Information Visualization – DH2321
Lecture 8-9: data tables, visual mappings, and visual representations

Mario Romero

2014/02/25

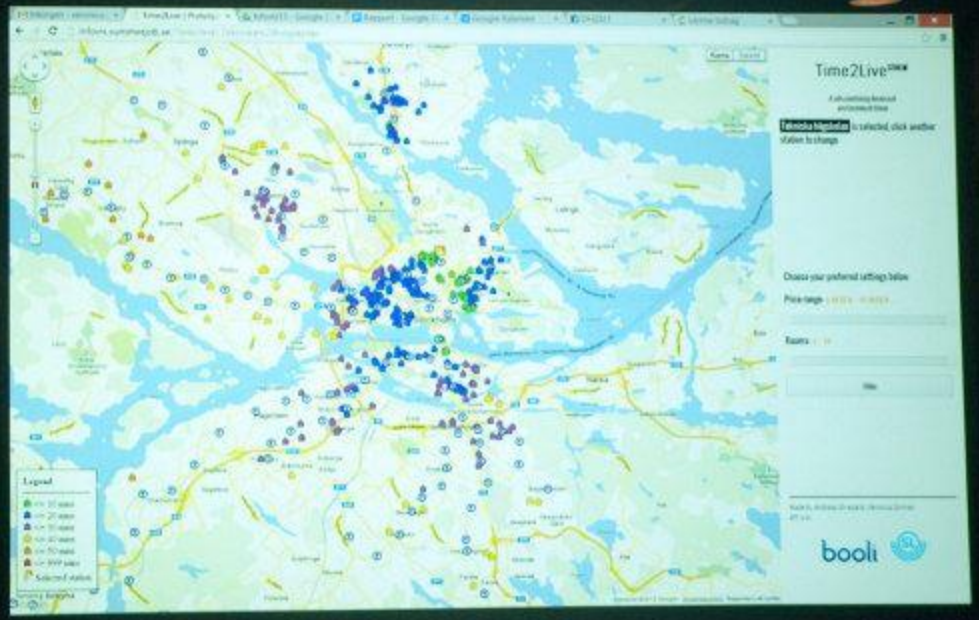
VICSTHLM
VISUALISATION INTERACTION COLLABORATION

KTH
VETENSKAP
OCH KONST

Mittelstaedt, E. (2002). Unfolding.

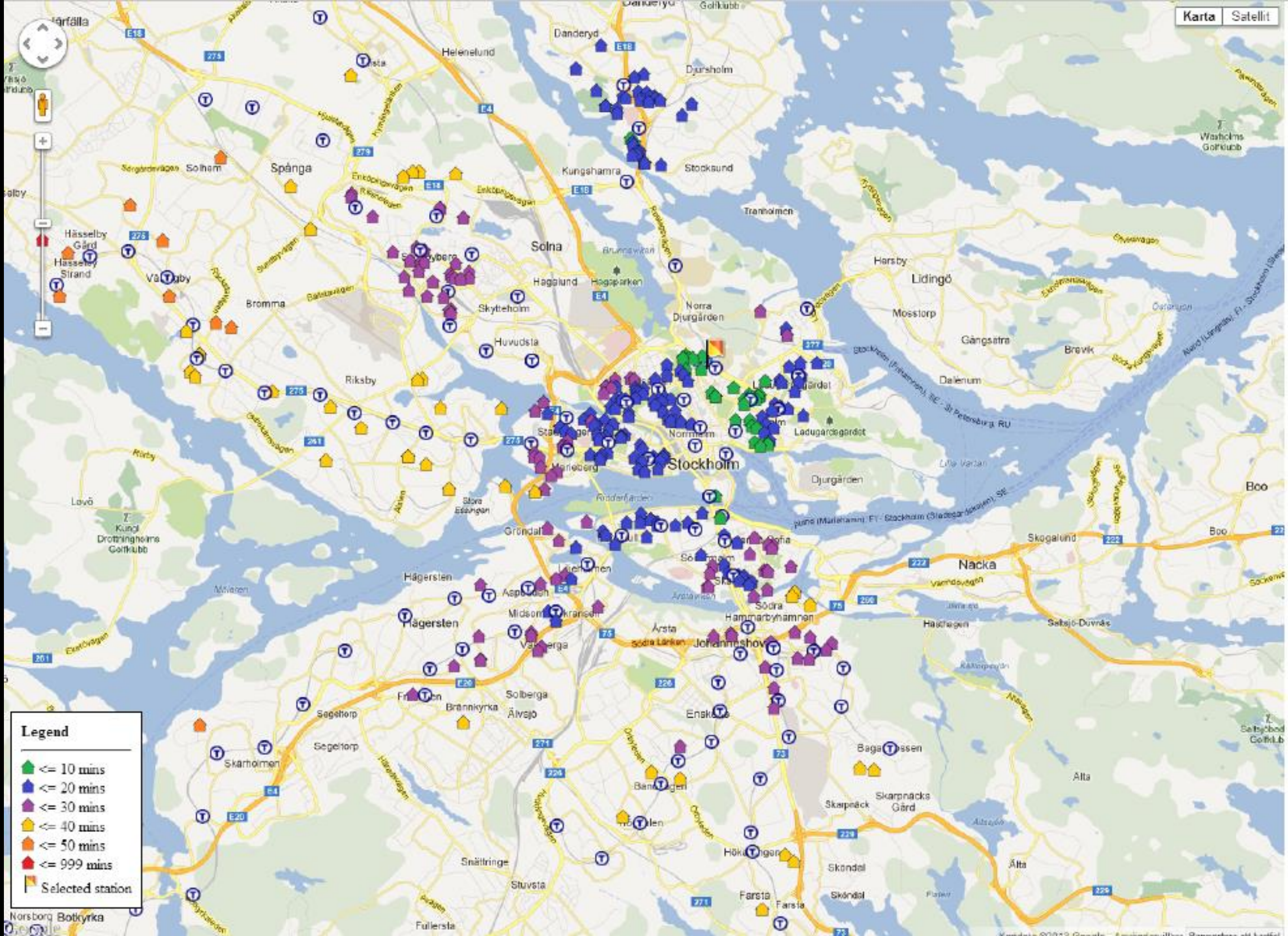

Methods and Techniques
Google Maps API
Data APIs – SL for commute times and Booli for ads
Time algorithm
Google maps
SL
booli
March 4, 2013
TimeToLive

TimeToLive



March 4, 2013

TimeToLive



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 Ulvesand, Veronica Ginman

API:s by

booli SL

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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13. Reading Assignments for Next Class.
14. Working groups and one-on-one feedback

Visualizing the Stock Market

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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.

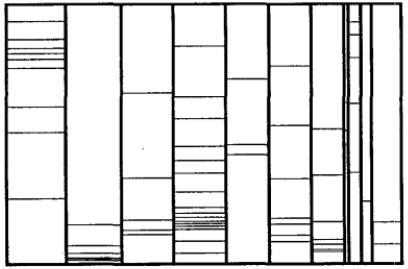


Figure 1: Typical slice-and-dice layout

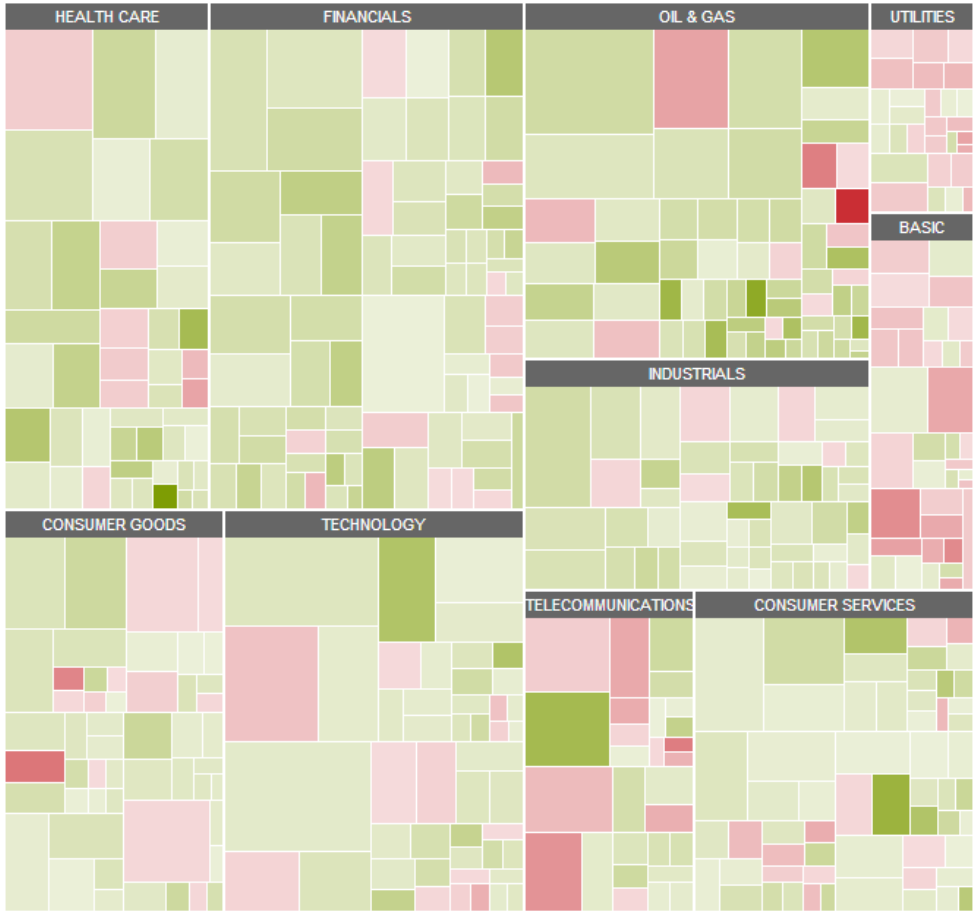
Figure 2: New layout scheme, described below

Map of the Market

Like 227 +1 107 Tweet 371

All

Locate Company



DJIA	Nasdaq	S&P 500
+0.64%	+0.69%	+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

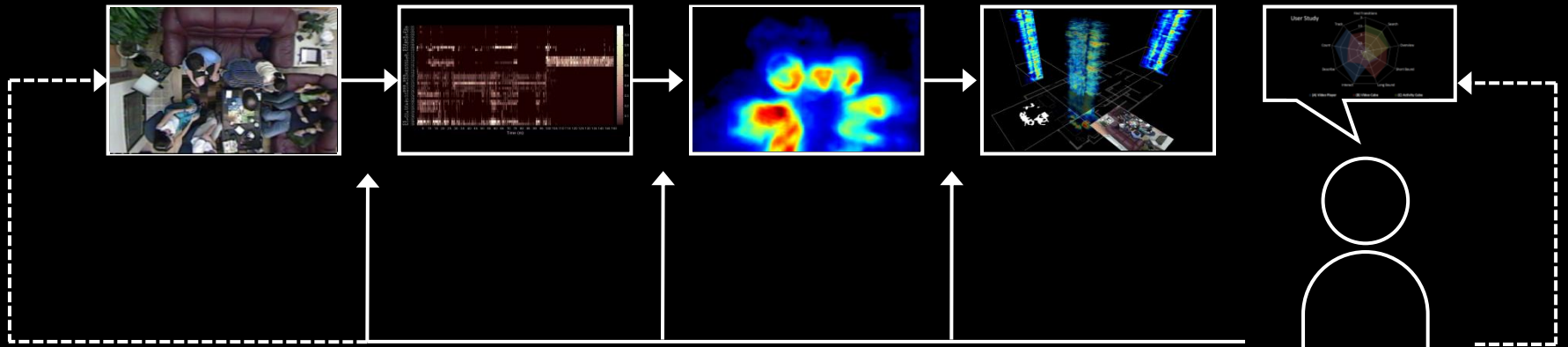
2/24/14 **Nokia unveils Nokia X its first Android phone** MARKETWATCH
NOK GOOG MSFT

2/24/14 **Pfizer pneumonia vaccine study meets objectives** MARKETWATCH
PFE

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

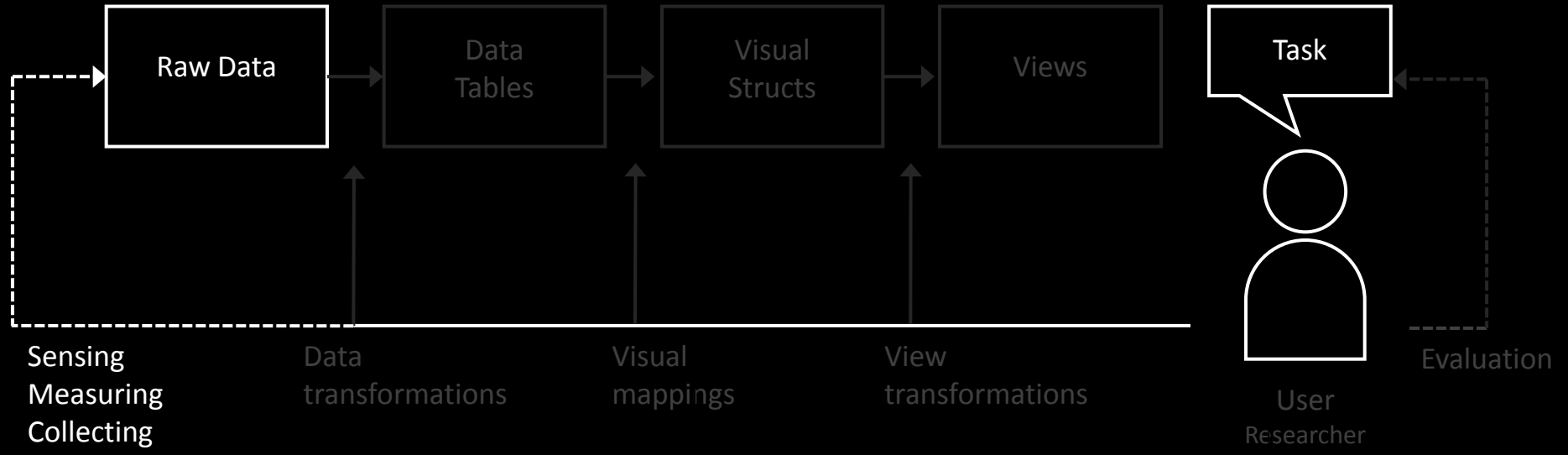
Information Visualization Pipeline

expanded from **Readings in Information Visualization: Using Vision to Think**
By Stuart K. Card, Jock D. Mackinlay, Ben Shneiderman, 1999

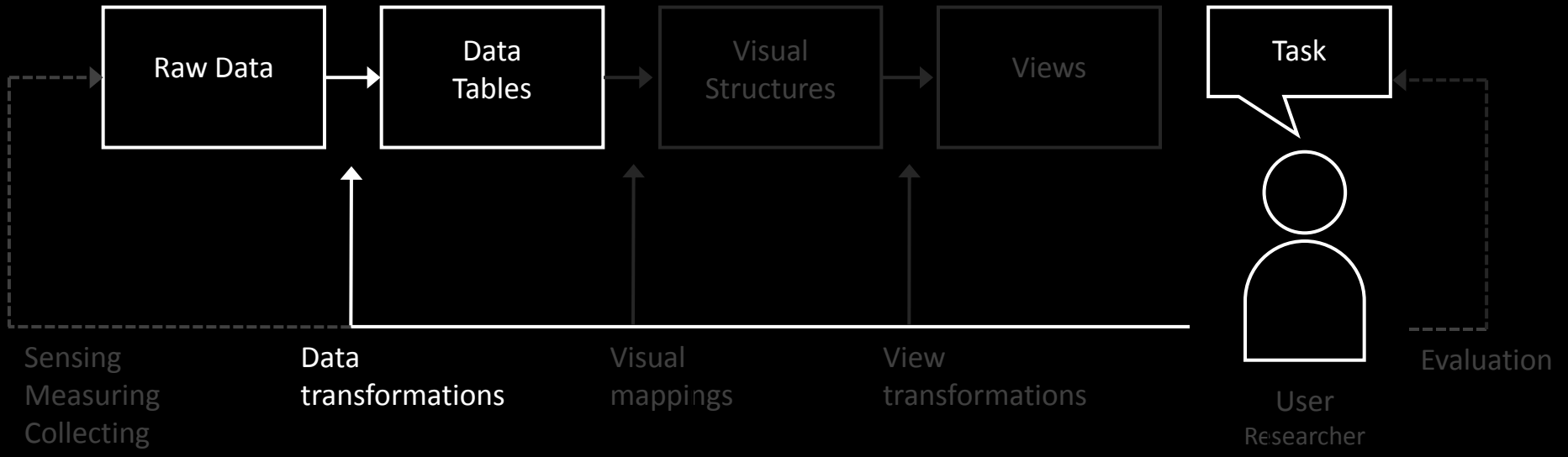


Quick Demo

Data


Raw Data
Data Tables
Visual Structs
Views
Task
Sensing
Measuring
Collecting
Data transformations
Visual mappings
View transformations
User
Researcher
Evaluation

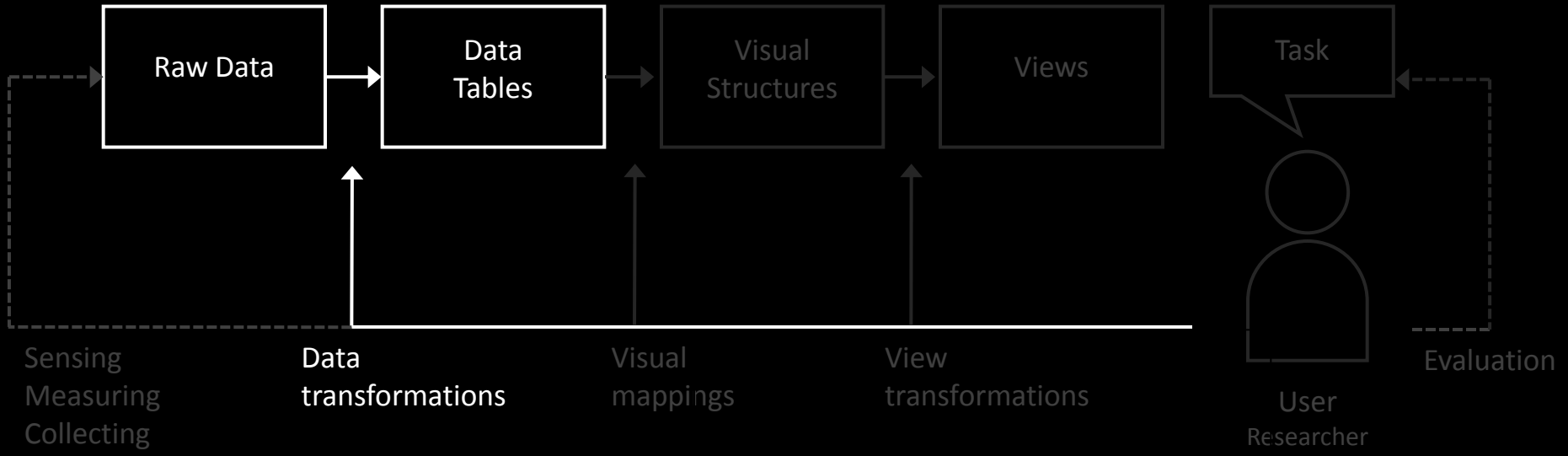
Data Tables and Data Transformations



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

	$Case_1$	**$Case_2$**	**$Case_3$**	**...**
$Variable_1$	$Value_{11}$	$Value_{21}$	$Value_{31}$	
$Variable_2$	$Value_{12}$	$Value_{22}$	$Value_{32}$	
$Variable_3$	$Value_{13}$	$Value_{23}$	$Value_{33}$	
...				…

$f(Case_1) = < Value_{11} , Value_{12} , … >$

Example

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

Sweden

Allsvenskan 2014

Countdown

-48

days to go

Overview | Fixtures and Results | Standings | News

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	v
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	v
10	BK Häcken	30	10	7	13	37	41	-4	37	^
11	Mjällby AIF	30	10	6	14	46	47	-1	36	v
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	=

UEFA Champions League Preliminary

UEFA Europa League

UEFA Europa League depending on domestic cup

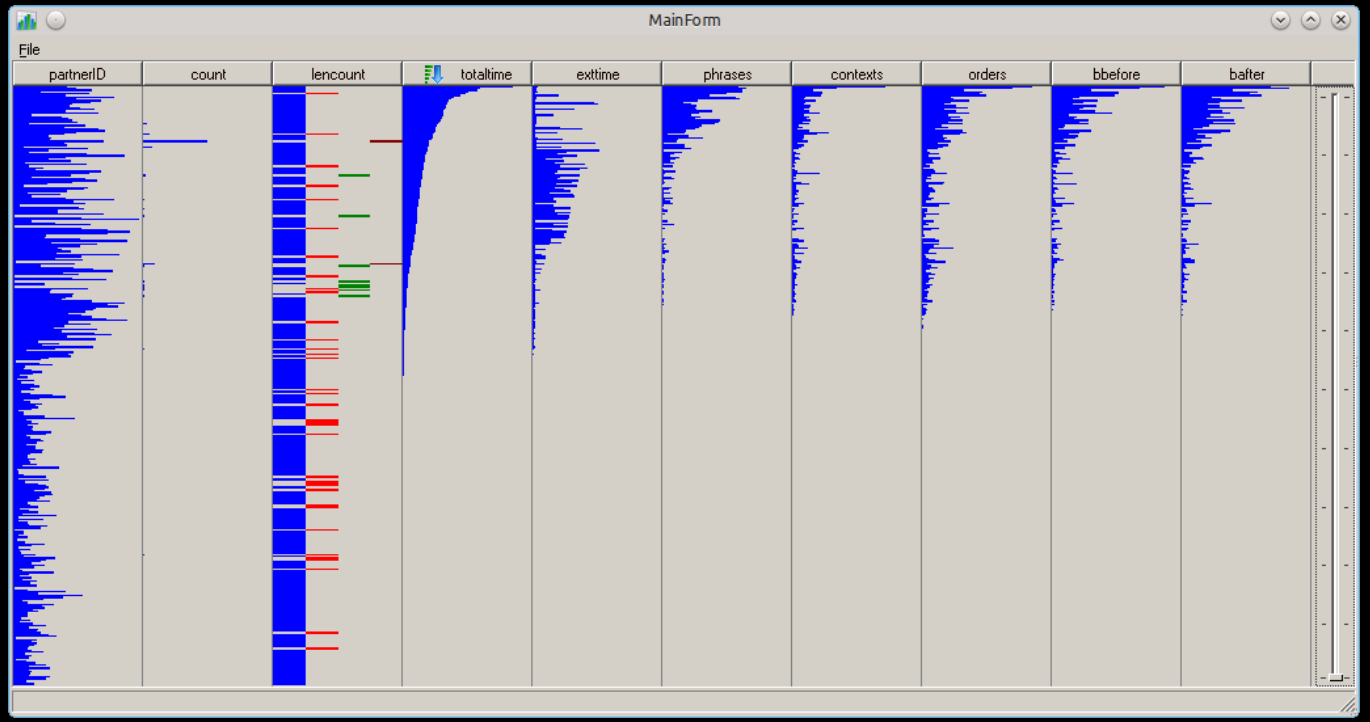
Relegation play-off

Relegation

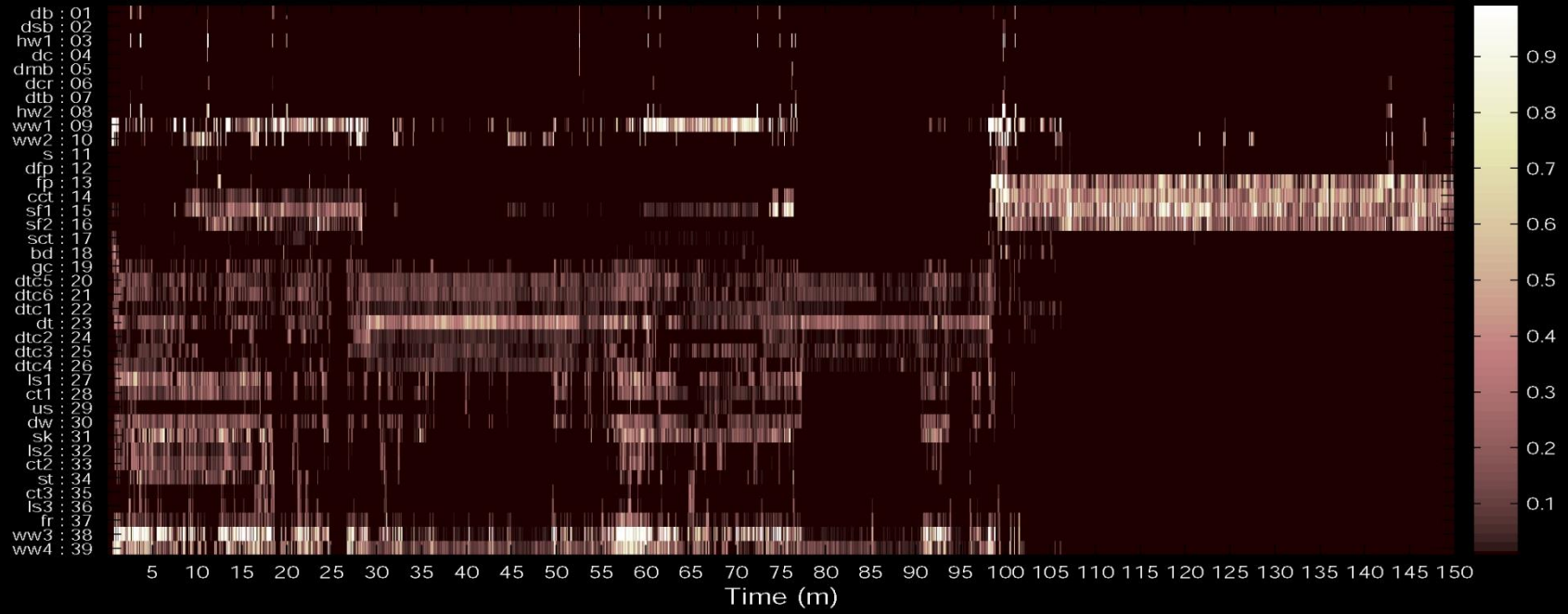
0 Like 0 Tweet 0 +1 Share

Visualizing Tables Directly

table visualizer

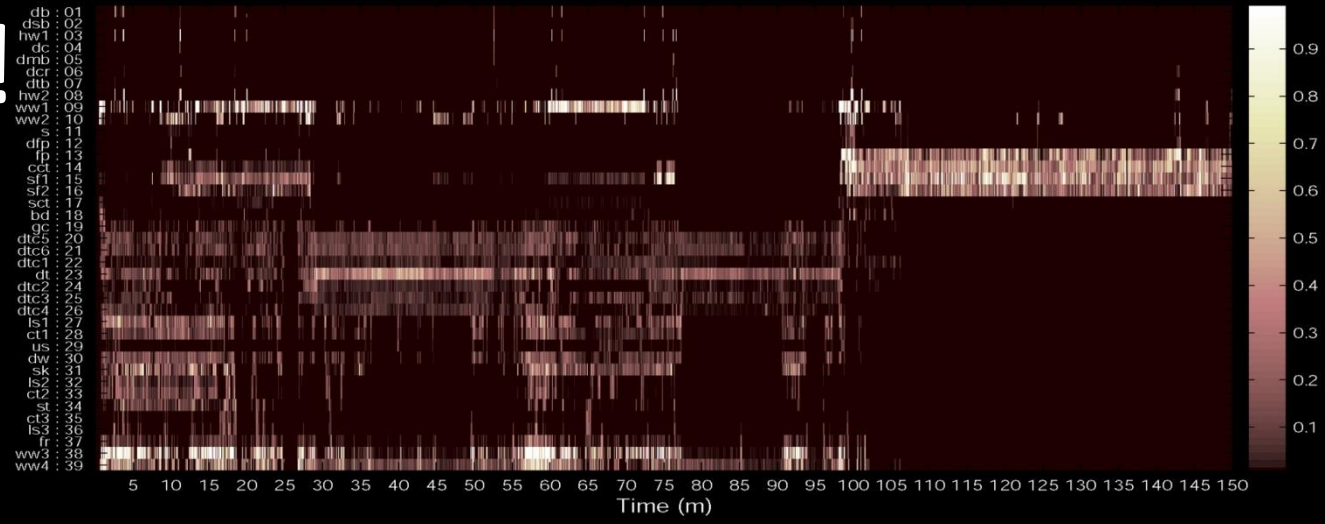


Aggregate Motion over Space



Formalize it!

- Data source
  - Overhead video
- Raw Data type
  - array
- Data transformations
  - Aggregate motion (s,t)
- Visual Reprentation
  - 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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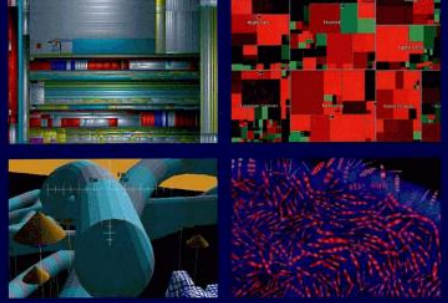
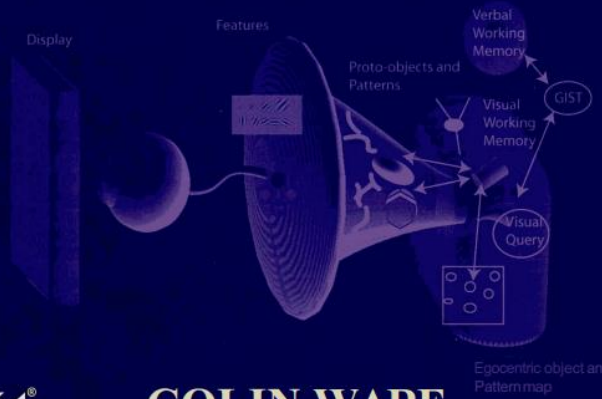


ELSEVIER

SECOND EDITION

INFORMATION VISUALIZATION

PERCEPTION FOR DESIGN



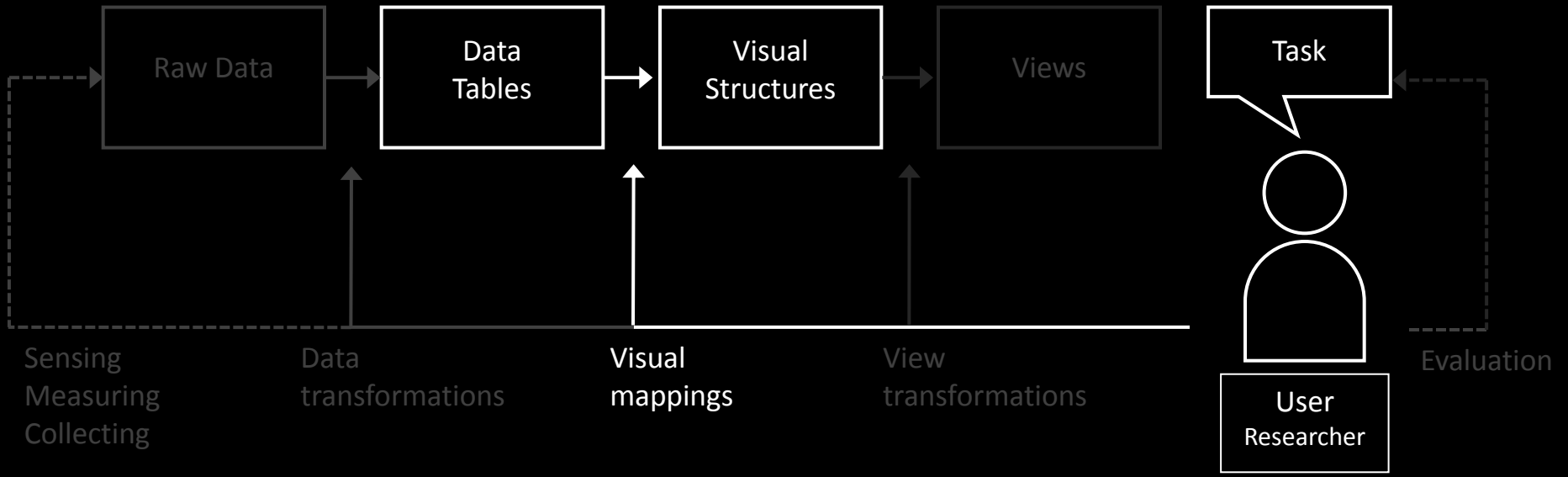
COLIN WARE

MORGAN

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

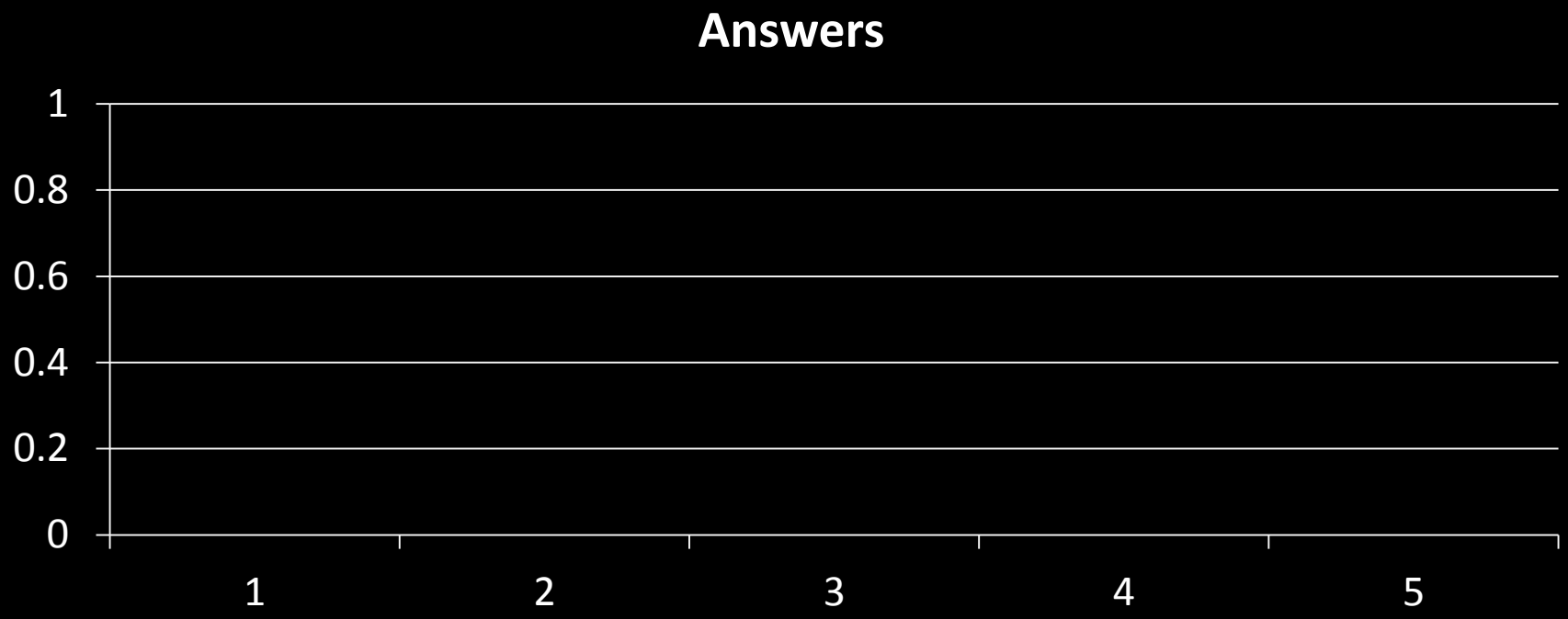


A Question about Human Perception

The human blind spot is:

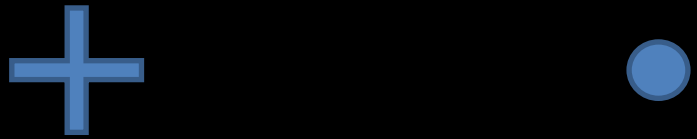
1. a myth.
2. a metaphor to explain our inability to see everything.
3. the area that is outside your field of vision that is approximately 175˚
4. your brain fooling you into thinking you see in an area where you actually can’t see.
5. the space between what you see in your rear-view mirror and your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

Results

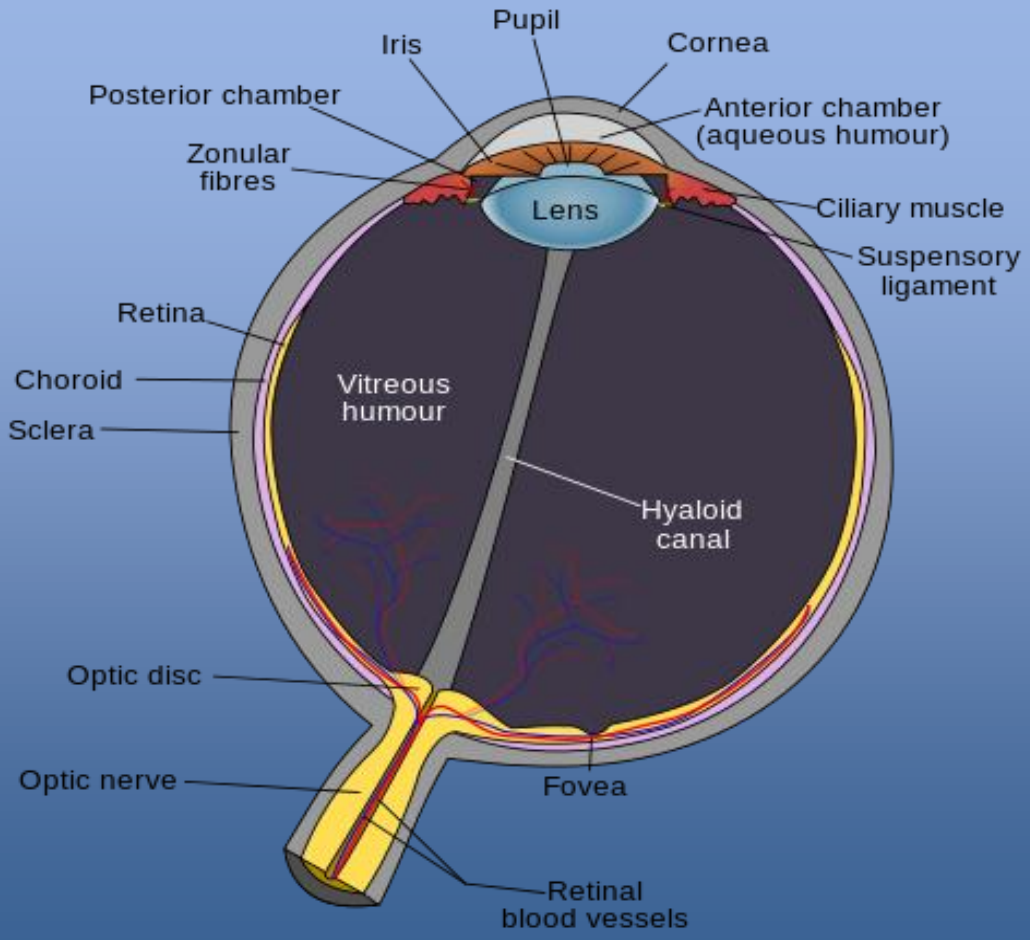


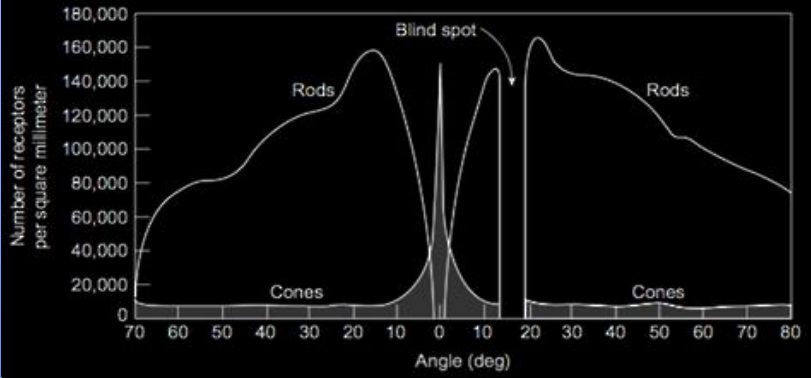
Try this out!

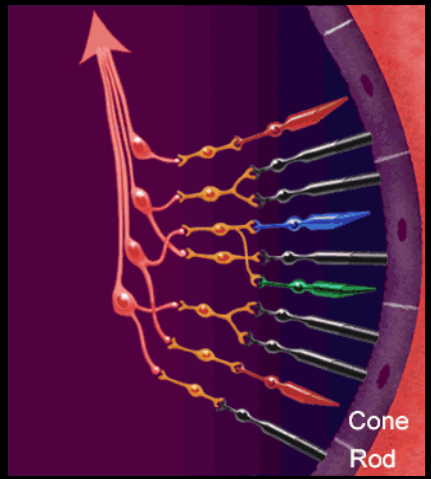
- Draw a cross and a circle about 5 cm apart
- Close left eye and look only at cross
- Place paper about 15 cm from nose



The Human Eye





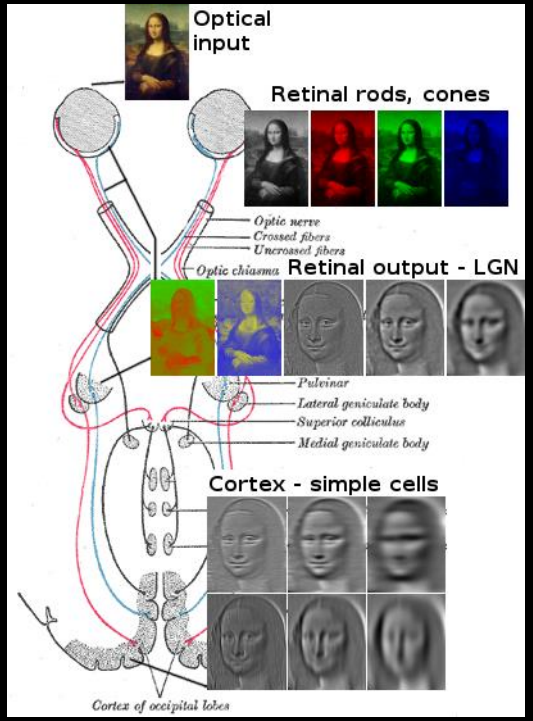


Human Vision

- 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 msecs

Attentive Processing

How many 3s?

12817687561389765469845069856049828267629809858458224509856458945098450980943585909103020990595959577256467505067890456788457898098216776548763649085609129496 86

Preattentive Processing

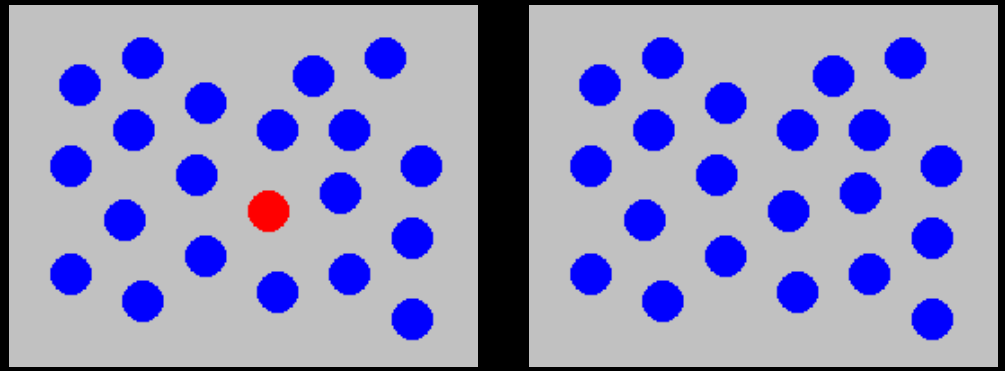
How many 3s?

1281768756138976546984506985604982826762
9809858458224509856458945098450980943585
9091030209905959595772564675050678904567
8845789809821677654876364908560912949686

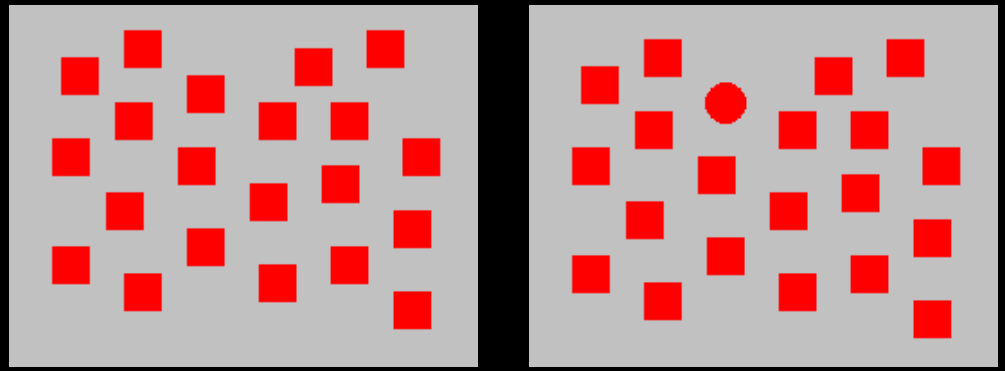
Tasks

- 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?

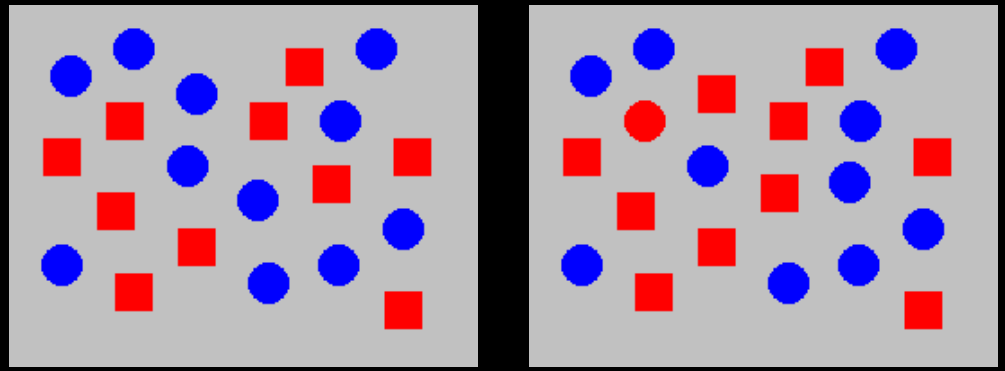


Which side has a red circle?



Which side has a red circle?

link



Potential Pre-attentive Features

Position
length
width
size
curvature
number

terminators
intersection
closure
hue
intensity
flicker

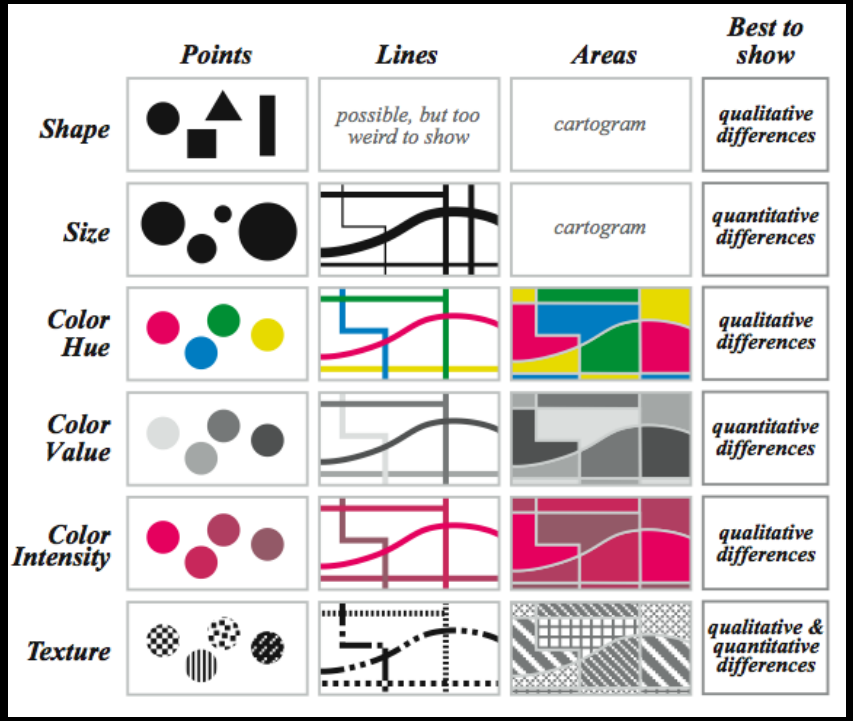
direction of motion
binocular lustre
Stereoscopic depth
3-D depth cues
lighting direction

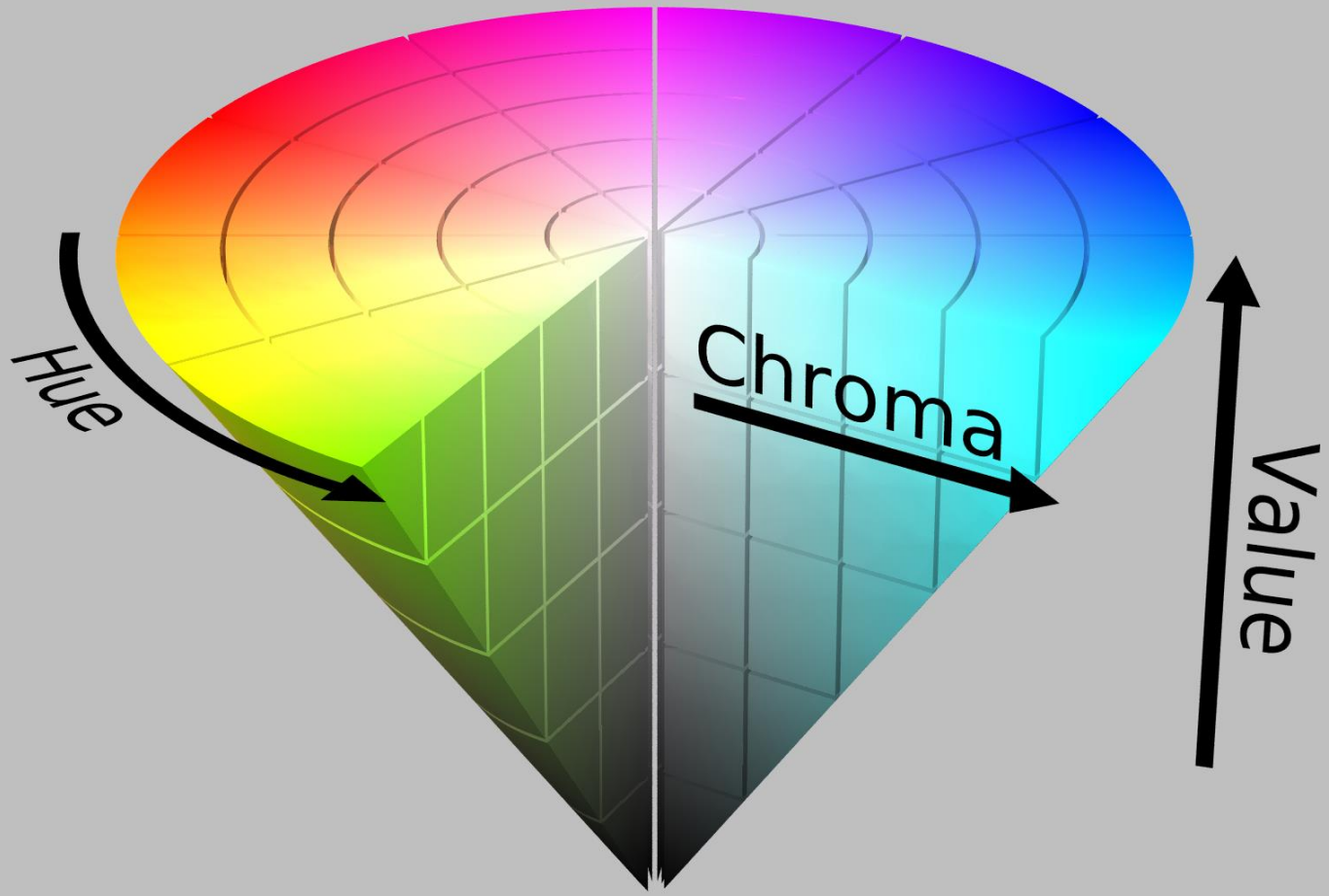
Discussion

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

Visual Types

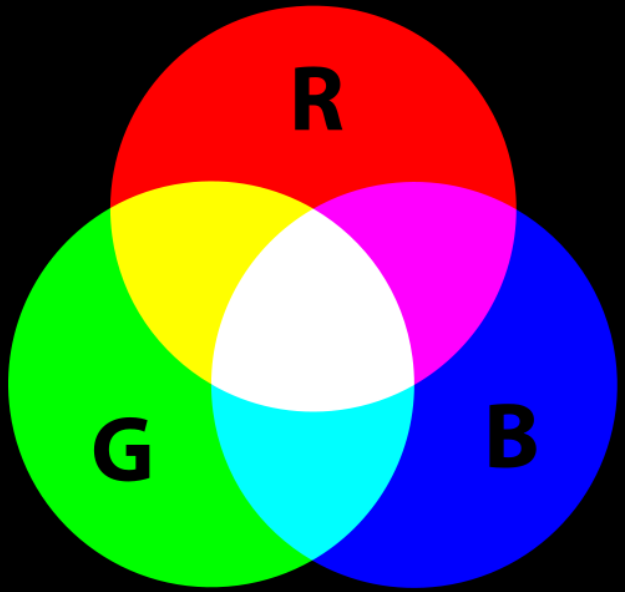
Jacques Bertin, Sémiologie Graphique, 1967



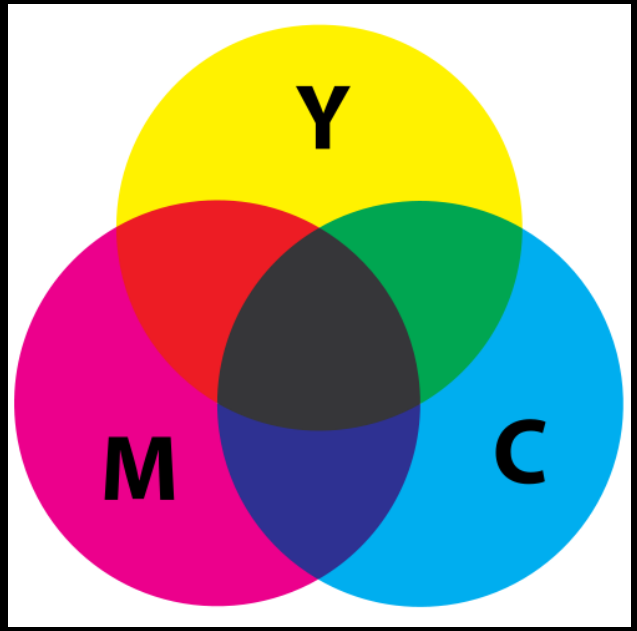

Hue
Chroma
Value

Additive vs. Subtractive Color

Additive

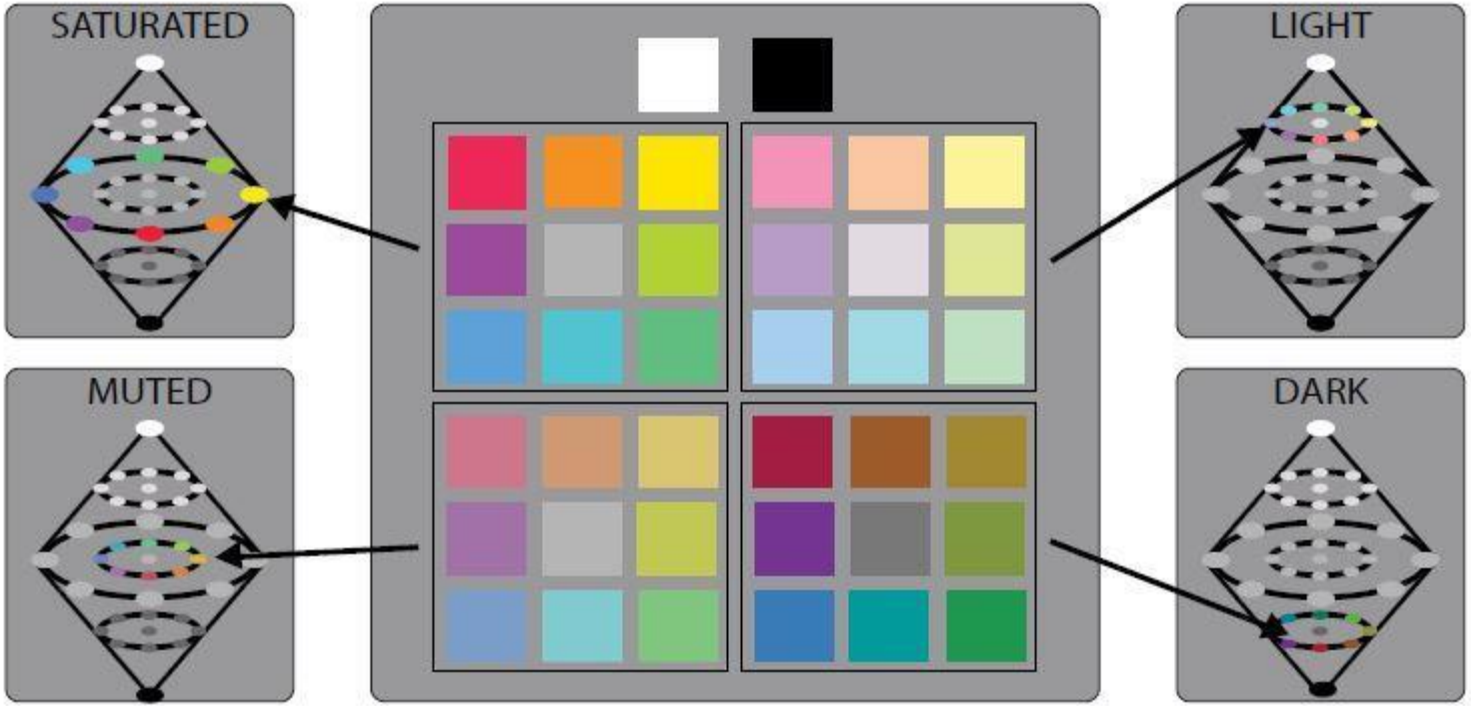


Subtractive



COLOR EMOTION GUIDE

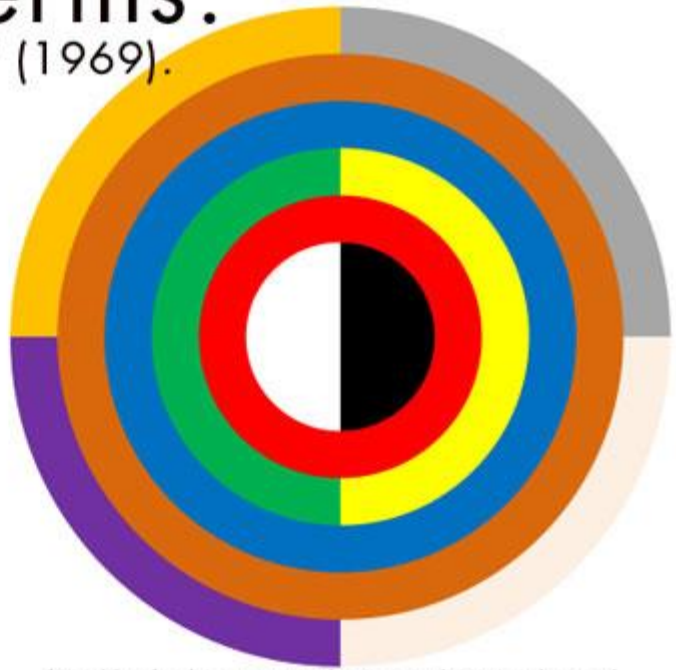
Berkeley Color Project (BCP) 37 Colors



Basic Color Terms:

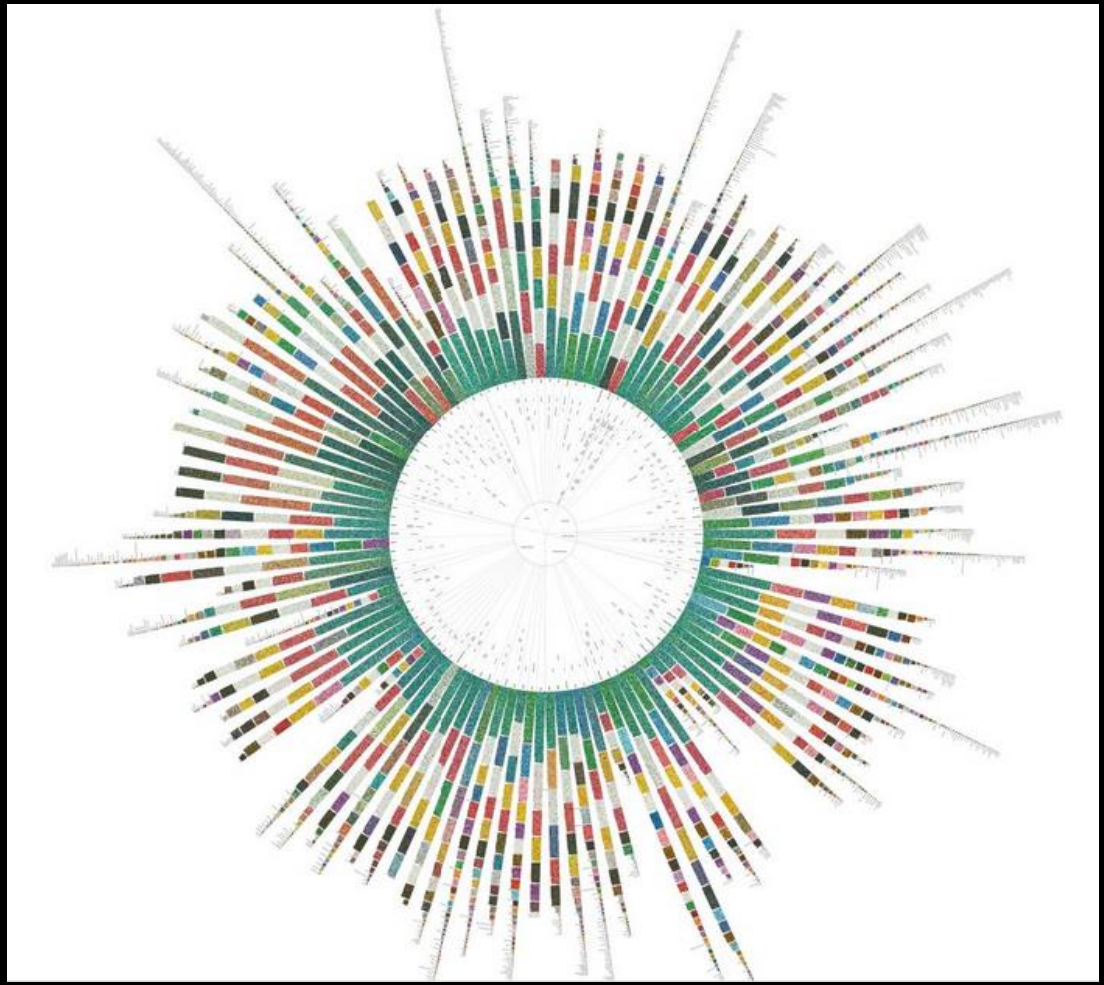
Their Universality and Evolution" (1969).

LANGUAGE OF COLOR



Berlin and Kay

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

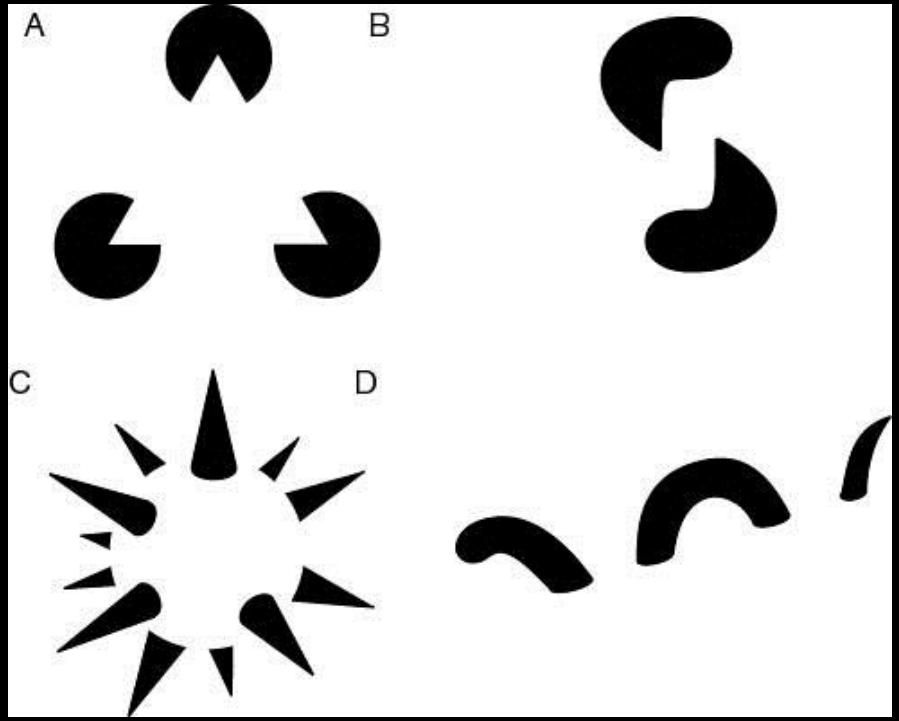


Gestalt Laws of Pattern Perception

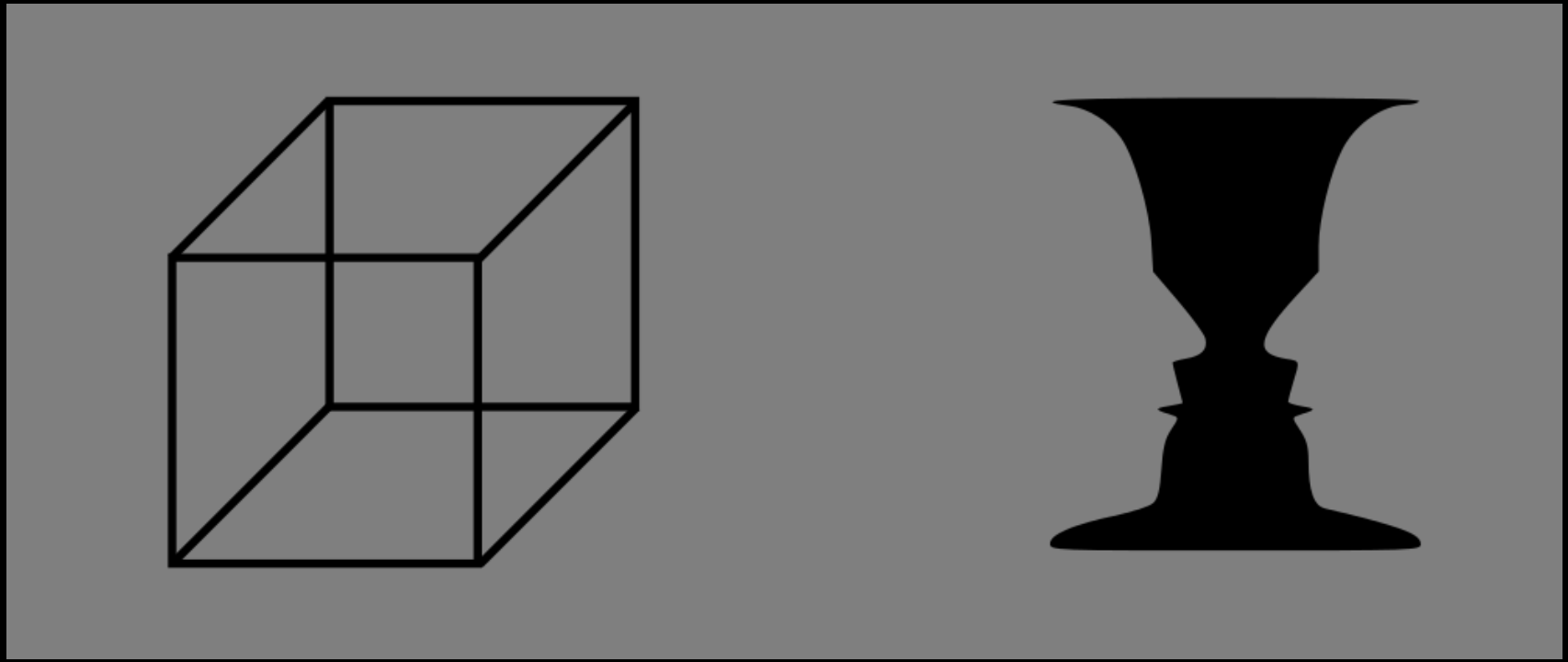
- German psychologists 1920s
- Understand perception
- Principles
  - Emergence
  - Reification
  - Multistability
  - Invariance
  - Grouping

Emergence

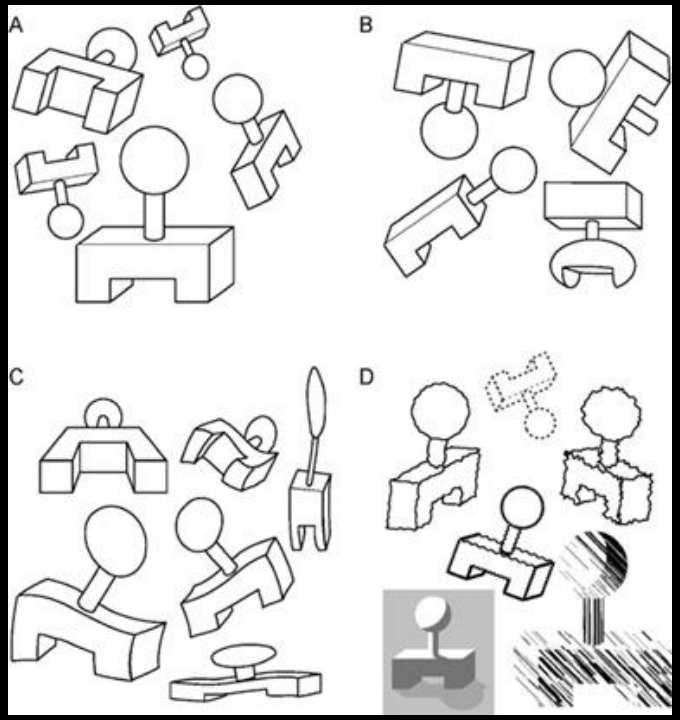
Reification



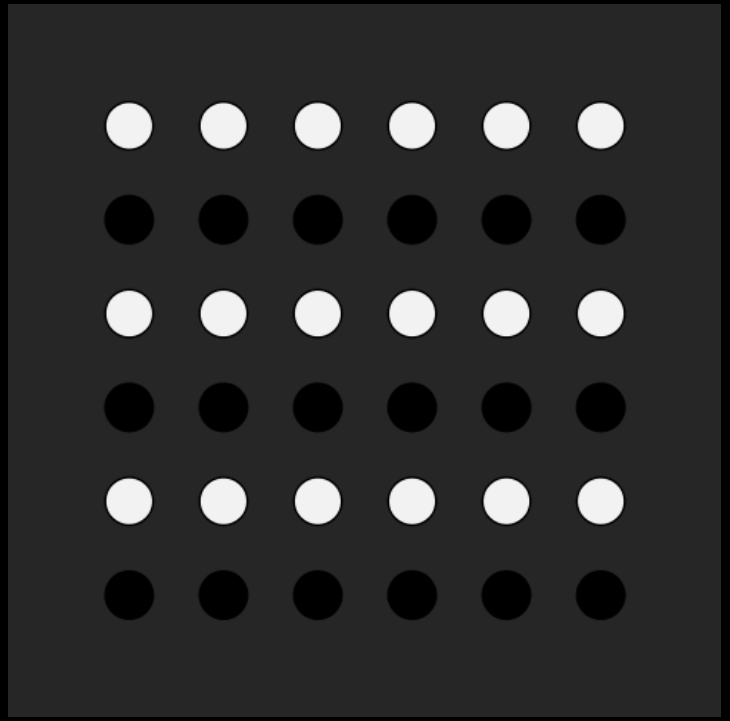
Multistability



Invariance

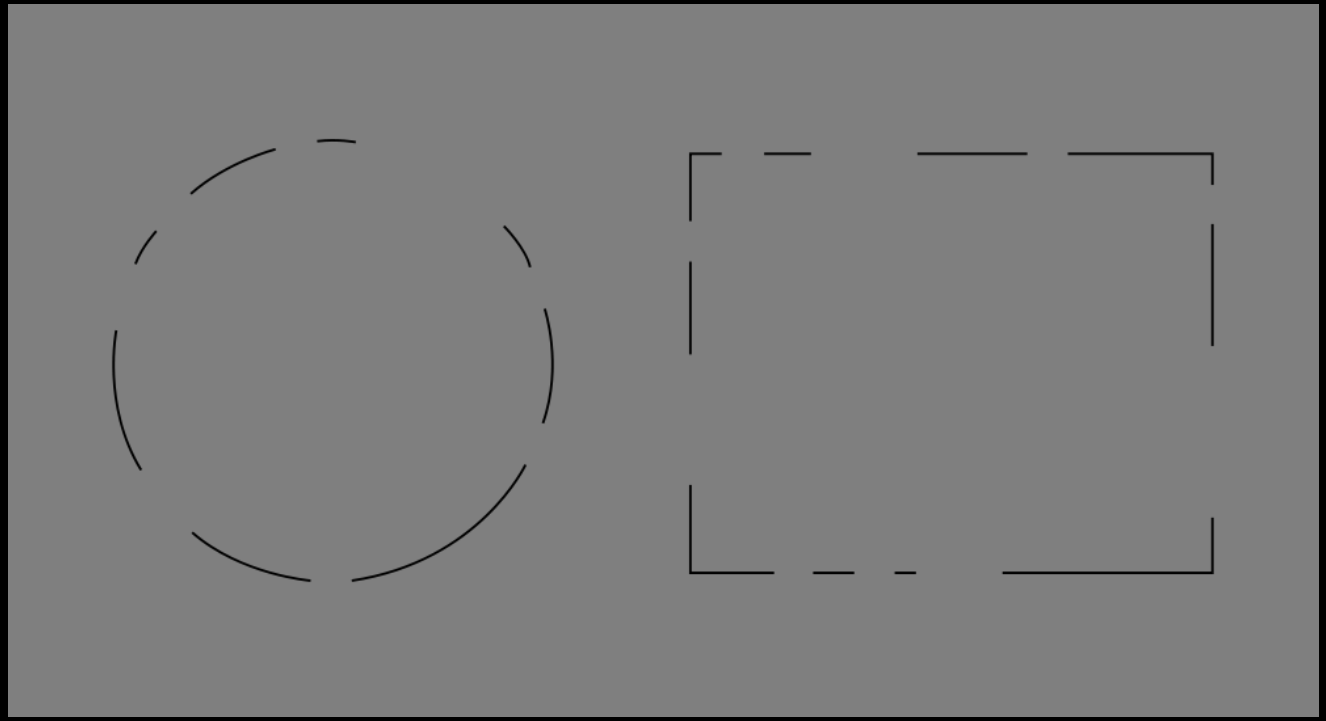


Group: Similarity



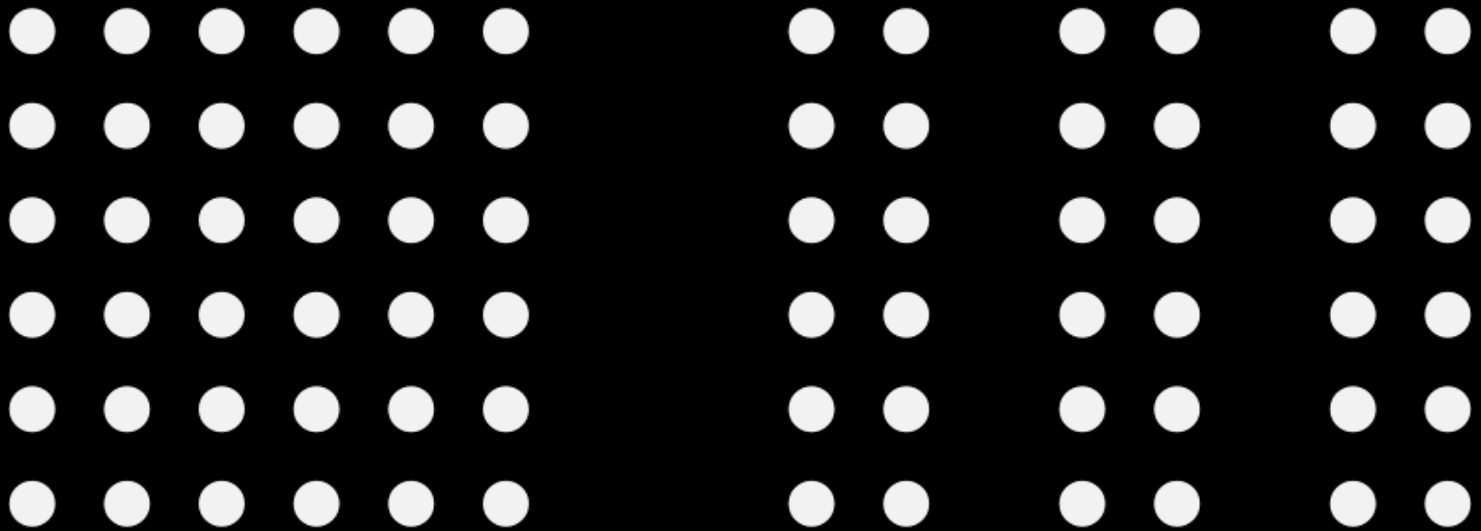
Similarity

Group: closure

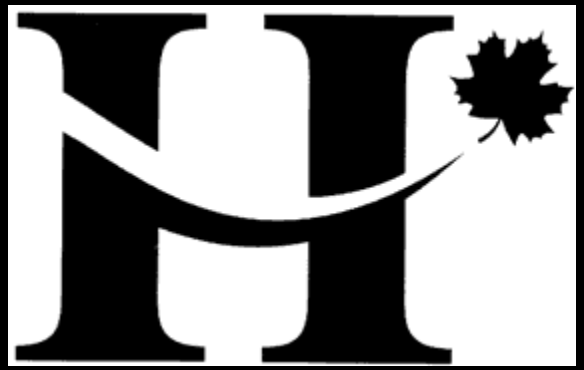


Group: Closure

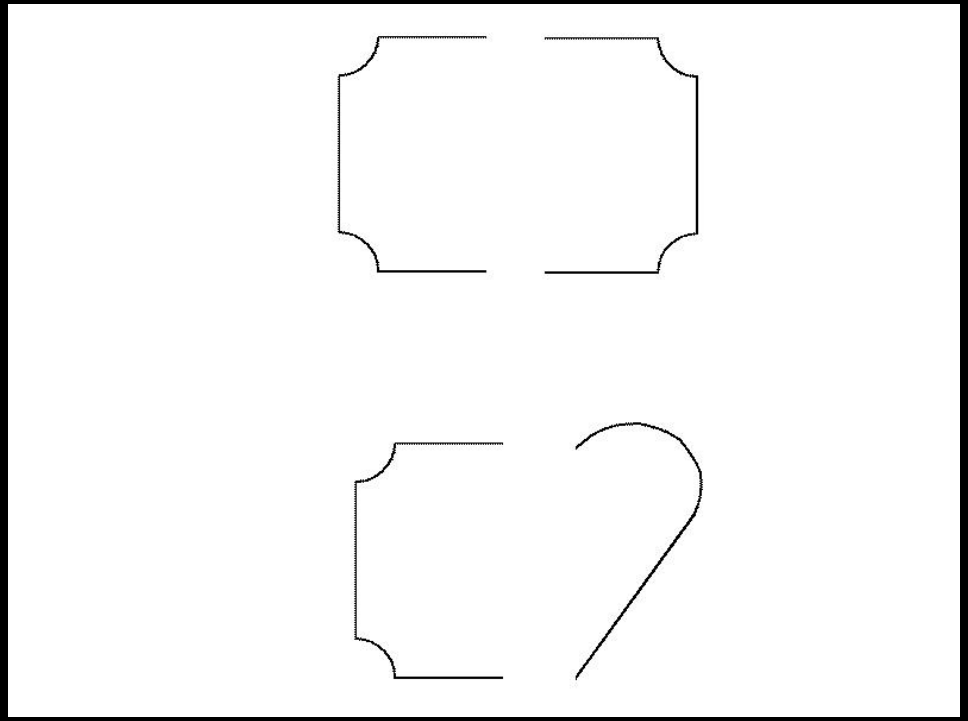
Group: Proximity



Group: continuity



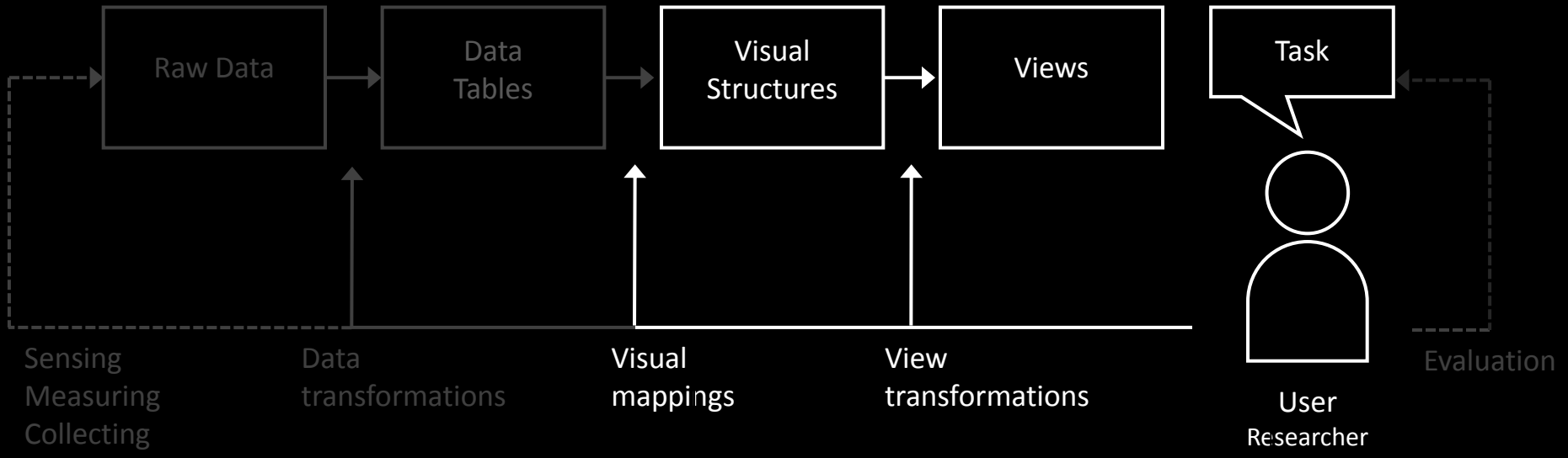
Group: symmetry



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.
7. Introduce Visual Mappings.
8. **Break**.
9. Update Group 3 and 4.
10. Introduce Visual Structures.
11. **Break**
12. Update Group 5 and 6.
13. Reading Assignments for Next Class.
14. Working groups and one-on-one feedback

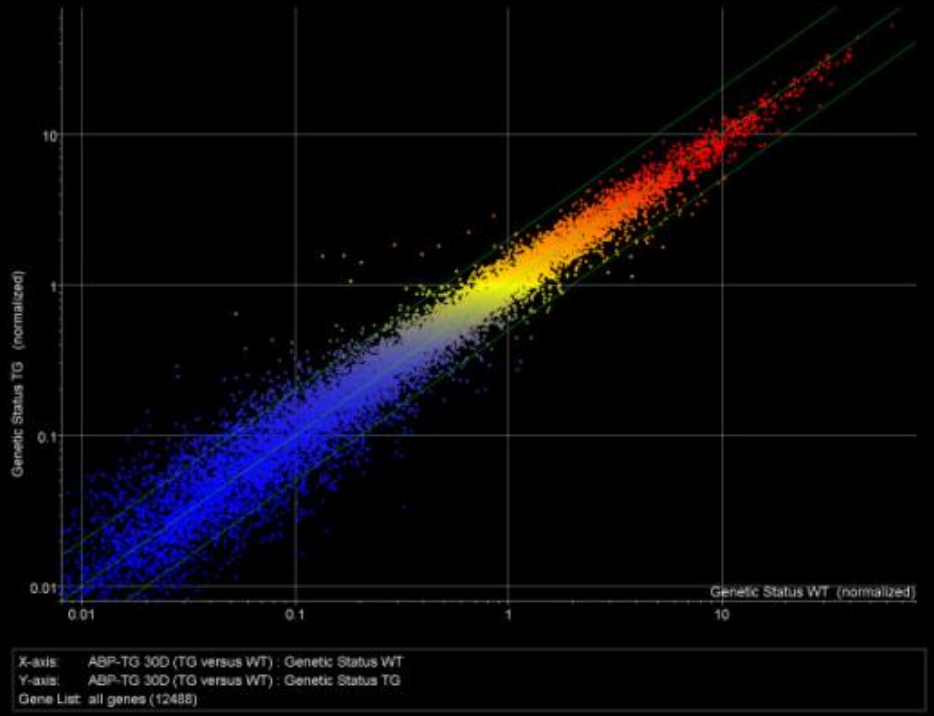
Next: Visual Structures, Views, Tasks



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: Scater Plot



Scatterplot Matrix

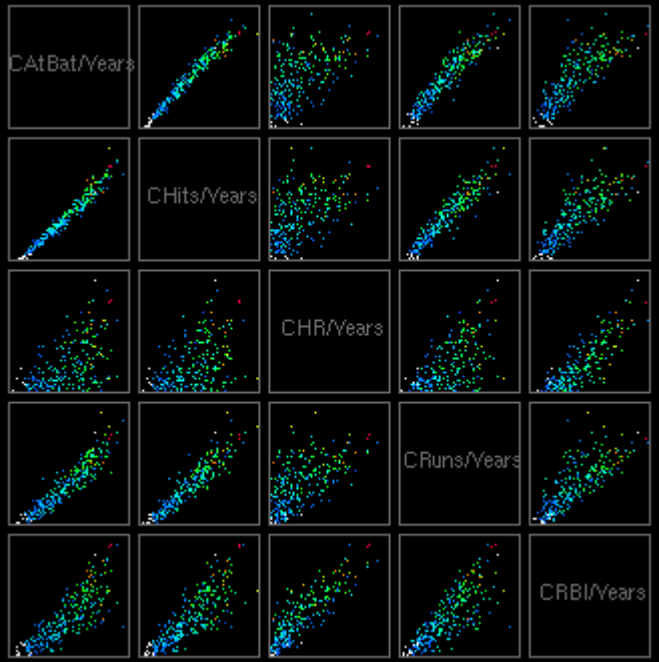
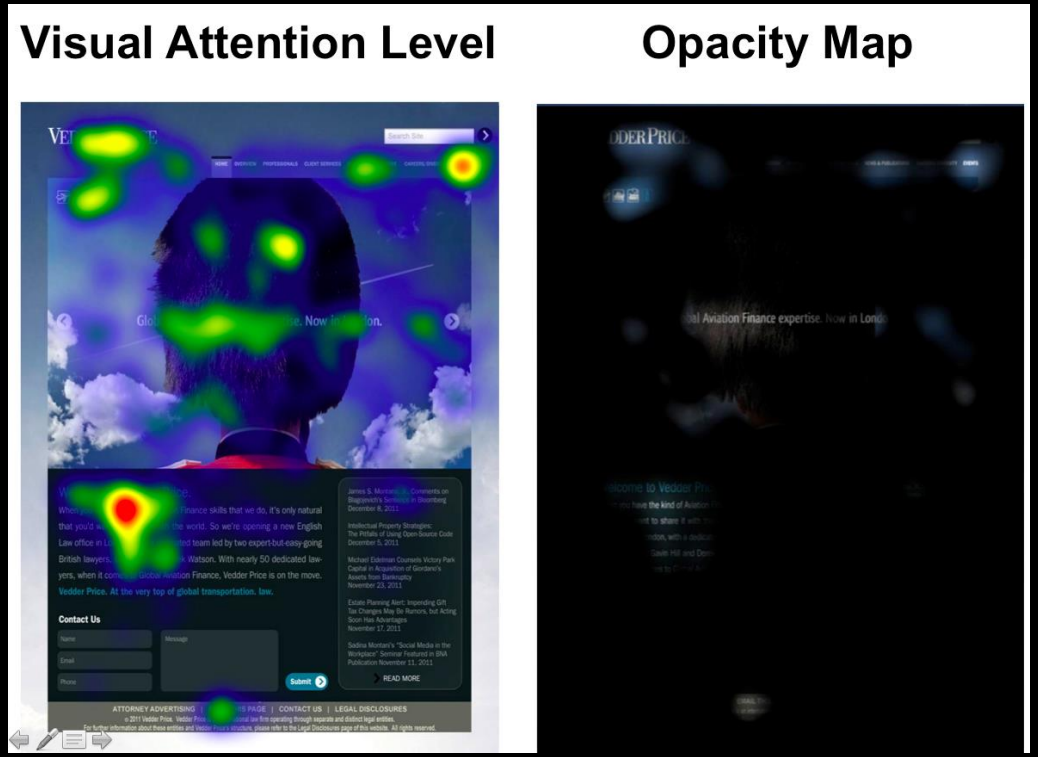
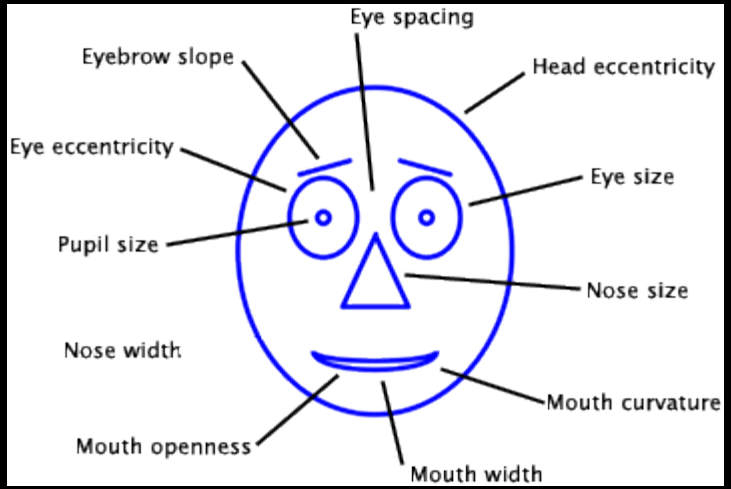


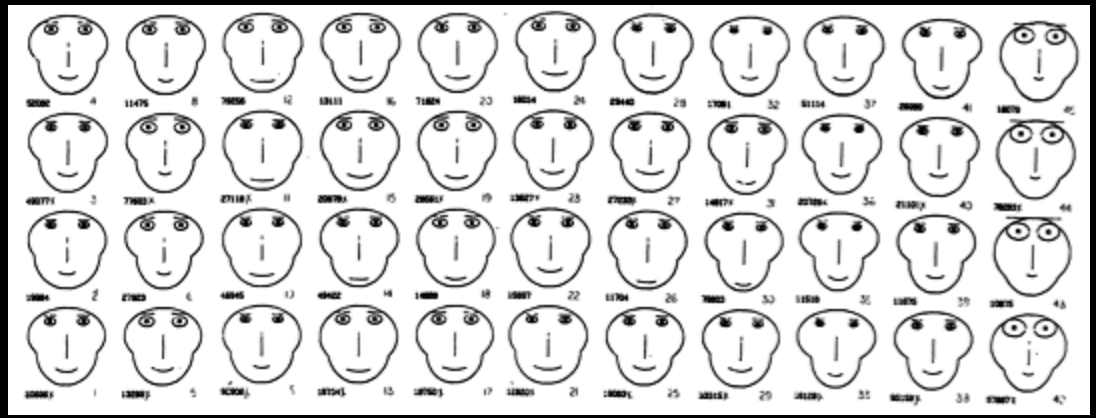
Table Visualization

Visual Attention Heatmap

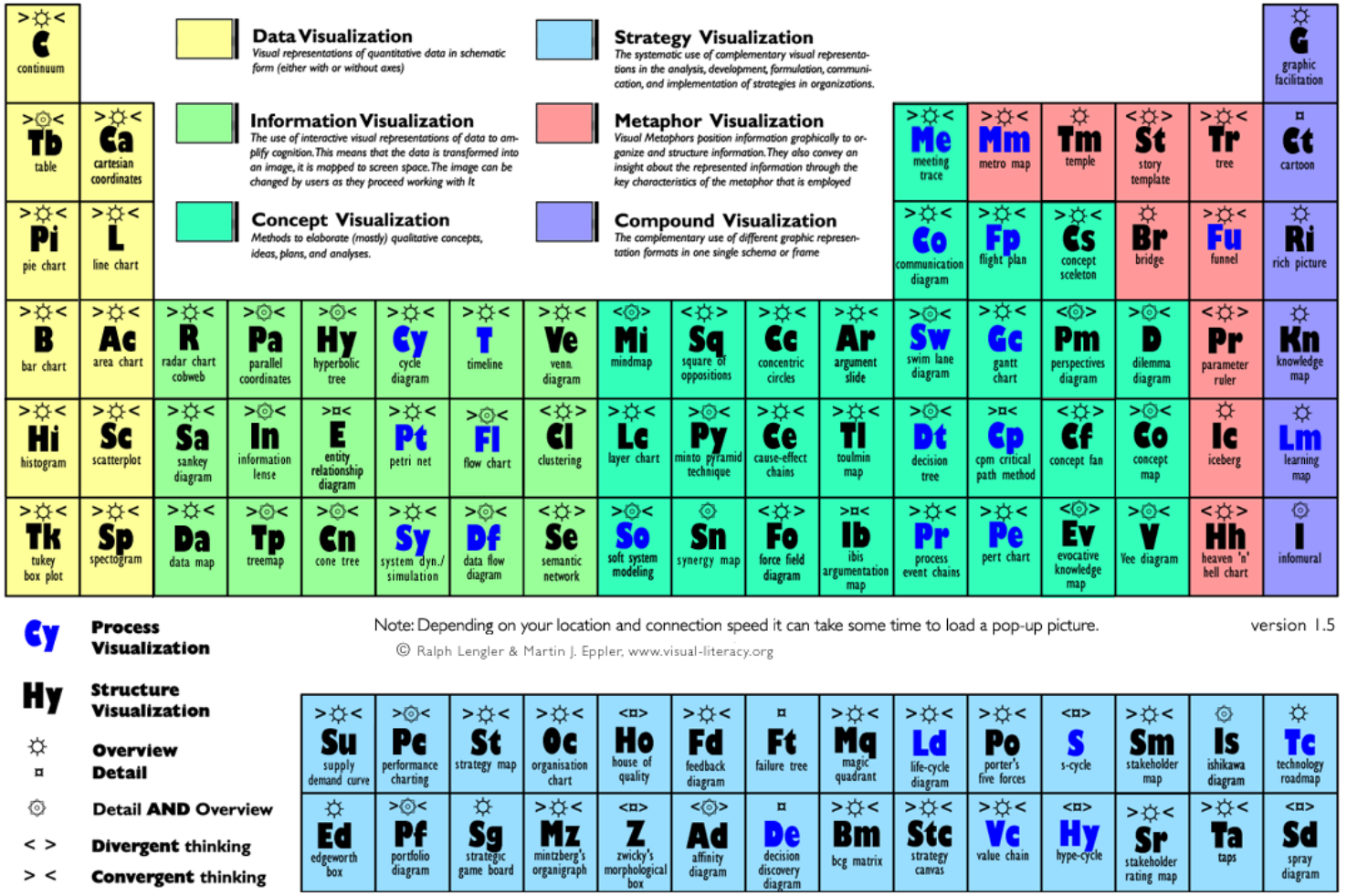


Chernoff Faces





A PERIODIC TABLE OF VISUALIZATION METHODS



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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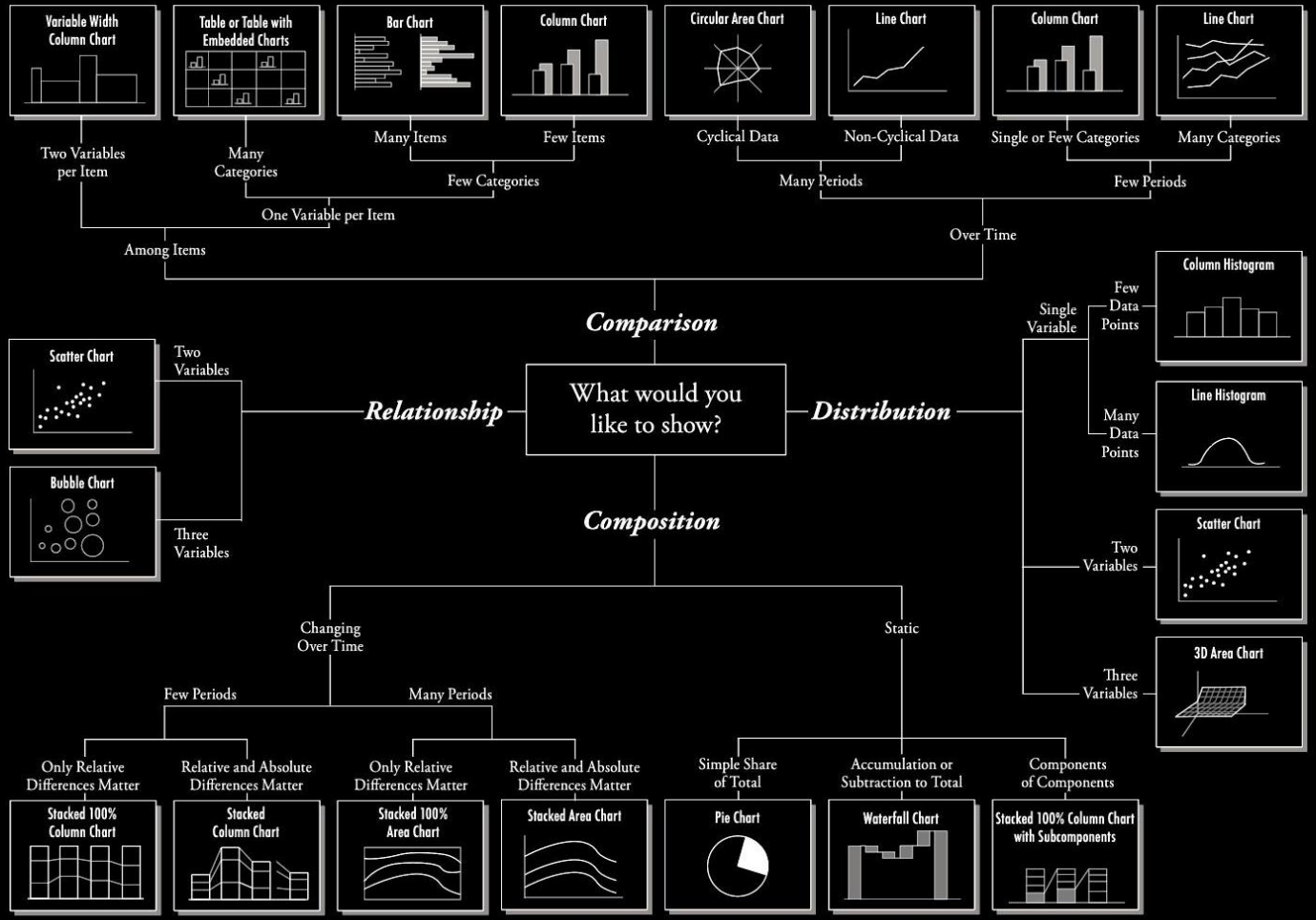
Chart Suggestions—A Thought-Starter



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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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