VISUAL ANALYTICS

APPLICATION AREAS

LECTURE 8

Petra Isenberg

TOC

- Business Intelligence
- Legal Matters
- Work at Aviz

ANALYSIS IN THE BUSINESS SECTOR

BUSINESS INTELLIGENCE

"An interactive process for exploring and analyzing structured and domain-specific information to discern trends or patterns, thereby deriving insights and drawing conclusions.

The business intelligence process includes communicating findings and effecting change."

Gartner

→ there are many more definitions and they don't all say the same thing

BUSINESS INTELLIGENCE

- Typical Goals:
  - increase profitability
  - decrease costs
  - improve customer relationship management
  - decrease risks (e.g. credit risk analysis)
- Main goal: aid in making decisions

ANALYSIS IN ENTERPRISES IN GENERAL

- business analysts
- data analysts
- data scientists
→ typical user population for analysis & visualization tools

Sean Kandel, Andreas Paepcke, Joseph M. Hellerstein, Jeffrey Heer: Enterprise Data Analysis and Visualization: An Interview Study. IEEE Trans. Vis. Comput. Graph. 18(12): 2917-2926 (2012

A STUDY

researchers conducted semi-structured interviews in enterprises:

- 35 analysts (26 male)

- 25 organizations: healthcare, retail, finance, social networking, insurance, ...

Sean Kandel, Andreas Paepcke, Joseph M. Hellerstein, Jeffrey Heer: Enterprise Data Analysis and Visualization: An Interview Study. IEEE Trans. Vis. Comput. Graph. 18(12): 2917-2926 (2012

QUESTIONS

- What tasks do analysts perform?
- What kinds of data sources and formats do they work with?
- What tools do they regularly use and how do they use them?
- How do analysts vary in terms of programming proficiency?
- How do analysts vary in terms of statistical proficiency?
- What are the "results" of analysis?
- What happens to these results "downstream"?
- What are recurring bottlenecks and pain points?
- How important is scalability?
- How important is sociability?
- What is the relationship between analysts and other business units?
- Where are analysts situated within their corporate hierarchy?

THE ANALYST

Three archetypes found

1) hackers

- most comfortable manipulating data
- used 3+ programming languages (R, Python, SQL, ...)
- complex workflows
- work quite isolated (don't need a lot of help)
- used visualizations: Tableau, Excel, PPT, D3, ...

THE ANALYST

Three archetypes found

2) scripters

- most analysis done in R/Matlab
- not versed in custom operations (parsing, scraping)
- generally worked on data from data warehouse (with help from IT staff)
- applied models to data
- did exploratory analysis with visualization

THE ANALYST

Three archetypes found

3) application user

- performed most operation in spreadsheet or analysis app (SAS/JMP, SPSS, ...)

- needed help preparing data

- typically worked on smaller datasets

ANALYSTS

		Hacker																						Scripter							Application User					
		Analytics	Biology	Datamart	Finance	Finance	Healthcare	Healthcare	Healthcare	Healthcare	Insurance	Marketing	Marketing	News Aggregator	Retail	Retail	Social Networking	Social Networking	Social Networking	Visualization	Visualization	Web	Web	Analytics	Analytics	Analytics	Finance	Healthcare	Media	Retail	Finance	Insurance	Retail	Retail	Sports	Web Security
Process																																				
Discovery	Locating Data	X	X	X	X	X	X	X	X	X				X			X	X	X	X					X	X										
	Field Definitions	X	X	X	X	X	X	X			X	X		X			X	X	X	X																
Wrangle	Data Integration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X			X	X					X		
	Parsing Semi-Structured	X			X		X		X	X	X	X	X	X	X	X	X	X	X					X	X			X	X					X		
	Advanced Aggregation and Filtering	X			X	X					X		X	X	X	X	X							X						X				X		
Profile	Data Quality	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X			X	X		X	X		X	X	X
	Verifying Assumptions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X				X				X	X		X	X			X	X
Model	Feature Selection	X		X	X		X		X	X	X		X	X	X	X	X	X				X		X				X	X		X	X	X	X	X	X
	Scale	X		X	X		X		X	X			X	X	X	X	X					X		X				X	X		X	X	X	X	X	X
	Advanced Analytics	X		X	X		X		X	X			X	X	X	X	X					X		X				X	X			X				
Report	Communicating Assumptions						X	X		X		X				X								X	X			X	X			X				
	Static Reports		X	X		X		X	X		X					X	X			X				X				X		X		X				
Workflow	Data Migration	X	X	X	X	X	X	X			X	X		X	X	X	X	X		X			X	X				X	X							
	Operationalizing Workflows		X	X		X	X		X			X		X	X	X	X	X		X				X				X	X	X						
Tools																																				
Database	SQL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X					
	Hadoop/Hive/Pig	X			X			X						X	X		X		X			X														
	MongoDB												X					X																		
	CustomDB	X					X	X	X	X								X				X		X												
Scripting	Java	X		X		X		X	X	X		X	X	X		X	X			X																
	Perl																					X	X													
	Python	X		X	X		X		X	X	X	X		X	X	X	X					X		X												
	Clojure														X																					
	Visual Basic		X																												X		X			
Modeling	R	X		X				X	X		X	X	X	X	X		X		X					X	X			X	X							
	Matlab			X			X						X			X		X					X		X											
	SAS	X											X		X	X	X	X					X		X											
	Excel		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X			X	X			X	X	X	X	X	X	X	X	X

IT TEAM

- Crucial role in process
  - getting, maintaining, accessing data
  - operationalize workflows
  - provide documentation

OTHER FINDINGS

- data:
  - stored in variety of repositories and formats
- consumers of analysis:
  - many different departments, also other analysts
  - static reports shared most commonly, sometimes dynamic dashboards

OTHER FINDINGS

- collaboration
  - work on analysis task mostly done individually
  - resources shared, however: data, scripts, results, documentation

REPORTED CHALLENGES

- discovery
  - where is my data?
  - what does my data mean? (unclear field names, missing units, timezones, ...)

REPORTED CHALLENGES

- wrangling
  - processing semi-structured data
  - data integration from multiple sources
  - advanced aggregation and filtering

I spend more than half of my time integrating, cleansing and transforming data without doing any actual analysis. Most of the time I'm lucky if I get to do any analysis. Most of the time once you transform the data you just do an average... the insights can be scarily obvious. It's fun when you get to do something somewhat analytical.

REPORTED CHALLENGES

- profiling
  - assessing & improving data quality (missing data, wrong formats, ...)
  - checking assumptions (data distribution, semantics of data, ...)

REPORTED CHALLENGES

- modeling
  - finding the right features to analyze
  - scale of data
  - visualization of statistical models missing

REPORTED CHALLENGES

- reporting
    - how to document assumptions
    - flexibility in reports missing

REPORTED CHALLENGES

- workflows are non-linear
  - moving data between tools necessary (creates formatting issues)
  - creating repeatable, reliable, and scalable workflows

BUSINESS ANALYSIS TOOLS

a research view

TOOLS PREDECESSORS

- Management Information Systems (MIS)

- Management Decision Systems (MDS)

- Decision Support Tools (DSS)

- Executive Information Systems (EIS)

- Analysis Information Systems (AIS)

- ...

TOOLS

- **Professional**
  - SAP Business Intelligence
  - IBM Cognos
  - ...
- **Open Source**
  - SpagoBI
  - Pentaho
  - ...
- **Research**
  - see next slides

DOTLINK360

2013

dotlink**360**
Understanding Interfirm Relationships in Business Ecosystems with Interactive Visualization

Rahul C. Basole | Trustin Clear | Mengdie Hu | Harshit Mehrotra | John Stasko
contact: basole@gatech.edu

GeorgiaInstitute
of **Tech**nology

BUSINESS ECOSYSTEM INTELLIGENCE

- market analysts
  - understand competitive trends/strategies/threats/opportunities
- executives
  - identify strategic collaborations & customers, find areas for innovation
- venture capitalists
  - identify investment opportunities, see how they fit in the business landscape

DESIGN PROCESS

- field study of analysts
- derive set of design requirements
- develop initial version
- user testing
- redesign

DATA SOURCES

- Thomson Reuters SDC Platinum database
  - commercial database
  - ca. 700,000 global alliances, agreements, joint-ventures, since 1985
- Capital IQ Compustat
  - contains e.g. quarterly financial and accounting data for active and inactive publicly listed companies

DATA TRANSFORMATION

- turned data into a network
  - nodes = companies
  - edges = agreements
- nodes have multiple attributes
- edges have multiple types
- +temporal data

→ time-varying multivariate network

DESIGN REQUIREMENTS

- Field study
  - online survey + interviews
  - 24 senior industry individuals (market analysts, executives, venture capitalists)
  - each >10 years of experience

DESIGN REQUIREMENTS

top-down & bottom-up examination of an ecosystem are critical

"*it is helpful to have a birds-eye view of the ecosystem, but at the same time [the system] should be able to allow users to drill down into individual companies and segments.*"

DESIGN REQUIREMENTS

- understanding interfirm connectivity, composition, and temporality is vital

- comparative perspectives drive insight

- first: communicate agreement summaries (structural information) → then: offer details

- provide a familiar metaphor while supporting direct and prompt interaction, not complex queries and commands

- add common network-related analysis tasks (see the InfoVis lecture on graphs and networks)

MULTIPLE VIEWS

details

Company Information

Hewlett-Packard Co

(P) HPQ : NYSE | United States

ECOSYSTEM SEGMENTS
Device Manufacturers [Primary]
Platform Providers
System Integrators

COMPETITORS
(P) IBM
(P) SAP AG
(P) Samsung Electronics Co Ltd
(Sb) Oce NV
(P) Canon Inc
(P) Infosys BPO Ltd
(P) Toshiba Corp
(s) Wipro Technologies
(P) Konica Minolta Photo Imaging
(P) Teradata Corp
(P) CGI Corp
(P) Cap Gemini SA
(P) Cisco Systems Inc
(P) Lexmark International Inc
(P) Brother Industries Ltd
(P) Tata Consultancy Services Ltd
(P) Lenovo Group Ltd
(P) Acer Inc
(P) Computer Sciences Corp

CONTACT INFORMATION
3000 Hanover St,Palo Alto
CA 94304-1185

Phone : 650-857-1501
Fax : 650-857-5518

http://www.hp.com

View all agreements
View structural properties

Agreement Details

EXPAND ALL   SORT BY   SELECT ▼

SELECT			
STRATEGIC			
R &D			
MANUFACTURING			
SUPPLY			
MARKETING			
LICENSING			
OTHER			

⊞ 07/08/1994 ■■□■■□□ Complete
⊞ 07/08/1994 ■■□■■□□ Complete
⊞ 02/08/1994 ■■□□■■□ Complete
⊞ 01/01/1994 ■□□□■■□ Complete
⊞ 07/06/1993 ■□□■■□□ Complete
⊞ 07/06/1993 ■□□■■□□ Completed/Signed
⊞ 06/00/1993 ■□□■■□□ Completed/Signed
⊞ 02/01/1993 ■■□□□■□ Pending
⊞ 02/01/1993 ■□■■■□□ Completed/Signed
⊞ 06/09/1992 ■■□■■□□ Completed/Signed
⊞ 03/06/1992 ■■□■□■□ Completed/Signed
⊞ 01/07/1992 ■■□□■■□ Completed/Signed
⊞ 01/00/1992 ■■■■■□□ Completed/Signed
⊞ 07/03/1991 □■■■■□□ Terminated
⊟ 06/04/2003 ■■□□■□□ Completed/Signed

Partners: Microsoft Corp, Intel Corp

Description: Korea Telecom Co Ltd, a unit of KT Corp, Microsoft Corp, Intel Corp and Hewlett-Packard Co formed a strategic alliance to provide marketing services for wireless Internet services and equipments. Under terms of the agreement, the alliance was to jointly develop and sell a wireless Internet product called K-MAC. K-MAC is a package of wireless Internet-related software, applications, systems and consulting services to customers.

Agreement Type

■ Strategic   ■ R &D   ■ Manufacturing
■ Supply   ■ Marketing   ■ Licensing
■ Other

Structural Properties

Hewlett-Packard Co

View company information

Alliances
Total : 515
Strategic : 462
R&D : 152
Marketing : 177
Manufacturing : 61
Supply : 28

Alliance Status
Letter of Intent : 5
Completed/Signed : 412
Terminated : 6
Pending : 92

Alliance Composition
Exploitation Index (EXPLT Index) : 0.699
Exploration Index (EXPLR Index) : 0.295
Portfolio Diversity Index (PDI) : 0.653

Alliance Activity Index (AI) : 23.0

Structural Properties
Size : 104.0
Centrality
    Degree : 569
    Betweenness : 81954.7
    Closeness : 0.05
    Eigenvector : 0.21
Cluster Coefficient : 0.07
Complexity Index
    Vertical Complexity (VC) : 0.019
    Horizontal Complexity (HC) : 0.980
   Geographic Complexity (GC) : 0.692
    Total Complexity : 0.013

MULTIPLE VIEWS

timeline

MULTIPLE VIEWS

portfolio overview

MULTIPLE VIEWS

WIREVIS

Remco Chang, Mohammad Ghoniem, Robert Kosara, William Ribarsky, Jing Yang, Evan Suma, Caroline Ziemkiewicz, Daniel Kern, Agus Sudjianto

IEEE Visual Analytics Science and Technology (VAST) 2007.

- financial institutions have obligation to discover suspicions financial transactions
  - can be fined if not found or shut down
- many transactions are purely digital & banks often are only the middle "man"
- large banks need to monitor hundreds of thousands of transactions per day

WIREVIS

Remco Chang, Mohammad Ghoniem, Robert Kosara, William Ribarsky, Jing Yang, Evan Suma, Caroline Ziemkiewicz, Daniel Kern, Agus Sudjianto

WireVis
Visualization of Categorical, Time-Varying Data From Financial Transactions

UNC Charlotte
Remco Chang   Mohammad Ghoniem
Robert Kosara   William Ribarsky
Jing Yang   Evan Suma   Caroline Ziemkiewicz

Bank of America
Daniel Kern   Agus Sudjianto

https://www.youtube.com/watch?v=RPKcrLQBqiE

WIREVIS

goals

- provide overview of transactions over any period of time → apply to large data
- allow identification of patterns over time and keywords
- replace blind queries with in-place analysis
- provide search-by-example technique

WIREVIS

- wire transaction data
  - semi-structured data record
  - fixed data (sender, receiver, etc.)
  - optional free text
  - temporal, categorical, quantitative
- current (2007) procedure
  - filter based on risk assessment (e.g. money exceed threshold, sender/receiver is a high-risk country or organization)
  - look at spreadsheets

VISUAL ANALYSIS OF CUSTOMER FEEDBACK
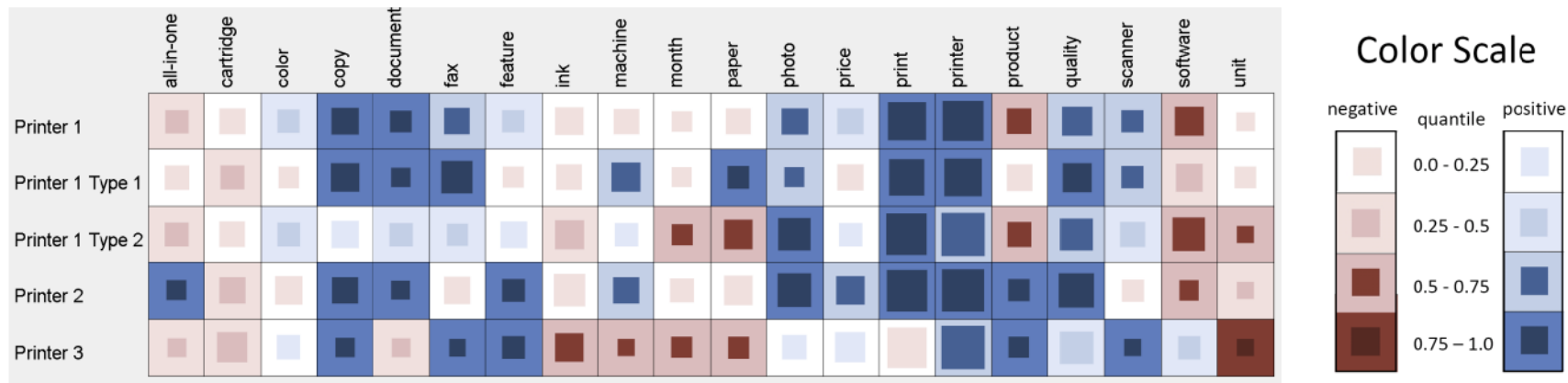
VISUAL ANALYSIS OF CUSTOMER FEEDBACK

1

ATTRIBUTE	POSITIVE	NEGATIVE
document	16.01%	0.0%
fax	32.3%	0.0%
ink cartridge	27.52%	0.0%
machine	25.84%	0.0%
photo	24.15%	0.0%
scanner	20.22%	0.0%

2

ATTRIBUTE	POSITIVE	NEGATIVE
document	0.0%	8.06%
fax	0.0%	17.74%
ink cartridge	0.0%	33.87%
machine	0.0%	32.25%
photo	0.0%	11.29%
scanner	0.0%	9.67%

3

ATTRIBUTE	POSITIVE	NEGATIVE
document	10.0%	10.0%
fax	60.0%	0.0%
ink cartridge	50.0%	0.0%
machine	30.0%	0.0%
photo	30.0%	20.0%
scanner	0.0%	80.0%

4

ATTRIBUTE	POSITIVE	NEGATIVE
document	0.0%	45.45%
fax	0.0%	18.18%
ink cartridge	54.54%	0.0%
machine	36.36%	0.0%
photo	0.0%	36.36%
scanner	9.09%	0.0%

5

ATTRIBUTE	POSITIVE	NEGATIVE
document	0.0%	10.0%
fax	40.0%	0.0%
ink cartridge	0.0%	50.0%
machine	0.0%	40.0%
photo	20.0%	0.0%
scanner	40.0%	0.0%

6

ATTRIBUTE	POSITIVE	NEGATIVE
document	0.0%	33.33%
fax	0.0%	16.66%
ink cartridge	0.0%	66.66%
machine	100.0%	0.0%
photo	16.66%	16.66%
scanner	33.33%	16.66%

7

ATTRIBUTE	POSITIVE	NEGATIVE
document	71.42%	0.0%
fax	14.28%	0.0%
ink cartridge	0.0%	14.28%
machine	0.0%	71.42%
photo	14.28%	14.28%
scanner	42.85%	14.28%

LEGAL MATTERS

or

working with large corpora of electronic texts

E-DISCOVERY (MOSTLY USA)

- legal electronic document discovery
  - for use in law suits
  - regulatory information requests
  - investigations, audits, freedom of information act, ...
- documents typically given to court & opponent
- if complaint received, corporations have to produce all related information

Electronic Discovery Reference Model

Electronic Discovery Reference Model / © 2014 / v3.0 / edrm.net
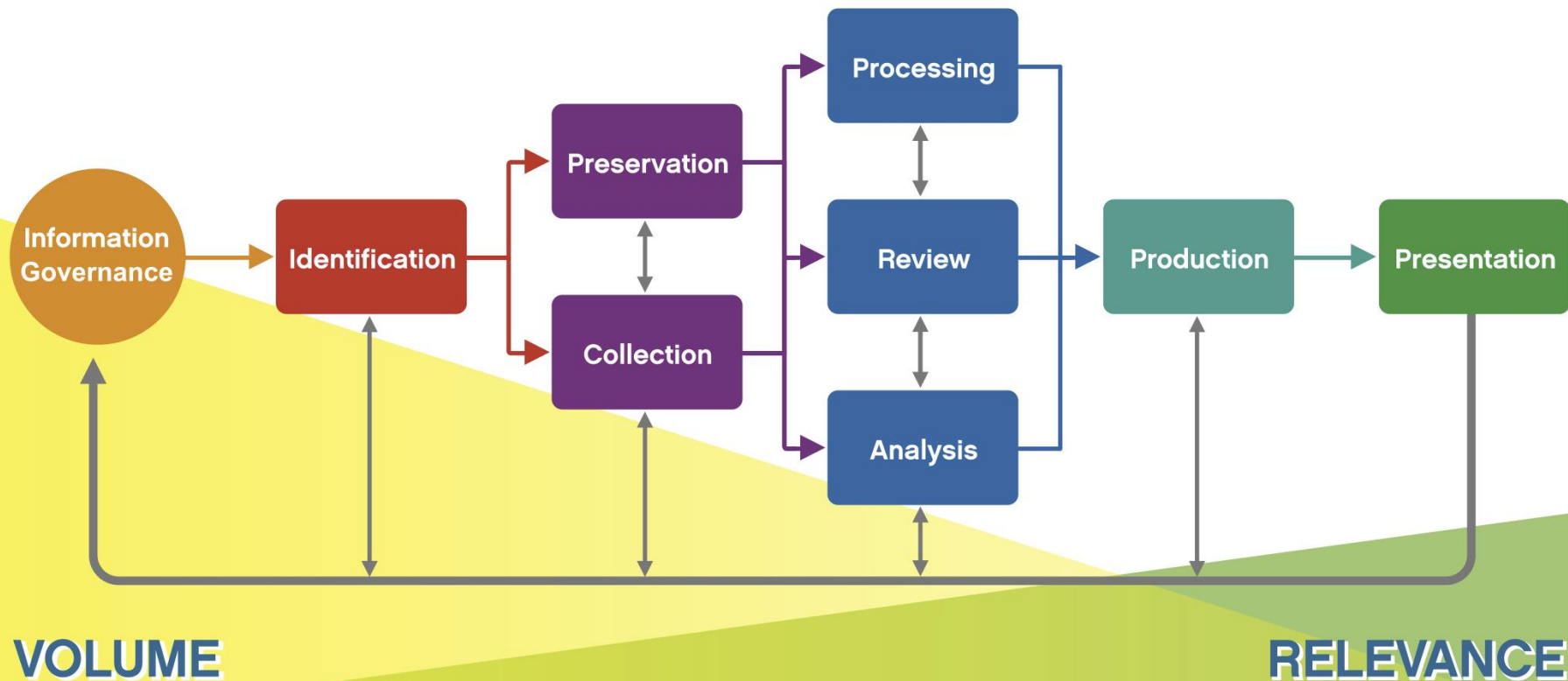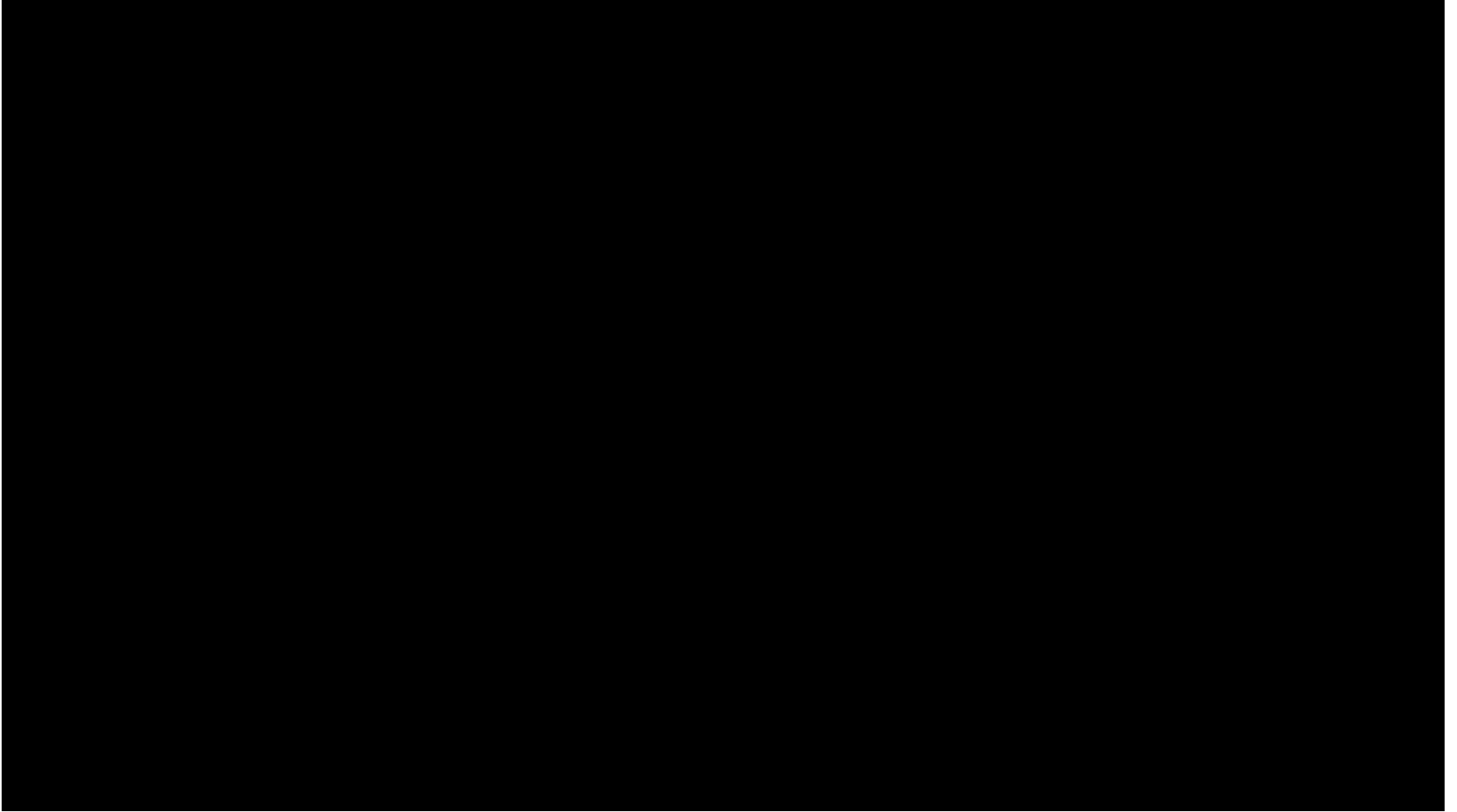
EXAMPLE TOOLS

Commercial: Attenex Patterns (now FTI Ringtail)

Document Viewer

Selected Document

Selected Concept

Document Concepts

Concepts from Document Collection

Email Message

Email Attachment

Cluster of Related Documents
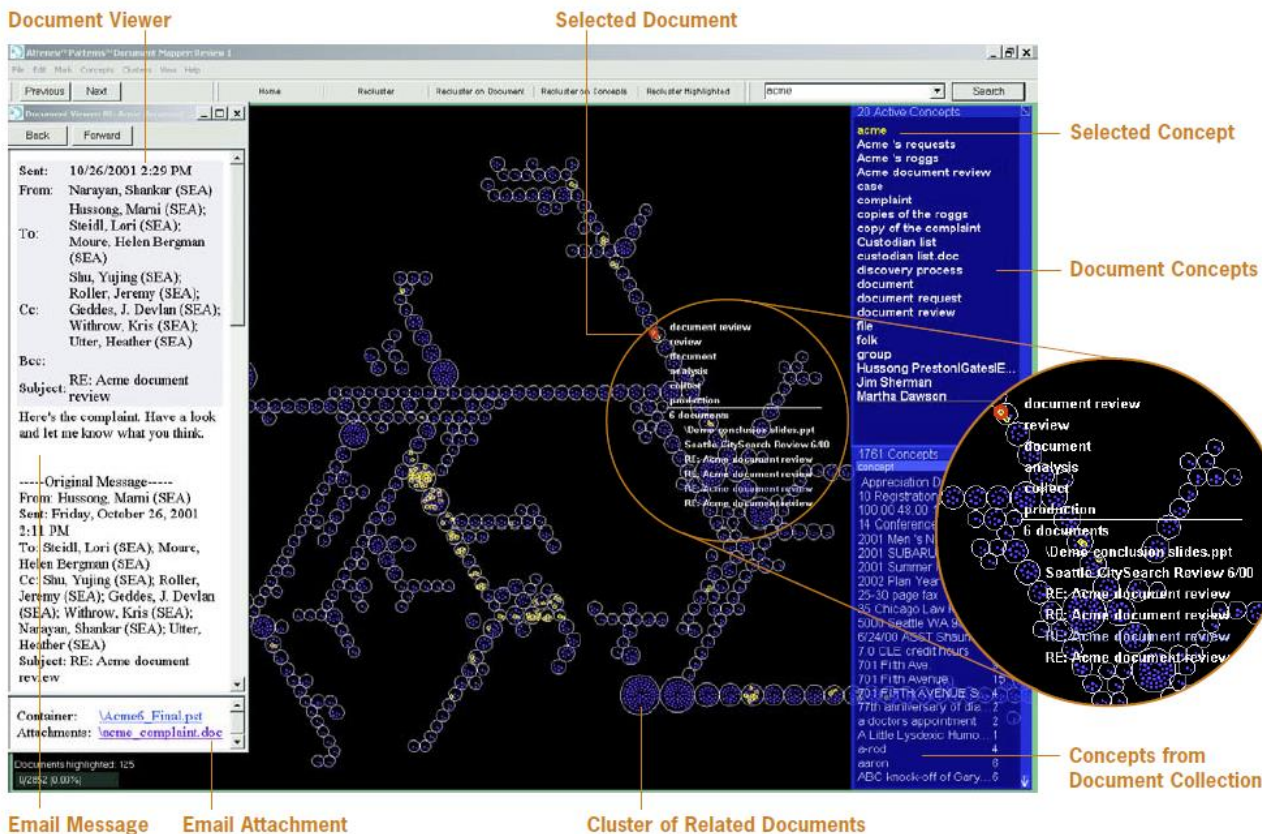
SUCCESS STORIES OF VA TOOL

- Lovells (6th largest law firm worldwide) was investigating 35Gb of email data
  - traditional method: estimated cost: 1 year, 4-5 million $US
  - with VA software: three months, cost 1 million $US
- JMBM law form represented spinal surgeon & inventor in intellectual property suit
  - 20 claims, 50 million pages of documents, contracts, patents, etc.
  - with VA software (used on 7 computers), 44 million pages sifted through in 4 months
  - important doc found, surgeon won, received $570 million in compensation

Figure 1. Magic Quadrant for E-Discovery Software

Source: Gartner (June 2014)

RESEARCH

- working on this level in research is difficult
  - man power for providing support
  - "research aspect" needs most attention
  - adoption of prototypes unlikely when stakes are high ($$$)
- thus, next: smaller research projects in regards to document analysis

PARALLEL TAG CLOUDS

C. Collins, F. B. Viégas, and M. Wattenberg, "Parallel Tag Clouds to Explore and Analyze Facted Text Corpora," in *Proc. of the IEEE Symp. on Visual Analytics Science and Technology (VAST)*, 2009.

Parallel Tag Clouds to Explore
and Analyze Faceted Text Corpora

Christopher Collins
Fernanda B. Viégas
Martin Wattenberg

FACET ATLAS

CAMBIERA

Collaborative Brushing and Linking
for Co-located Visual Analytics
of Document Collections

Petra Isenberg & Danyel Fisher
Microsoft Research

VISUAL ANALYTICS @ AVIZ

www.aviz.fr

WORK AT AVIZ

- We often work non-applied (on generalizable conceptual problems)
  - collaboration
  - perception
  - interaction
- Some application areas:
  - biology
  - digital humanities
  - Wikipedia
  - sports

GENERAL CONCEPT

Collaboration

COLLABORATIVE ANALYSIS

- share task load
- share expertise
- joint problem solving

Space

Co-located | Distributed

Time

Synchronous
- Meeting room
- Classroom
- Museums
- Lab space

Video conferences
Media spaces

Asynchronous
- Shift Work (e.g. hospitals)

Email-based data discussions
Web-based data analysis
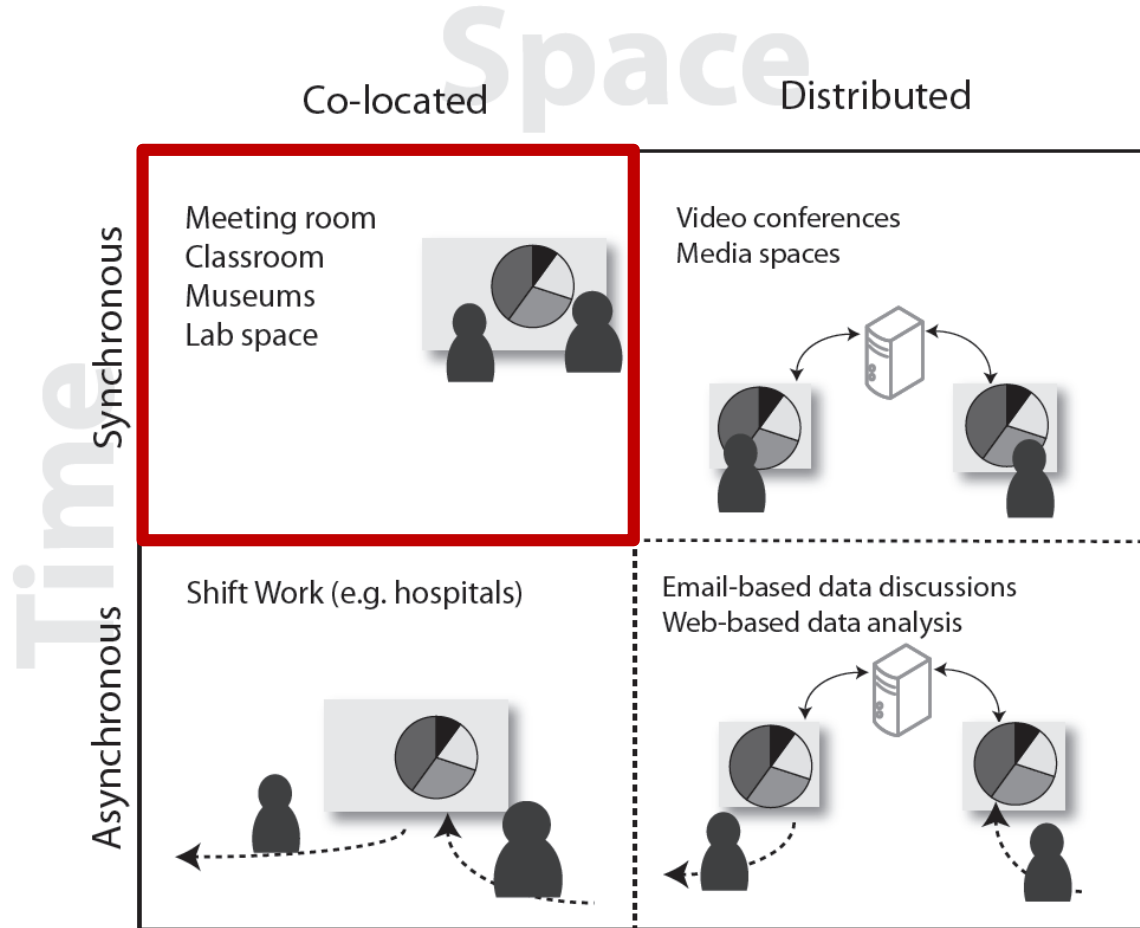
CHALLENGES

collaborative data analysis is still poorly understood

- collaborative analysis & sharing?
- collaborative space usage?
- task coordination?
- collaborative sensemaking?
- when & where?

CAMBIERA
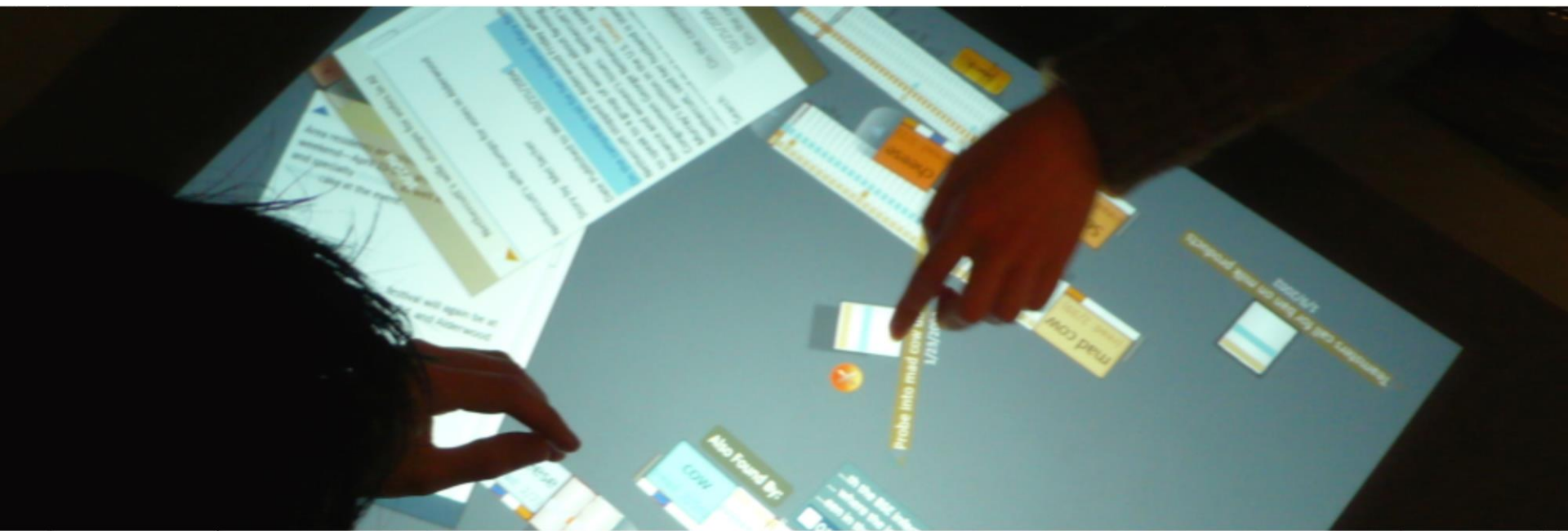
EXPLORATORY STUDY

understand digital tabletop as data analysis environment

- task coordination

- patterns of collaboration

- system design implications

Petra Isenberg, Danyel Fisher, Meredith Ringel Morris, Kori Inkpen, and Mary Czerwinski. An Exploratory Study of Co-located Collaborative Visual Analytics around a Tabletop Display. In Proceedings of Visual Analytics Science and Technology (VAST), pages 179–186, Los Alamitos, CA, USA, 2010. IEEE.

STUDY DESIGN

- participants:
  - 15 pairs
  - team members knew each other
  - master's or more advanced degree
  - enjoy puzzles / mysteries
  - age: 25 - 55
- data collected:
  - notes, video data, interaction logs, questionnaire, interview data
  - 2-pass video coding + visualization of log files

246 documents

e-coli contamination
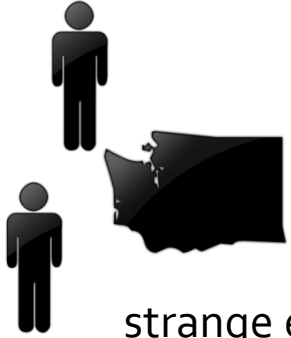
strange events
Alderwood, WA

car accident

poisoned apples

terrorism in south america

More information:
@ Visual Analytics Benchmark Repository
http://hcil.cs.umd.edu/localphp/hcil/vast/archive

RESULT

solving the problem collaboratively

Starting document

9 groups

6 groups

both: analyzing starting document

CLOSE COLLABORATION

one: analyzing starting document
other: exploring other data

LOOSE COLLABORATION
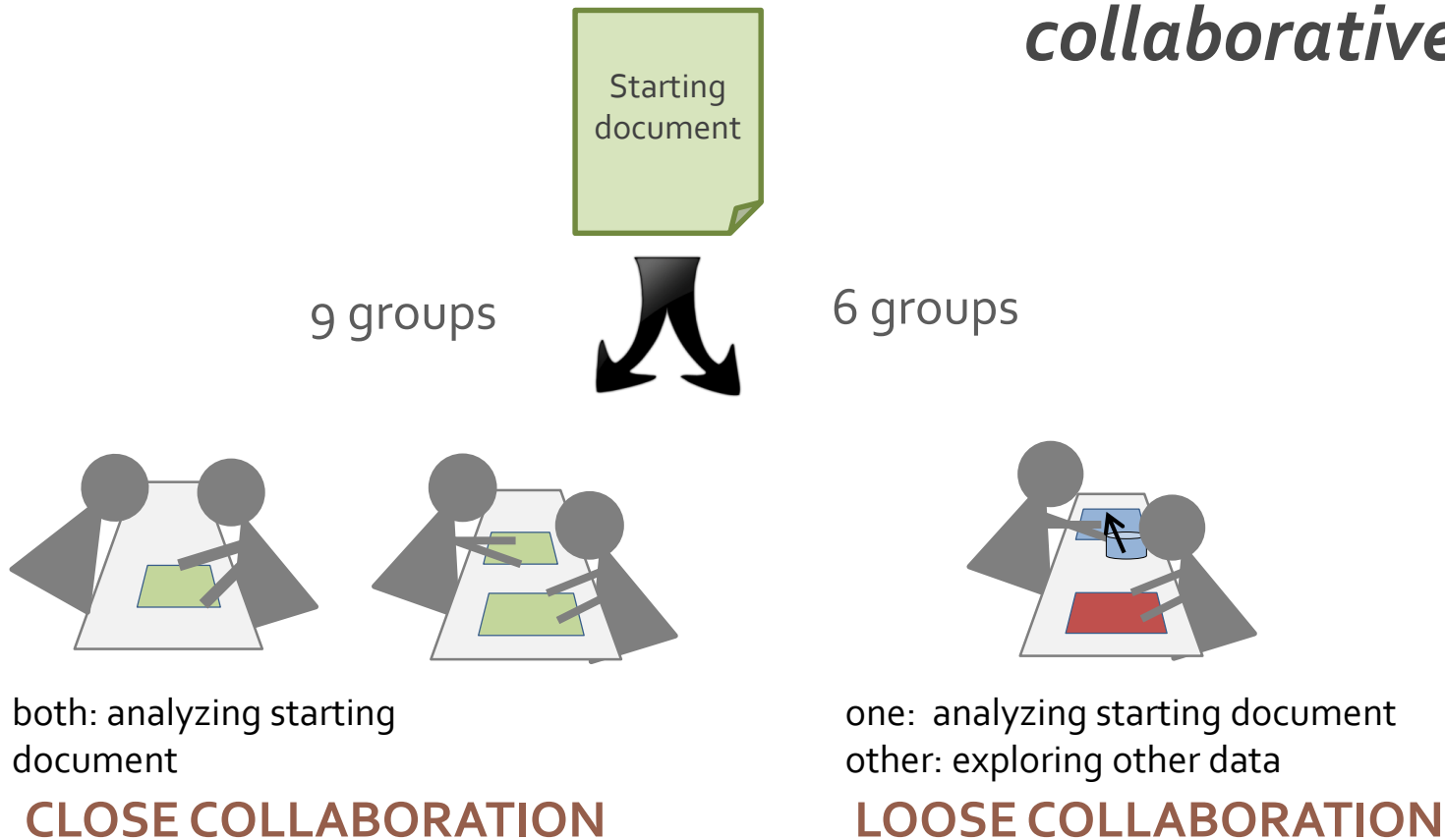
RESULTS

information sharing and collaboration

- different collaboration styles adopted
- influenced what data/views were shared
- allowed flexible investigation based on emerging information

close collaboration   loose collaboration

DISC   VE   SV   SIDV   SSP   SGP   DP   D

[extended fromTang et al., 2006]
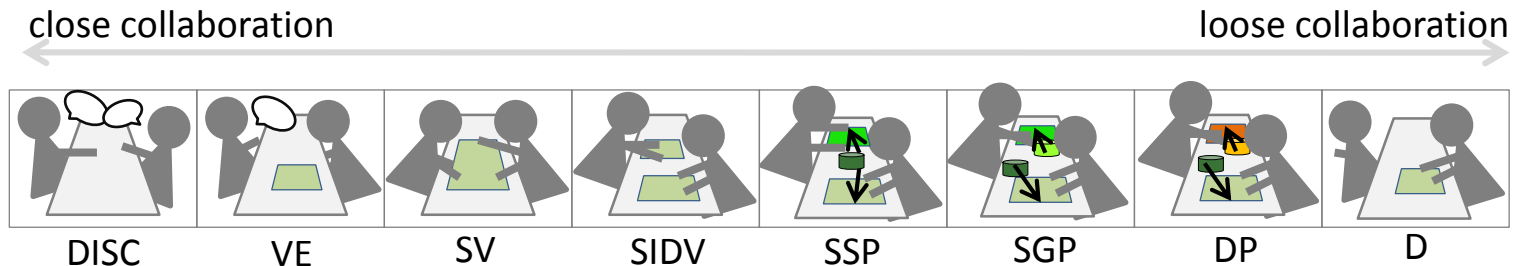
PROCESS
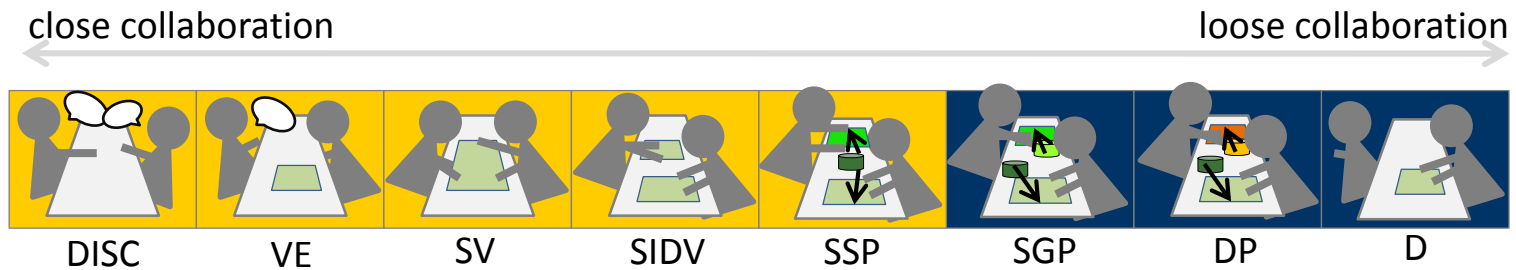
Pair	% C.C.	Coupling Styles
1	92%	
15	91%	
2	90%	
12	75%	
10	69%	
13	68%	
14	60%	
11	57%	
9	56%	
6	54%	
4	50%	
3	46%	
8	39%	
5	33%	
7	32%	
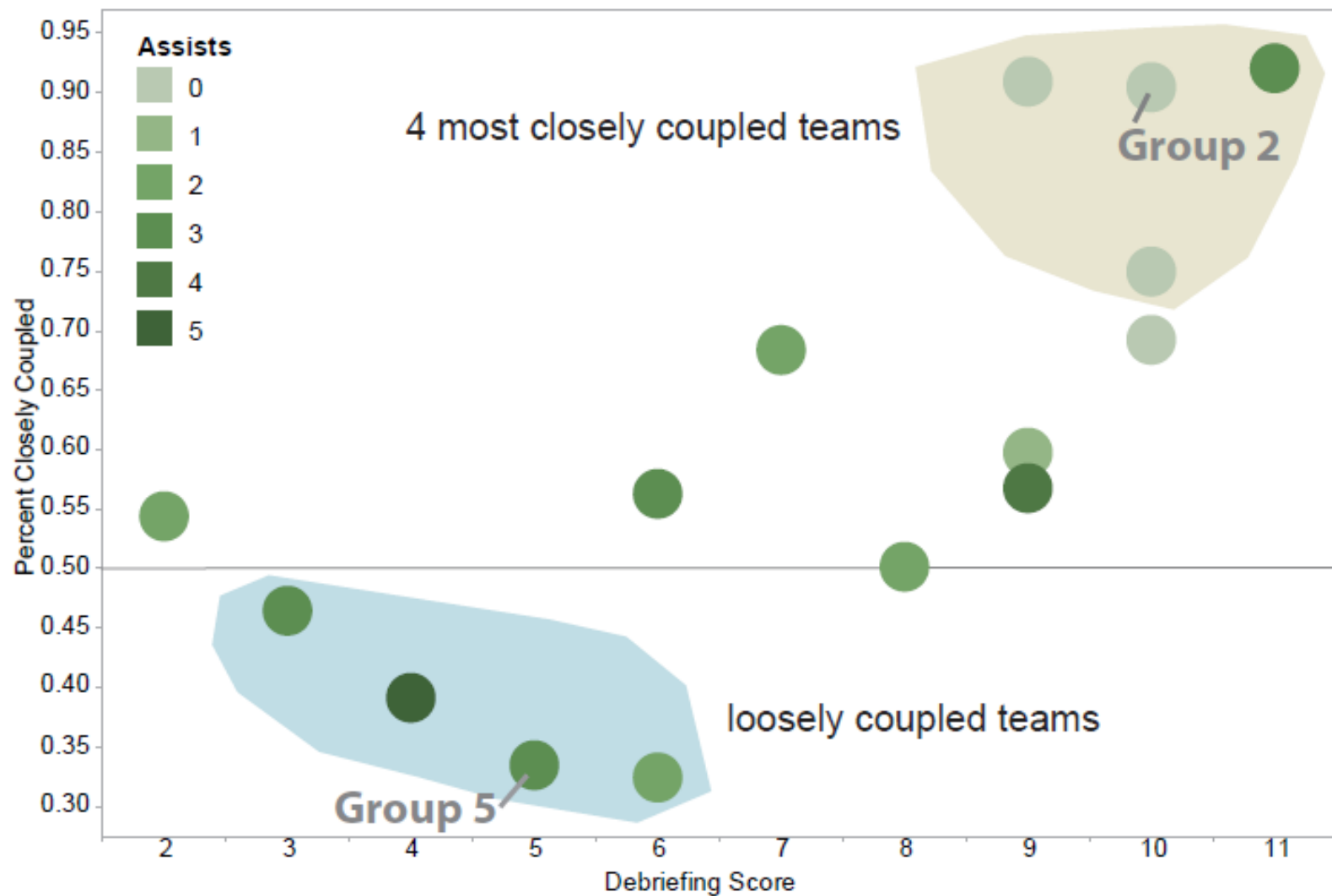
IMPLICATIONS FOR DESIGN

- design for transient behavior
  - strategies change & interfaces need to accommodate
  - design system features to support different styles
- encourage closely coupled work
  - awareness features possibly not strong enough for loosely-coupled teams
  - make common information even more obvious

GENERAL CONCEPT

perception

HYBRID IMAGE VISUALIZATION
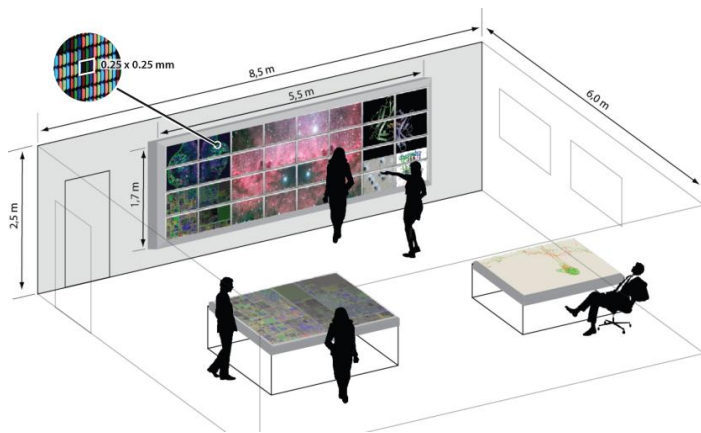
large displays
meeting rooms / war rooms
emergency response rooms

public viewing
open spaces
museums

0.25 x 0.25 mm

8,5 m

5,5 m

6,0 m

2,5 m

1,7 m
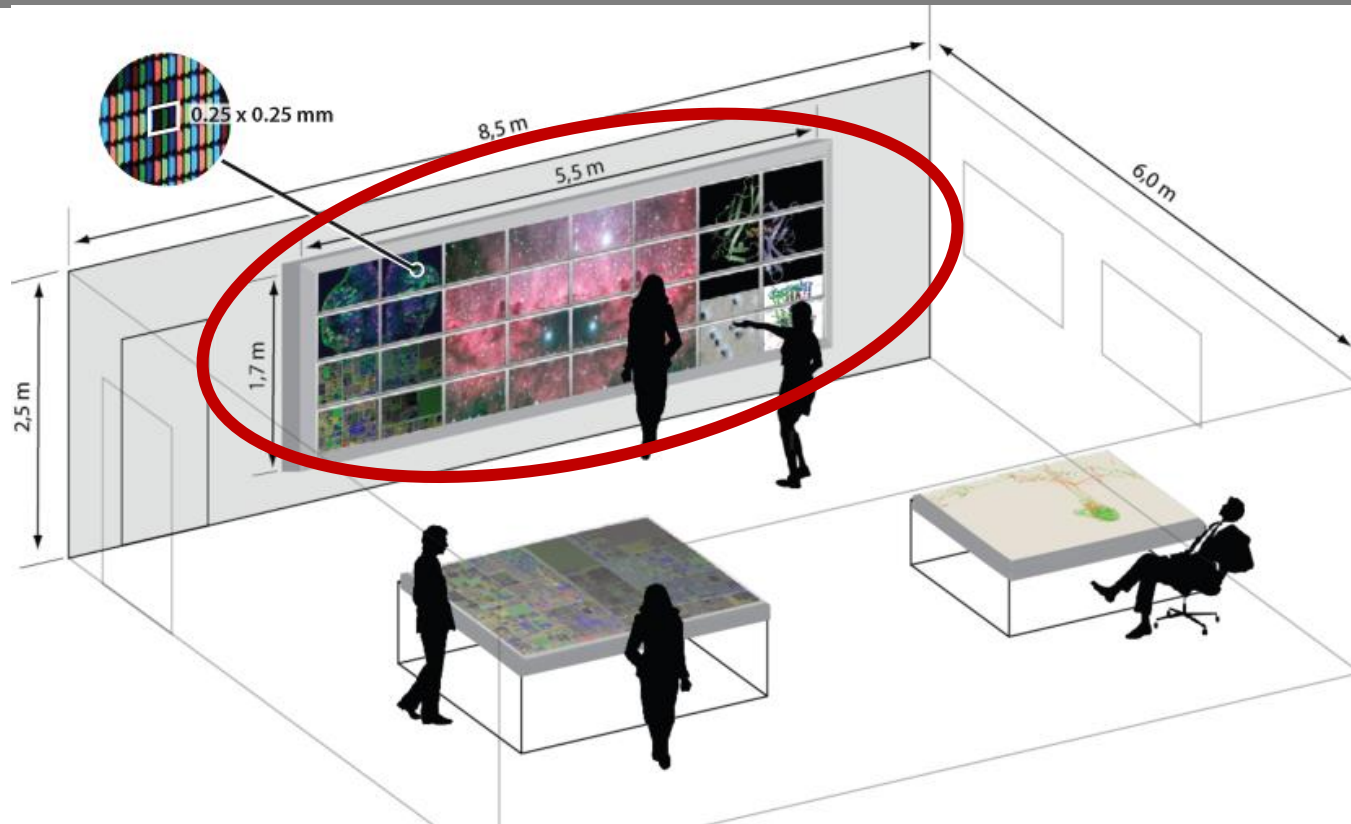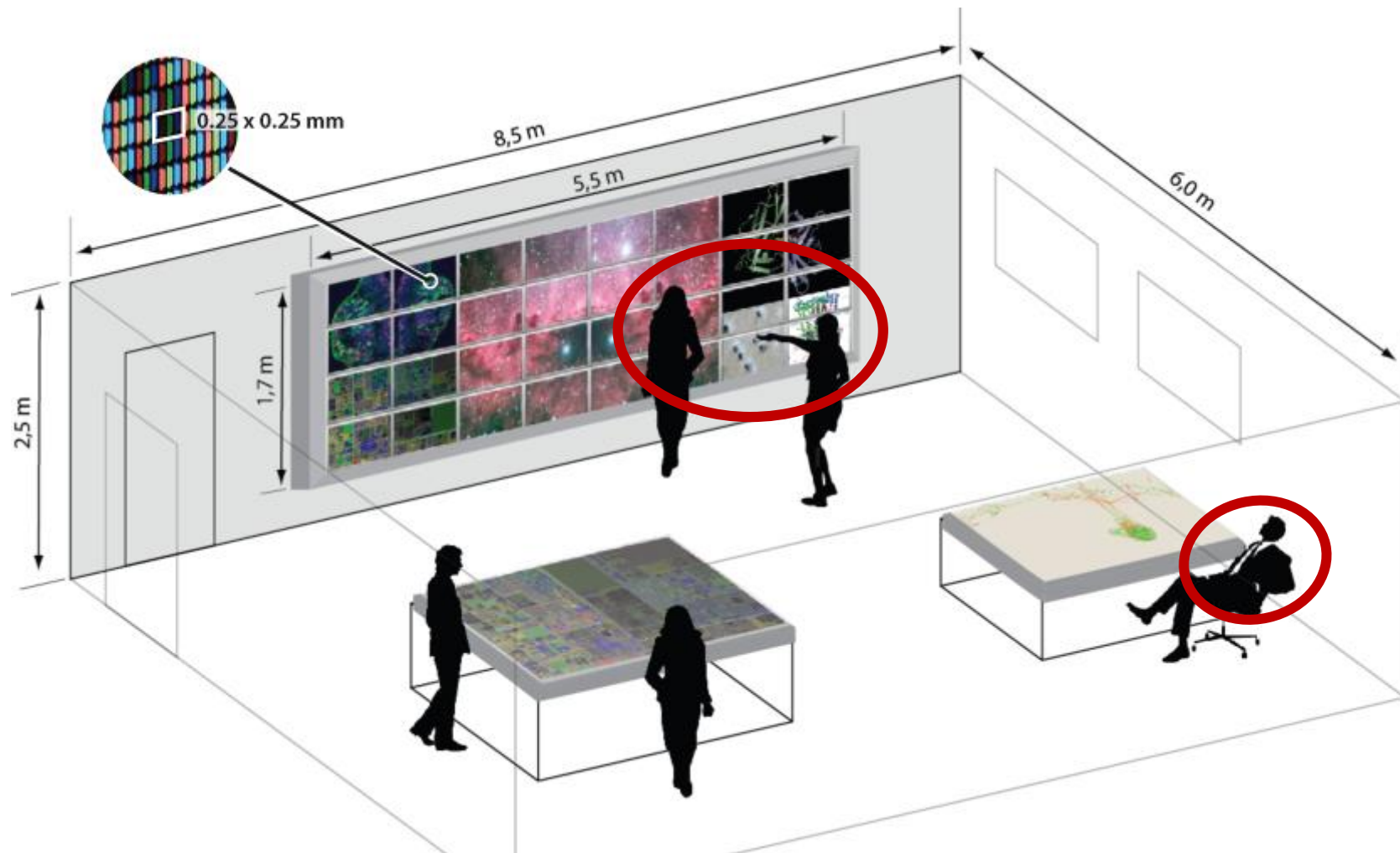
EXAMPLE DATA

23 years of daily temperatures for 32 cities

```
Station, Country, Station ID, SOUID,      Date,     Temperature (decidegrees Celsius), Temperature Quality
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-01,   -21,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-02,   -13,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-03,    -2,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-04,   -12,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-05,     0,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-06,   -13,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-07,   -40,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-08,     6,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-09,    35,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-10,    44,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-11,    48,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-12,    60,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-13,    22,       0
BERLIN-DAHLEM, GERMANY, 41,    133,1990-01-14,    30,       0
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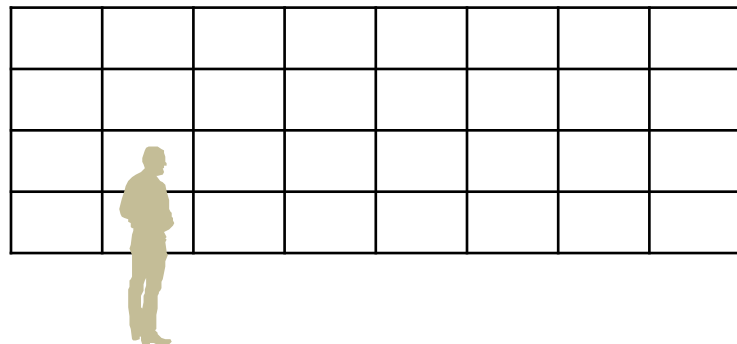
NAÏVE APPROACH

Optimize for one specific viewing distance

overviews from far

Problem:
detailed information lost
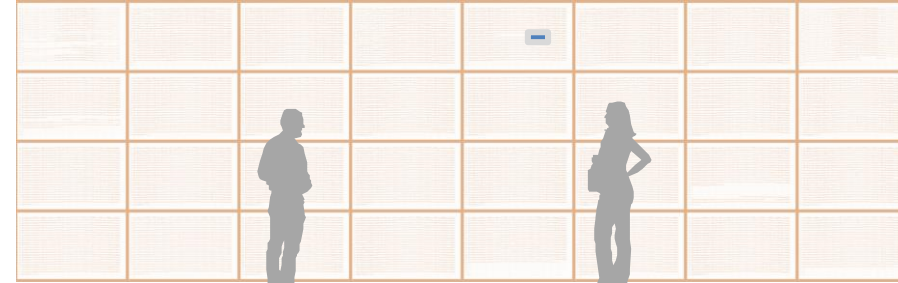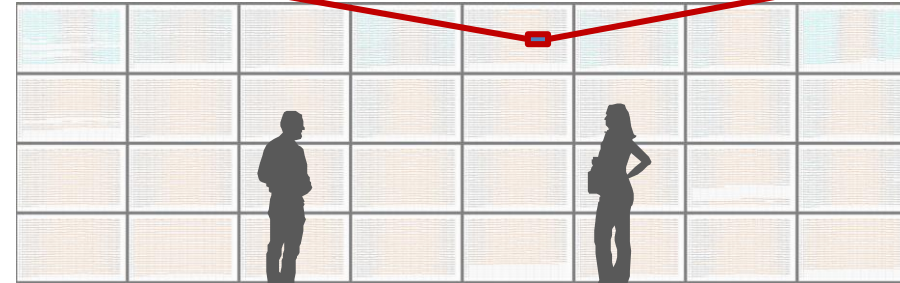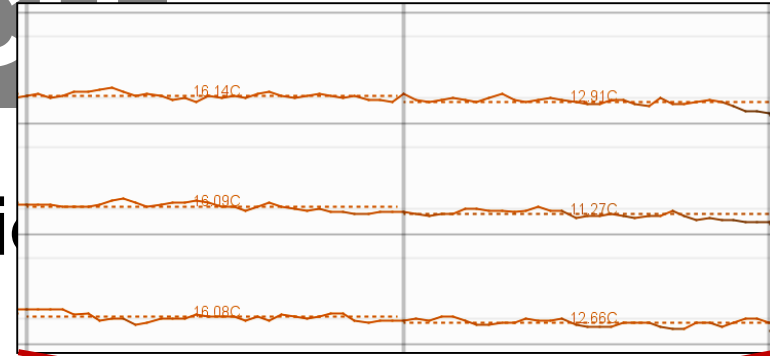
detail from close

Problem:
mental aggregation, comparison

NAÏVE APPROACH

Optimize for one specific view

overviews from far

detail from close

Problem:
detailed information lost

Problem:
mental aggregation, comparison

POSSIBLE APPROACHES

- Dynamic integration
  (tracking people & adapting content)

- Static integration
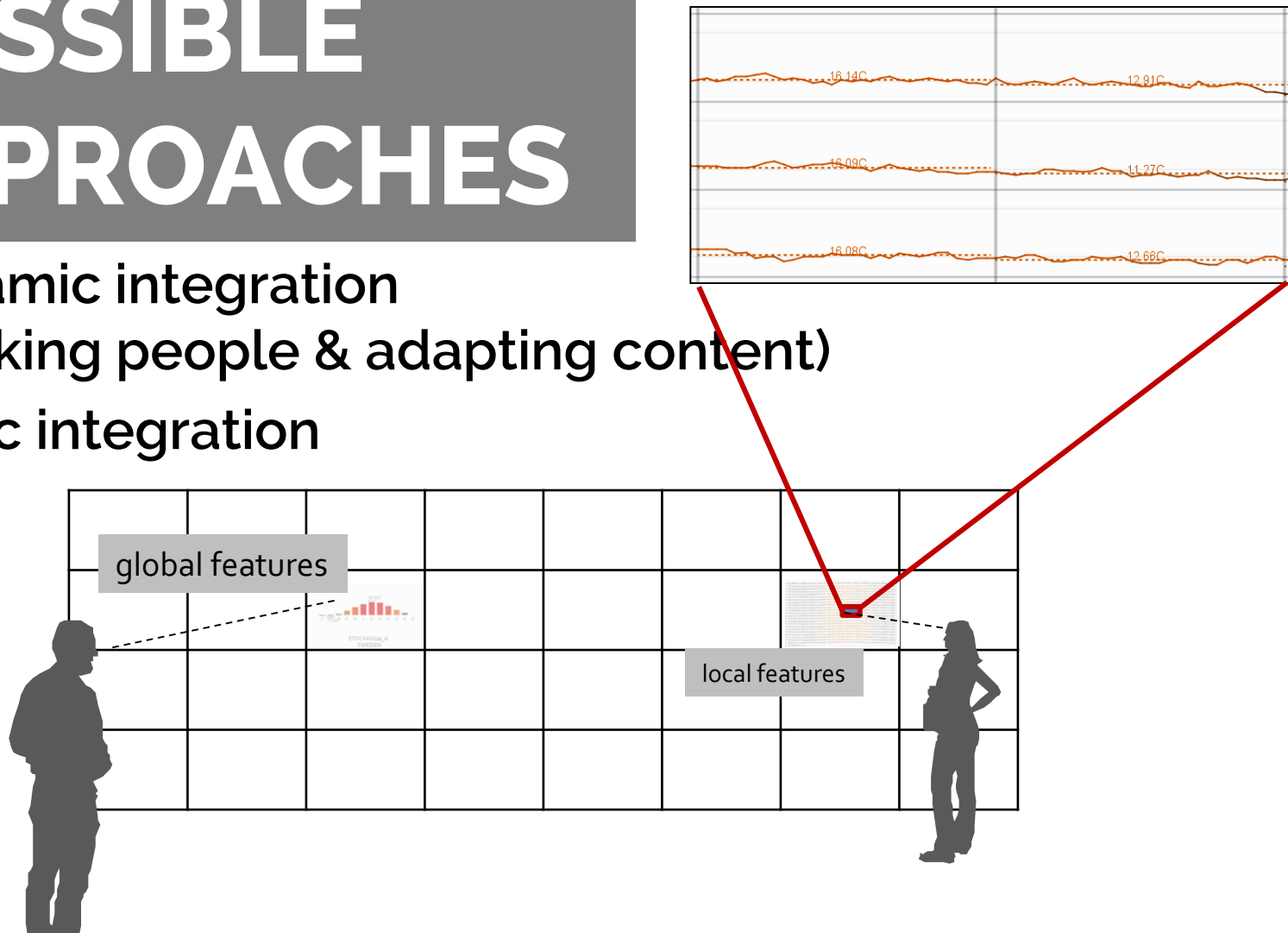
STATIC APPROACHES

Juxtaposition:
global & local features next to each other

http://visual.ly/b2b-content-marketing-2014-benchmarks-budgets-and-trends

Infographic Layout

http://world.net
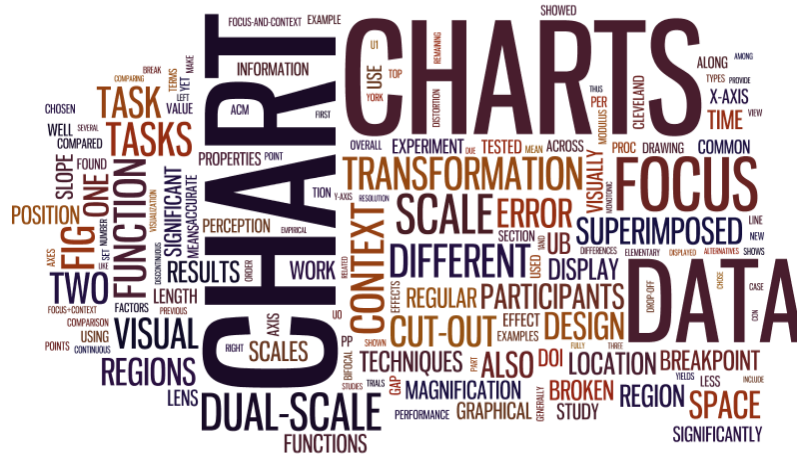
Large Tag Clouds

STATIC APPROACHES

Nesting:
local inside global features
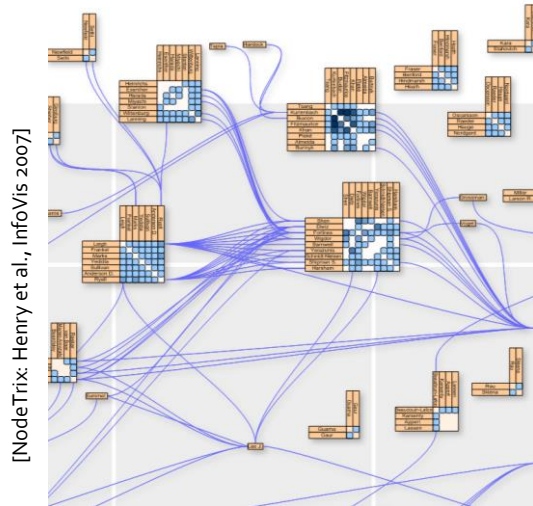
NodeTrix
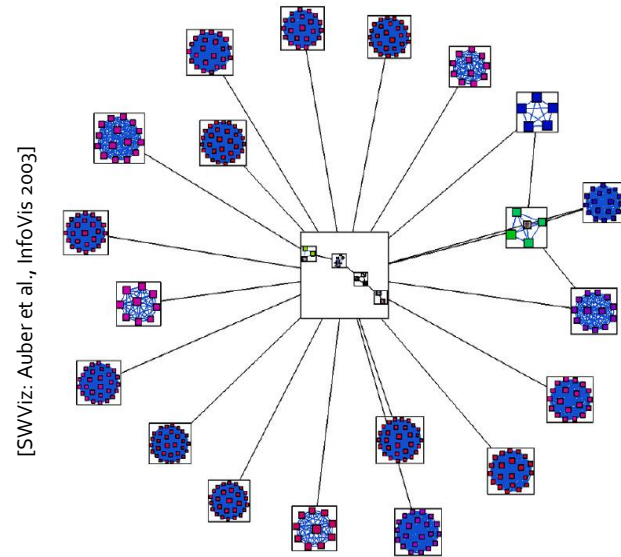
SWViz

STATIC APPROACHES

Visual aggregation:
local forms global features
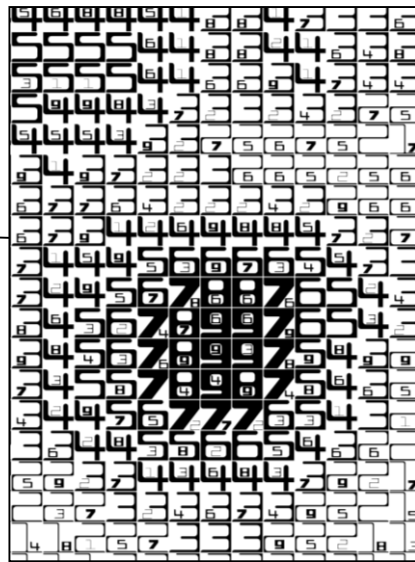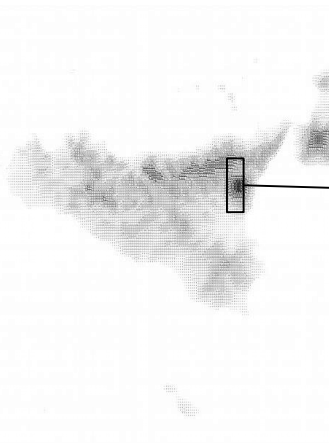
FatFonts

Arcimboldo Paintings, Calligrams

STATIC APPROACHES

Blending:
local & global features overlap

Map regions over map detail   Label detail over bar chart   Hybrid image visualization
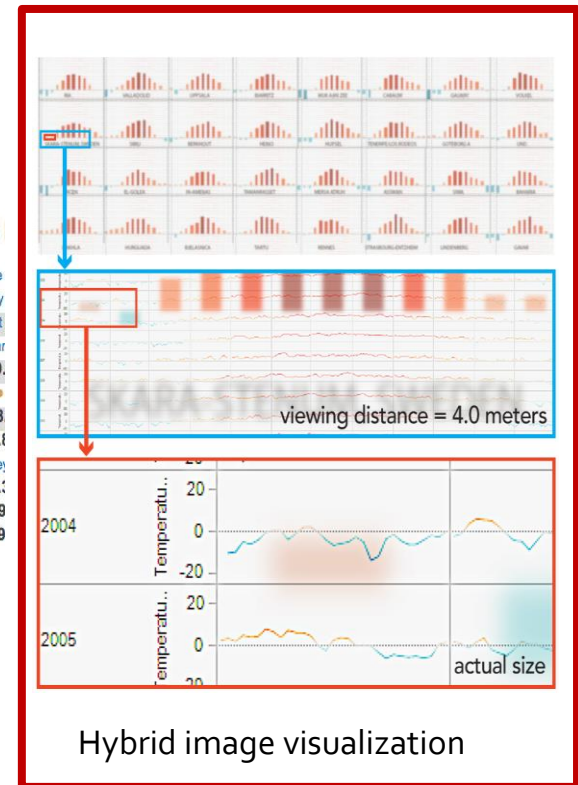
HYBRID IMAGES

blurred

+
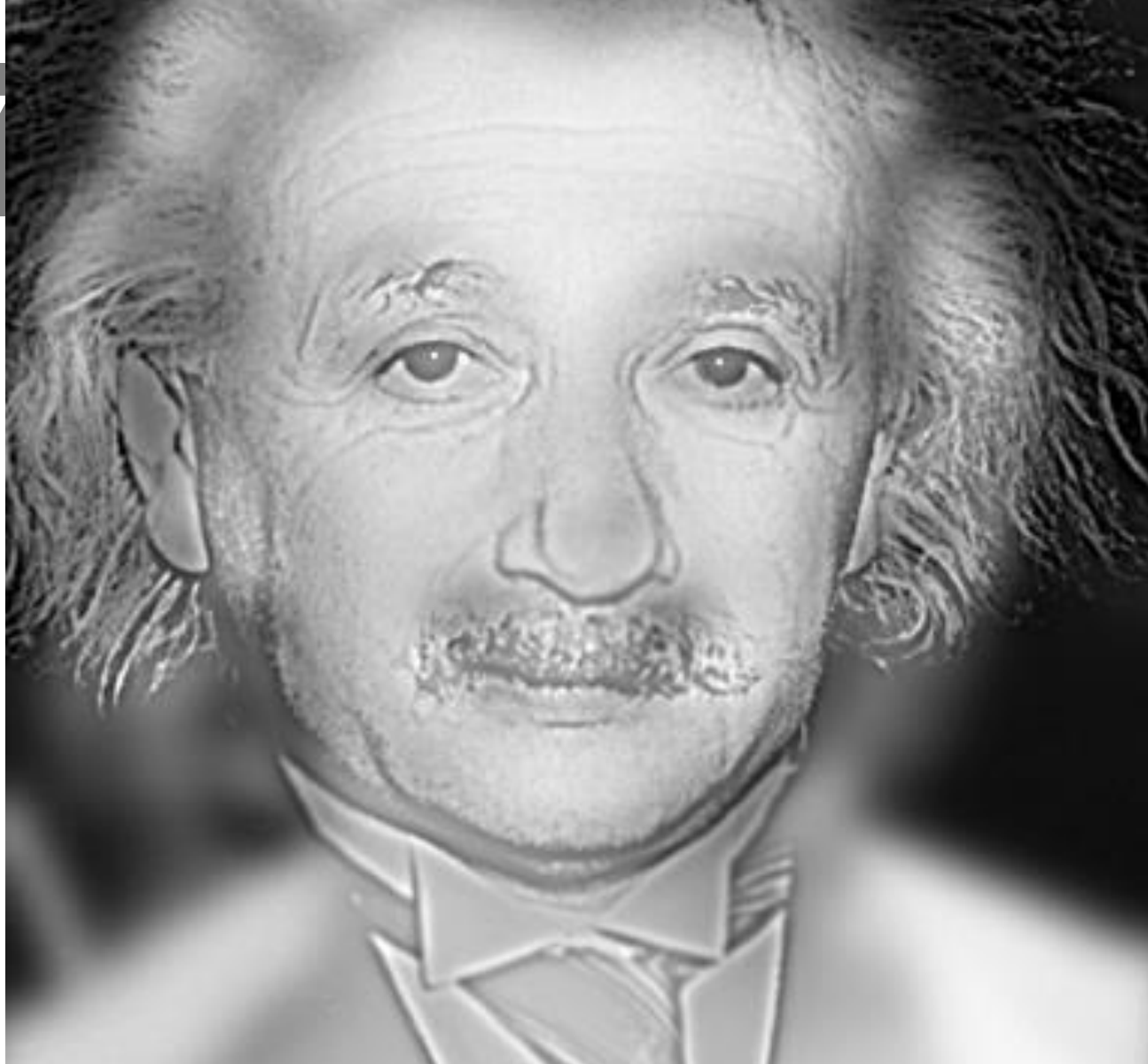
edges
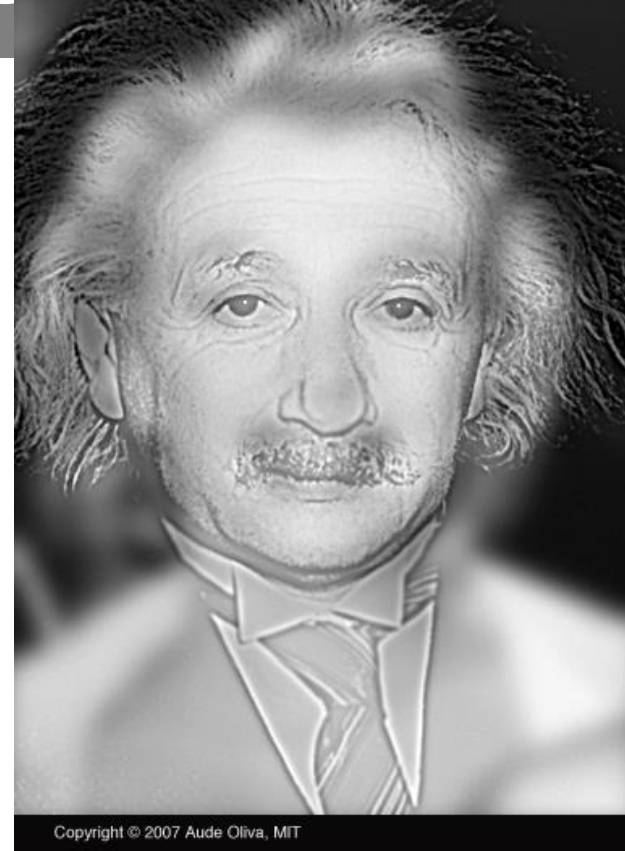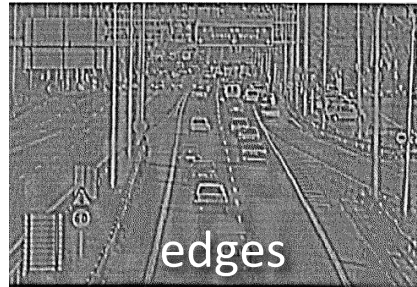
[VICTIM OF TIME: THE THEORY]

Information Visible vs. Distance to the display

- 2 pixels
- 4 pixels
- 8 pixels
- 16 pixels
- 32 pixels
- 64 pixels
- 128 pixels
- 256 pixels
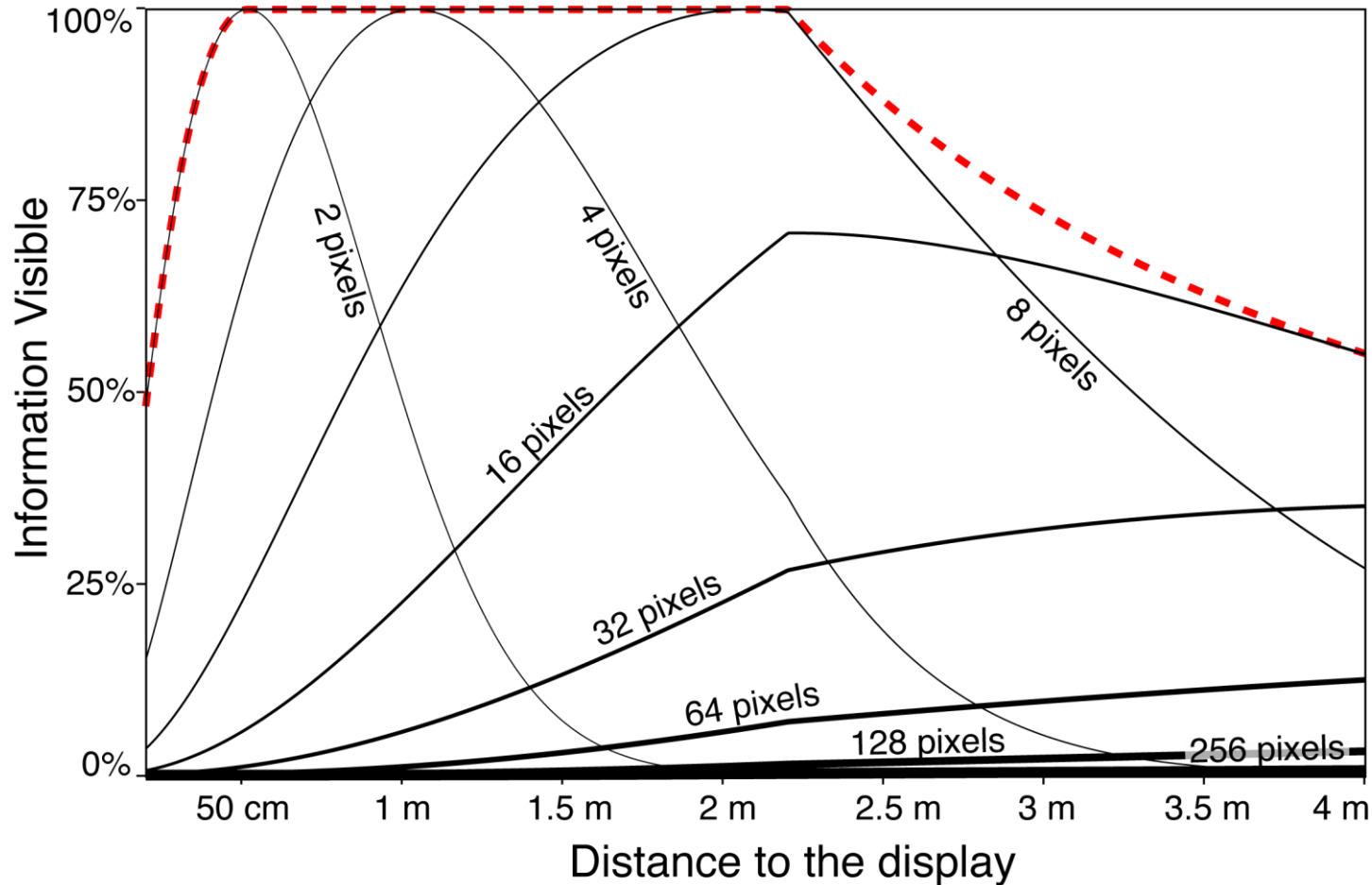
HYBRID IMAGE VISUALIZATION - VIDEO
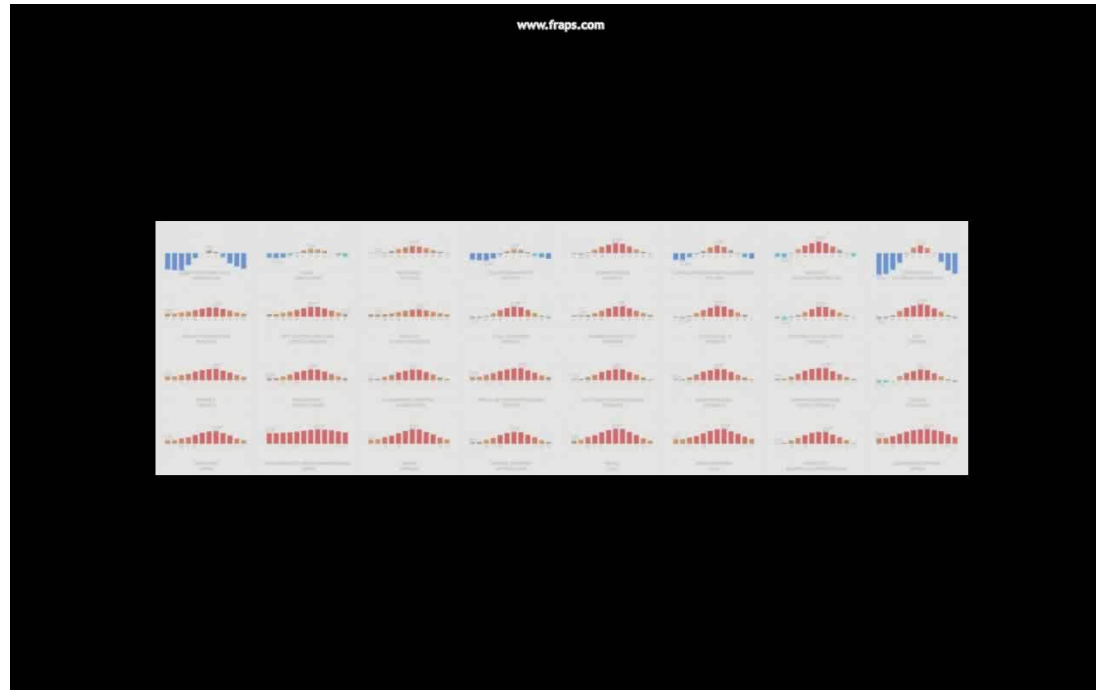
ALPHA BLENDING ONLY - VIDEO
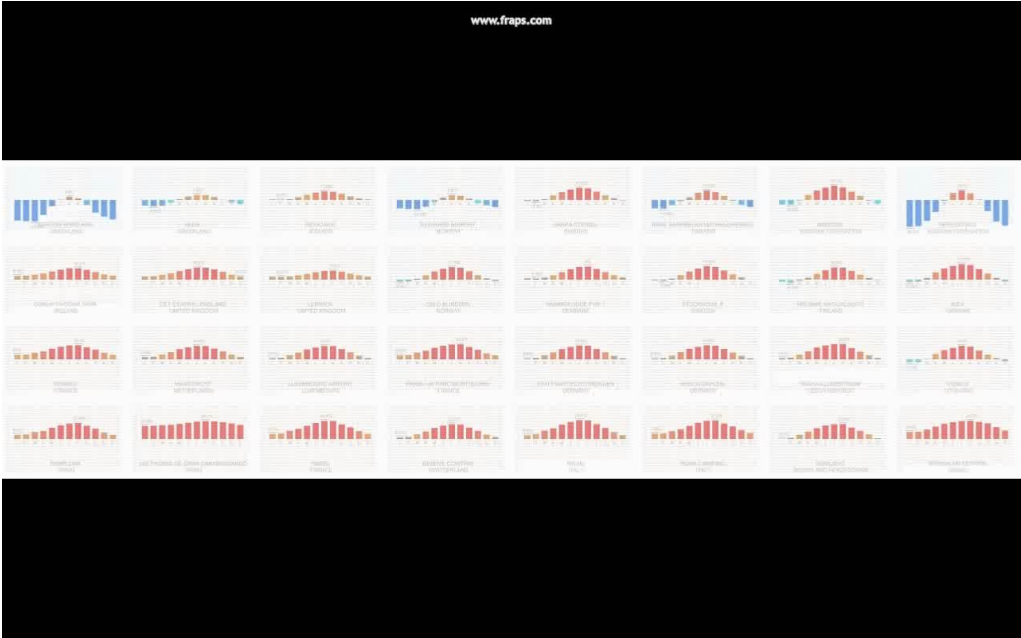
HERTZSPRUNG RUSSELL DIAGRAM – VIDEO
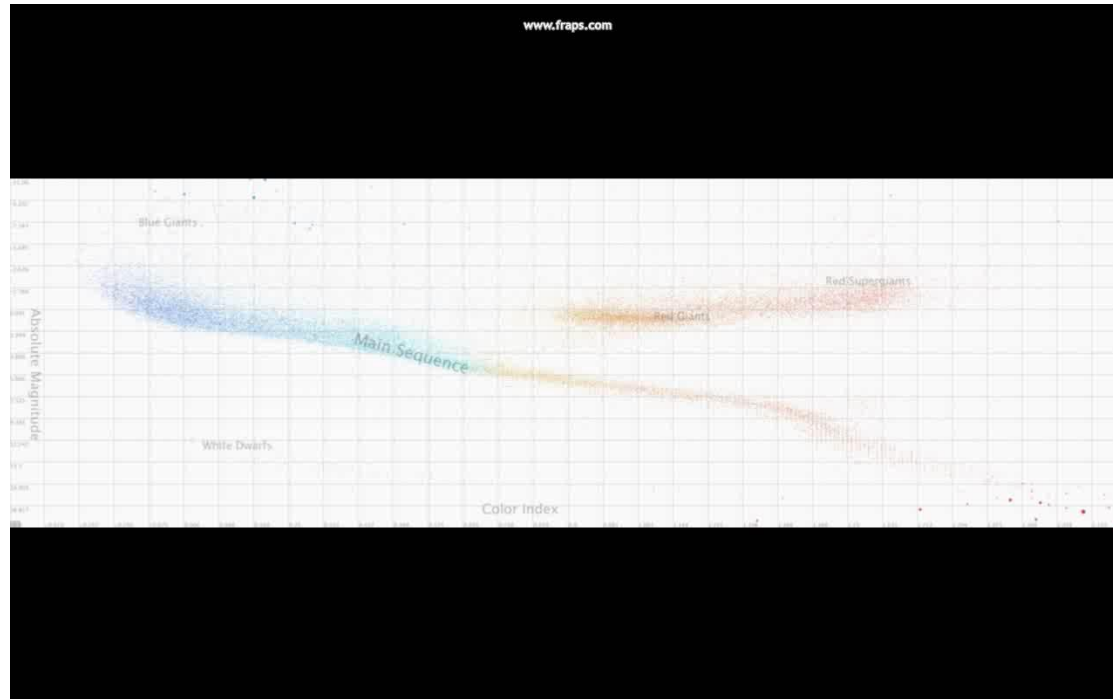
TREEMAP - VIDEO

HYBRID IMAGE MAKER

Viewer distance (m) 0.7

0   1   2   3   4   5   6   7   8   9   10

Sol

3m   0.7m

679.0px

400px	100px	40px	20px	10px	5px
0.1m	0.025m	0.01m	0.005m	0.003m	0.001m
0.122c/d	0.489c/d	1.222c/d	2.443c/d	4.887c/d	9.773c/d
400px	100px	40px	20px	10px	5px

Hybrid renderer settings

Draw background ☑

Draw near image ☑

Hipass radius 5   0   20   40   60   80   100

Transparent hipass ☐

Hipass contrast 1.5   0   1   2

Hipass brightness 1.5   0   1   2

Near image opacity 1   0   0.5   1

Draw far image ☑

Blur radius 30   0   20   40   60   80   100

Far image opacity 0.5   0   0.5   1

Post contrast 2   0   1   2

Post brightness 0.8   0   1   2

Draw bezels ☑
Draw settings ☐

Draw power spectrum ☑
Log scale power spectrum y ☑
Highlight frequency band ☐

Frequency band midpoint 49   2   102

Frequency band width 2   2   12   22   32   42

APPLICATIONS @ AVIZ

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BUBBLE-TV

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