


Interactive Visualization for Computational Linguistics


ESSLII 2009

2

Evaluation



Evaluating InfoVis Purpose?



Information Visualization is the use of computer-supported interactive visual representations of abstract data to amplify cognition. (Card et al.)

Evaluating InfoVis: purpose

- Are we trying to make the right vis?
(making the right vis / making the vis right)
- Does it do what is really required?
- Have we made what we were trying to make?
- Does it enable some task?
- Is the data represented?

- Does it enable insight?
- Does it enhance cognitive abilities?

Non empirical methods

- Complexity proof
- Verifying algorithmic correctness
- Verifying correct data – representation mapping
- Verifying novelty of the representation
- Demonstrating the match of the representation to task by case scenarios

Insight

- varies from person to person
- instance to instance;
- hard to define, and consequently hard to measure.
- answering questions you didn't know you had
- did infovis play a role in discovery
- temporally elusive
- teamwork and social factors

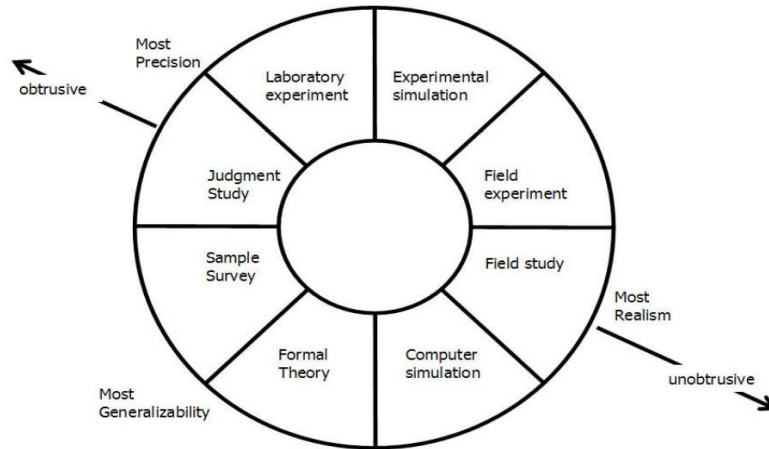
Choosing an Evaluation Approach

three particularly desirable factors:

each methodology favours one or two of these factors, often at the expense of the others

- **Generalizability:** a result is generalizable to the extent to which it can apply to other people (than those directly in the study) and perhaps even extend to other situations
- **Precision:** a result is precise to the degree to which one can be definite about the measurements that were taken and about the control of the factors that were not intended to be studied
- **Realism:** a result is considered realistic to the extent to which the context in which it was studied is like the context in which it will be used.

Choosing an Evaluation Approach



Choosing an Evaluation Approach

Field Study:

- in the actual situation,
- observer tries as much as possible to be unobtrusive.

- realism is high
- results are not particularly precise
- likely not particularly generalizable

- generate a focused but rich description of the situation being studied.

Choosing an Evaluation Approach

Field Experiment:

- realistic setting;
- trades some degree of unobtrusiveness for more precision in observations.

- realism is still high, it has been reduced slightly by experimental manipulation.
- results may be more readily interpretable
- specific questions are more likely to be answered

Choosing an Evaluation Approach

Laboratory Experiment:

- experimenters fully design the study.
- can provide for considerable precision.
- measurements possible - when and known

- less realistic – can provides more information

- introducing more realism will likely reduce the possible precision

Choosing an Evaluation Approach

Experimental Simulation:

- experimenter tries to keep precision
- introduces some realism via simulation.
- examples
 - ▣ studying driving under influence
 - ▣ 'Wizard of Oz'
- can provide considerable information while reducing the dangers and costs of a more realistic experiment.

Choosing an Evaluation Approach

Judgment Study:

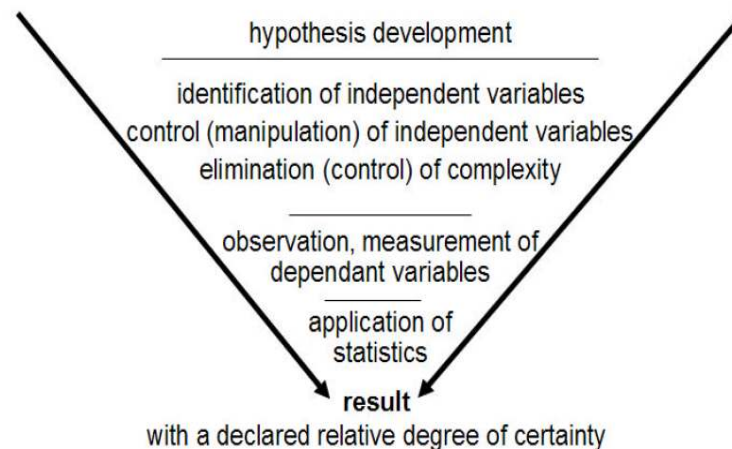
- person's response to a set of stimuli
- creating 'neutral conditions'.
- perceptual studies often use this approach.
- Examples
 - ▣ Speed of recognition
- Setting can have impact

Choosing an Evaluation Approach

Sample Survey:

- discovering relationships between a set of variables in a given population.
- proper sampling of the population can lead to considerable generalizability.
- responses are hard to calibrate.
- despite difficulties, much useful information can be gathered this way. We as a community must simply be aware of the caveats involved.

Quantitative Methodology



Qualitative Evaluation

holistic approaches that consider the interplay among factors

Observation Techniques

- unobtrusive
- notes are taken as observations occur
- observations include
 - ▣ setting, time, people, tasks, data, subtleties .
- include both the overt and covert
- include both the positive and negative

- be concrete whenever possible.
- distinguish between verbatim accounts and paraphrased and/or remembered.

Inspection Qualitative Methods

Usability Heuristics:

- Well established

Collaboration Heuristics:

- communication and coordination, awareness, territoriality, Mechanics of Collaboration

Information Visualization Heuristics:

- knowledge and task, Tufte's, Bertin, cognitive (Ware)

Common Method:

- first pass - gain an overview
- second pass - asses interface components in detail

- akin to the design term guidelines

Qualitative Methods as Primary

- to develop a richer understanding through holistic approach.
- enables full, rich descriptions rather than to make statistical inferences
- may be factors that can be numerically recorded
- can be used at any time in the development life cycle.
- as a preliminary step in the design process.

In Situ Observational Studies:

Participatory Observation:

Laboratory Observational Studies:

Contextual Interviews:

Albert Einstein

'Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted'

Usability evaluation *if wrongfully applied*

- ❑ stifle innovation by quashing (valuable) ideas
- ❑ promote (poor) ideas for the wrong reason
- ❑ lead to weak science
- ❑ ignore how a design would be used in everyday practice

Greenberg, S. and Buxton, B. (2008)

[Usability Evaluation Considered Harmful \(Some of the Time\)](#). In *Proceedings of ACM Conference on Human Factors in Computing Systems - CHI'08*, ACM Press, pages 111-120

Early design as sketches

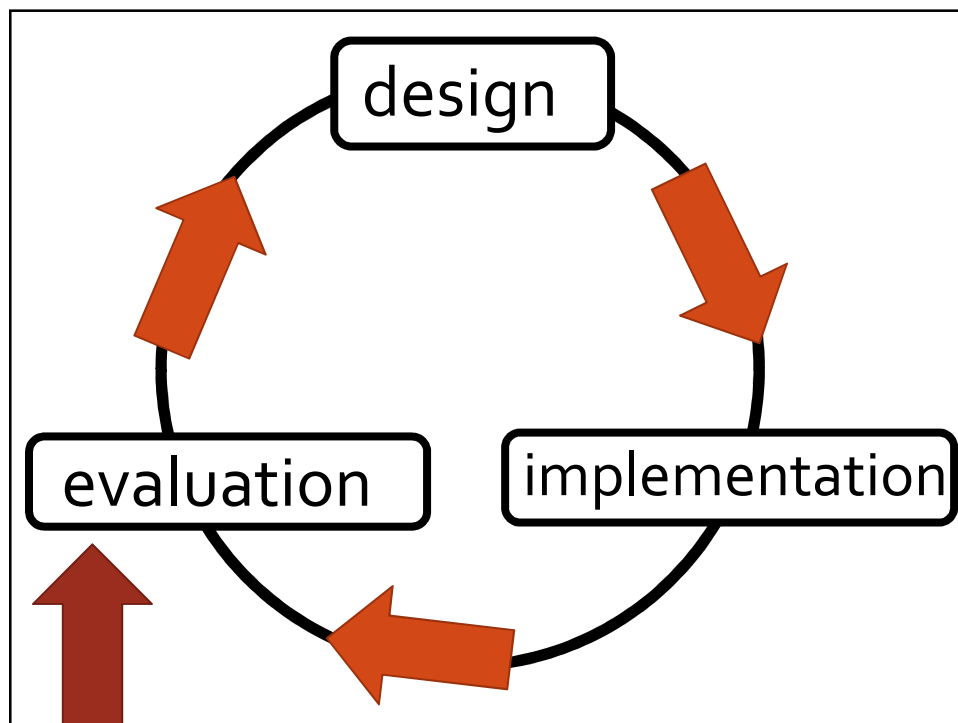
EVOCATIVE
SUGGEST
EXPLORE
QUESTION
PROPOSE
PROVOKE
TENTATIVE
NONCOMMITTAL

Sketches are innovations & valuable

Method

23

- Generative study
 - ▣ Analysis of existing context (data, tools, work environment, collaboration...)
 - ▣ Derive rich understanding of needs and context
- Design sketching
- Discussions with data experts
- Prototype design
- Implementation
- Deployment and evaluation



Generative Study

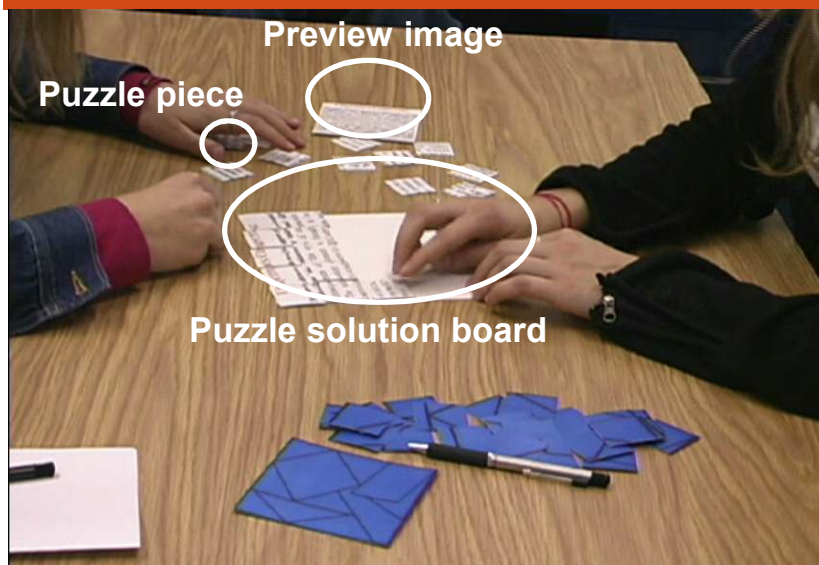
25

- Understand visualization context:
 - How people work *without information visualization* or with pre-existing visualizations
 - How information work is situated in existing workplace practices and environment
 - How teams work together
 - Domain-specific nuances of information use

- Goal is to *describe meaning* not make statistical inference

Russell Kruger

Observational Study



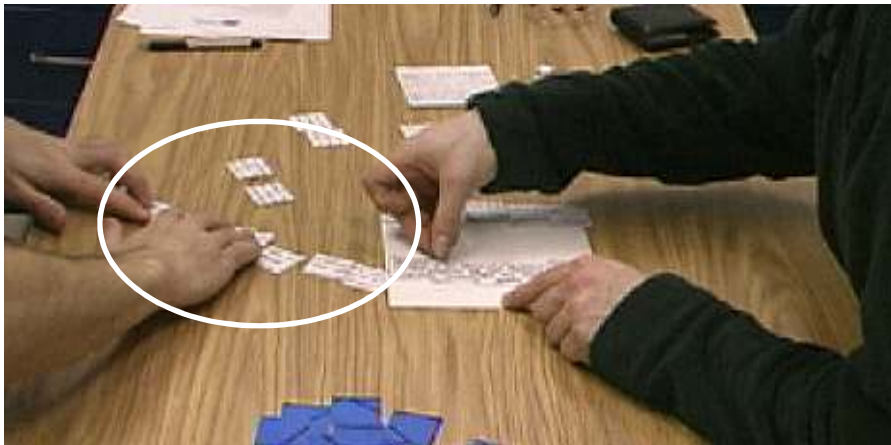
1. Comprehension

- Ease of reading, ease of task, alternate perspective



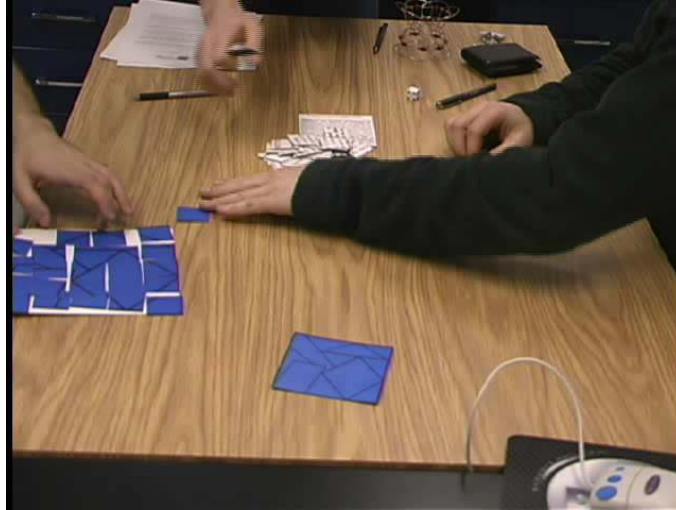
2. Coordination

- Establishment of personal spaces



2. Coordination

- Establishing group orientation

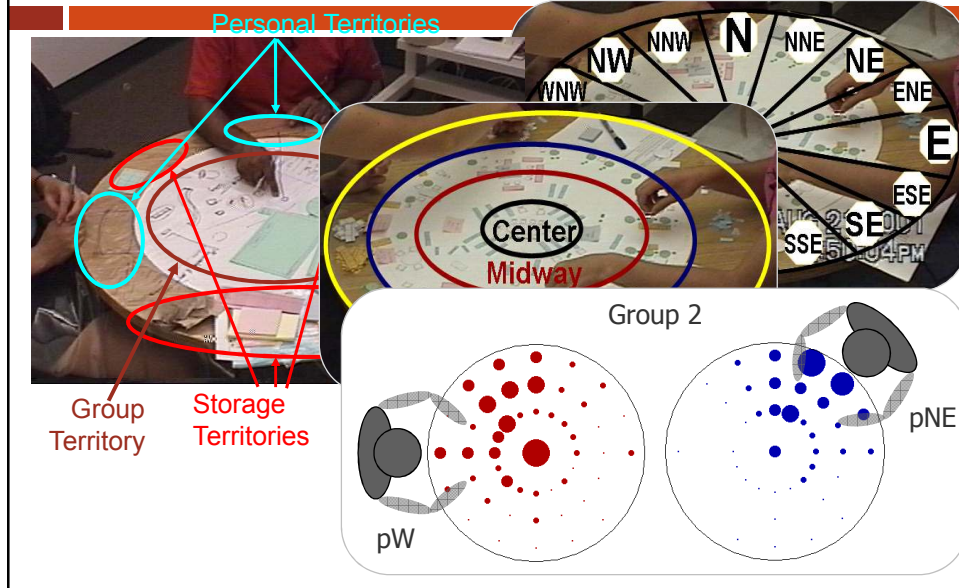


3. Communication

- Intentional communication



Analyzing Observations



Rotation, translation & Mobile Storage



Solutions from the Real World

- Organizing items
- Passing and sharing items
- Storing items



Currents - sharing



Petra Isenberg



Real world information



Picture from (McGee, 2001)

Petra Isenberg



Real world information



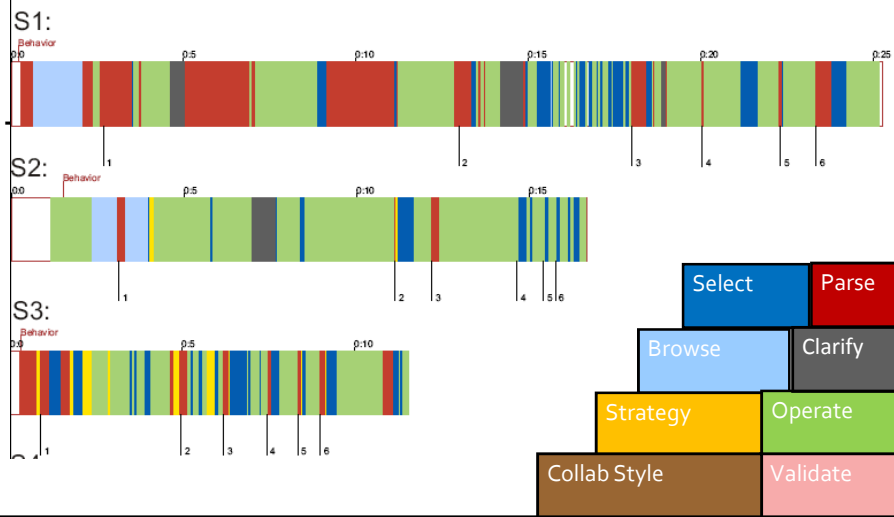


Observational Study



8 Processes

Browse	Parse	Clarify	Strategize
Discuss Collab	Validate	Select	Operate



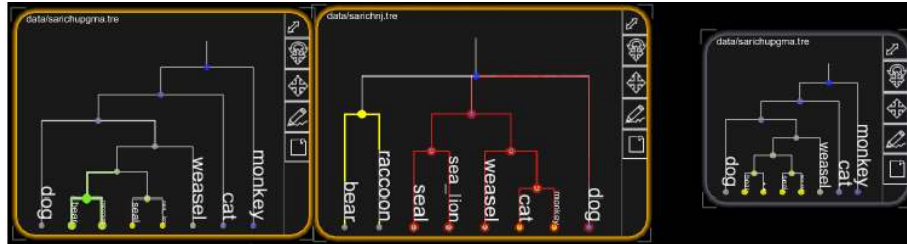
Information visualization workbench



Petra Isenberg



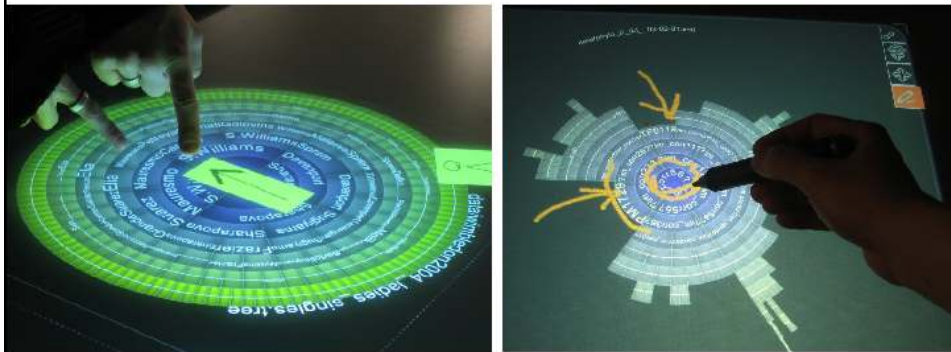
Information visualization workbench



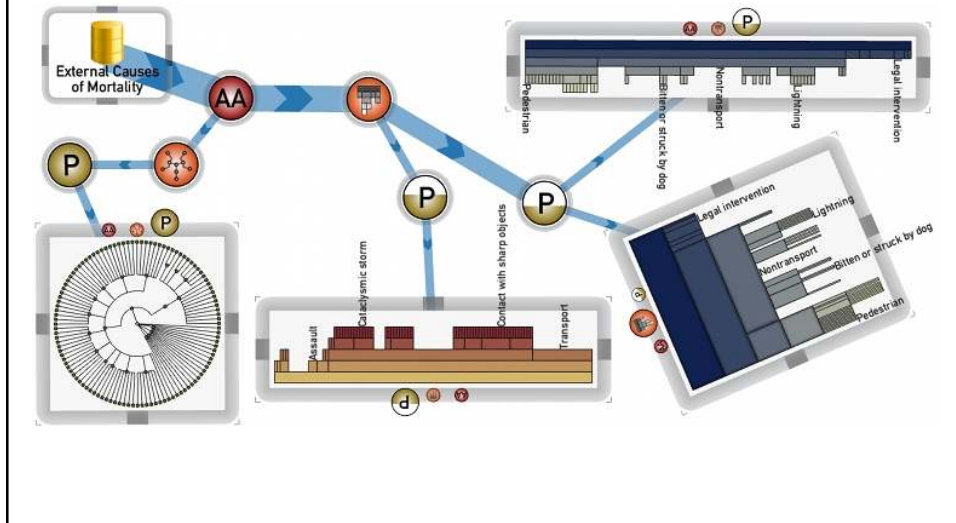
Petra Isenberg



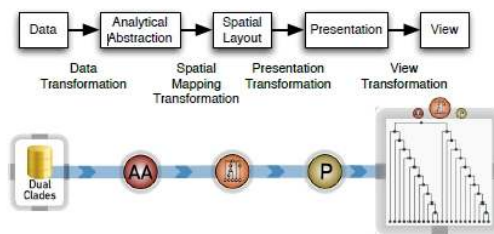
Information visualization workbench



Lark's collaborative information visualization environment



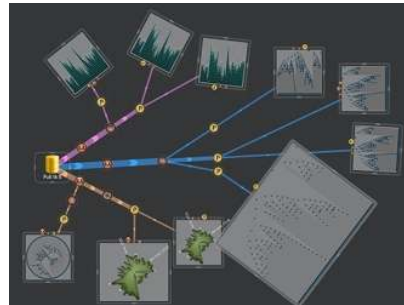
Pipeline Representation



Visualization Pipeline Branch

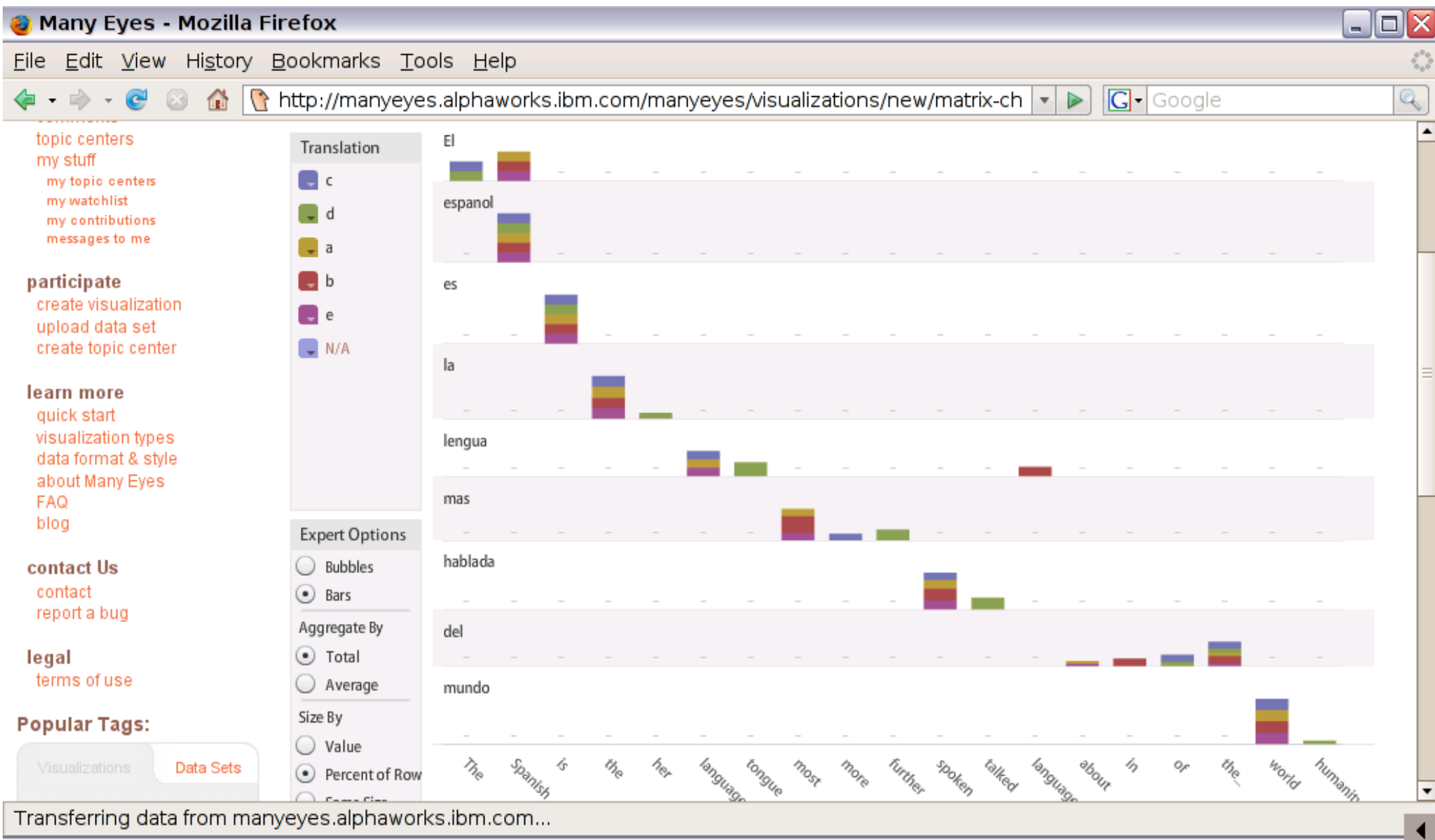


Joint Work



References

1. P. Isenberg and S. Carpendale. Interactive tree comparison for co-located collaborative information visualization. *IEEE Transactions on Visualization and Computer Graphics*, 13(6):1232–1239, 2007.
2. P. Isenberg, A. Tang, and S. Carpendale. An exploratory study of visual information analysis. In *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, pages 1217–1226, New York, NY, USA, 2008. ACM.
3. M. Tobiasz, P. Isenberg, and S. Carpendale. Lark: Coordinating Co-located Collaboration with Information Visualization.



Matrix chart MT viz

Translation Visualization: Spanish

(7:30 PM) Christopher:> es realmente grande para poder hablar a mis colegas en américa latina con este sistema

(7:34 PM) Adrianna:> Sí , yo estoy de acuerdo , esto hará que la compañía sea mucho mas eficiente .

(7:36 PM) Christopher:> me siento , pero julio el ingresos informe va a ser de tres semanas tarde que llegan a su oficina

(7:37 PM) Adrianna:> Eso no es un problema , pero usted pudo hacer las correcciones que yo le pedi que hiciera en la nueva sección del informe

(7:38 PM) Christopher:> no yet, he sido llegar los preparativos para la banff conferencia

(7:40 PM) Adrianna:> Usted debiera haber estado revisando el informe más que preocuparse por la próxima reunión en Banff

(7:41 PM) Christopher:> que planificación informe sólo vacío de acción ; hay que poner en marcha para producir un resultado

(7:43 PM) Adrianna:> De acuerdo , entonces yo voy a trabajar en la estrategia de implementación y le enviaré una copia más tarde

Adrianna:

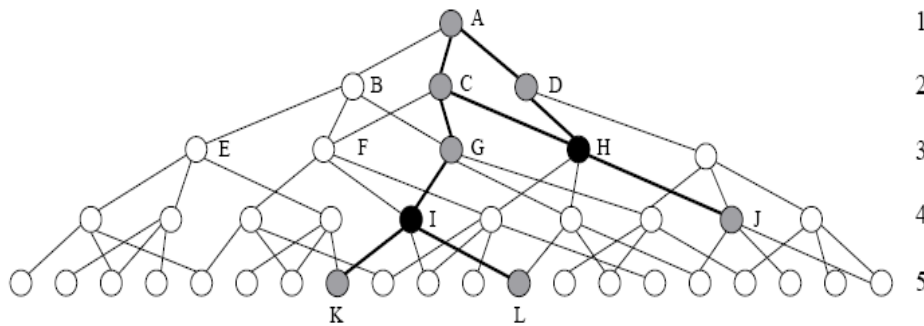


Figure 1: A SASH, where $p = 2$, $c = 3$ and $k = 2$

Gorman and Curran, Scaling Distributional Similarity to Large Corpora

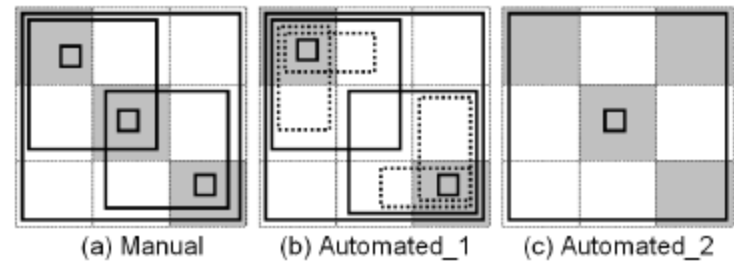


Figure 1: Sample phrases that are generated from a human alignment and an automated alignment: Gray cells show the alignment links, and rectangles show the possible phrases. Ayan and Dorr, Going Beyond AER: An Extensive Analysis of Word Alignments and Their Impact on MT

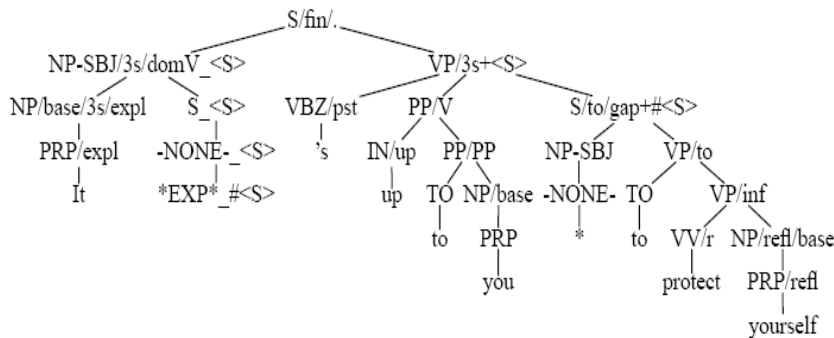


Figure 5: An Annotated Parse Tree

Schmid, Trace Prediction and Recovery with Unlexicalized PCFGs and Slash Features

Kirrkirr

File Edit Options History Help

Back Forward Keep Copy Word List: In English Reset

Search: i:xté:yewáltik Find! Clear Filter Word List

Network Formatted Entry Notes Multimedia Advanced Search

- Same meaning
- Same as
- Variant (apocoptation)
- See also
- Collocation

ixia:la:wi
ixia:ntiki:sa
ixia:po:teti
ixikaso:ntepai:lihtok
ixikasó:ntekwíxtok
ixikasó:ntepai:lowa
ixikasó:ntlakó:ltia
ixikasó:ntlakó:tok
ixike:kets:l
ixikelo:ni
ixikextlah
ixiko:tsiliwi
ixikohso
ixikohtia
ixikwelpachiwi
iximali:ntok
iximatiliwi
iximela:wa
iximo:motsi:ni
iximónexé:wi
ixine:si
ixine:stok
ixinekwiilih
ixinekwiiliwi
ixinepanihtok
ixinepanowa
ixinetechowa
ixipahli
ixipahli
ixipan
ixipantalo:ntepai:lihtok
ixipantaló:ntekwíxtok

ixipantaló:ntekwíxtok

ixipantalo:ntepai:lihtok

ixikasó:ntekwíxtok

ixipantaló:ntekwíxtok

ixikasó:ntepai:lihtok

ixité:yewáltik

ixité:yewál

tlamíhtiké:tl

Stop Moving Show Gloss Legend Scramble Shake Clear Random Pick

Network Formatted Entry Notes Multimedia Advanced Search

ixipantaló:ntekwíxtok

having ones trousers rolled up

Nahuatl-English ixipantaló:ntekwíxtok has 3 neighbours

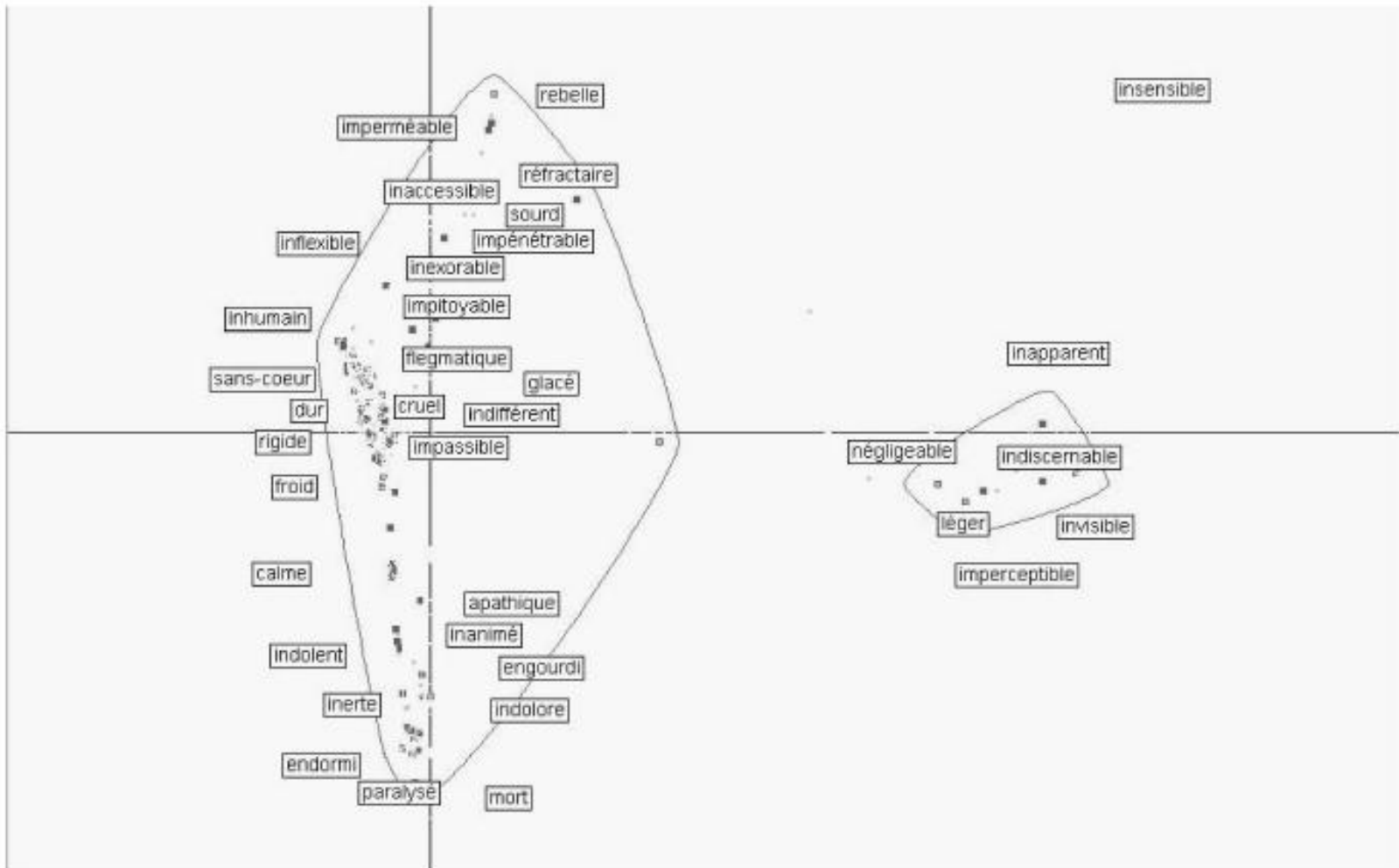
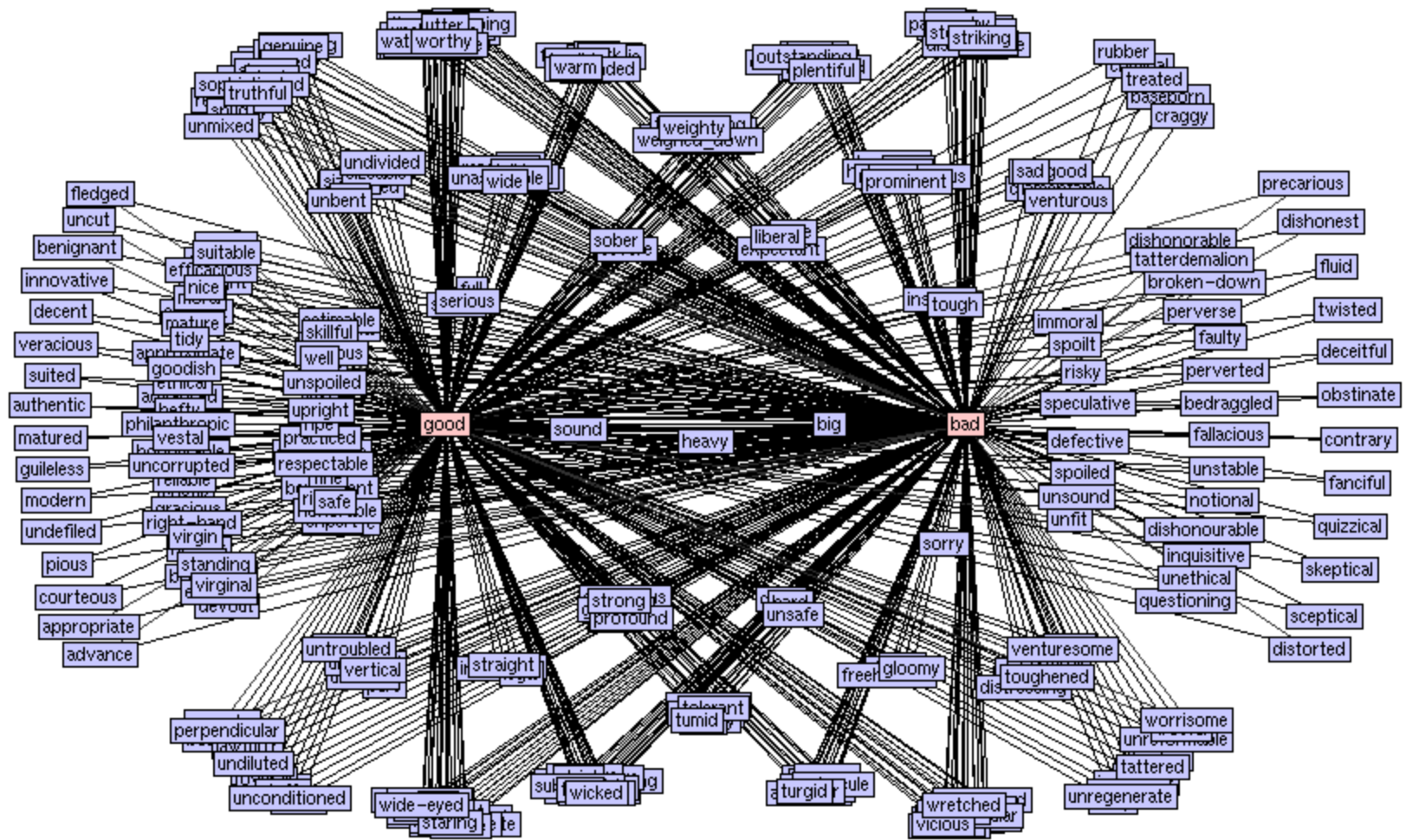
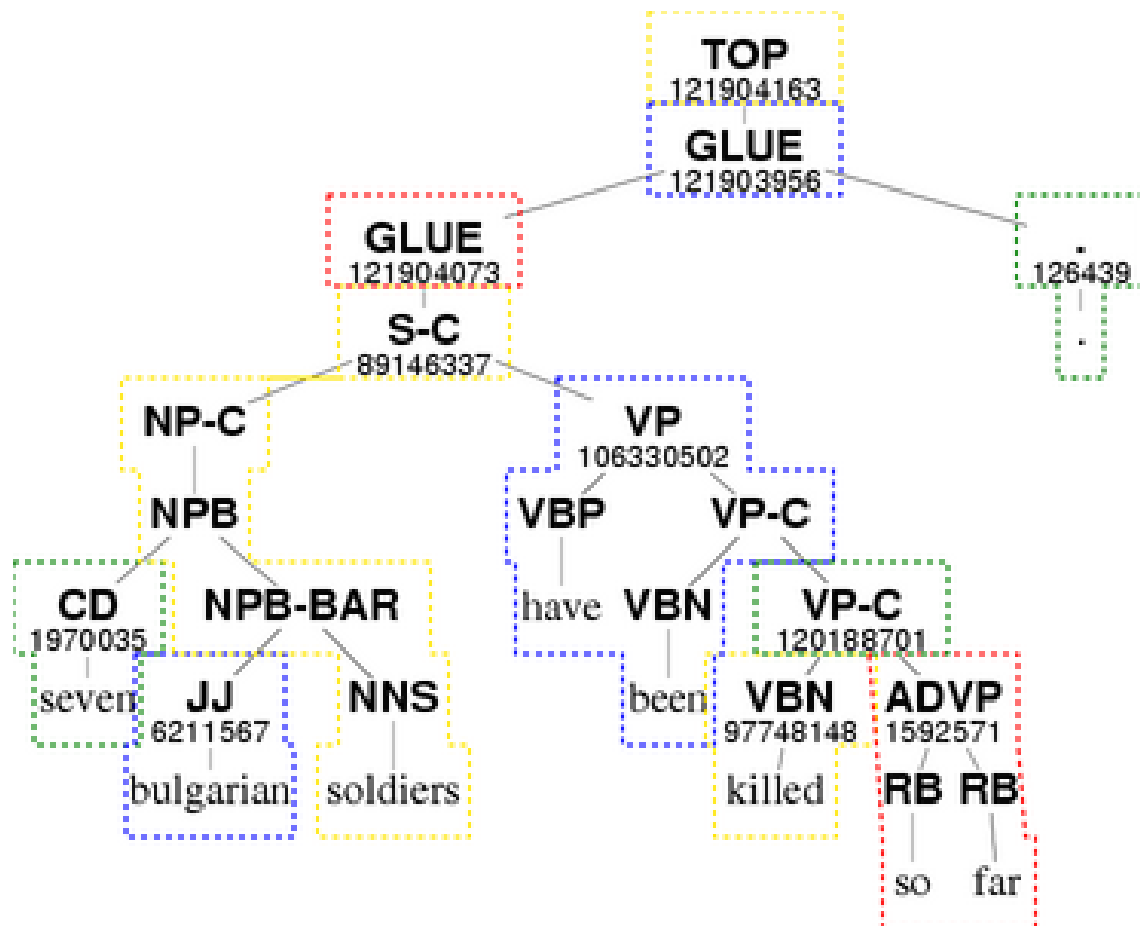
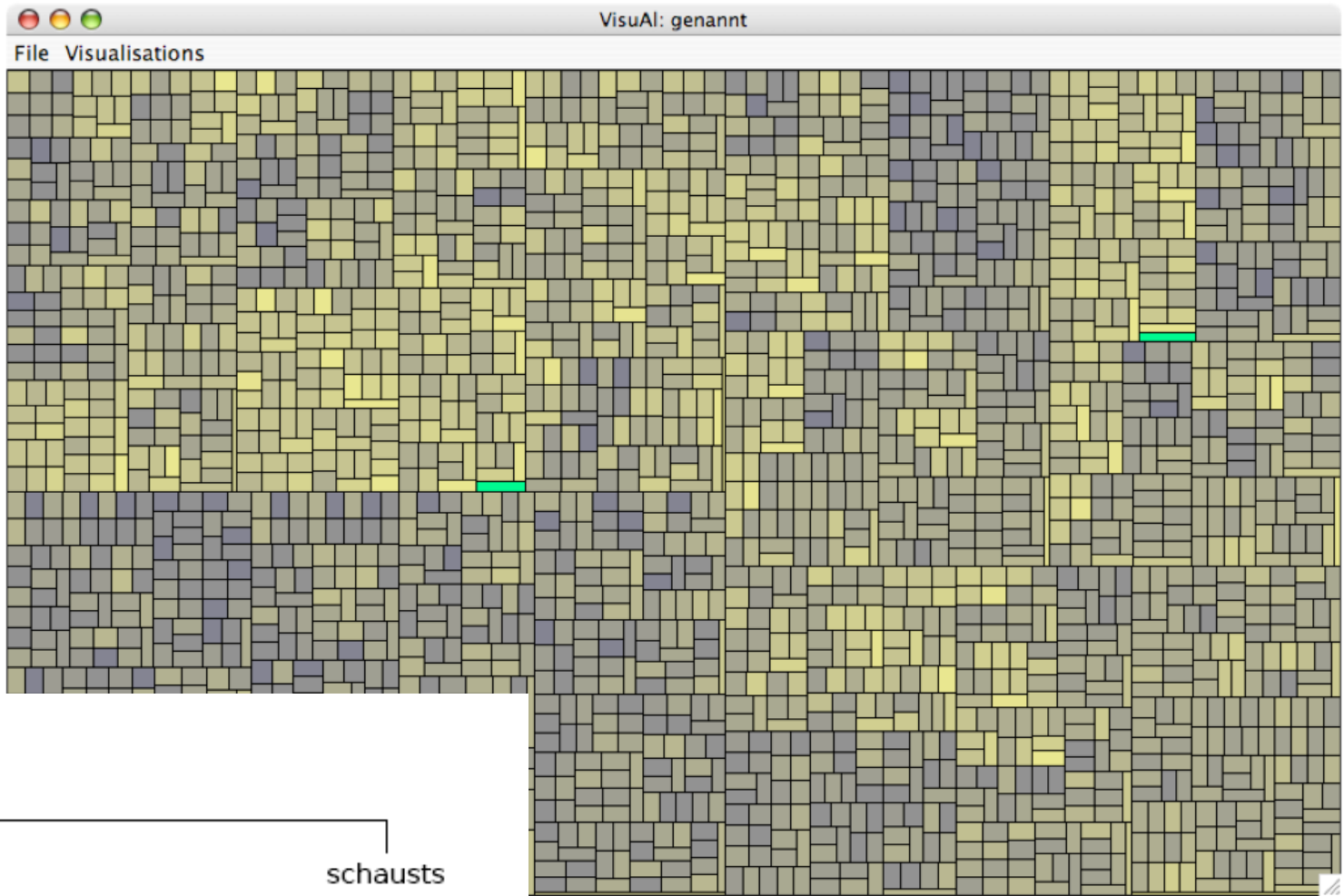
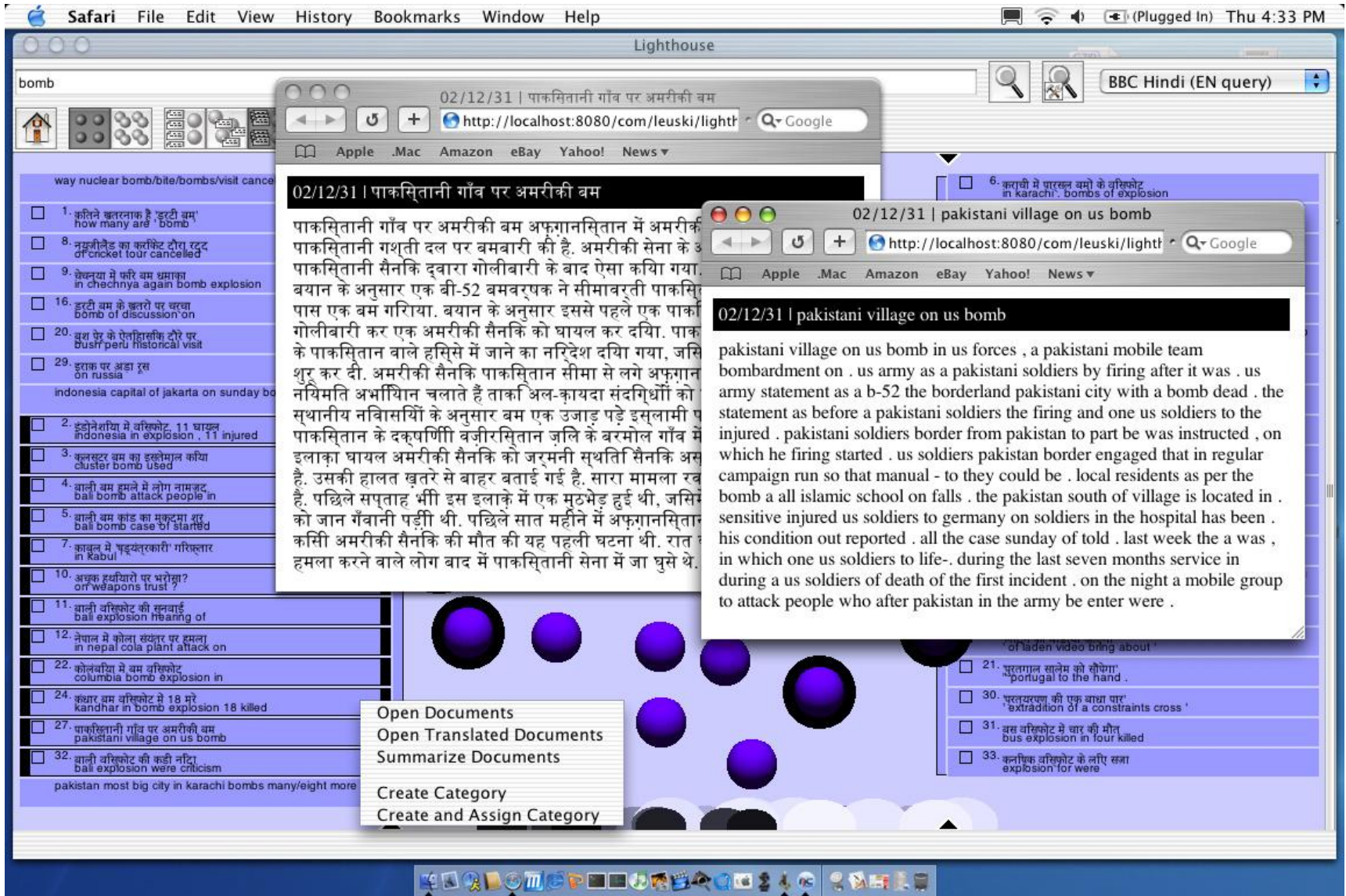


Figure 1
Two-cluster semantic space for the French headword *insensible*.









Infovis ok Help Options View Send KartOO

Northernlight Teoma Dmoz ToileDuQabac Nomade Lycos Hotbot Wisenut MSN Altavista Allthev

http://www.infovis.net/MainPage.htm

Main at InfoVis.net

A bilingual (English/Español) website devoted to Information Visualization, its techniques, who's who, resources, bibliography and a collaborative space for contributing to this rapidly evolving...

computer.org

www.lgd.fhg.de

www.cs.umbc.edu

www.cribbin.co.uk

www.erc.msstate.edu

www.graphics.stanford.edu

www.infovis.net

isdale.com

abstract

data

interested

university

visualization

network

techniques

focus

study

iee

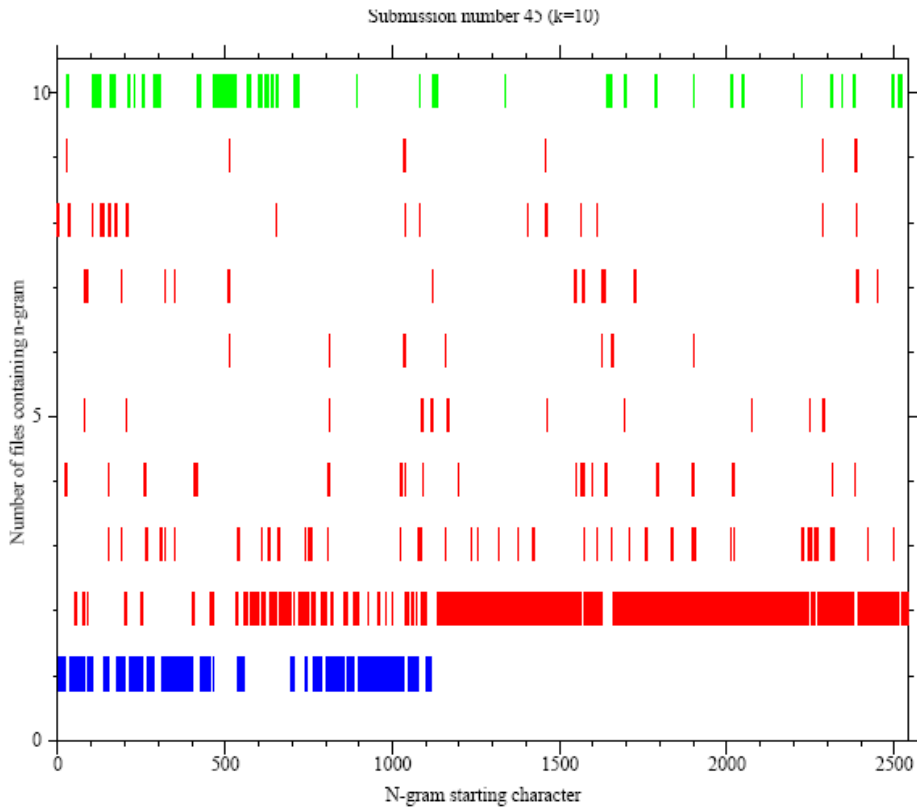
symposium

resource

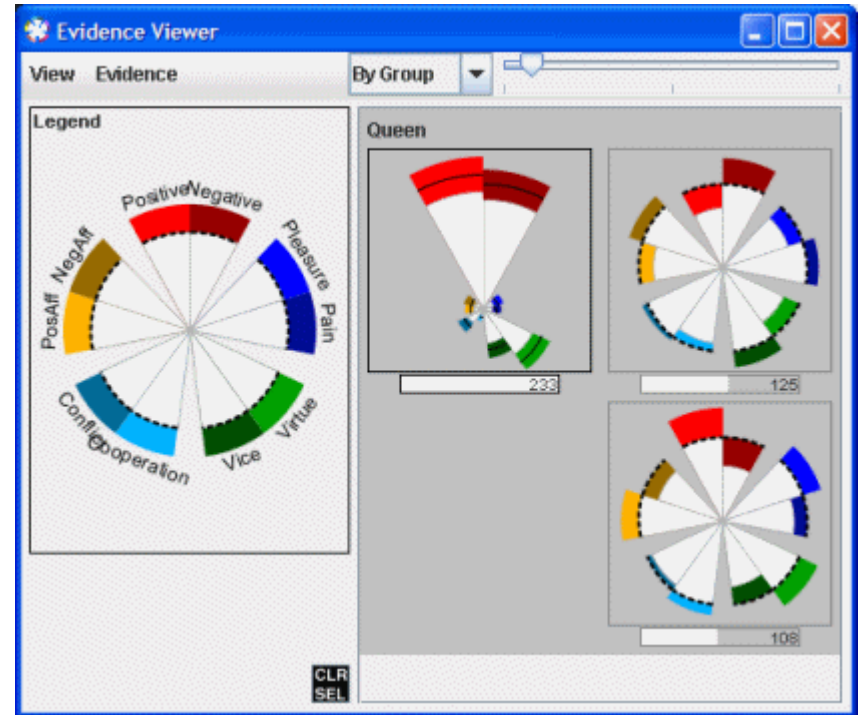
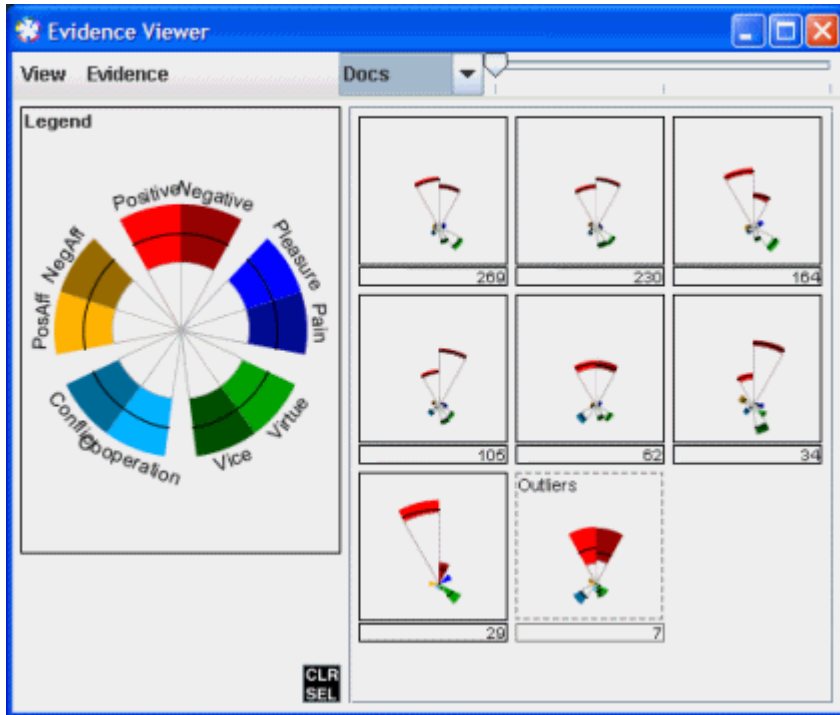
bibliography

collection

map nb 2



Two occurrences of a sequence is suspect



FeatureLens

Load About

Frequent Patterns

Filtering

Pattern contains :

Search patterns

Order patterns by

Frequency :

Length :

Trends :

Trends per section :

Append pattern to legend

// tonight
77 americans
75 security
74 congress
68 government
65 make
64 years
62 work
60 freedom
57 great
56 united
54 good
53 citizens
53 children
52 time
52 terrorists
51 states
50 economy
50 terror
48 war
44 iraq
43 the united states

previous 100 next 100

Load history go

HCLL, University of Maryland, 2007

Collection Overview : 'The State of the Union' (1 doc per line - 140 highl

Document View

Show Selection and context Results only

55

The United Nations concluded in 1999 that Saddam Hussein had biological weapons materials sufficient to produce over 25,000 liters of anthrax - enough doses to kill several million people. He has not accounted for that he has given no evidence that he has destroyed them.

Sections Overview

2001-1 2001-2 2002 2003 2004 2005 2006

Order patterns by

Frequency :

Length :

Trends :

Trends per section :

he has not[that saddi freedom terrorists war

187

Open Research Problems

CL Expertise for InfoVis

Improving Document Visualization

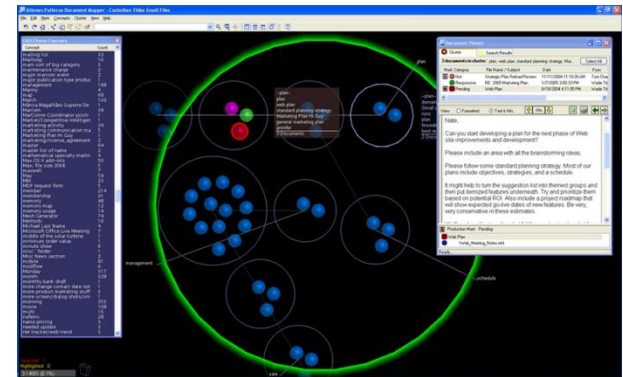
189

- Incorporating WSD, detection of multi-word entities, idioms
- Enabling cross-language comparisons
- Document “difference” visualizations on a semantic level
- Deriving document structure to aid document navigation
- Abstracting document visualization to a level useful and usable for information retrieval (next generation search engine interface)

e-Discovery

190

- A specialized form of document visualization for lawyers:
 - ▣ Thousands of documents classified individually
 - ▣ Clustering speeds things up drastically
- More accurate keyword detection
- Auto-classification with measures of confidence
- ... Very profitable sector already!

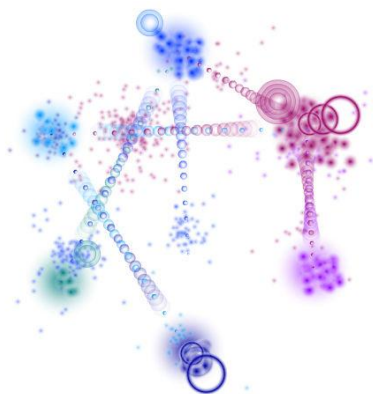


Attenex.com, 2008

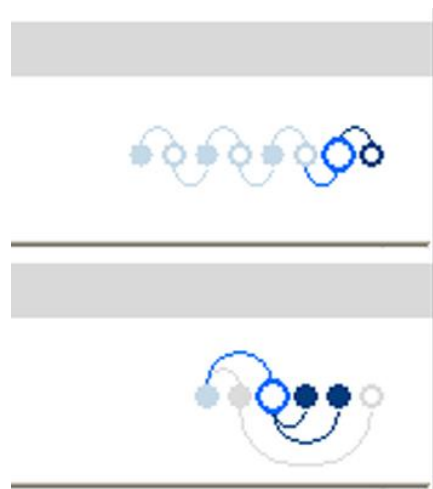
Navigating Email and IM Chat

191

- Existing visualizations use only surface characteristics (letter/word counts, punctuation, meta-data)
- Imagine navigating your email/chat history thematically



BubbaTalk (Tat and Carpendale, 2002)

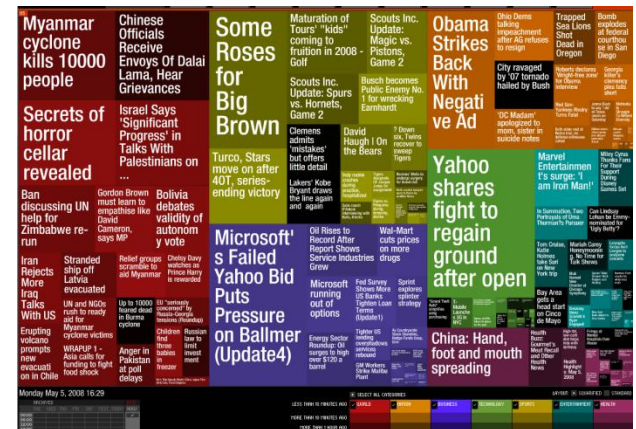
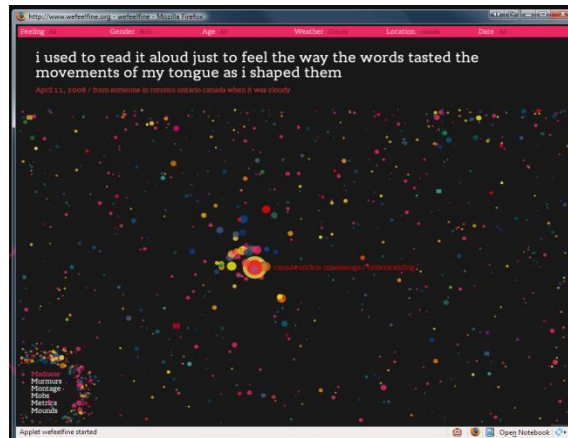


Thread Arcs (Kerr, 2003)

Managing Streaming Data

192

- RSS feeds from news and blogs
- Facebook/Twitter updates
- Academic journals/library update services
- Social vis community is very active here, appropriating whatever CL methods they can figure out!

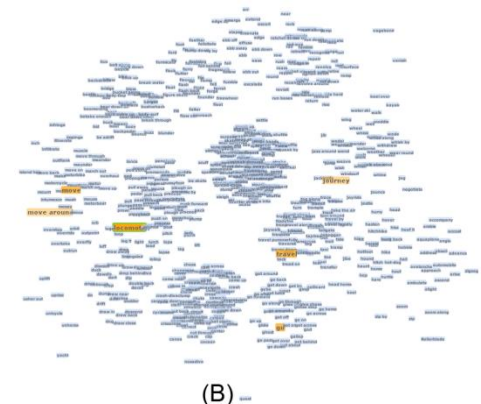
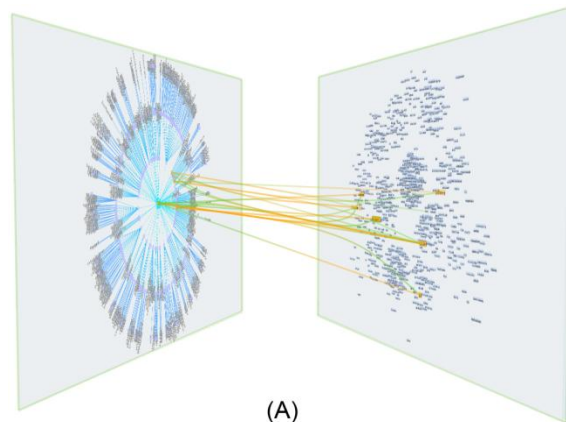


InfoVis to Further CL Research

Structural Comparisons

194

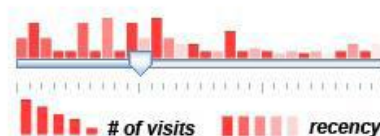
- Visualization to show similarities and differences in data structures:
 - ▣ Comparing parse trees and parse representations
 - ▣ Comparing ontologies, other knowledge sources
 - ▣ Language change over time
 - ▣ Lexical semantic distance measures
 - ▣ Others?



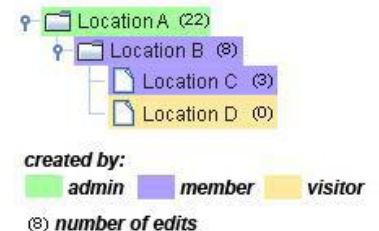
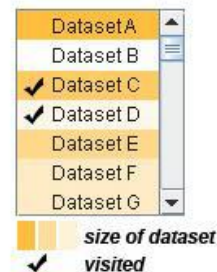
Exploratory Data Analysis

195

- Visualizing corpora
 - ▣ Quality control
 - ▣ Deep investigation of inter-annotator agreements
 - ▣ Discover areas of imbalanced data coverage
- Interactive exploration of parameter spaces
 - ▣ “What changes when I adjust this parameter?”



Scented Widgets

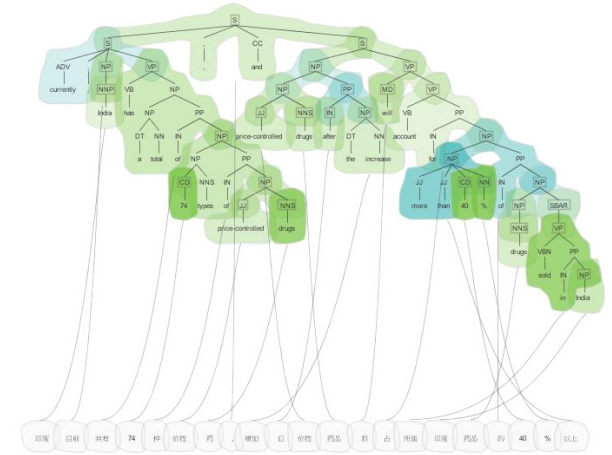
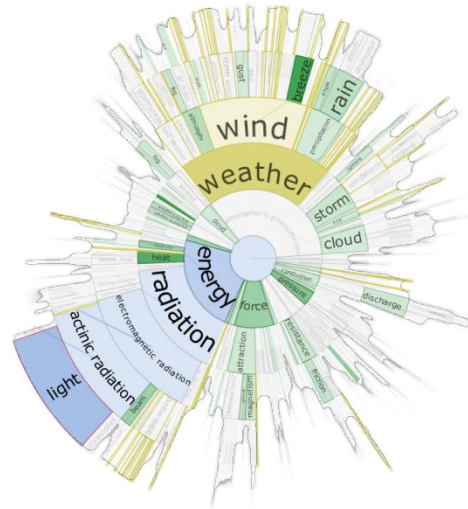
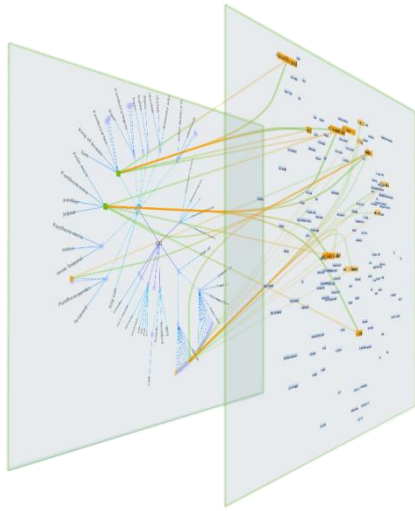


Willett et al., InfoVis 2007

Understanding NLP Processes

196

- “Live” visualization of automata
 - ▣ Dialogue system construction
 - ▣ Visualizing non-determinism
- Visualizing uncertainty in parametric models
- Visualization of chart pruning and beam search
- Hypothesis tracking
 - ▣ Machine translation
 - ▣ Speech recognition
- Others?



*<http://www.infovis-wiki.net> → Research & Education → Linguistic Visualization
or Search "linguistic visualization wiki"*

CHRISTOPHER COLLINS

CCOLLINS@CS.UTORONTO.CA

GERALD PENN

GPENN@CS.UTORONTO.CA

SHEELAGH CARPENDALE

SHEELAGH@UCALGARY.CA

