

Übung zur Vorlesung

Informationsvisualisierung

Emanuel von Zezschwitz
Ludwig-Maximilians-Universität München
Wintersemester 2014/2015

Organisatorisches

- Informationen zu Vorlesung & Übung
<http://www.medien.ifi.lmu.de/lehre/ws1415/iv/>
- Anmeldung über Uniworx:
<https://uniworx.ifi.lmu.de/?action=uniworxCourseWelcome&id=311>
- **Phase 1: Übungsblätter** - Verständnis- und Klausuraufgaben (**freiwillig**)
- **Phase 2: Projekt** (**freiwillig, 5%-10% Klausurbonus**)

Weitere Informationen

- Informatiker Forum
<http://www.die-informatiker.net/>
- Mimuc Twitter Account (inoffiziell)
<http://twitter.com/mimuc>
- Medieninformatik LMU Facebook Gruppe (inoffiziell)
<https://www.facebook.com/groups/36775131102/>

Einbringung ins Studium

- **Master**

- **Modul:** WP16: Computergrafik 3 (für Master Medieninformatik)
- **ECTS-Credits:** 6
- **Note:** Teilnahme an Klausur

- **Diplom**

- **SWS:** 2 (Vorlesung) + 2 (Übung)
- **MM-Säule** (Butz)
- **Note:** Teilnahme an Klausur

Klausur

- **Termin: 03.02.2015**, 10:00-12:00 Uhr
Ort: Geschwister-Scholl-Platz 1, Raum B 101
- **Closed Book**
- Klausurvorbereitung in den Übungen in der Woche vor der Klausur

Visualization

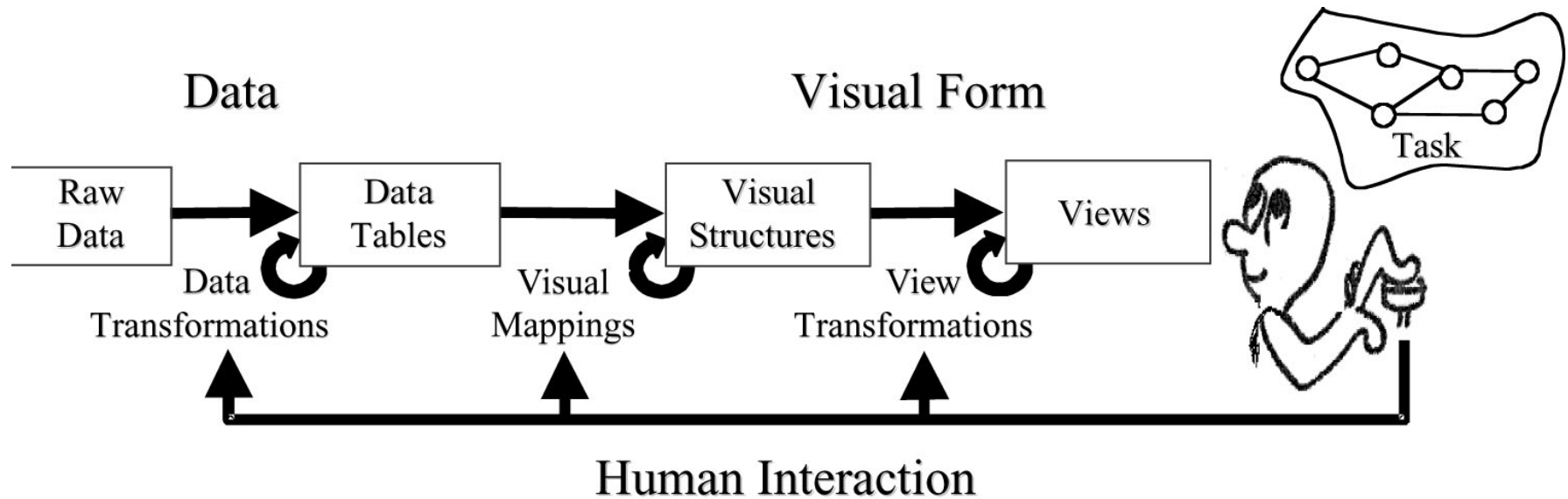


© <http://philip.greenspun.com/>

“Graphical excellence is that which gives to the viewer the **greatest number of ideas** in the **shortest time** with the **least ink** in the **smallest space**.”

Edward Tufte [1]

InfoVis Reference Model



Raw Data: idiosyncratic formats

Data Tables: relations (cases by variables) + meta-data

Visual Structures: spatial substrates + marks + graphical properties

Views: graphical parameters (position, scaling, clipping, ...)

Lie Factor

“The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the quantities represented.”

Edward Tufte [1]

Lie Factor

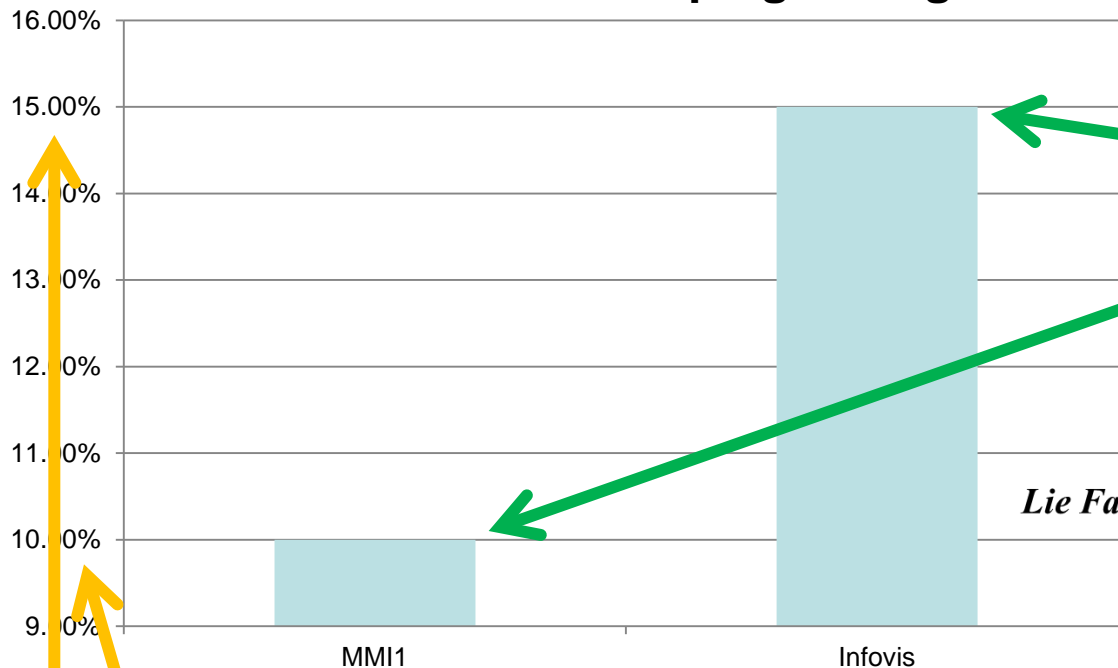
$$\textit{Lie Factor} = \frac{\text{size of effect shown in graphic}}{\text{size of effect in data}}$$

$$\textit{size of effect} = \frac{|\text{second value} - \text{first value}|}{\text{first value}}$$

should be close to 1

Lie Factor

amount of students sleeping during lectures



size of effect in graph

$$\frac{|6 - 1|}{1} = 5$$

$$\text{Lie Factor} = \frac{\text{size of effect shown in graphic}}{\text{size of effect in data}}$$

$$\text{size of effect} = \frac{|\text{second value} - \text{first value}|}{\text{first value}}$$

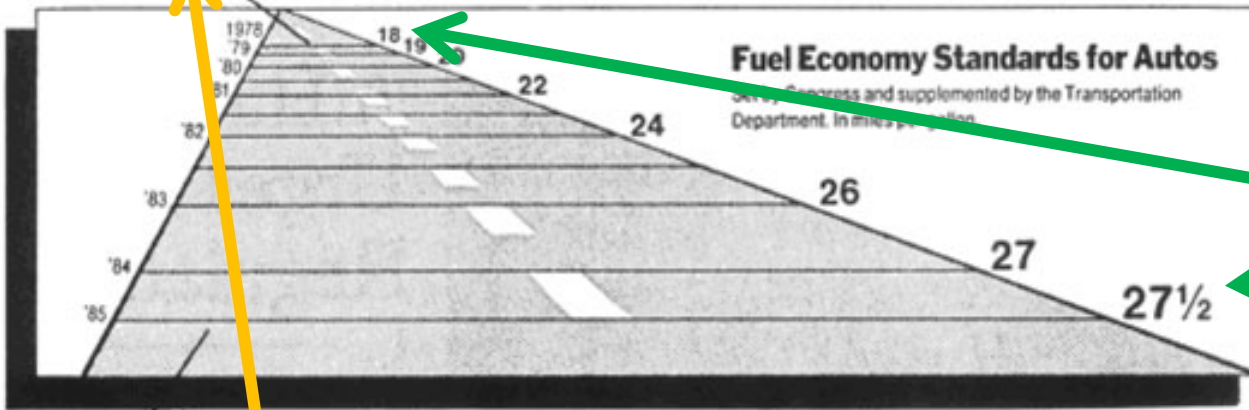
$$\text{Lie Factor} = \frac{5}{0.5} = 10$$

$$\frac{|15 - 10|}{10} = 0.5$$

size of effect in data

Lie Factor

This line, representing 18 miles per gallon in 1978, is 0.6 inches long.



size of effect in data

$$\frac{|27.5 - 18|}{18} = 0.53$$

This line, representing 27.5 miles per gallon in 1985, is 5.3 inches long.

$$\frac{|5.3 - 0.6|}{0.6} = 7.83$$

size of effect in graph

$$\text{Lie Factor} = \frac{7.83}{0.53} = 14,8$$

Lie Factor?



MONSTROUS COSTS
Total House and Senate campaign expenditures, in millions

by Nigel Holmes [2]

Data-Ink Ratio

“A large share of ink on a graphic should present data-information, the ink changing as the data change. Data-ink is the non-erasable core of a graphic, the non-redundant ink arranged in response to variation in the numbers represented.”

Edward Tufte [1]

Data-Ink Ratio

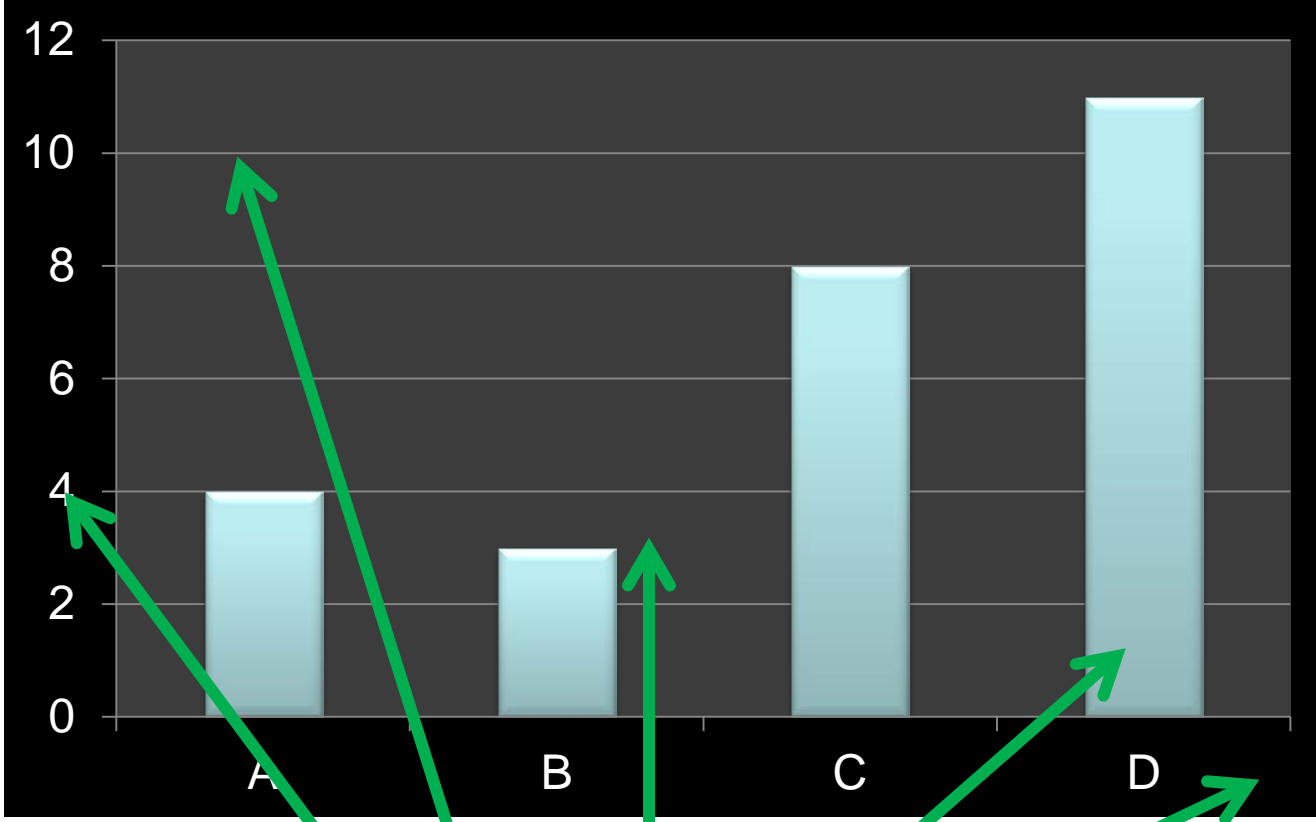
$$\textit{Data-ink ratio} = \frac{\text{Data-ink}}{\text{Total ink used in the graphic}}$$

should be close to 1

5 Data-Ink Principles by Tufte

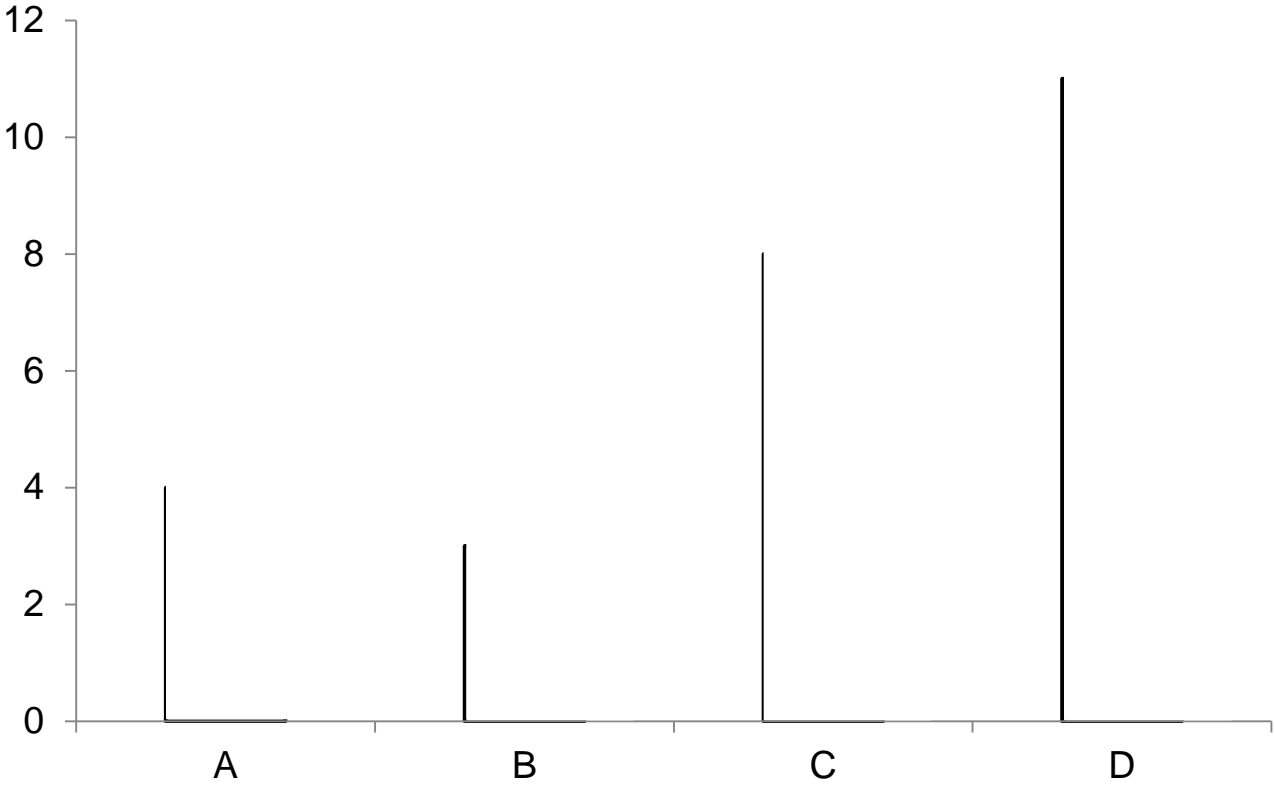
1. above all else show data
2. maximize data-ink ratio
3. erase non-data-ink
4. erase redundant data-ink
5. revise and edit

Data-Ink Ratio



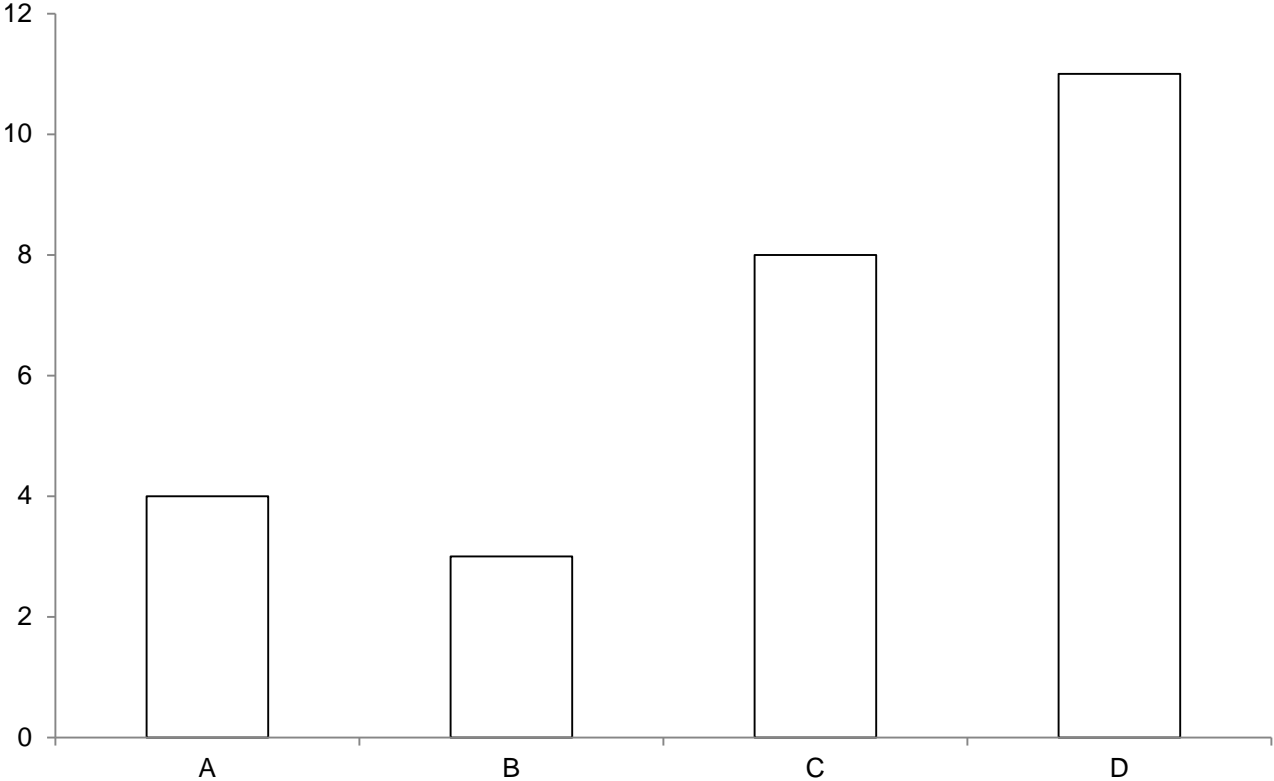
Is this data-ink?

Data-Ink Ratio

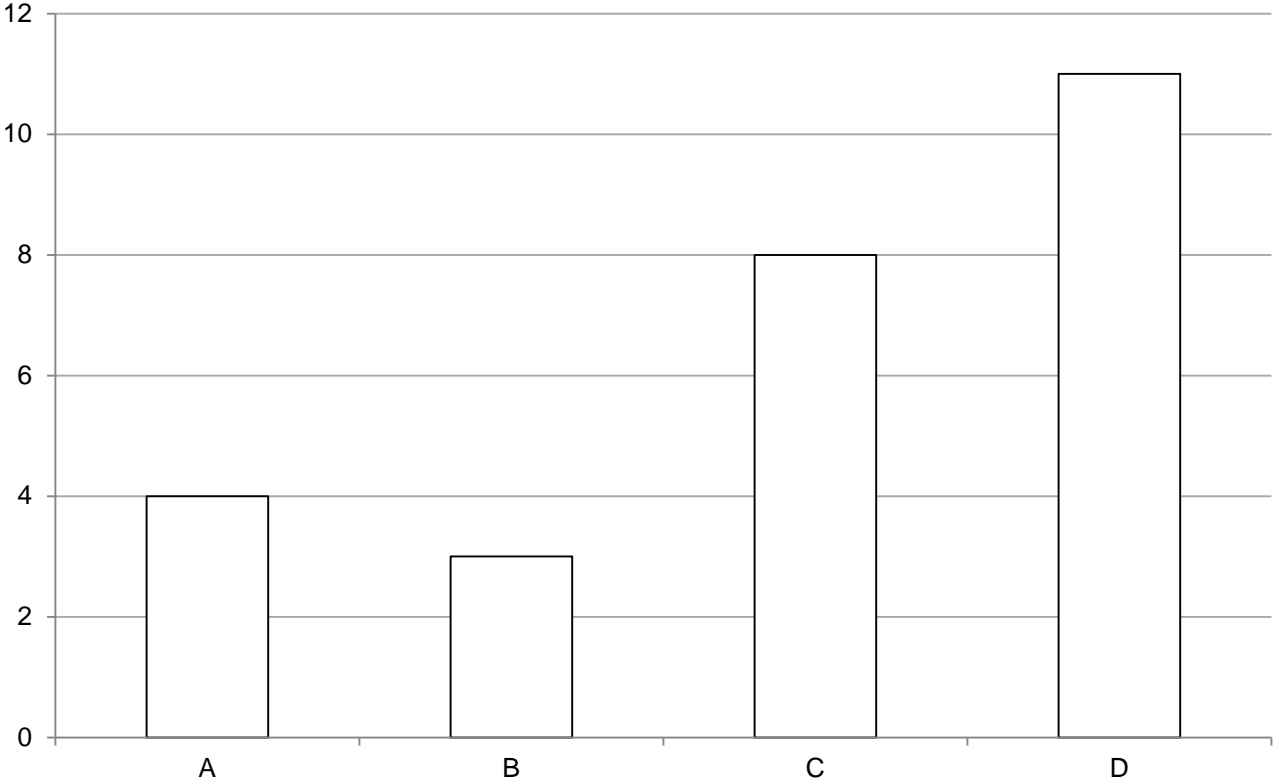


possible Tufte version

Data-Ink Ratio



Data-Ink Ratio



Chartjunk

“Chartjunk promoters imagine that numbers and details are boring, dull, and tedious, requiring ornament to enliven. If the numbers are boring, then you've got the wrong numbers.”

Edward Tufte [1]

Chartjunk – Different Opinions

“A good approach to information graphics includes an appeal to the reader, immediately followed by a true account of the story... I want to make room for enjoyment, delight, aesthetic appreciation and wit, and a friendly “you can understand this” approach.”

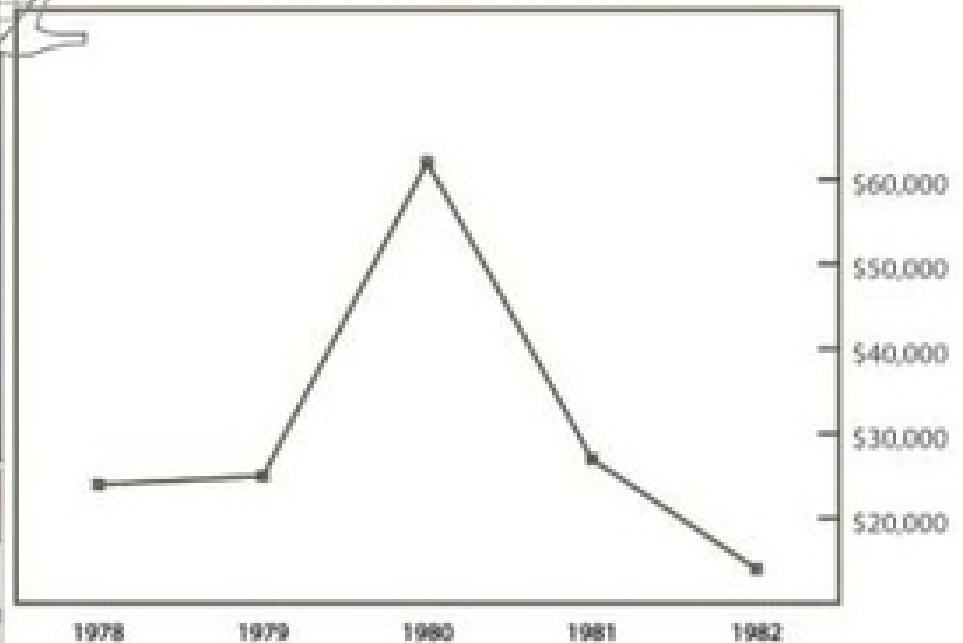
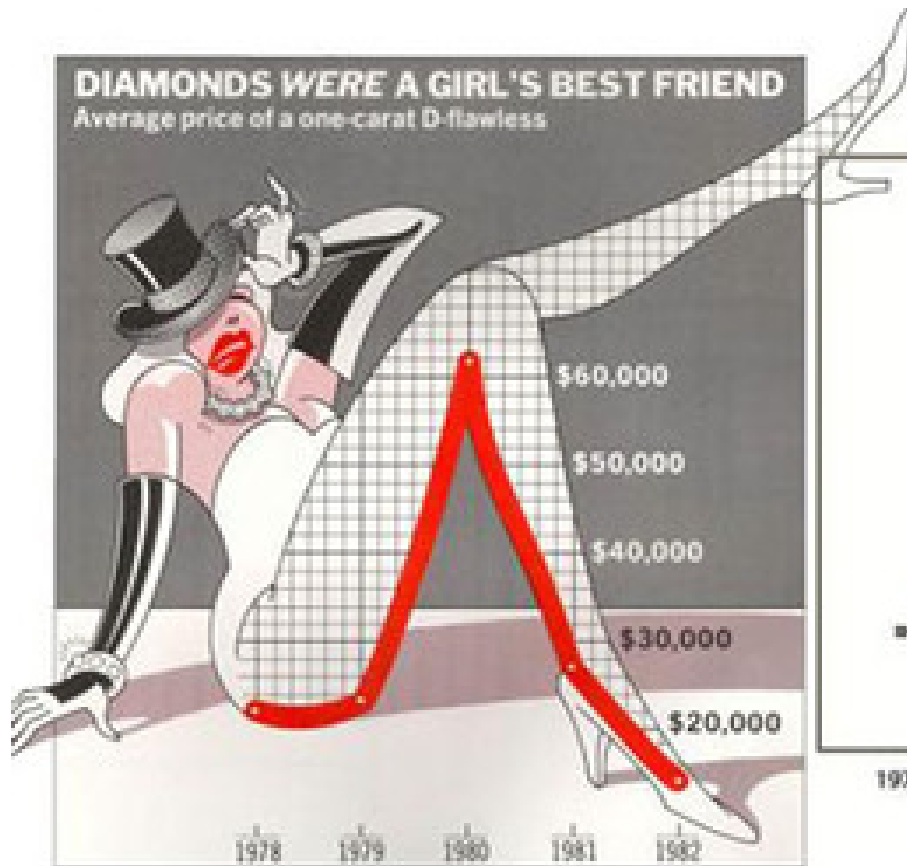
Nigel Holmes [2]

Chartjunk

Nigel Holmes [2]
(Design)

vs

Edward Tufte [1]
(Minimalist)



Bateman et al. [2]

Chartjunk – Pros and Cons

Nigel Holmes

vs

Edward Tufte

- can contain a message
- aesthetical
- better memorable
- ...

➤ Communicating data

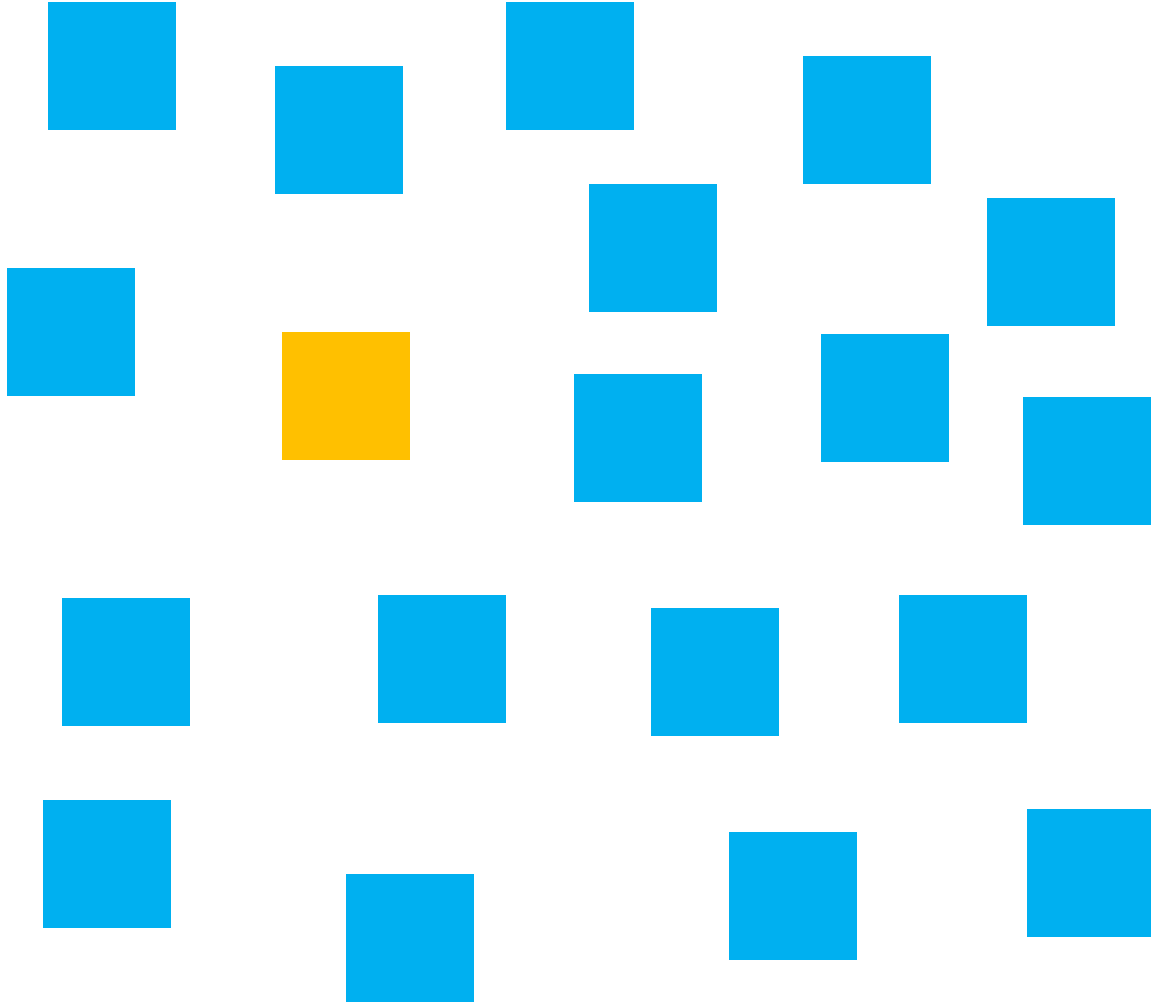
- objective
- clear
- fast to perceive
- ...

➤ Data analysis

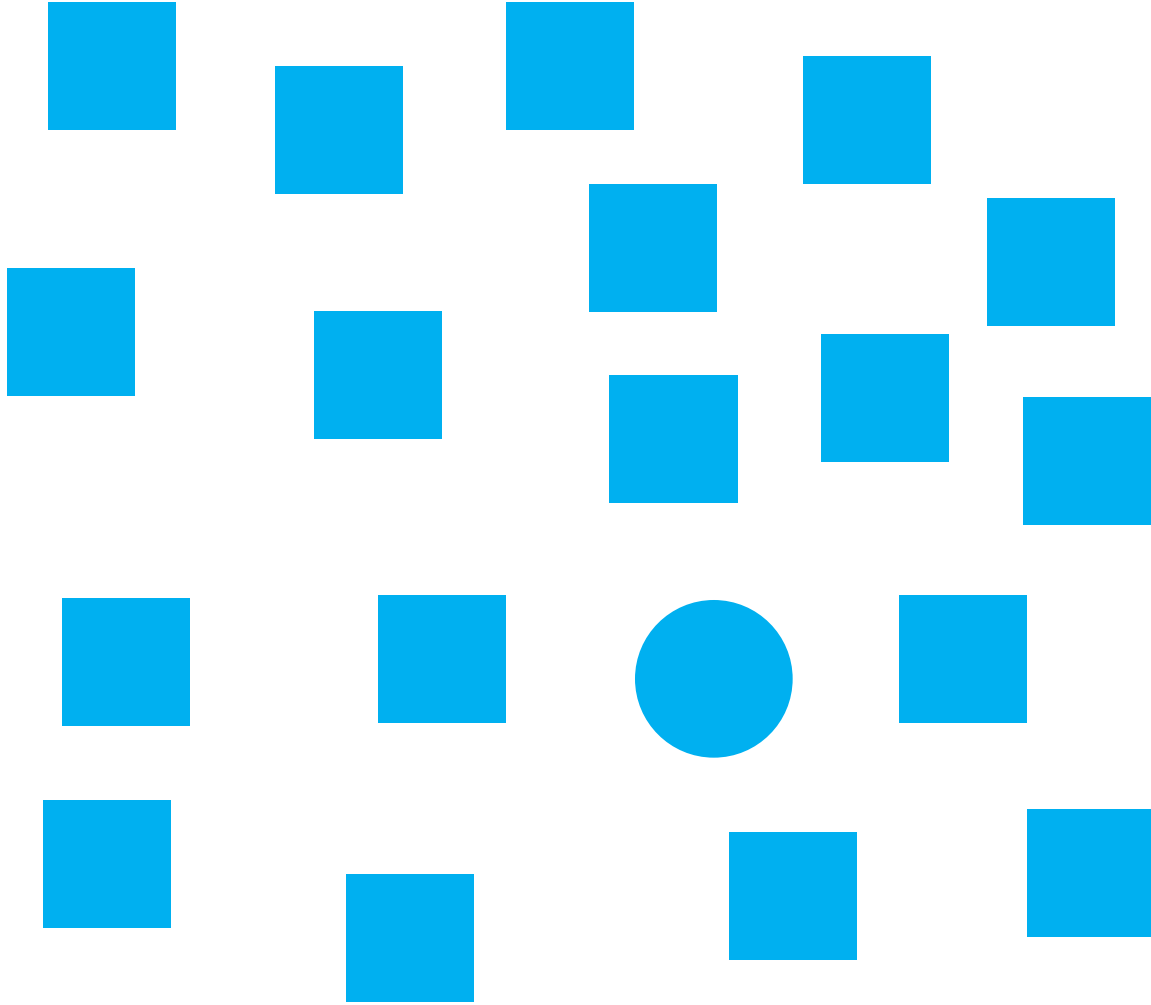
Preattentive Perception

200 – 250 ms

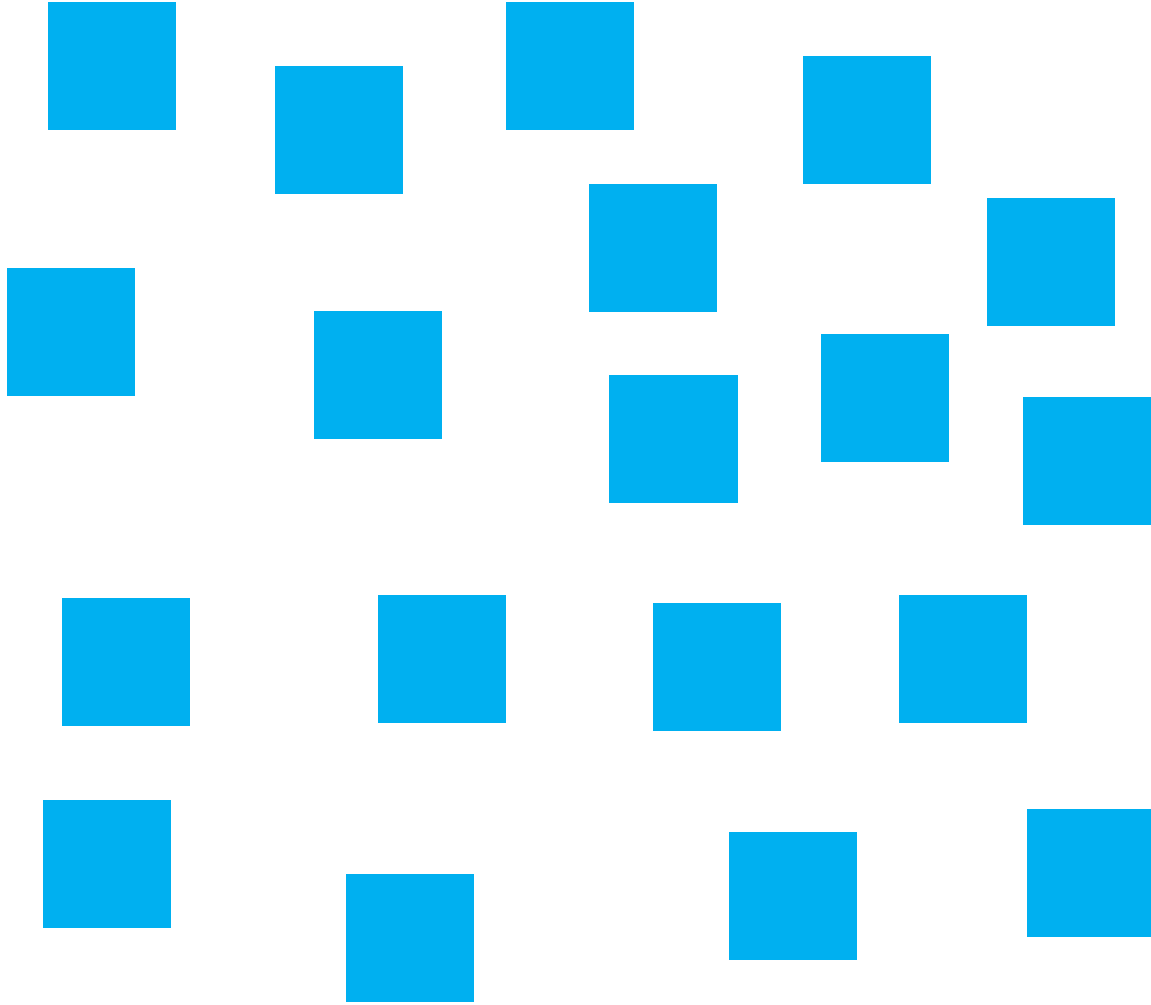
Color pops out



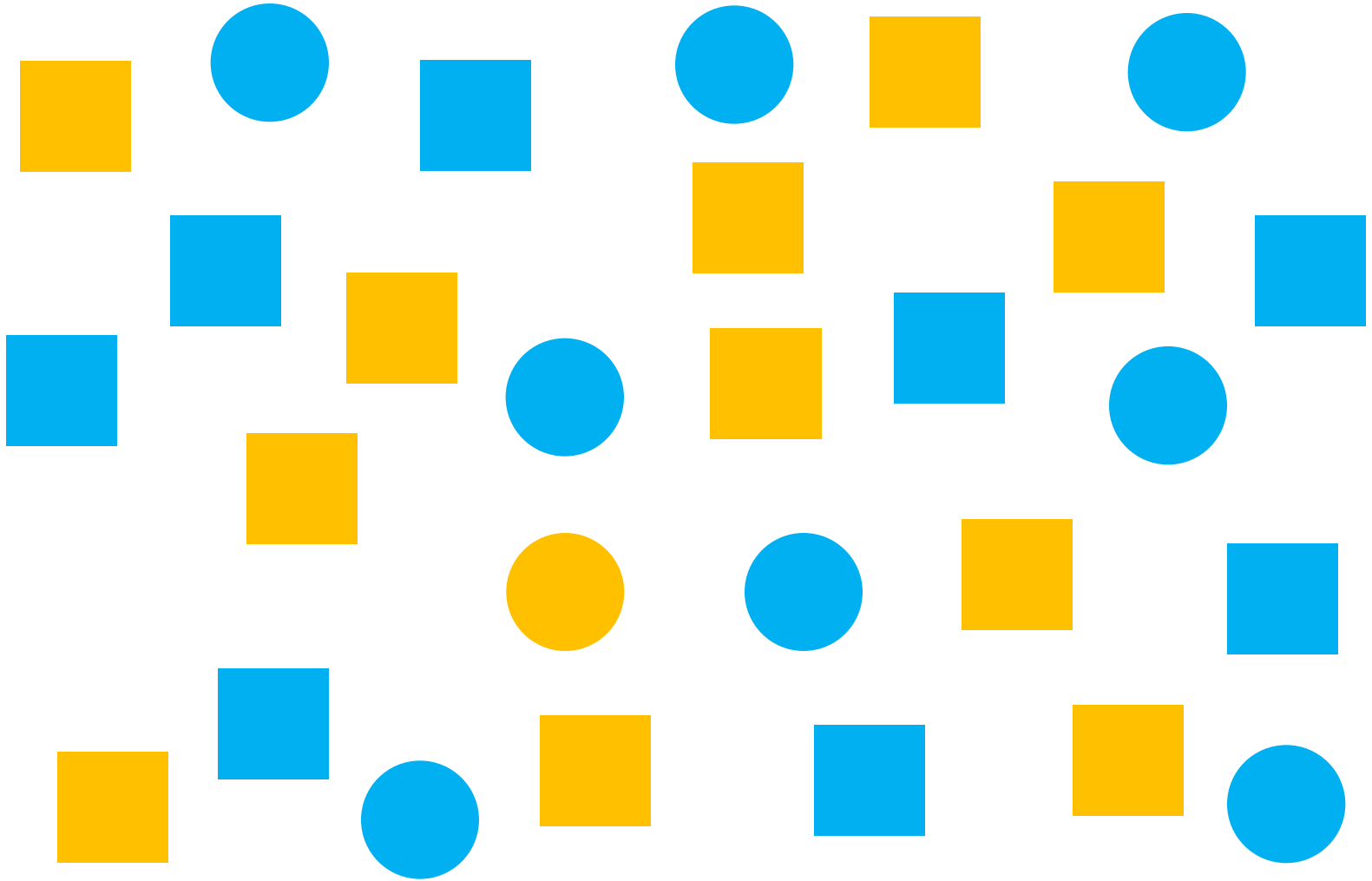
Shape pops out



Flicker pops out



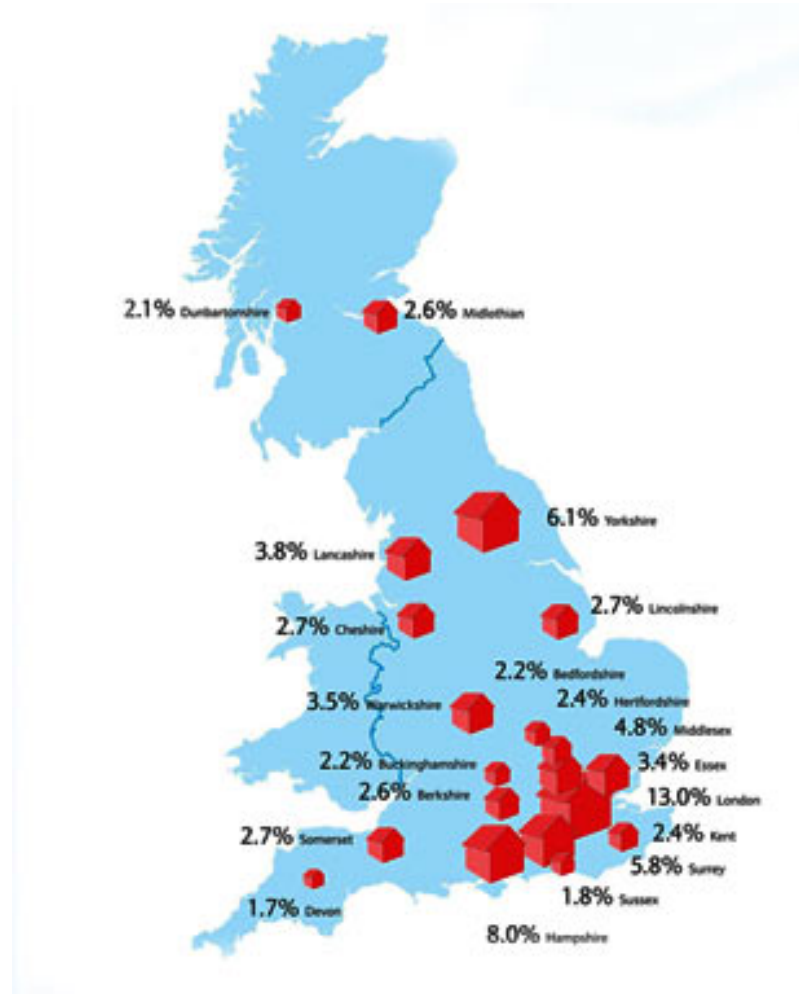
Conjunction does not pop out



**Design and preattentive
perception?**

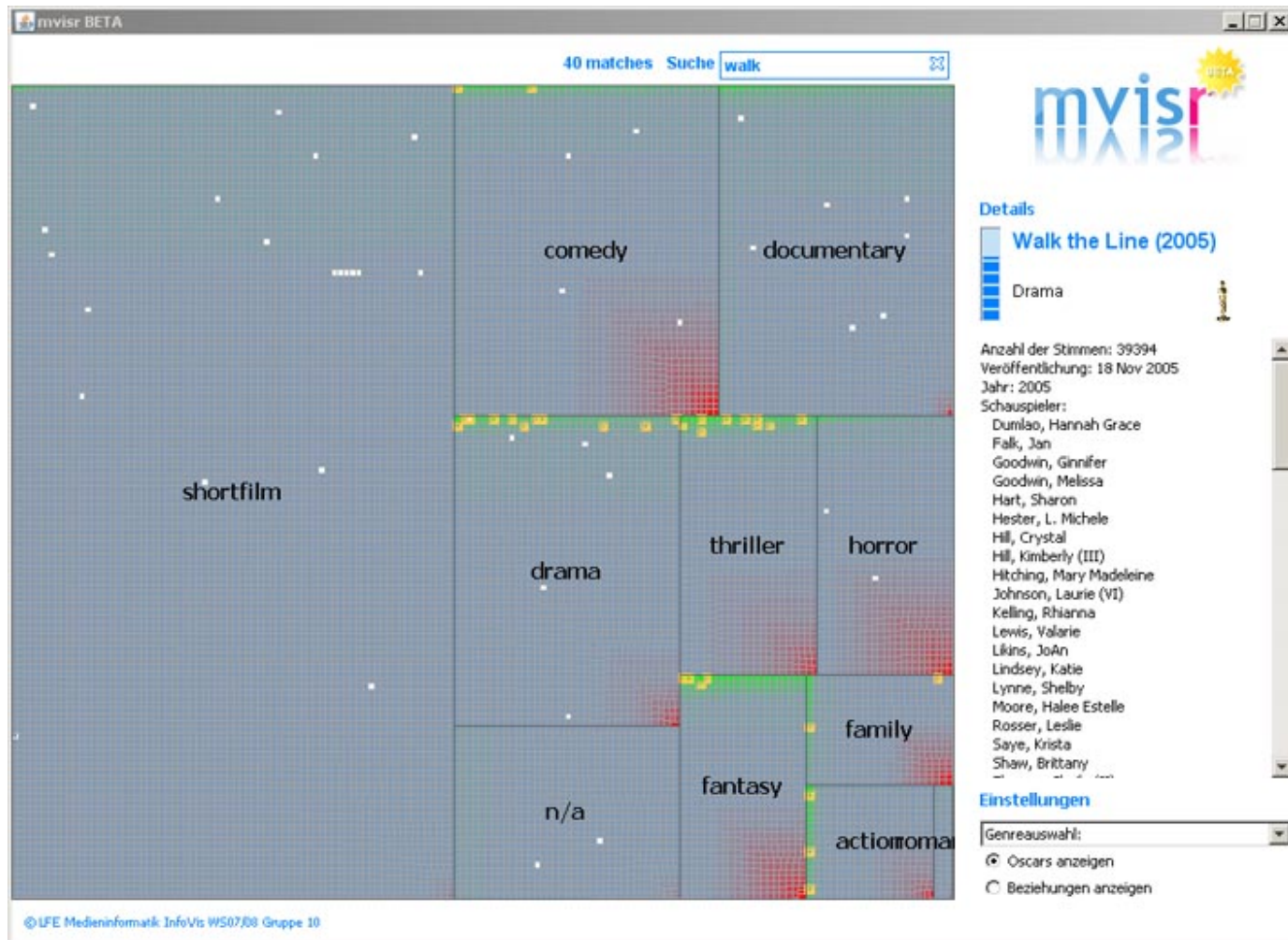
Examples

Wealth distribution in the UK



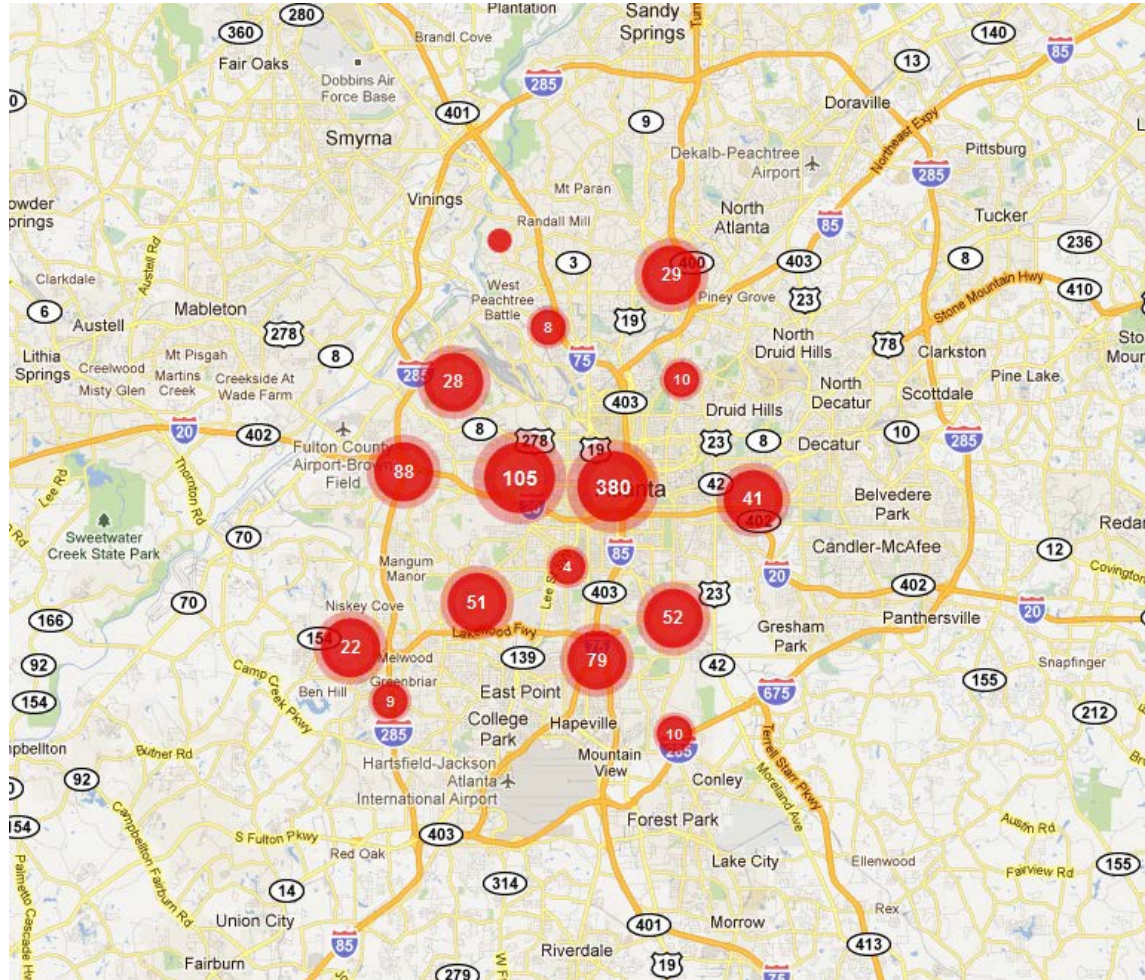
Examples

Movie Visualization



Examples

Crime in Atlanta



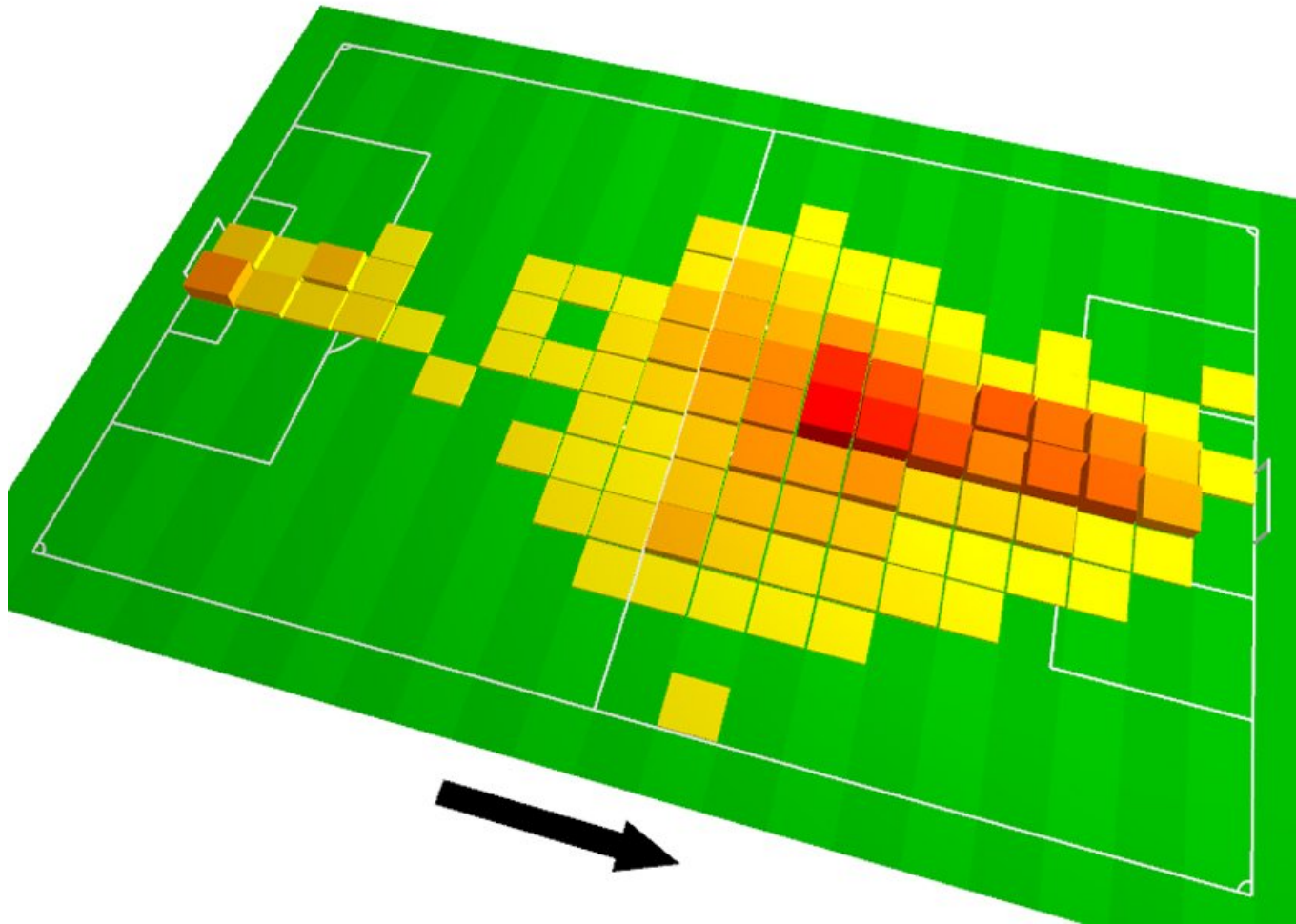
Examples

Obama versus Romney



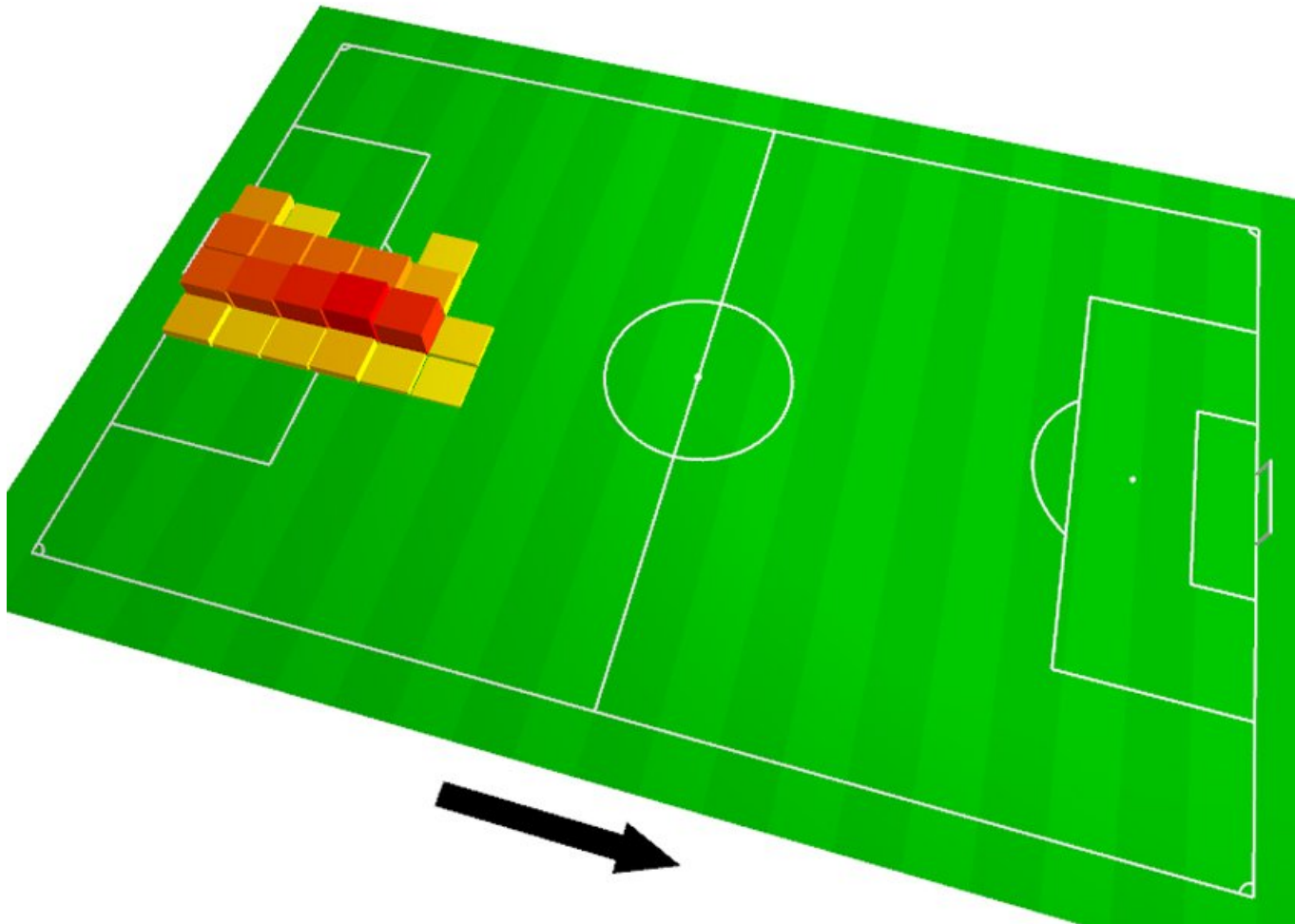
© <http://www.thespeakersgroup.com/blog/obama-romney-2012-convention-speech-word-clouds/>

Visualization and Perception



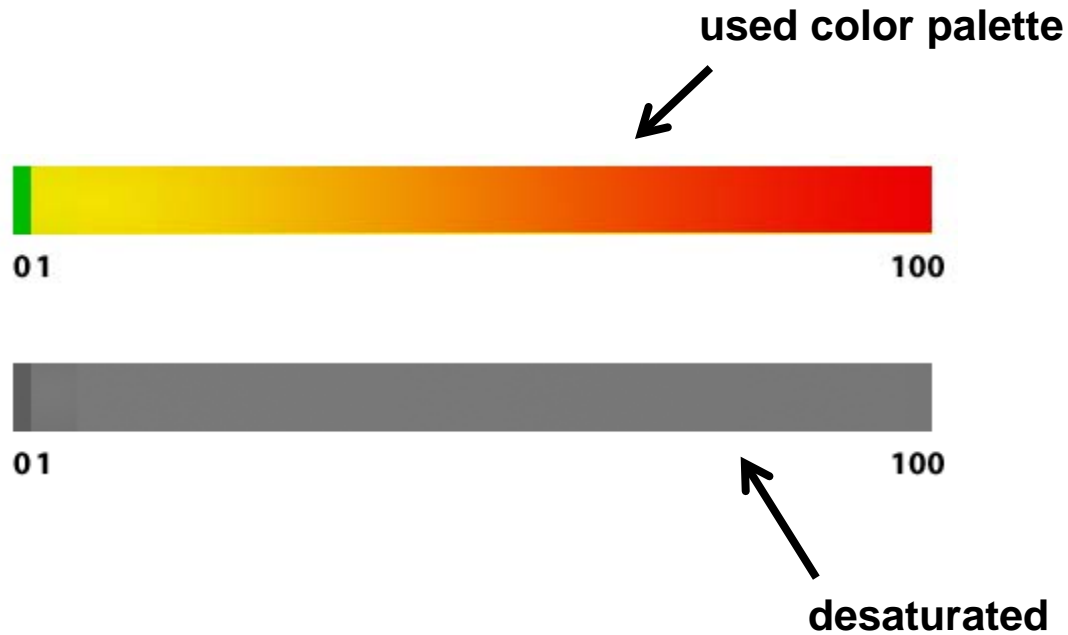
© Spiegel online

Visualization and Perception

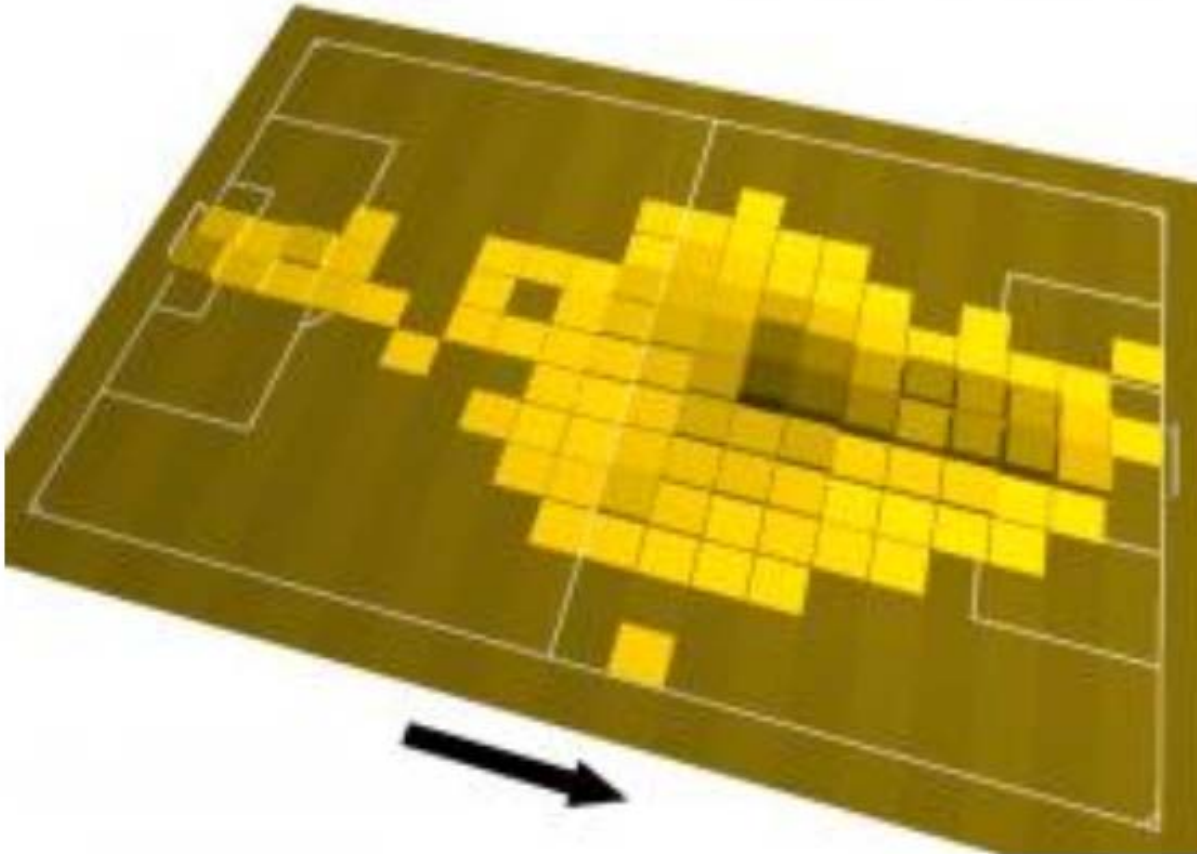


© Spiegel online

Visualization and Perception



Visualization and Perception



as perceived by a red-green color blind
(<http://www.etre.com/tools/colourblindsimulator/>)

Change Blindness

Example



Example



Theories

- **Overwriting?**
- **First Impression?**
- **Nothing is Stored?**
- **Everything is Stored, Nothing is Compared?**
- **Feature Combination?**

Further Reading: <http://www.csc.ncsu.edu/faculty/healey/PP/index.html>

Referenzen

1. Edward Tufte. The Visual Display of Quantitative Information. Second Edition, Graphics Press, USA, 1991.
2. Nigel Holmes. Designer's Guide to Creating Charts and Diagrams, Watson-Guptill Publications, 1984.
3. Scott Bateman, Regan L. Mandryk, Carl Gutwin, Aaron Genest, David McDine, and Christopher Brooks. 2010. Useful junk? the effects of visual embellishment on comprehension and memorability of charts. In Proc. CHI 2010.