Opening the Black Box of Interaction in Visualization

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VIS Tutorial 2014

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DARMSTADT

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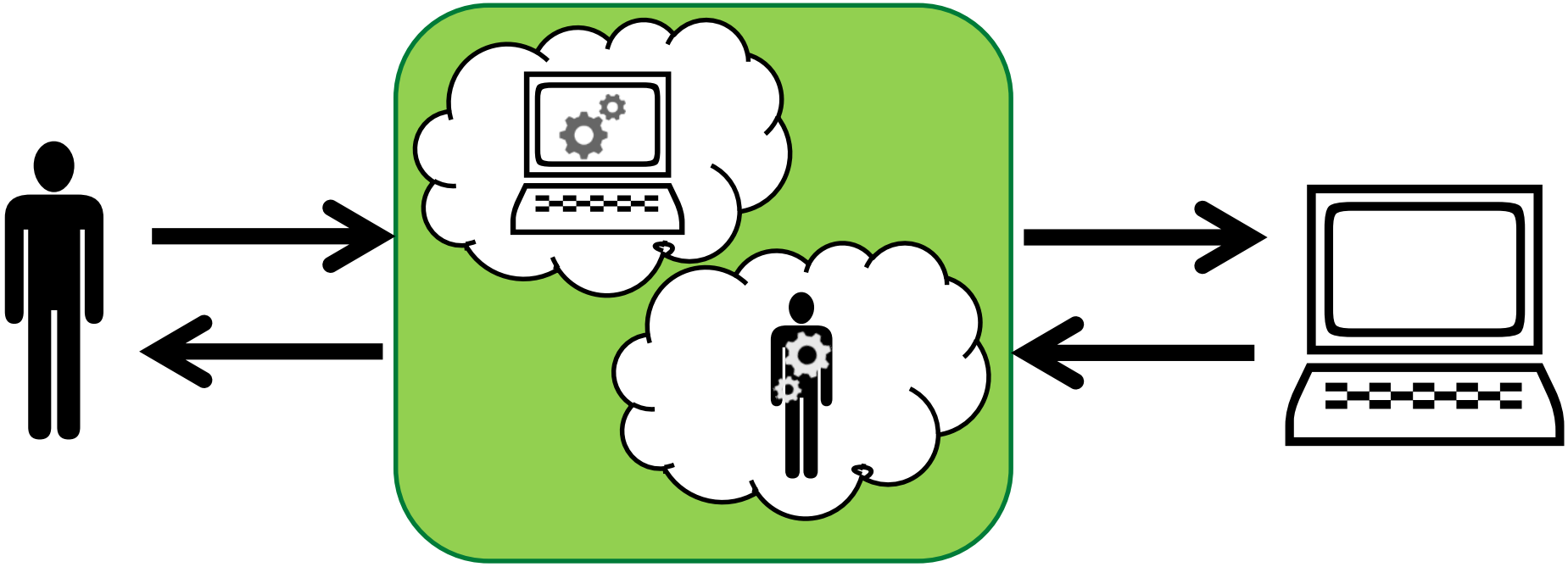
3. Dominikus Baur Interfacery

PART III: INTERACTION METAPHORS AND GUIDELINES

Speaker: Dominikus Baur

Part 3: Interaction metaphors



Activities: What the user does to trigger a change in the computer (*Action*)

Metaphor: What the user thinks the computer is doing and vice versa (*Understanding*)

Architecture: What the computer actually does (*Reaction*)

6Ws of Interaction

WHY do we interact?

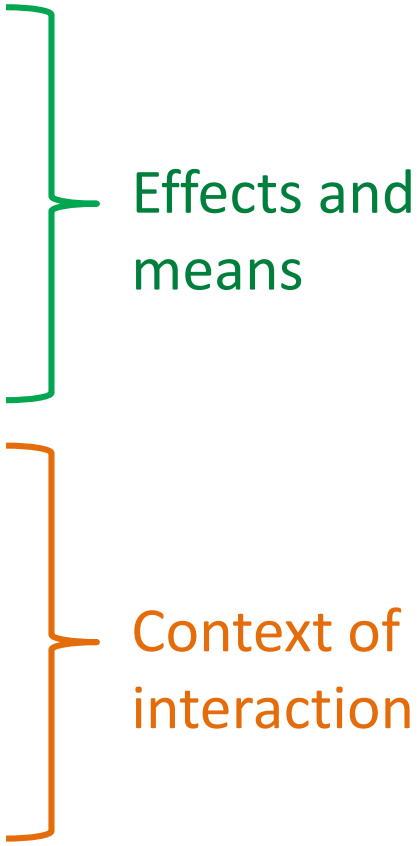
WHAT is the purpose?

HOW do we interact?

WHO interacts?

WHEN do we interact?

WHERE is interaction used?



[adapted from Roth13, Jansen et al 13]

ENABLE

INTERACTIVE DATA EXPLORATION

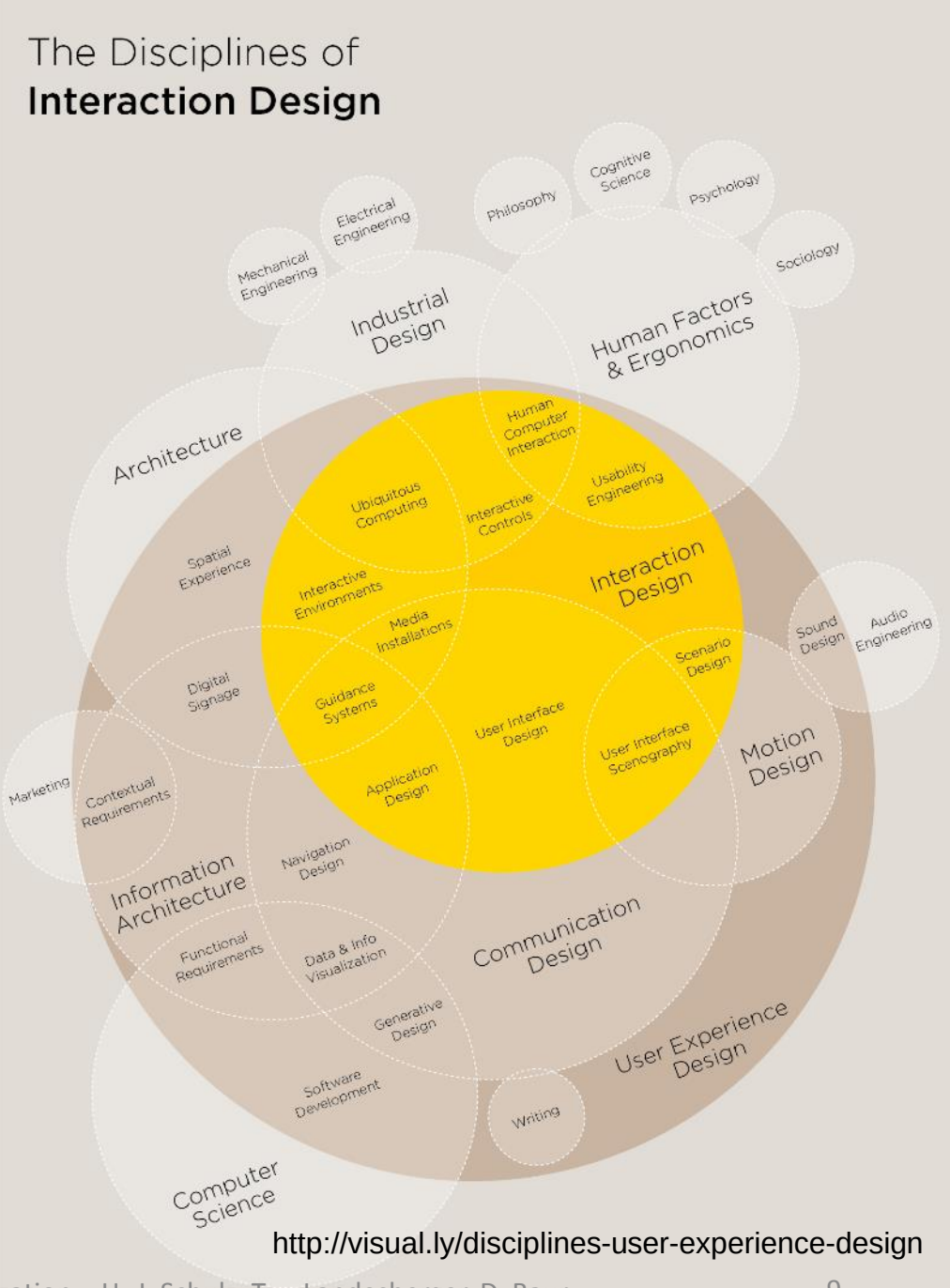
ENABLE
UNDERSTANDABLE
MEMORABLE
INTERACTIVE
DATA EXPLORATION

INTERACTION DESIGN

1_verplank-interaction-design.avi

Interaction design

- more of a craft than an (exact) science
- heuristics-based
- related/overlapping fields:
  - UXD (User Experience Design)
  - UID (User Interface Design)
  - Usability Engineering
  - ...



http://visual.ly/disciplines-user-experience-design

ENABLE
UNDERSTANDABLE
MEMORABLE
INTERACTIVE
DATA EXPLORATION

PROCESS

What are you designing?

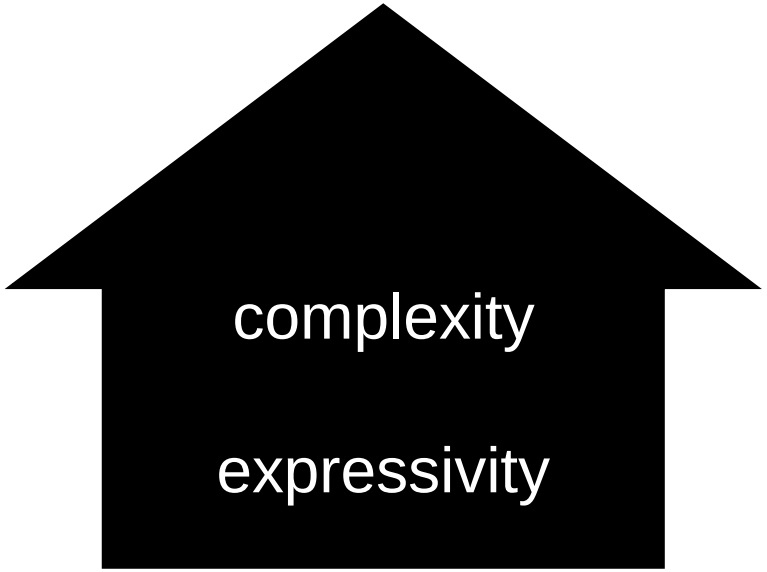
- Data exploration/analysis tool
- Data presentation
- (proof-of-concept for visualization technique)

Context

- Audience (researchers, analysts, general public)
- Platform (desktop, interactive surface, mobile)
- Data (fixed dataset with known insights, fixed dataset, real-time data)

Goals

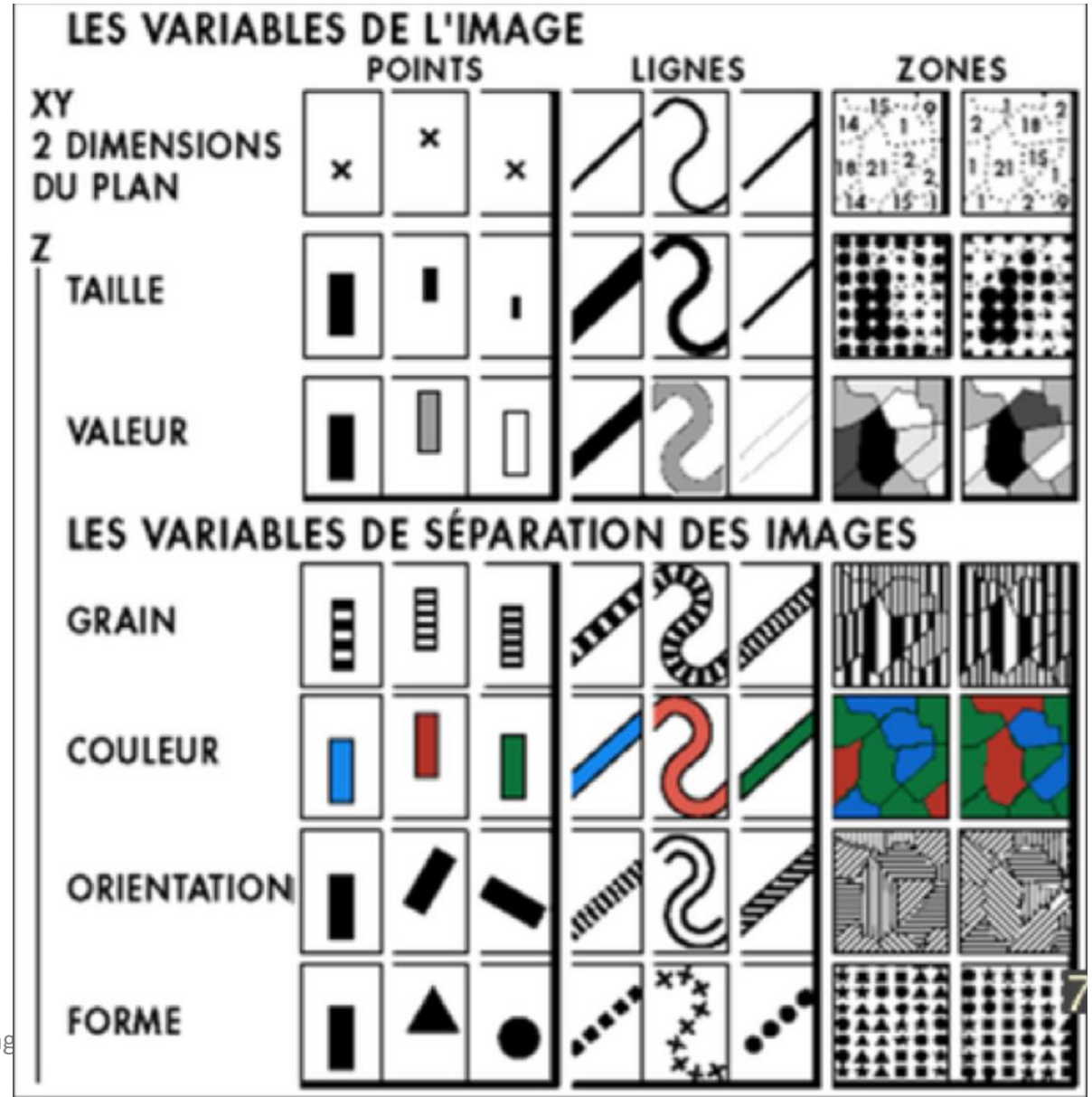
- in-depth analysis
- casual exploration
- quick lookup



Data presentation architecture

- basically: prioritize aspects of your data
- which aspects to visualize how?
- start with static representations (along visual variables)
- additional info (details-on-demand) via interaction

Visual variables



Visual encoding

- depends on your data
- iterative process
- can be intertwined with or preceeded by interaction

Interaction

- see various models from part 1
- based on goals and context
- for existing techniques: use learned interactions
- for novel techniques/platforms: use learned interactions from the platform

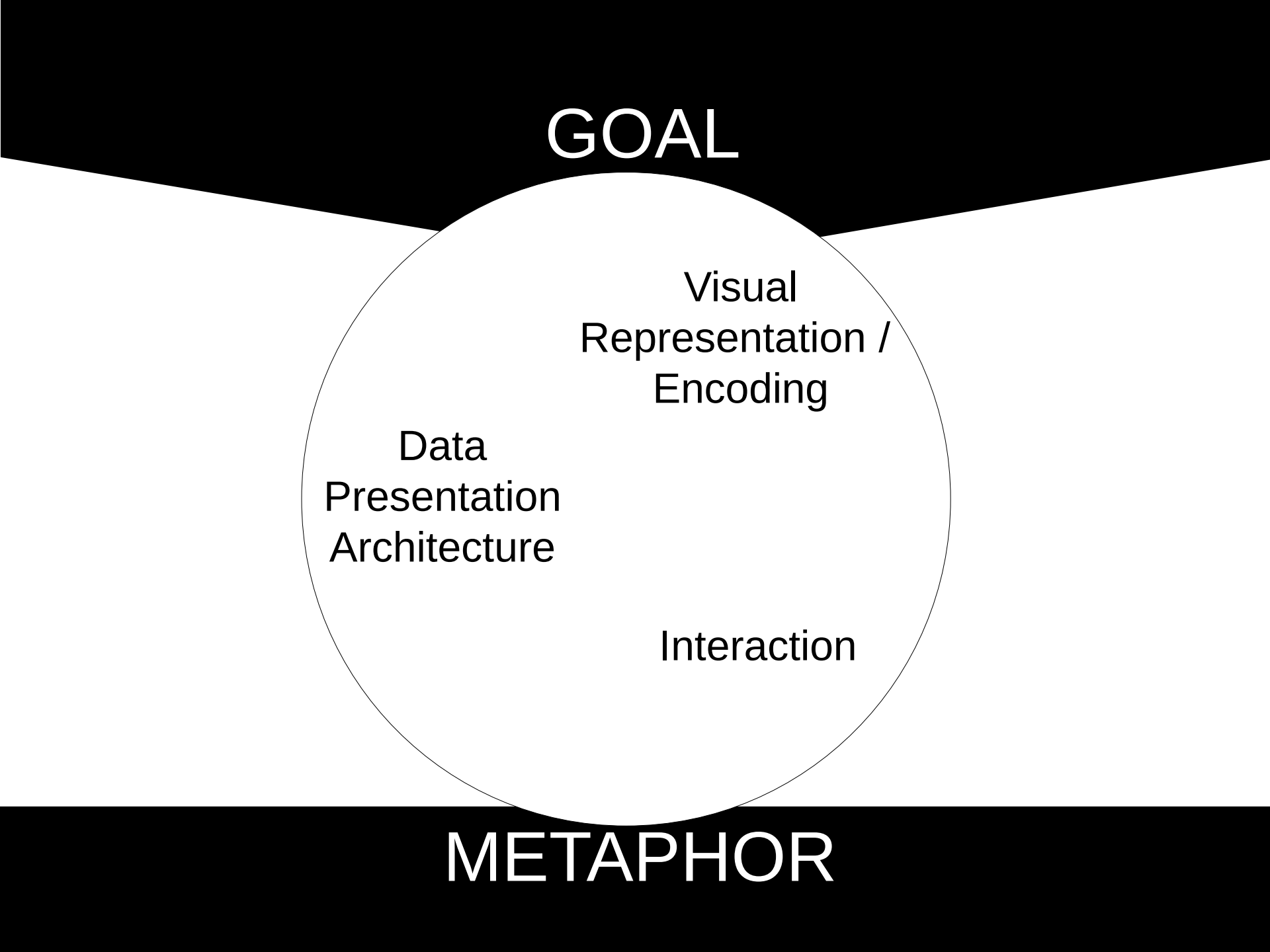
2_touchwave.avi

Interaction scale

Navigation (*select view type*)

Filtering/Highlighting (*select perspectives on the data*)

Microinteractions (*details-on-demand*)


GOAL
Visual
Representation /
Encoding
Data
Presentation
Architecture
Interaction
METAPHOR

HEURISTICS

HCI “Laws”

- Fitts’ Law (Paul Fitts 1954)
- Hick’s Law (William Edmund Hick 1952
- Teslers’ Law (Larry Tesler 1984

Heuristics examples:

- Shneiderman: 8 golden rules
- Nielsen: 10 Usability Heuristics
- ...

8 golden rules

1. Strive for consistency.
2. Enable frequent users to use shortcuts.
3. Offer informative feedback.
4. Design dialog to yield closure.
5. Offer simple error handling.
6. Permit easy reversal of actions.
7. Support internal locus of control.
8. Reduce short-term memory load.

Elmqvist et al.: Fluid Interaction

DG1: Use smooth animated transitions between states

DG2: Provide immediate visual feedback on interaction

DG3: Minimize indirection in the interface

DG4: Integrate user interface components in the visual representation

DG5: Reward interaction

DG6: Ensure that interaction ‚never ends‘

DG7: Reinforce a clear conceptual model

DG8: Avoid explicit mode changes

[Elmqvist et al. 2011]







10 Usability Guidelines You Just HAVE To Follow

Gulf of what?? Number 7 made me tear up a little.

posted on Aug. 14, 2014, at 8:14 a.m.

Dom Swaggo
Usability Chief

Follow 289 Follow @uxdork

1. Prevent errors

BUZZFEED IN

Meet The Two Brothers
Shocking "Hood Prank"
Videos People Can't St

Connect with BuzzFeed A

Heuristics

- Absolute minimum of interaction design
- Usually tells you what NOT to do!
- Works well as checklist
- Can be used for evaluation

METAPHORS

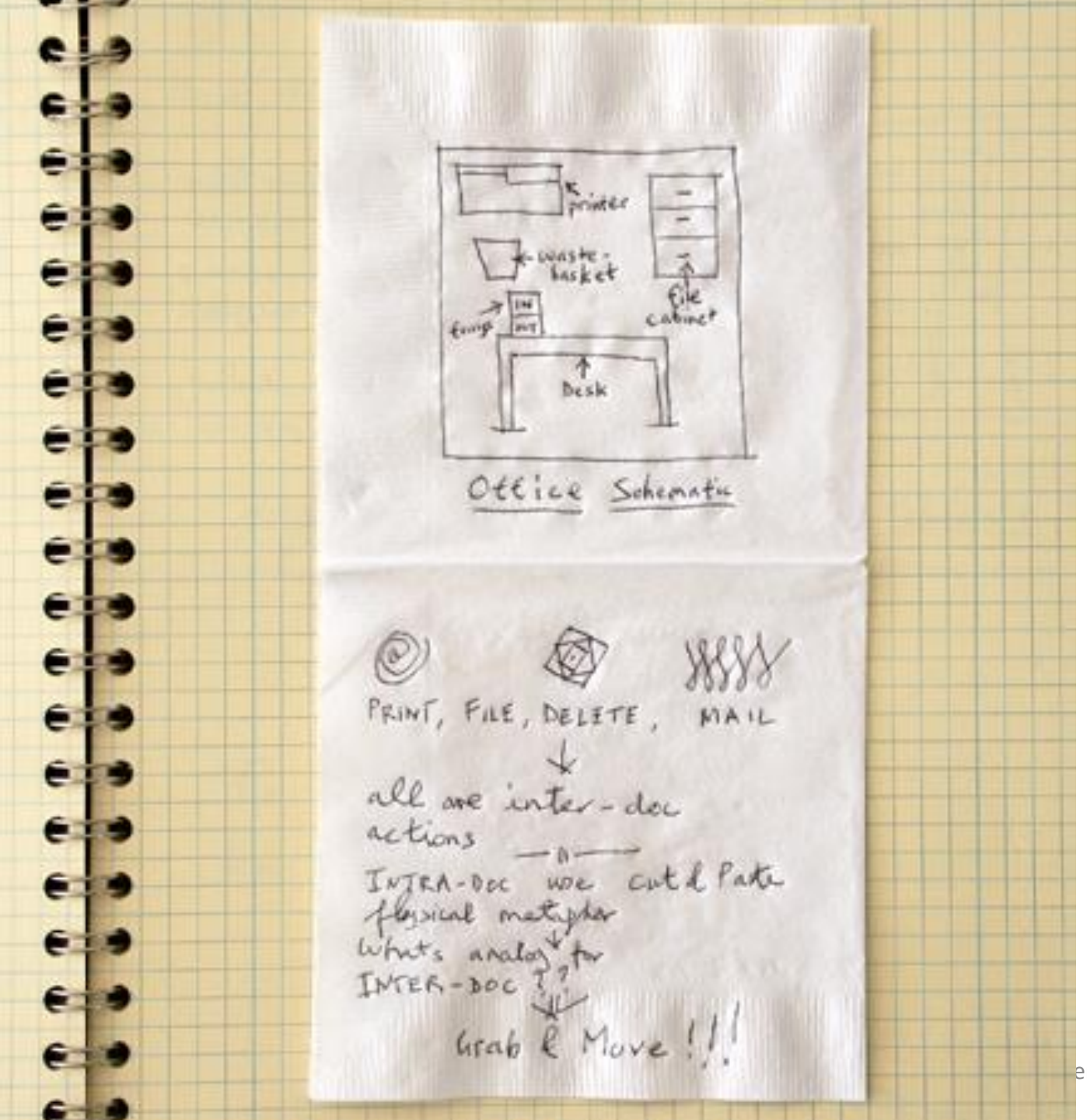
„The essence of metaphor is understanding and experiencing one kind of thing in terms of another.“

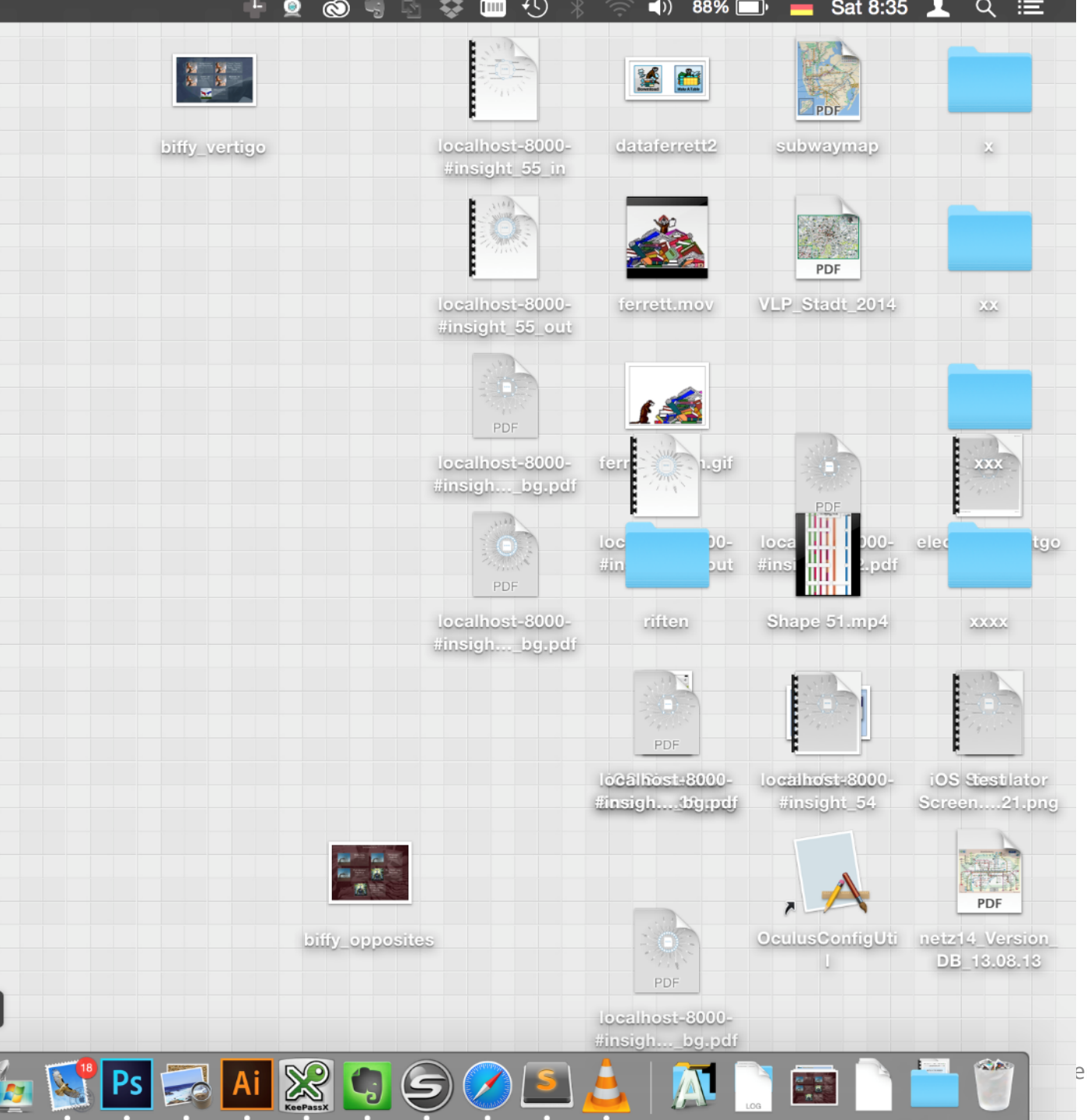
Lakoff & Johnson: Metaphors We Live By

Metaphors

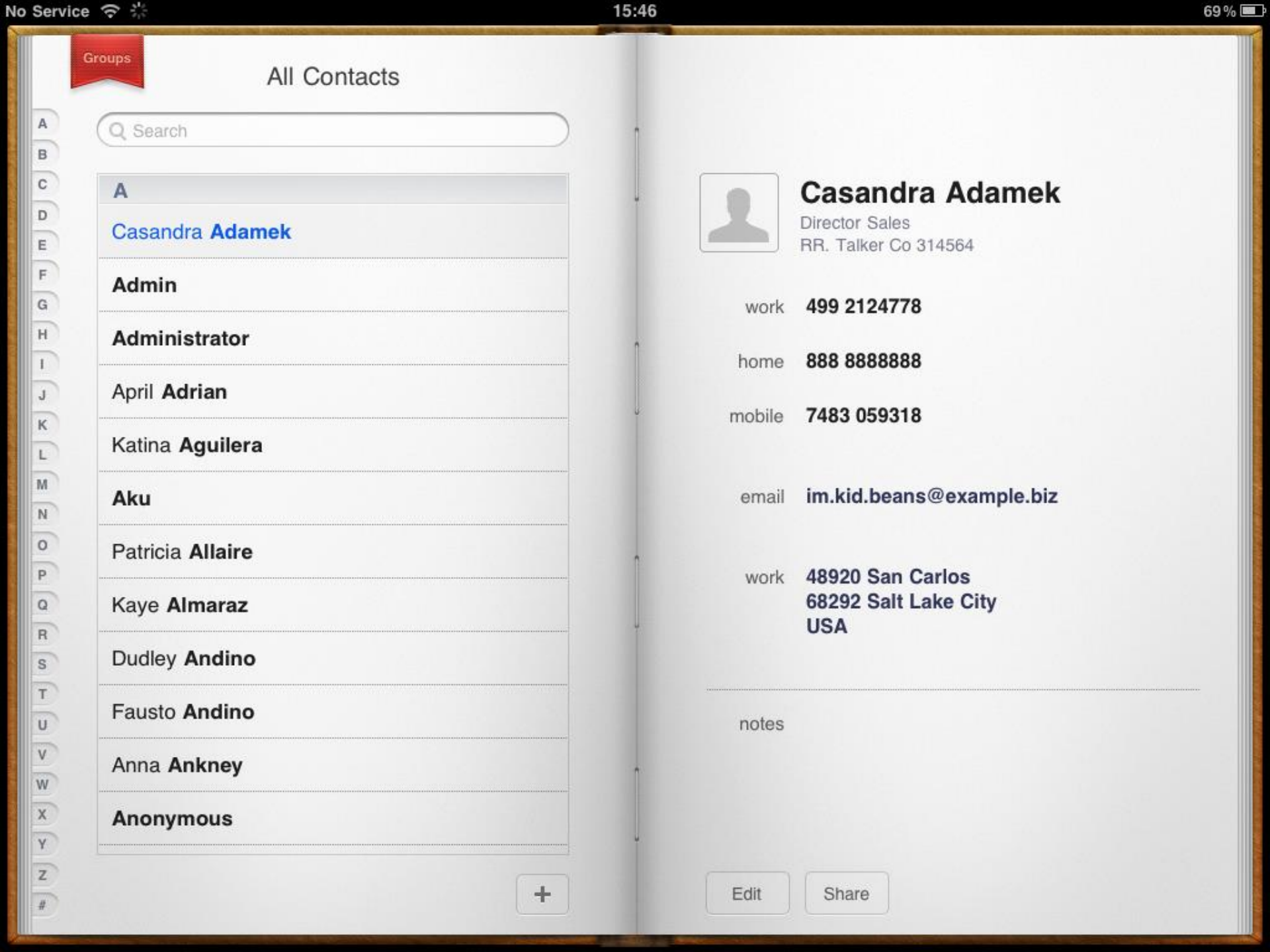
- in IxD: mental model that both designers and users adhere to
- users can rely on knowledge about how one thing works to operate the other
- shortcut towards understanding and memorizing and interface

Metaphor example: desktop





Metaphor example: desktop


No Service
15:46
69 %
Groups
All Contacts
Search
A
B
C
D
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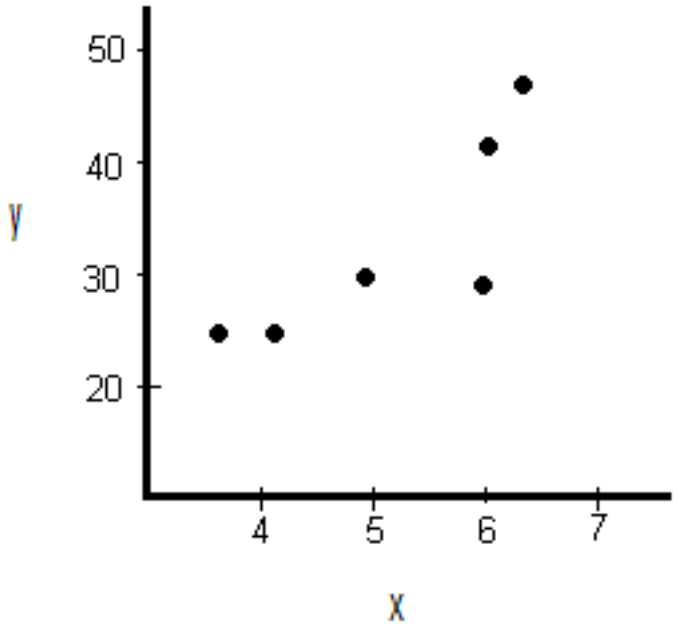
A
Casandra Adamek
Admin
Administrator
April Adrian
Katina Aguilera
Aku
Patricia Allaire
Kaye Almaraz
Dudley Andino
Fausto Andino
Anna Ankney
Anonymous
+
Casandra Adamek
Director Sales
RR. Talker Co 314564
work 499 2124778
home 888 8888888
mobile 7483 059318
email im.kid.beans@example.biz
work 48920 San Carlos
68292 Salt Lake City
USA
notes
Edit
Share

Metaphors in visualization?



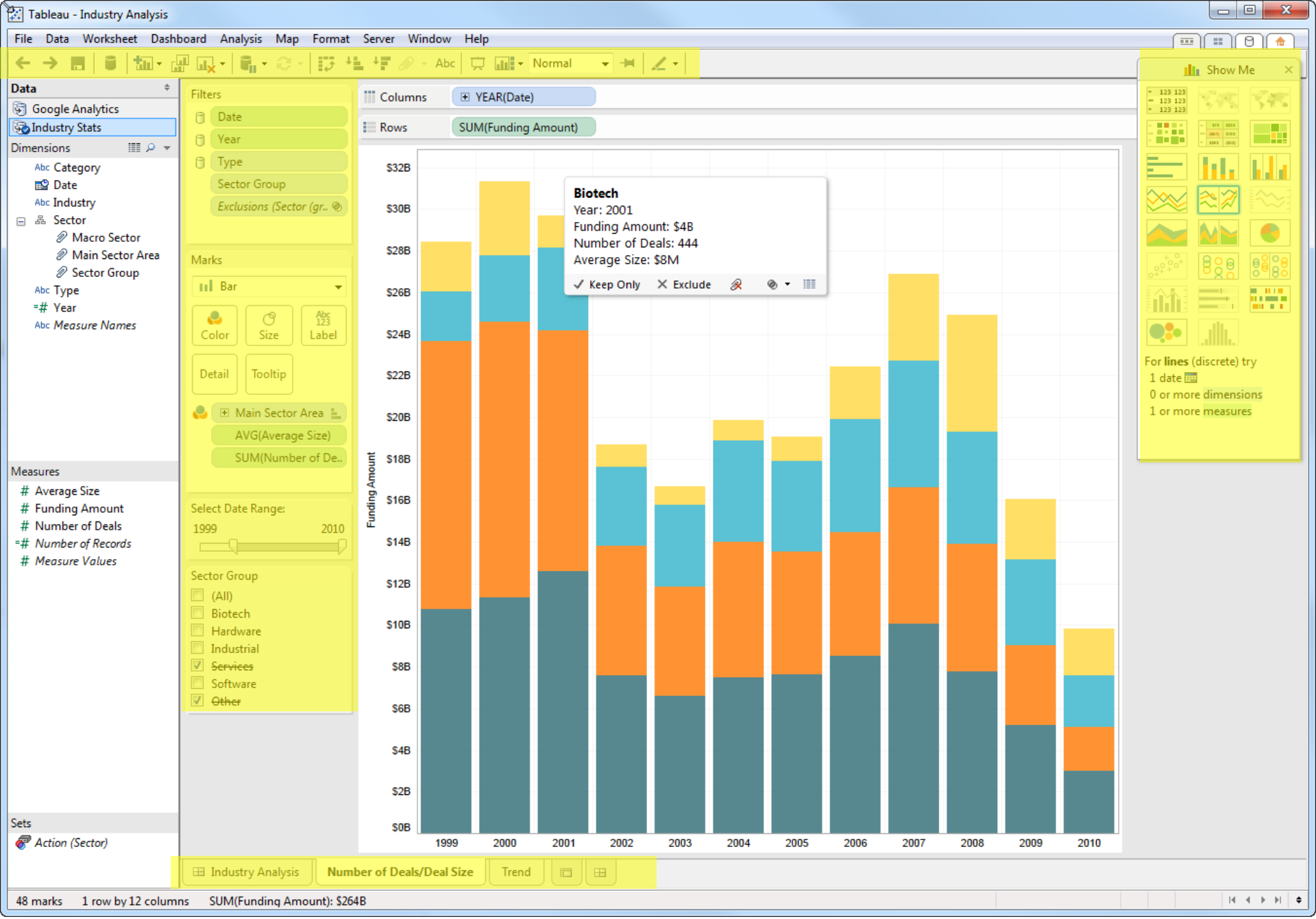


Tableau - Industry Analysis
File Data Worksheet Dashboard Analysis Map Format Server Window Help
Normal
Data
Google Analytics
Industry Stats
Dimensions
Category
Date
Industry
Sector
Macro Sector
Main Sector Area
Sector Group
Type
Year
Measure Names
Measures
Average Size
Funding Amount
Number of Deals
Number of Records
Measure Values
Sets
Action (Sector)
Filters
Date
Year
Type
Sector Group
Exclusions (Sector (gr..
Marks
Bar
Color
Size
Label
Detail
Tooltip
Main Sector Area
AVG(Average Size)
SUM(Number of De..
Select Date Range:
1999
2010
Sector Group
(All)
Biotech
Hardware
Industrial
Services
Software
Other
Columns
YEAR(Date)
Rows
SUM(Funding Amount)
Biotech
Year: 2001
Funding Amount: $4B
Number of Deals: 444
Average Size: $8M
Keep Only
Exclude
Funding Amount
$32B
$30B
$28B
$26B
$24B
$22B
$20B
$18B
$16B
$14B
$12B
$10B
$8B
$6B
$4B
$2B
$0B
1999
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2004
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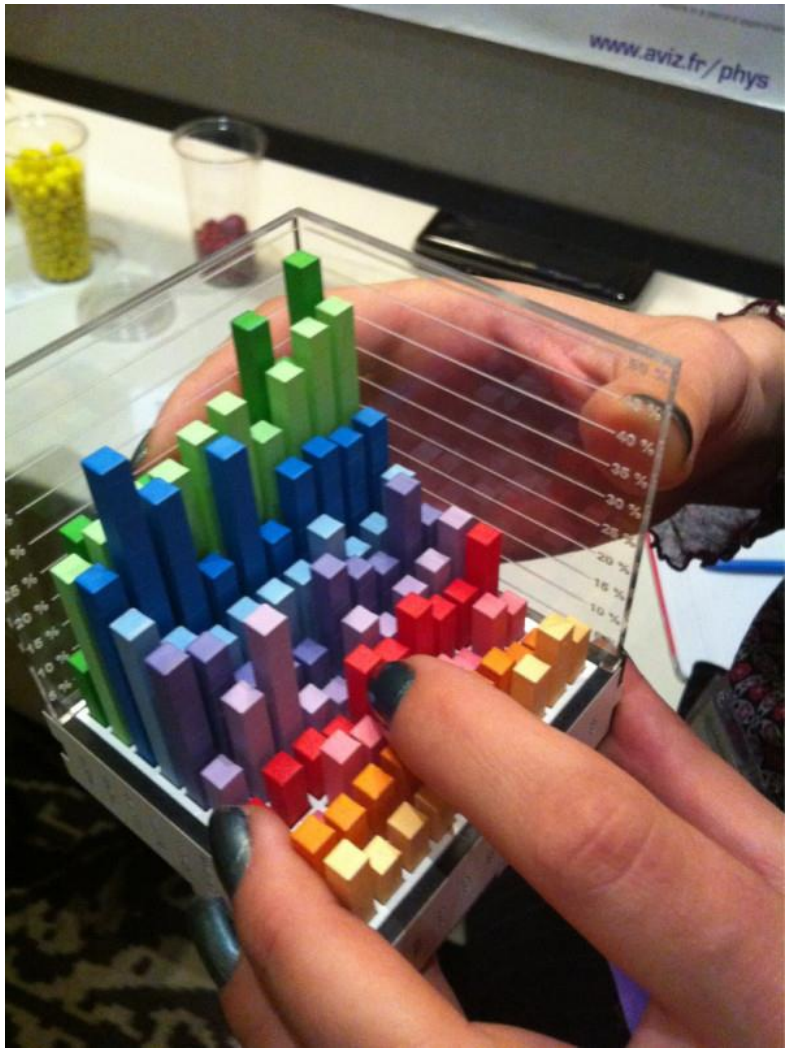
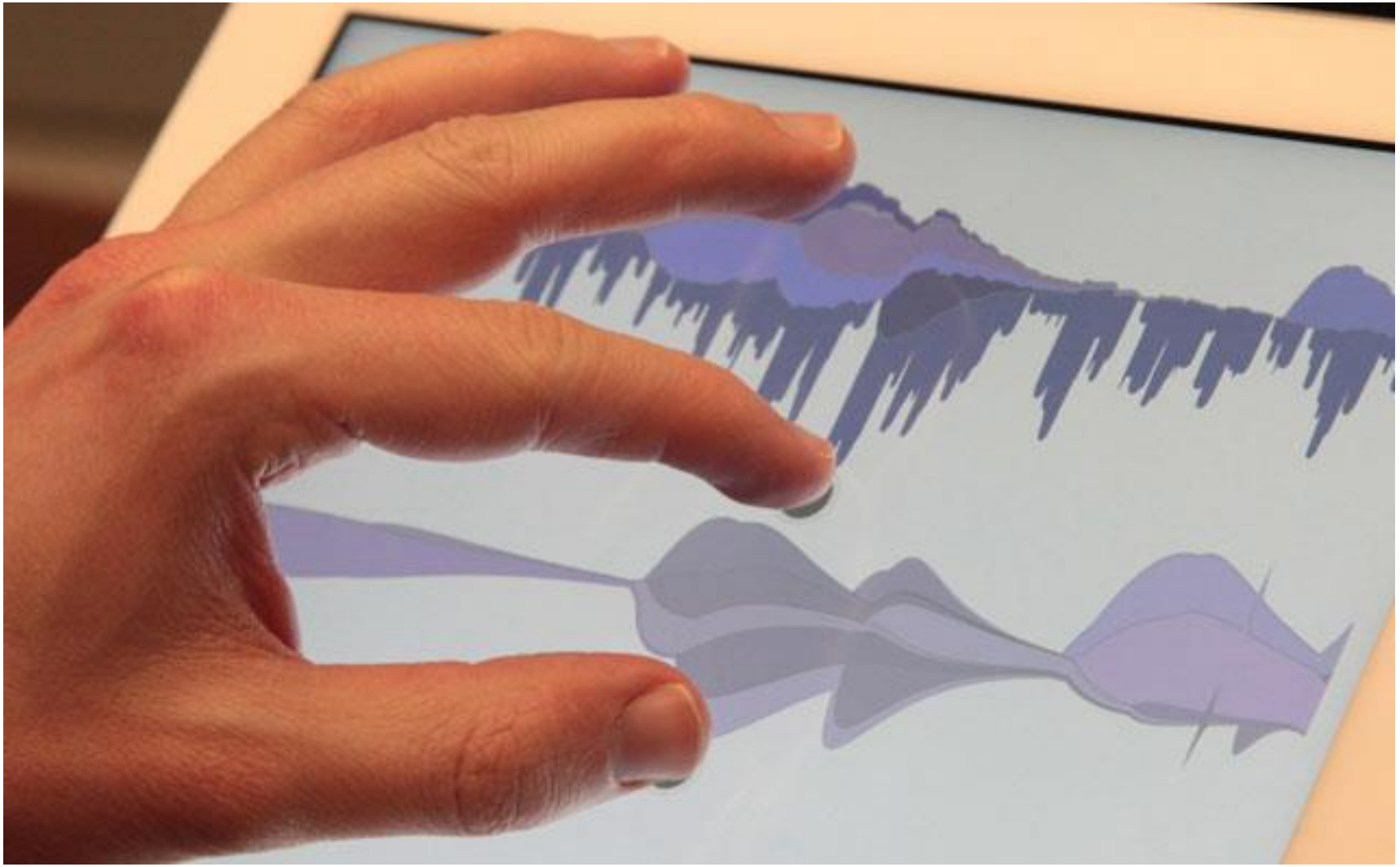
2006
2007
2008
2009
2010
Show Me
For lines (discrete) try
1 date
0 or more dimensions
1 or more measures
Industry Analysis
Number of Deals/Deal Size
Trend
48 marks
1 row by 12 columns
SUM(Funding Amount): $264B

Visualizations as physical objects

http://twitpic.com/b53yc8/full



Visualizations as physical objects:



3_heider-simmel.mp4

Heider-Simmel Illusion

4_metaphor-physical.avi

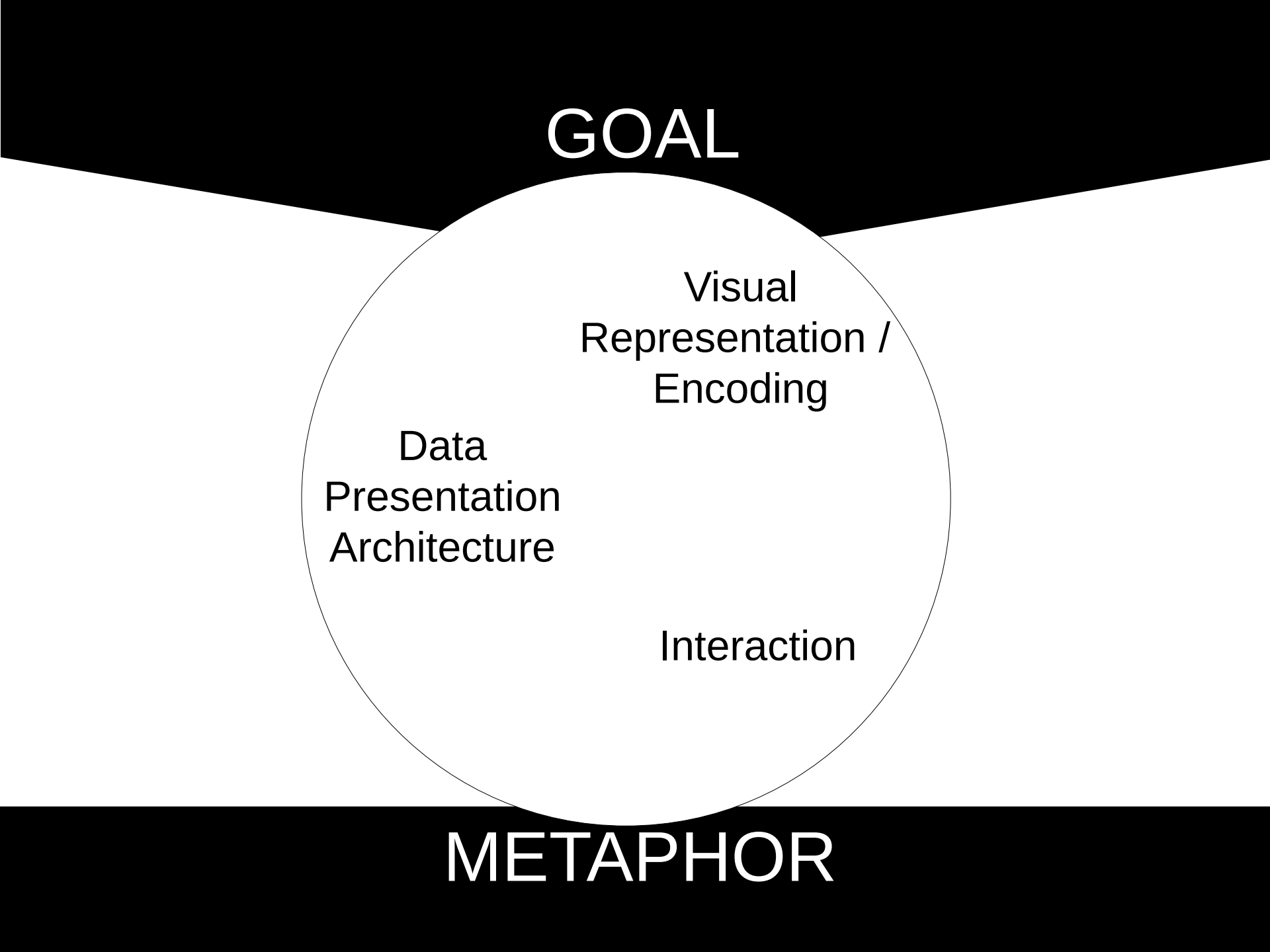
5_metaphor-orientation-evernote.avi

6_metaphor-orientation-facebook.avi

7_fun-facebook-messages.avi

Metaphors: Benefits & caveats

- Pro:
  - clear entry point
  - solves problems of discoverability and orientation
- Con:
  - too strict adherence, lose benefits of digital medium
  - users expectations are created by metaphor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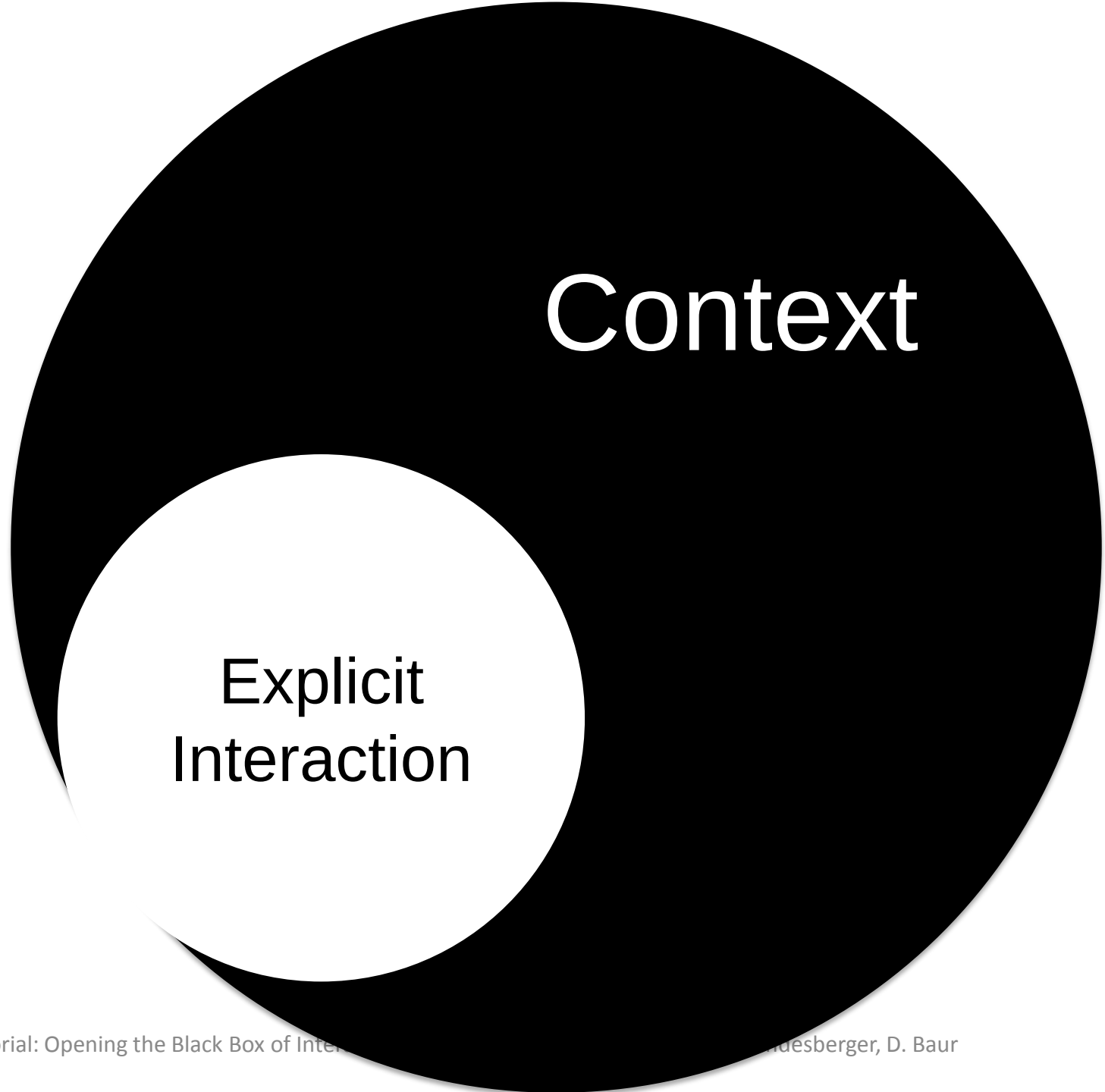
CONTEXT


Context
Explicit
Interaction

Context

- Audience (researchers, analysts, general public)
- Platform (desktop, interactive surface, mobile)
- Data (fixed dataset with known insights, fixed dataset, real-time data)

Dynamic context: sensors

- more and more sensors in computers and phones
- intricate, real-time, super-human data
- especially useful for start-up

Trivial dynamic context

- time of day
- day of week/month

Dynamic context: geolocation

- second-most important dimension after time
- implemented in more or less every device
- works well in tandem with compass

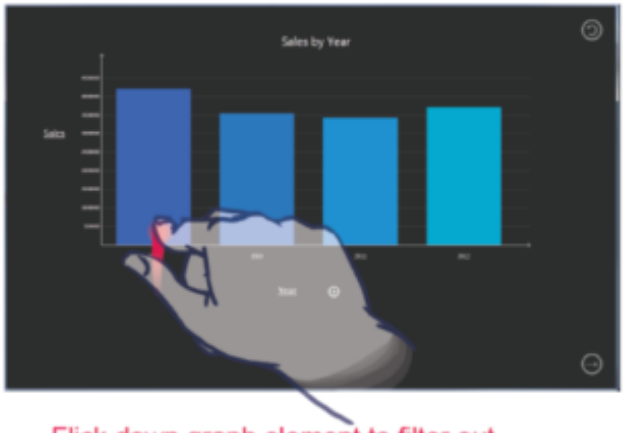
Dynamic context: Others

- Camera
- Microphone
- Touch
- Device orientation
- Bio-sensors

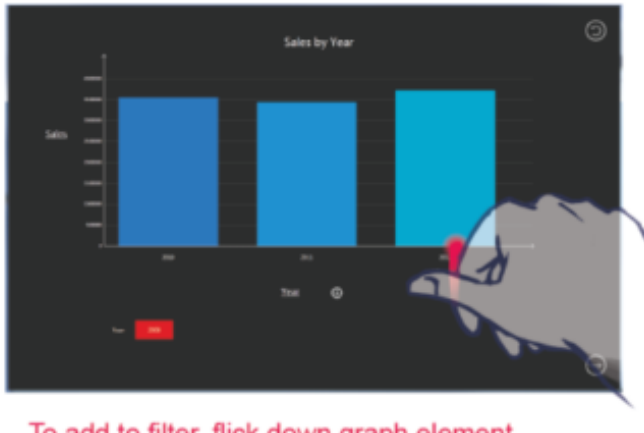
EXAMPLE FOR ONE SPECIFIC DEVICE CONTEXT: MOBILE/TOUCH INTERACTION

8_mobile-interaction-nutshell.mp4

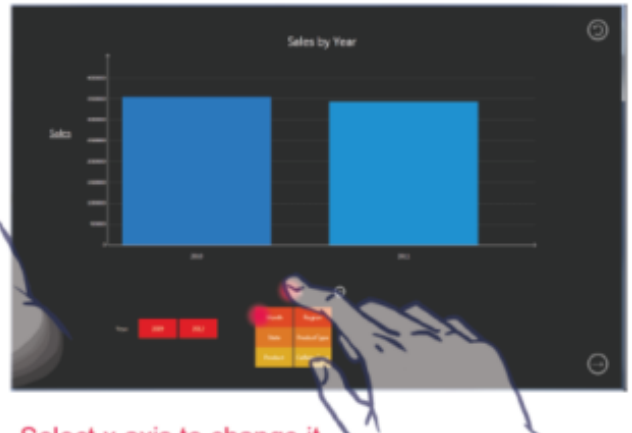
Mobile interaction in a nutshell:



Flick down graph element to filter out

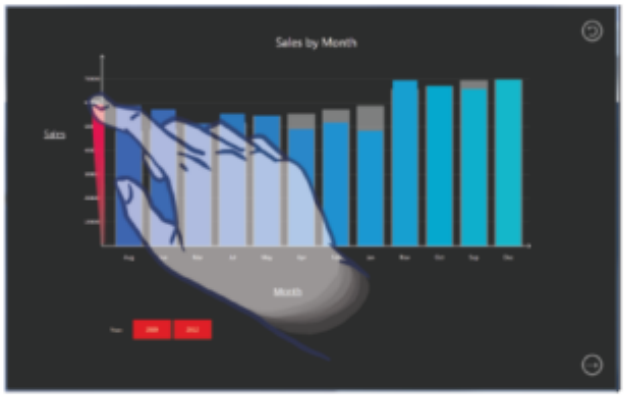


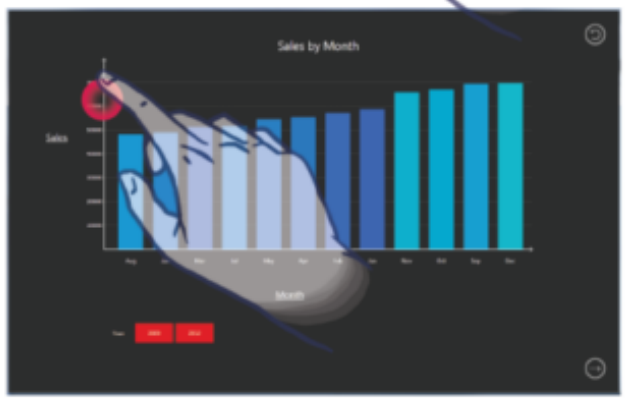
To add to filter, flick down graph element to exclude it from the view



Select x axis to change it

X axis changes and keeps filters





Drag vertically along axis to sort by ascending order (hold to preview state and release for final change)

[Drucker et al.: TouchViz 2013]

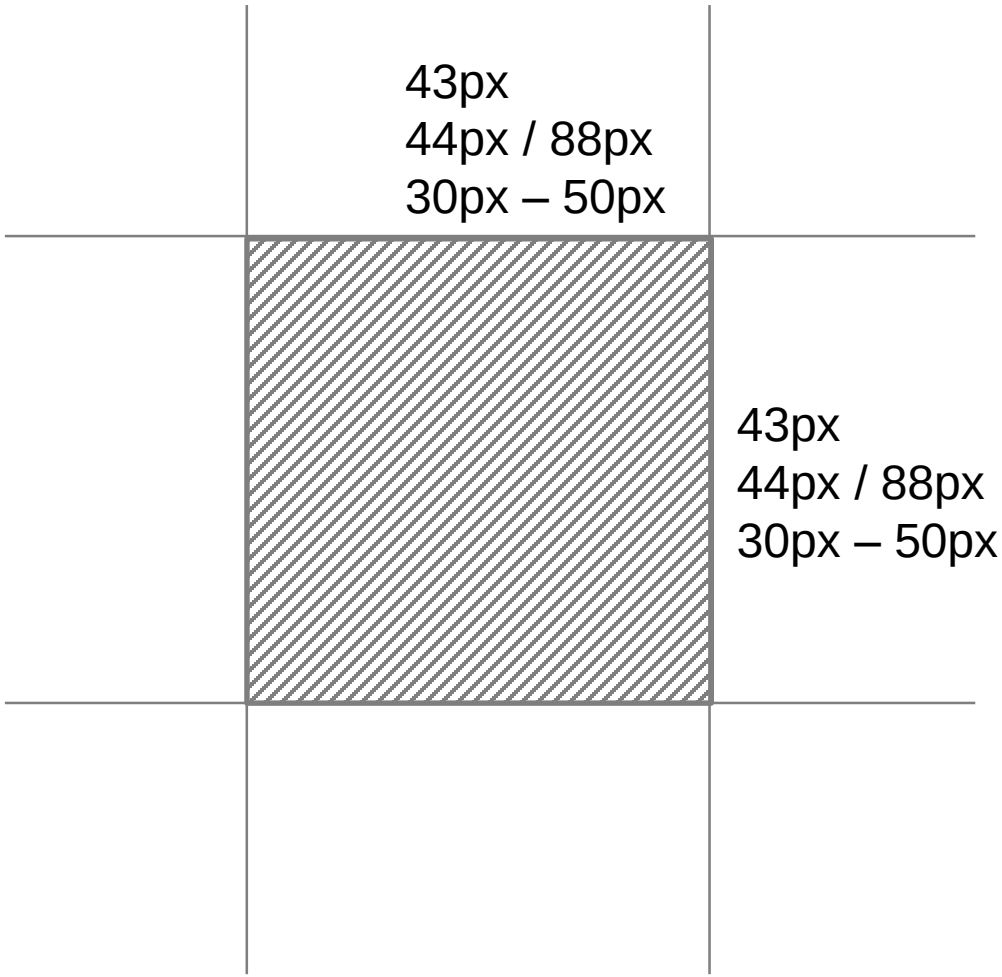
9_touch-scatterplots.mp4

[Sadana et al.: AVI 2014]

10_point-it.avi

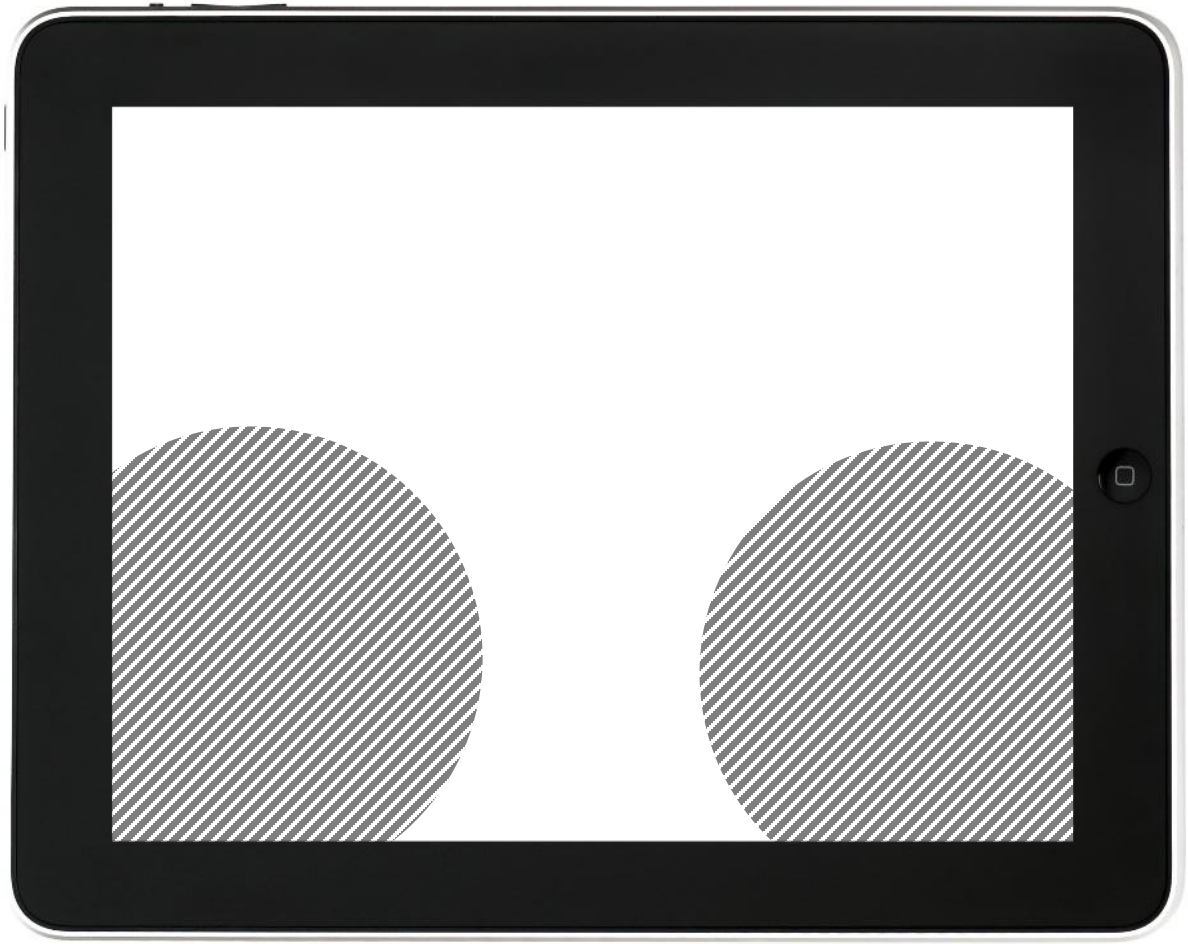
[Sultanum et al.: ITS 2011]

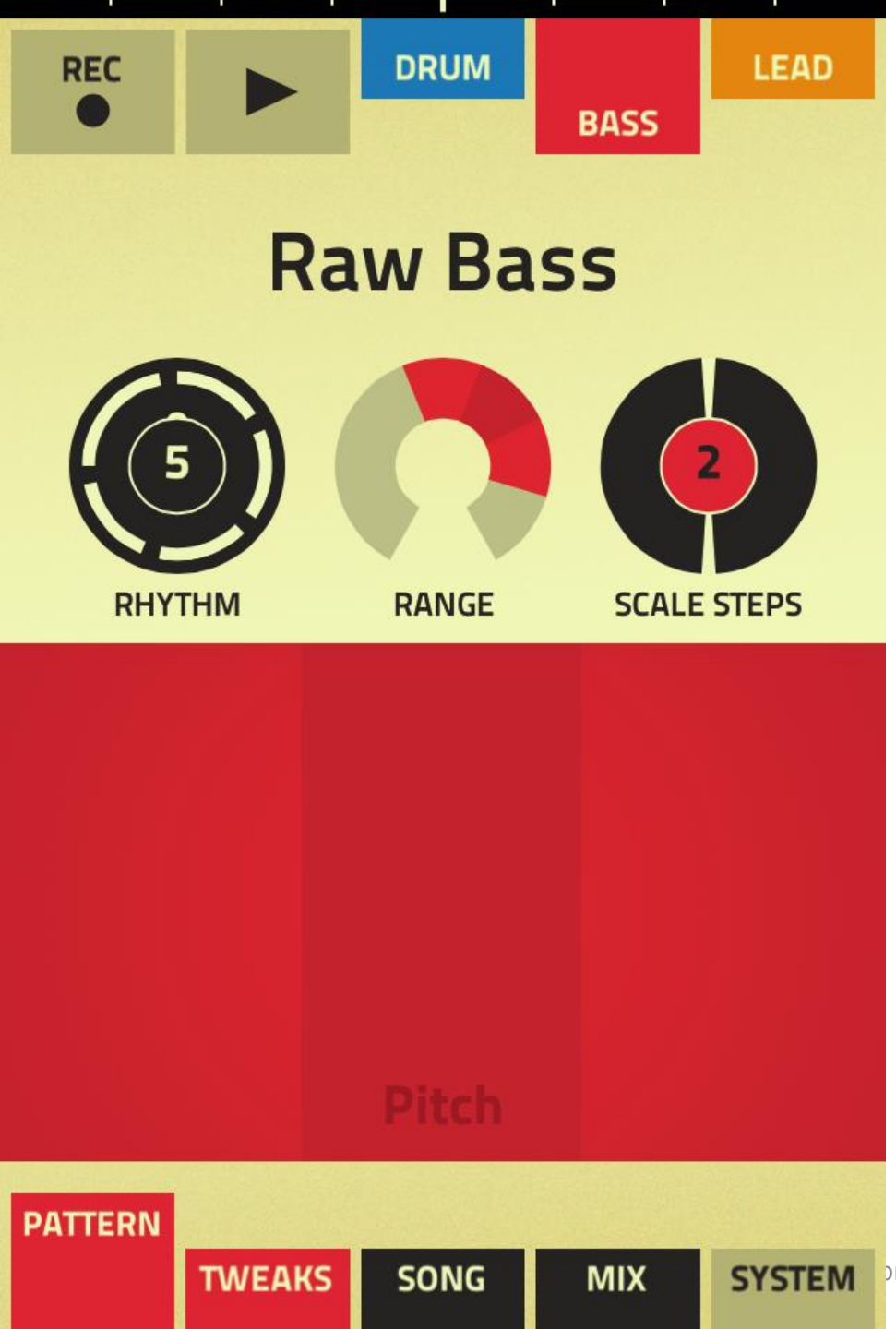
Ergonomics



Nokia
Apple
Microsoft

Ergonomics II





Discoverability

App: „FIGURE“

Learned interactions/conventions

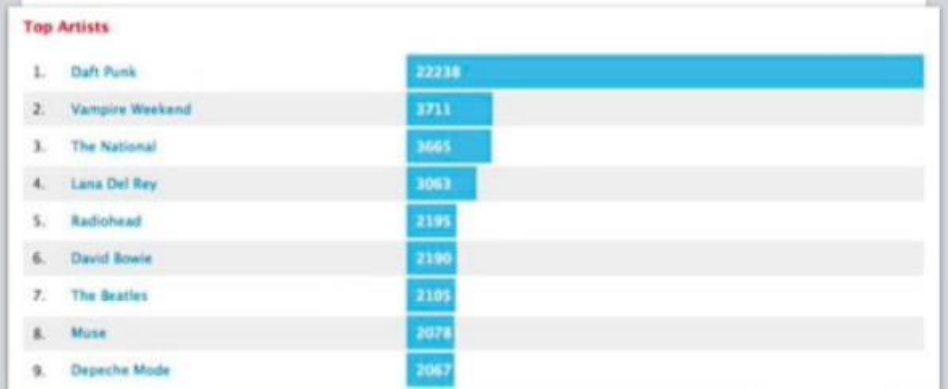
o2-de 11:40 80%

Status Photo Check In

Music

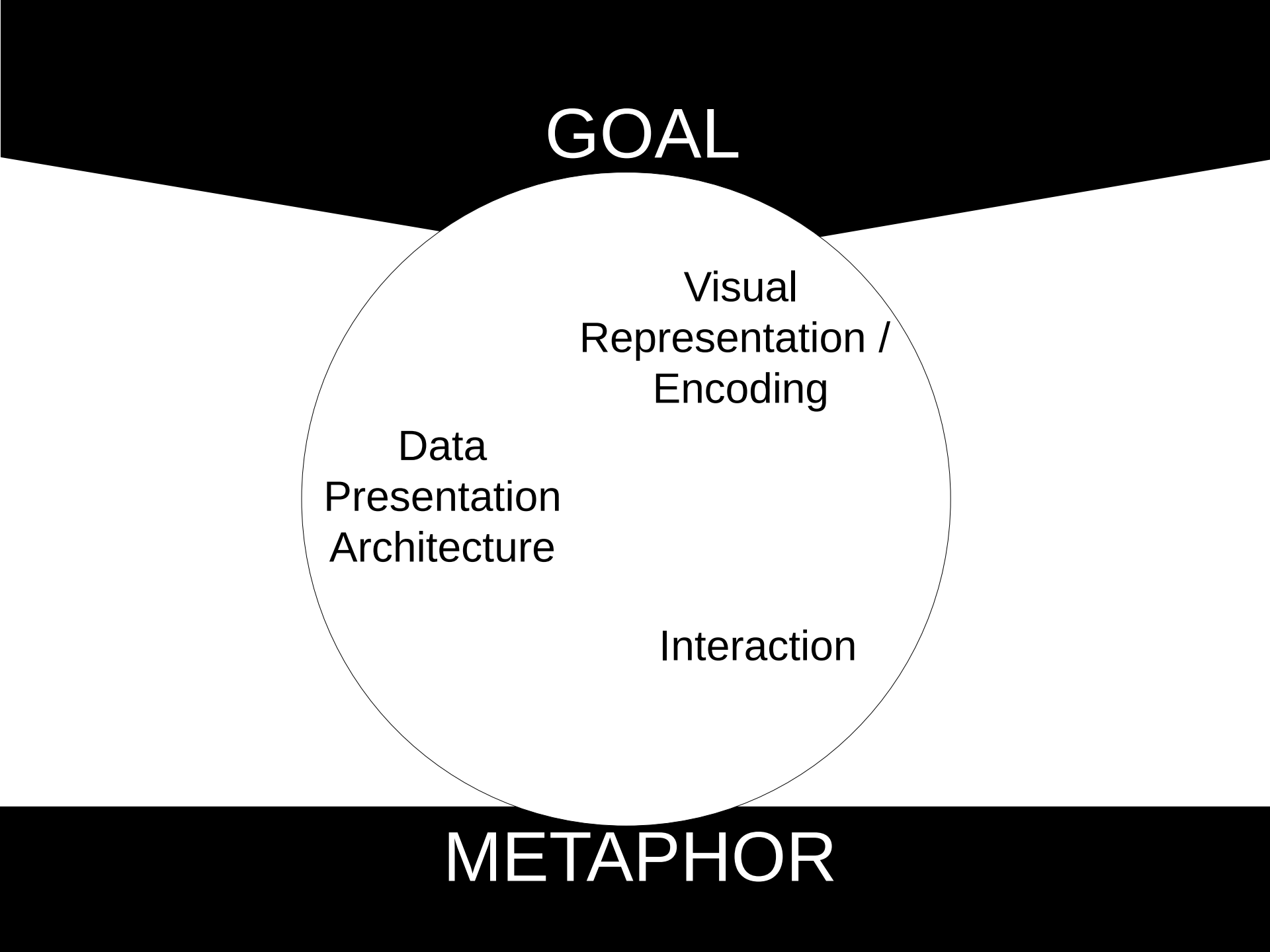
Last.fm
4 minutes ago

A little known duo called **Daft Punk** pre-released their new album this morning on **iTunes**, and **Last.fm** users have responded. With Random Access Memories dominating the real time charts, what are your thoughts on it?



Touch/mobile devices

- ergonomics
- context (social, environmental)
- discoverability
- learned interaction/conventions
- fun!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