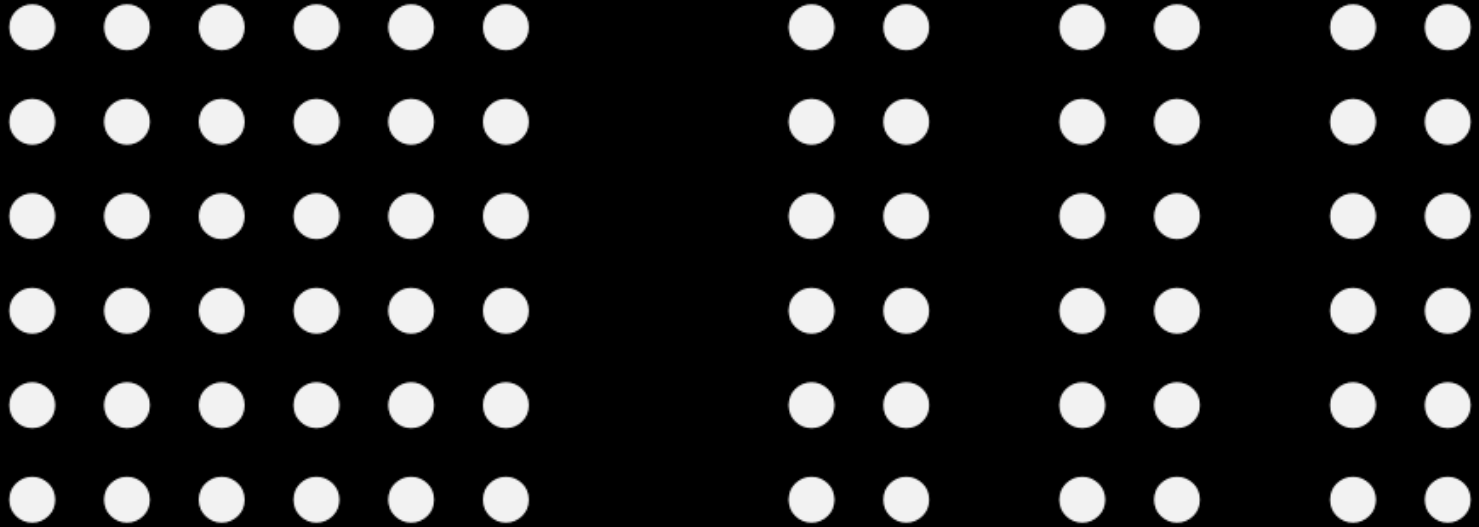
Group: closure



Group: Closure



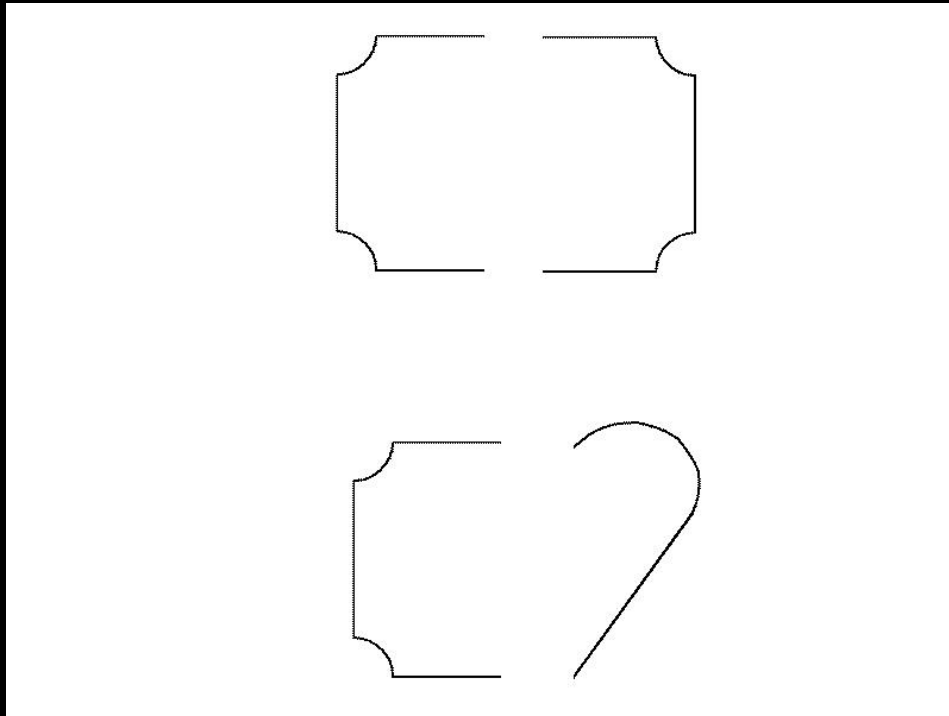
Group: Proximity



Group: continuity



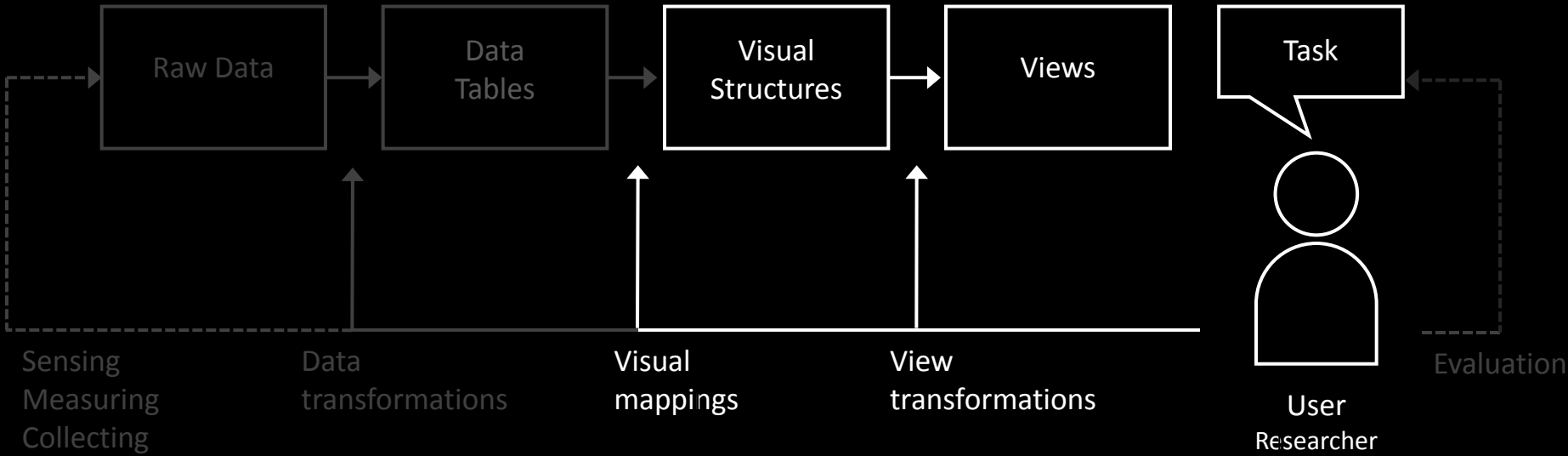
Group: symmetry



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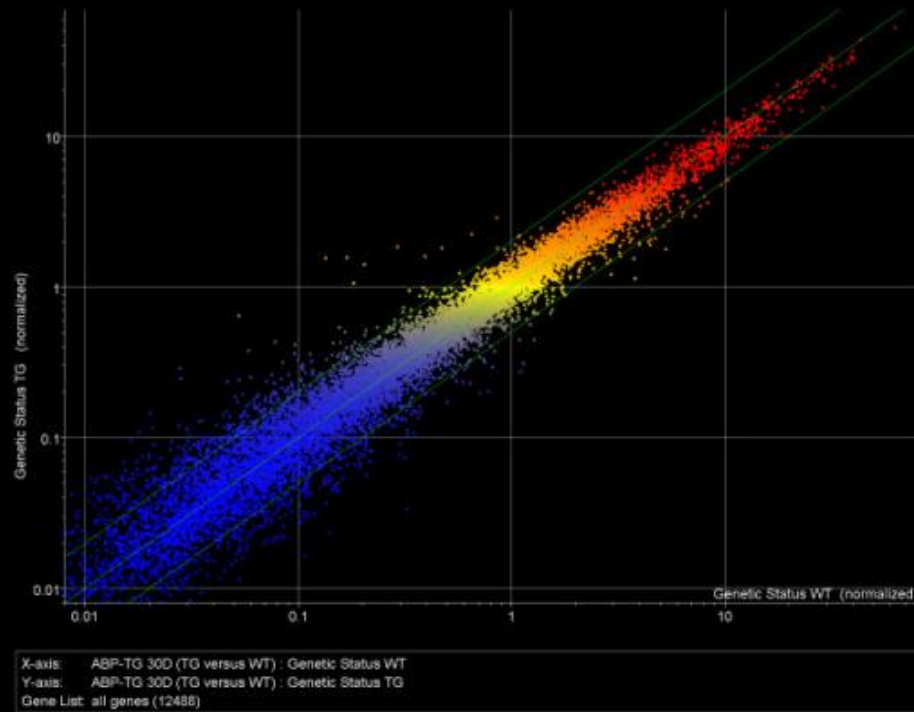
Next: Visual Structures, Views, Tasks



Brainstorm: what visual structures can you discover?

- In groups of 3, find and post two new visual structure in Facebook and Social
- 15 minutes
- Present

Example: Scatter Plot



Scatterplot Matrix

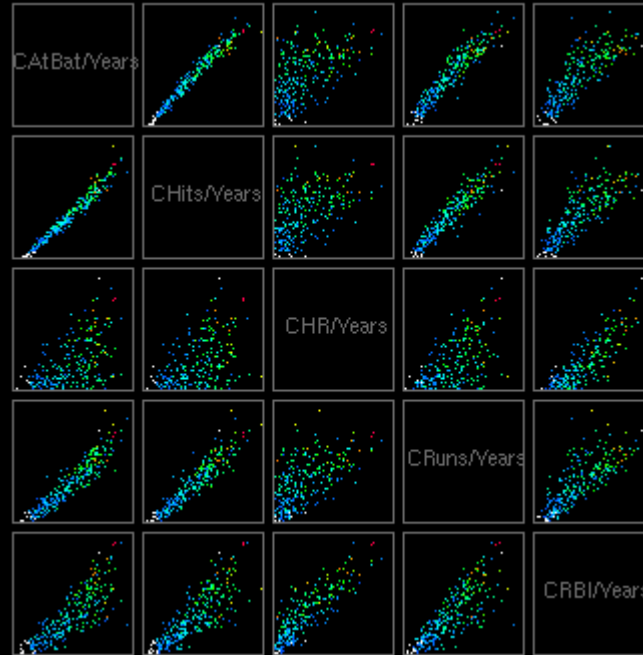
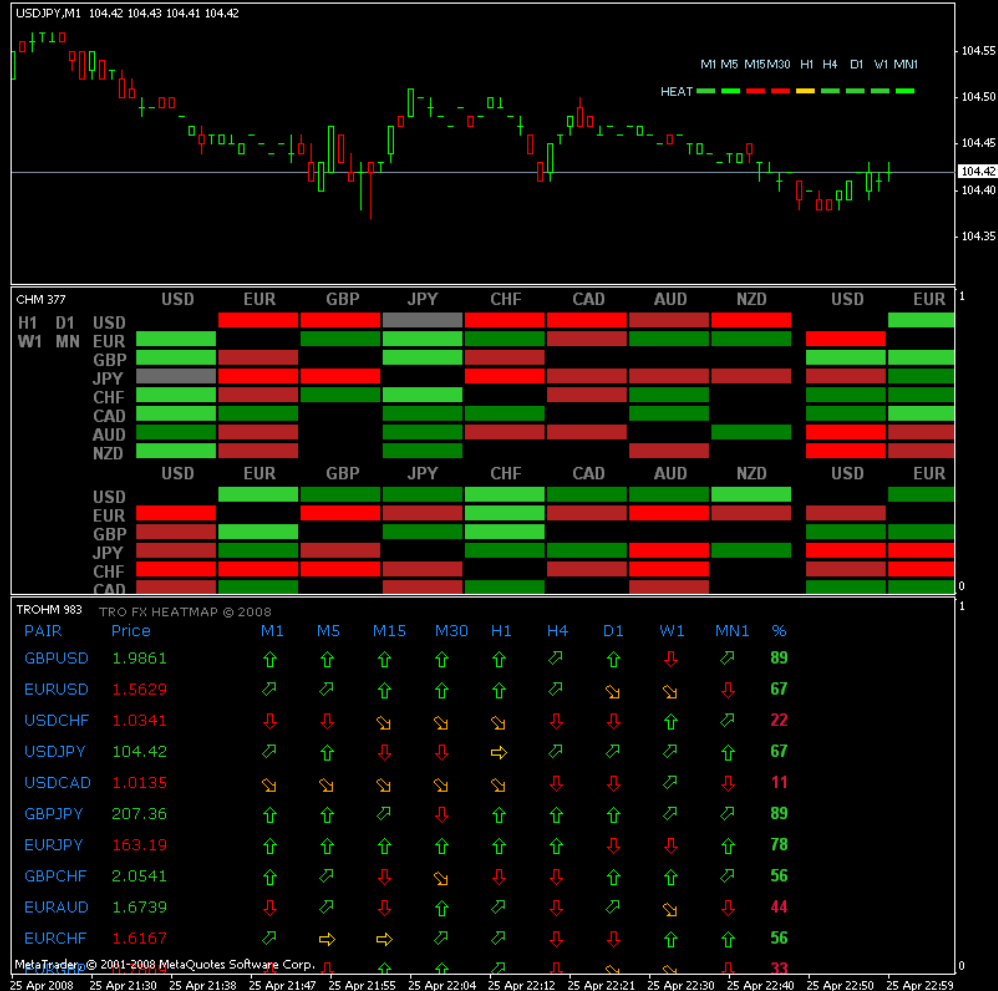


Table Visualization

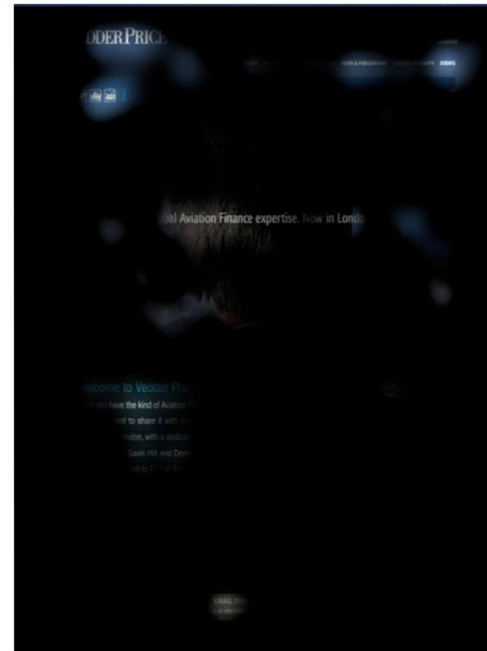


Visual Attention Heatmap

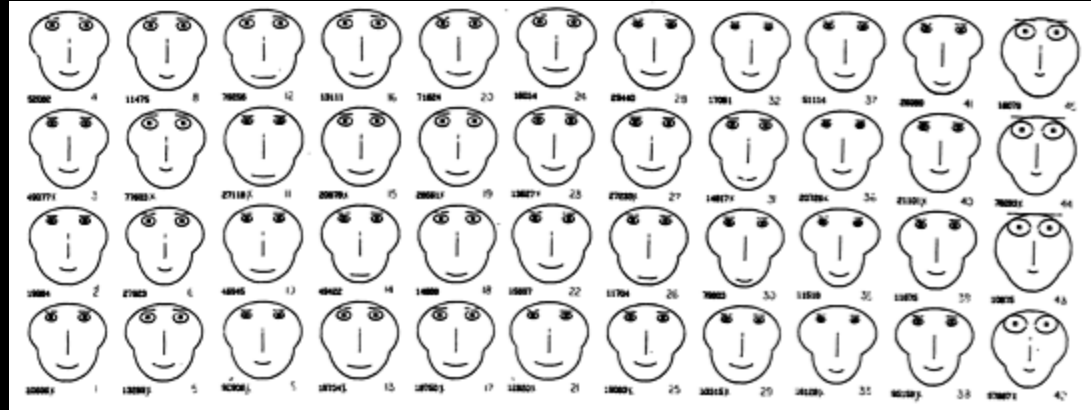
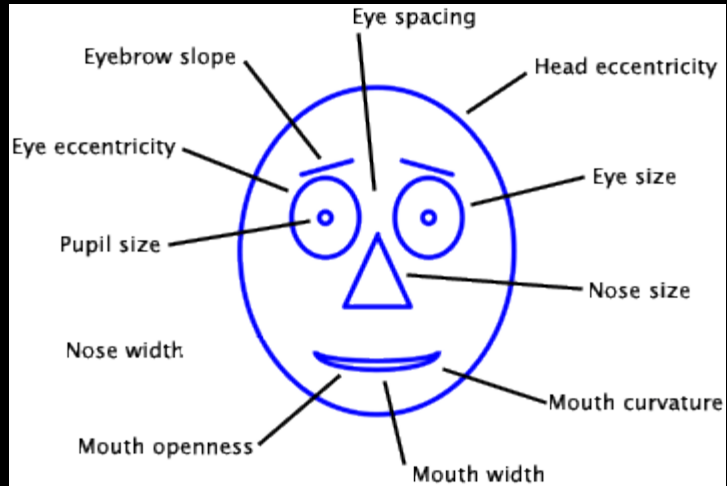
Visual Attention Level



Opacity Map



Chernoff Faces



A PERIODIC TABLE OF VISUALIZATION METHODS

C continuum													G graphic facilitation				
Tb table	Ca cartesian coordinates	Data Visualization <i>Visual representations of quantitative data in schematic form (either with or without axes)</i>										Strategy Visualization <i>The systematic use of complementary visual representations in the analysis, development, formulation, communication, and implementation of strategies in organizations.</i>					
Pi pie chart	L line chart	Information Visualization <i>The use of interactive visual representations of data to amplify cognition. This means that the data is transformed into an image, it is mapped to screen space. The image can be changed by users as they proceed working with it.</i>										Metaphor Visualization <i>Visual Metaphors position information graphically to organize and structure information. They also convey an insight about the represented information through the key characteristics of the metaphor that is employed.</i>					
		Concept Visualization <i>Methods to elaborate (mostly) qualitative concepts, ideas, plans, and analyses.</i>										Compound Visualization <i>The complementary use of different graphic representation formats in one single schema or frame.</i>					
Me meeting trace	Mm metro map	Tm temple	St story template	Tr tree	Ct cartoon												
Co communication diagram	Fp flight plan	Cs concept skeleton	Br bridge	Fu funnel	Ri rich picture												
B bar chart	Ac area chart	R radar chart cobweb	Pa parallel coordinates	Hy hyperbolic tree	Cy cycle diagram	T timeline	Ve venn diagram	Mi mindmap	Sq square of oppositions	Cc concentric circles	Ar argument slide	Sw swim lane diagram	Gc gant chart	Pm perspectives diagram	D dilemma diagram	Pr parameter ruler	Kn knowledge map
Hi histogram	Sc scatterplot	Sa sankey diagram	In information lens	E entity relationship diagram	Pt petri net	Fl flow chart	Cl clustering	Lc layer chart	Py minto pyramid technique	Ce cause-effect chains	Tl toulmin map	Dt decision tree	Cp cpm critical path method	Cf concept fan	Co concept map	Ic iceberg	Lm learning map
Tk tukey box plot	Sp spectrogram	Da data map	Tp treemap	Cn cone tree	Sy system dyn./ simulation	Df data flow diagram	Se semantic network	So soft system modeling	Sn synergy map	Fo force field diagram	Ib ibis argumentation map	Pr process event chains	Pe pert chart	Ev evocative knowledge map	V Vee diagram	Hh heaven 'n' hell chart	I informal

Cy **Process Visualization**

Hy **Structure Visualization**

- Overview**
- Detail**
- Detail AND Overview**
- Divergent thinking**
- Convergent thinking**

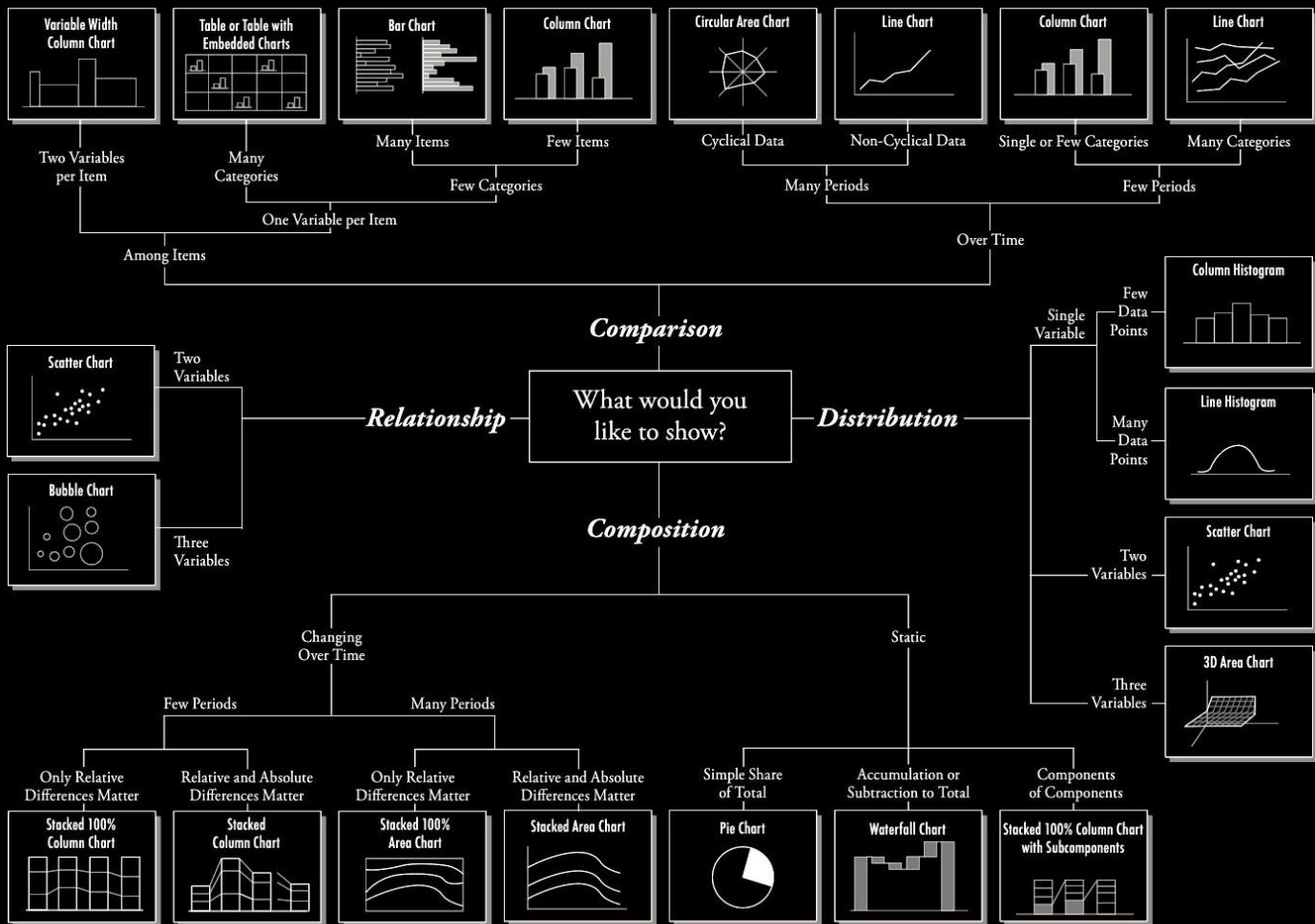
Note: Depending on your location and connection speed it can take some time to load a pop-up picture.

version 1.5

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Su supply demand curve	Pe performance charting	St strategy map	Oc organisation chart	Ho house of quality	Fd feedback diagram	Ft failure tree	Mq magic quadrant	Ld life-cycle diagram	Po porter's five forces	S s-cycle	Sm stakeholder map	Is ishikawa diagram	Tc technology roadmap
Ed edgeworth box	Pf portfolio diagram	Sg strategic game board	Mz mintzberg's organigraph	Z zwickly's morphological box	Ad affinity diagram	De decision discovery diagram	Bm bcg matrix	Stc strategy canvas	Vc value chain	Hy hype-cycle	Sr stakeholder rating map	Ta taps	Sd spray diagram

Chart Suggestions—A Thought-Starter



Assignments

- Read
 - Liu, Shixia, et al. "A survey on information visualization: recent advances and challenges." *The Visual Computer* (2014): 1-21.
 - <http://charlesneedham.com/en-us/um/people/shliu/Infovis-TVCJ.pdf>
- Based on today's lecture and the paper above, improve your designs for project 4
- Set up an individual group meeting with me for next week

Thank you!

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