Text

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2016-05-09

Why visualize text?

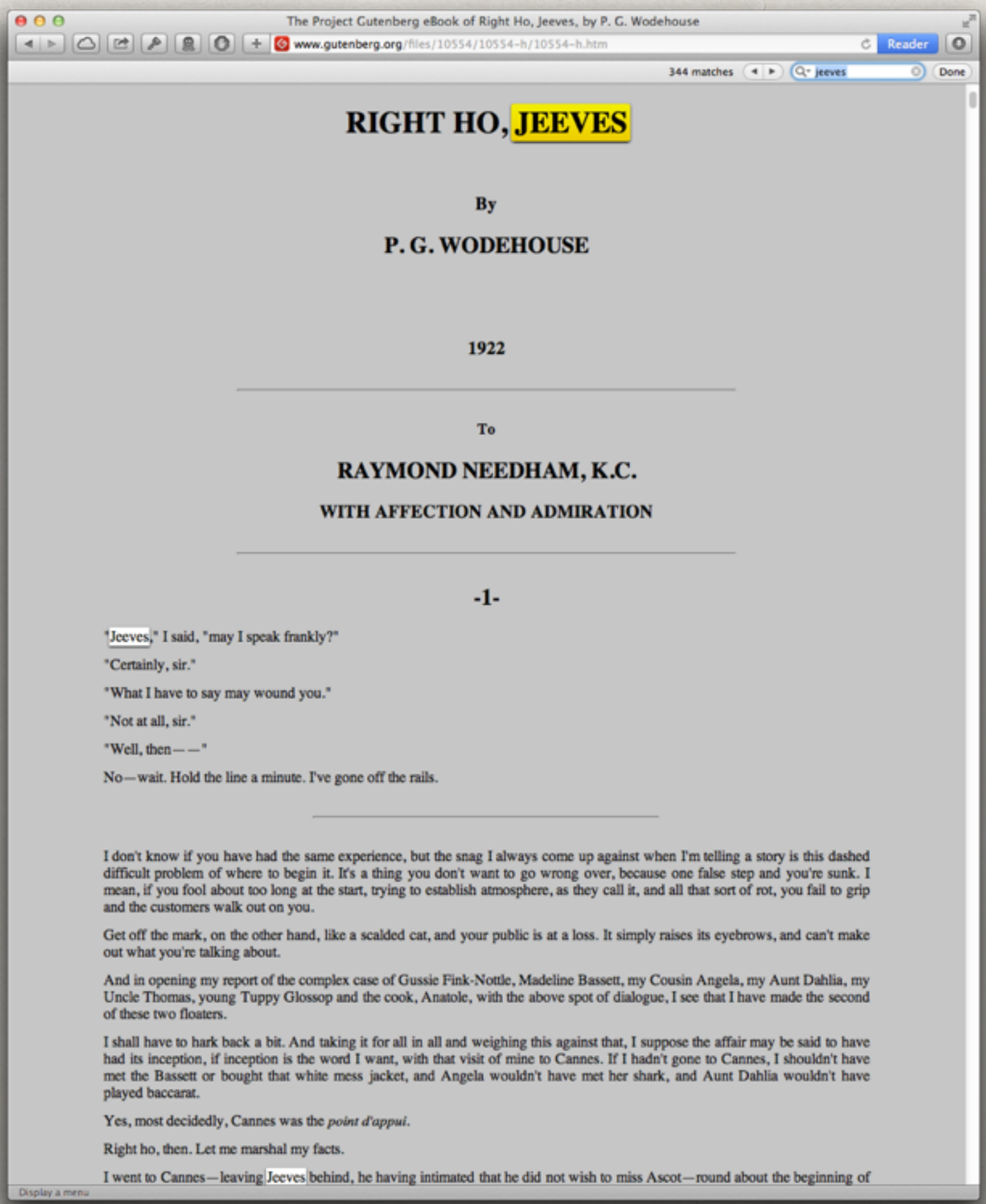
Visualization goals

Understanding - read a document
Summaries - get the "gist" of a document
Clustering - group together similar contents
Correlate - compare patterns in text to other data

High-level tasks

Find documents of interest in a collection
Find documents similar to ones I want
Identify the main themes or ideas of documents or collections
See the history of changes in a document
Find connections between documents

borrowed from J. Heer
and J. Stasko



Interaction tool includes context of position and length of document

All details available through interaction

Search is built in

Tool is familiar, readily available and convenient

census1.html — UNREGISTERED

census1.html

```
32
33          function makeScatterplot(){
34              var margin = {top:20, bottom:20, left:60, right: 20};
35              var width = 500, height = 500;
36              var xValue = function(d){return d[0]};
37              var yValue = function(d){return d[1]};
38              var xScale = d3.scale.linear();
39              var yScale = d3.scale.linear();
40              var xAxis = d3.svg.axis().scale(xScale).orient("bottom");
41              var yAxis = d3.svg.axis().scale(yScale).orient("left");
42
43
44
45              function chart(selection){
46
47                  selection.each(function(data){
48
49                      xScale.range([0,width - margin.left - margin.right])
50                      .nice()
51                      .domain(d3.extent(data, xValue));
52
53
54                      yScale.range([height - margin.top - margin.bottom, 0])
55                      .nice()
56                      .domain(d3.extent(data, yValue));
57
58                      var svg = d3.select(this).append("svg")
59                      .attr({width:width, height:height});
60
61                      var canvas = svg.append("g")
62                      .attr("transform","translate("+margin.left +","+margin.top+")");
63
64                      // create the dots
65                      var dots = canvas.selectAll("circle")
66                      .data(data)
67                      .enter()
68                      .append("circle");
```

Line 1, Column 16 | Tab Size: 4 | HTML

overview + detail display

syntactic structure is mapped to a color encoding

I don't know if you have had the same experience, but the snag I always come up against when I'm telling a story is this dashed difficult problem of where to begin it. It's a thing you don't want to go wrong over, because one false step and you're sunk. I mean, if you fool about too long at the start, trying to establish atmosphere, as they call it, and all that sort of rot, you fail to grip and the customers walk out on you.

Get off the mark, on the other hand, like a scalded cat, and your public is at a loss. It simply raises its eyebrows, and can't make out what you're talking about.

And in opening my report of the complex case of Gussie Fink-Nottle, Madeline Bassett, my Cousin Angela, my Aunt Dahlia, my Uncle Thomas, young Tuppy Glossop and the cook, Anatole, with the above spot of dialogue, I see that I have made the second of these two floaters.

I shall have to hark back a bit. And taking it for all in all and weighing this against that, I suppose the affair may be said to have had its inception, if inception is the word I want, with that visit of mine to Cannes. If I hadn't gone to Cannes, I shouldn't have met the Bassett or bought that white mess jacket, and Angela wouldn't have met her shark, and Aunt Dahlia wouldn't have played baccarat.

Yes, most decidedly, Cannes was the *point d'appui*.

Right ho, then. Let me marshal my facts.

LO, praise of the prowess of people-kings
of spear-armed Danes, in days long sped,
we have heard, and what honor the athelings won!
Oft Scyld the Scefing from squadroned foes,
from many a tribe, the mead-bench tore,
awing the earls. Since erst he lay
friendless, a foundling, fate repaid him:
for he waxed under welkin, in wealth he throve,
till before him the folk, both far and near,
who house by the whale-path, heard his mandate,
gave him gifts: a good king he!
To him an heir was afterward born,
a son in his halls, whom heaven sent
to favor the folk, feeling their woe
that erst they had lacked an earl for leader
so long a while; the Lord endowed him,
the Wielder of Wonder, with world's renown.
Famed was this Beowulf: far flew the boast of him,
son of Scyld, in the Scandian lands.
So becomes it a youth to quit him well
with his father's friends, by fee and gift,
that to aid him, aged, in after days,
come warriors willing, should war draw nigh,
liegemen loyal: by lauded deeds
shall an earl have honor in every clan.

YOU don't know about me without you have read a book by the name of The Adventures of Tom Sawyer; but that ain't no matter. That book was made by Mr. Mark Twain, and he told the truth, mainly. There was things which he stretched, but mainly he told the truth. That is nothing. I never seen anybody but lied one time or another, without it was Aunt Polly, or the widow, or maybe Mary. Aunt Polly—Tom's Aunt Polly, she is—and Mary, and the Widow Douglas is all told about in that book, which is mostly a true book, with some stretchers, as I said before.

1. US GOVERNMENT INTELLIGENCE REPORT: 7 OCTOBER 2008 from MI-5

MI-5 states that 100,000 bullets, six guns and military ware were among items police say they recovered after raiding a house in Narok, Kenya, belonging to Mr Thabiti Otieno. The MI5 officers are investigating how sleeping bags, Nato-approved 7.62mm calibre ammunition, military desert boots, combat rain jackets, military fuel tanks, British Army inscribed Land Rover spare parts, military machetes and knives, landed in the hands of an unauthorised person.

3. US GOVERNMENT TELEPHONE INTERCEPT: [October 10 2008]

Call placed from a pre-paid cell phone (Caller 1) in an apartment complex in Barcelona, Venezuela to a pre-paid cell phone (Caller 2) in a business district Carabobo, Venezuela. Conversation took place in Spanish at about 1217, Barcelona local time.

Caller 1: Jorge's place was raided last night. I think they [probably the police] were watching the place. They found the guns-
Caller 2: (interrupted) Shut up! Shut up! Just shut up! You can't say that.
Caller 1: Sorry, and we need a new source for the, uh, car parts.
Caller 2: I think I have a source. My friend has a connection to a guy who is selling parts. I'm going to contact him today or tomorrow.
Caller 1: When do you think we can get them?
Caller 2: I don't know. Just don't talk to anybody. I'll call you on this phone when we have anything. Don't call me and don't do anything.
[END]

1. News Article: Bangkok Post, March 2, 2008

Thai authorities seized an Ilyushin IL-76 aircraft carrying tons of weapons from North Korea during a refueling stop in Bangkok, a government official said. The pilot told Thai authorities the aircraft was headed to Sri Lanka, but its final destination was unknown, according to a spokesman for the Thai prime minister. It contained about 35 tons of weapons, including rocket-propelled grenades, shoulder-launched rockets and tubes that may be missile components, the spokesman said. The plane, which was detained Saturday, had five people onboard -- four from Ukraine and one from Belarus. They will appear in court Monday on charges related to illegal weapons smuggling, the spokesman said.

1. REPORT DATE: 9 October 2008 [provided to CIA by Pakistani Criminal Investigation Unit, Karachi Division]

NOTE: Surveillance report on the activities of Maulana Haq Bukhari, suspected to be a top leader within the Karachi faction of Lashkar-e-Jhangvi. Bukhari is frequently accompanied by Akram Basra, who acts as a driver and bodyguard. Additional information provided by police informants.

23 July 2008 – A delivery was made to a house in Lyari Town (a constituent town of Karachi) in a house believed to be used by Bukhari. The delivery was made by a two men in street clothing (as opposed to a uniform) who arrived in a white van, license LHR 6354, with single blue stripe on each side. The delivery consisted of three medium boxes (requiring two hands to move) and a small box (handsized). The boxes appeared to be heavy. One large box was square, the other rectangular. The small box was rectangular. It is unknown if Bukhari was home at the time of the delivery.

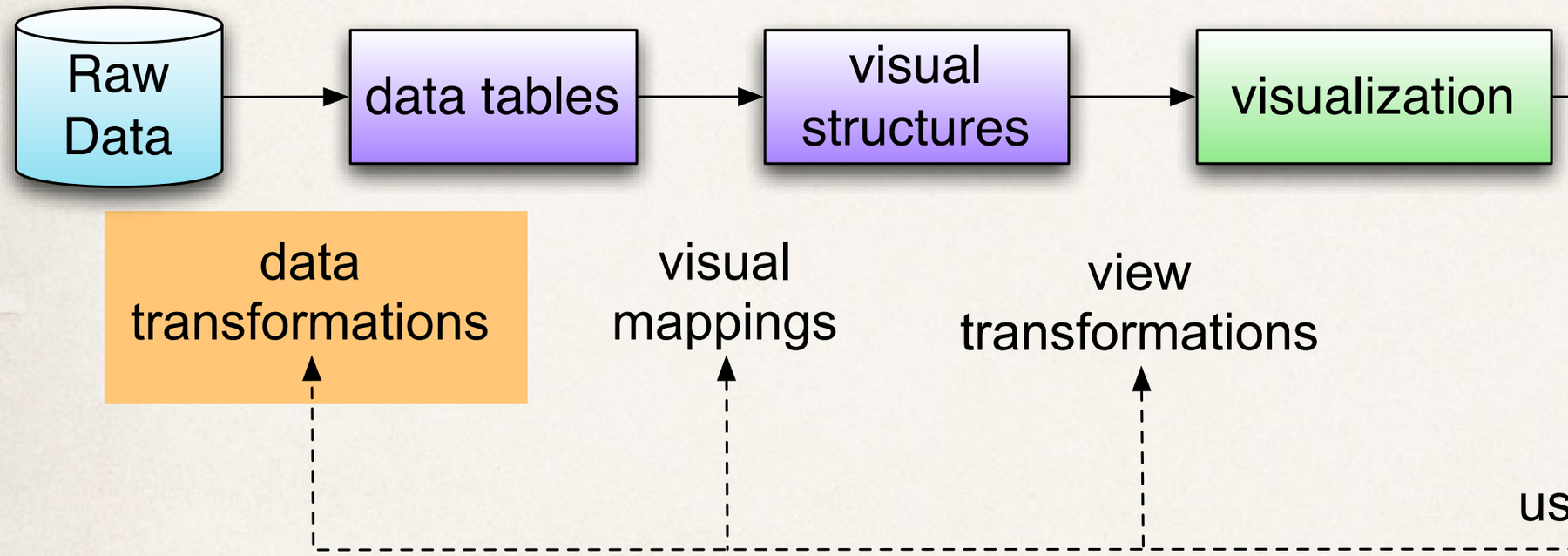
8 August 2008 – An unknown man visited the Lyari Town house where Bukhari is believed to stay. He arrived at 1615, and was let into the house immediately. Loud voices could be heard for a few moments, then they subsided. About fifteen minutes later a silver Mercedes left the rear of the house with what appeared to be three occupants. Due to the tinted glass it was impossible to identify the occupants of the vehicle. The house was surveilled for the next five hours; however no one came or went.

16 September 2008 – Bukhari was followed from his Lyari Town house to an apartment about 1.5 kilometers southeast. He entered the building and stayed there for about two hours. When he left he returned to his Lyari Town house at which time the observer believed he'd been discovered and left the area.

23 September 2008 – Bukhari and probably Basra are reported to have visited a house in the Katchi Abadis Old Settlement, on 835T Longhi Street. The informant, a vendor with business in the area, was passing by and noticed Bukhari and one other person enter the building at about 1430. The informant knew Bukhari by sight, but had never met him.

Visualization Pipeline

Insight!



Why is text visualization hard?

Text is high dimensional

(10,000+ unique words in a document)

Some words have ordering

January, February, March...

one, two, three...

Words have meaning, relationships and context

On St. Patrick's Day, the local bar serves green beer.

The pub downtown has been known to make their pints chartreuse on Saint Paddy's .

Patrick walked around the corner of Green St. and Day St., right into this bar sticking out of the wall and knocked himself senseless.

Extracting structure

metadata - data about the data

who wrote it, when, what collection is it from, how long is it, format, keywords

lexical level - break the document into *tokens*

characters, words, n-grams

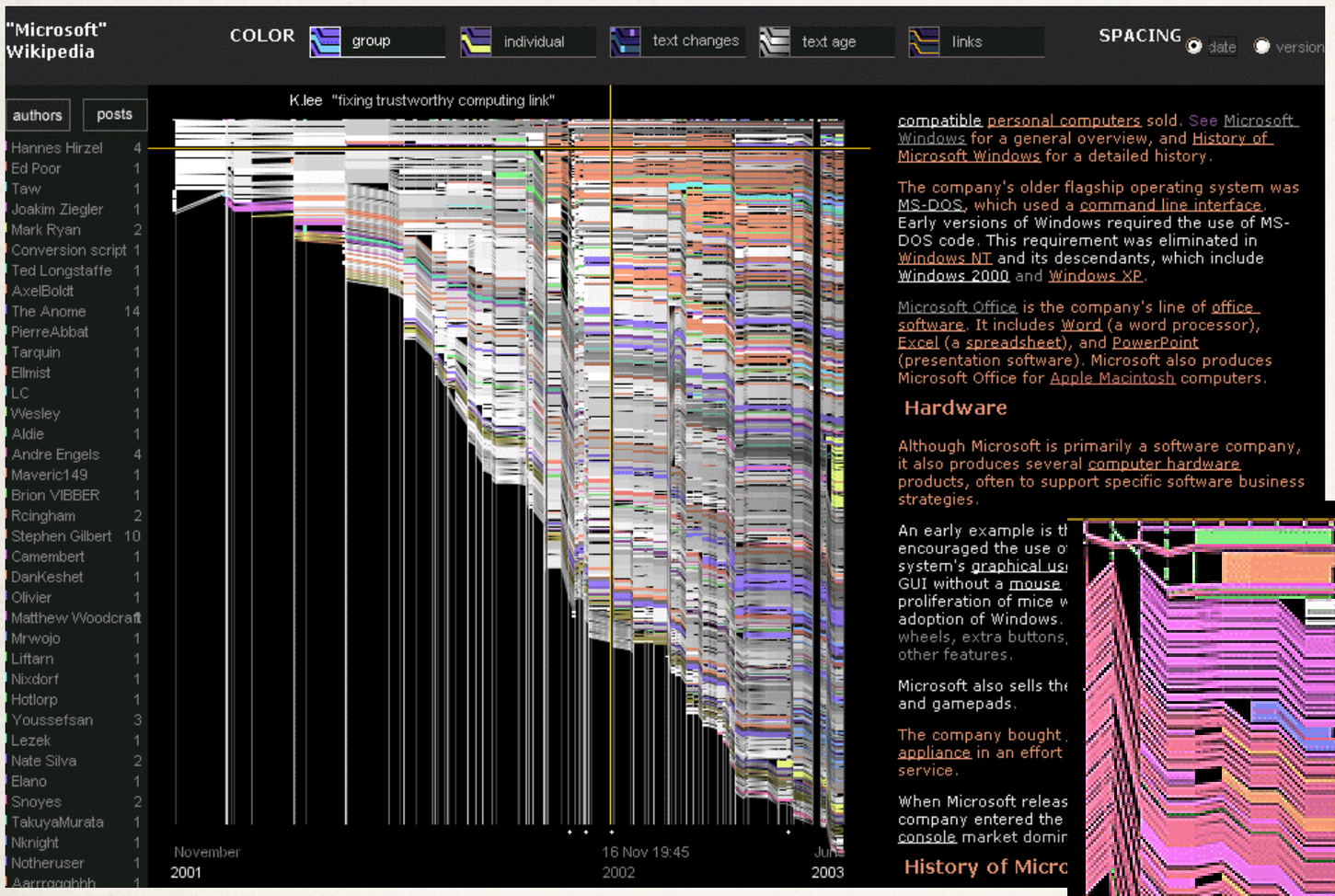
syntactic level - identify the function of tokens

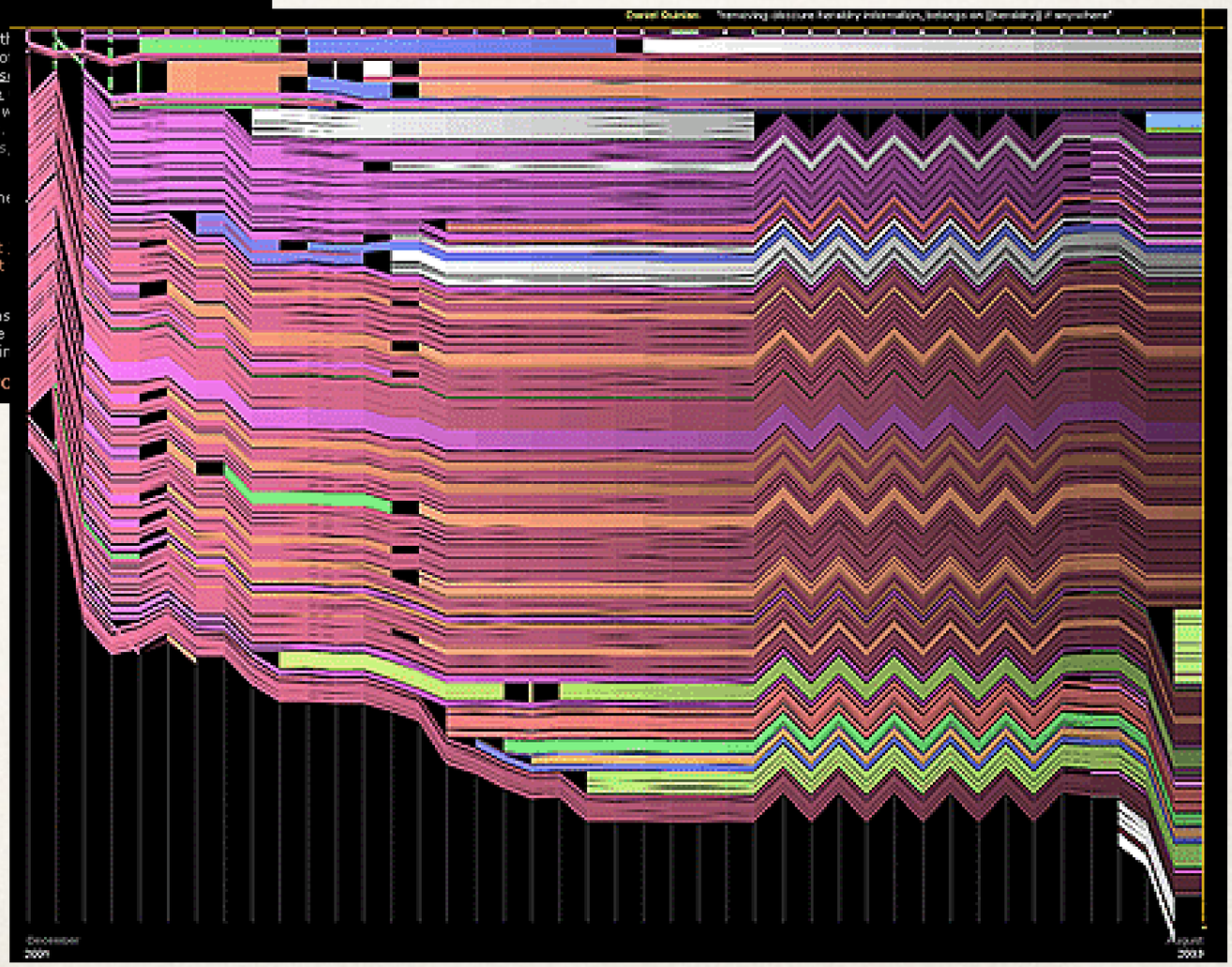
identify the part of speech or named entities (people, places, money, dates)

semantic level - extract meaning from the text

identify relationships between entities, themes, sentiment, etc..

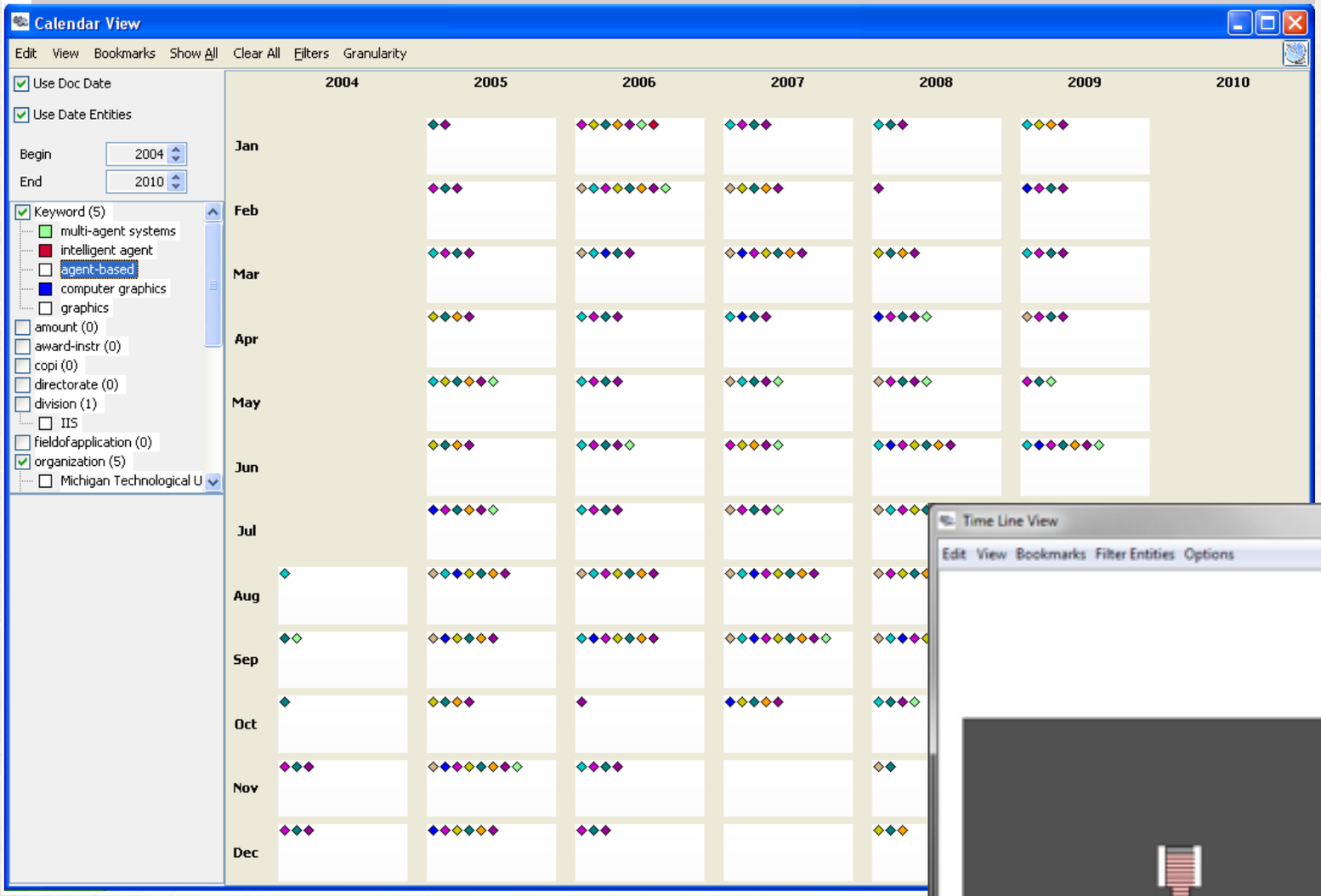
History flow

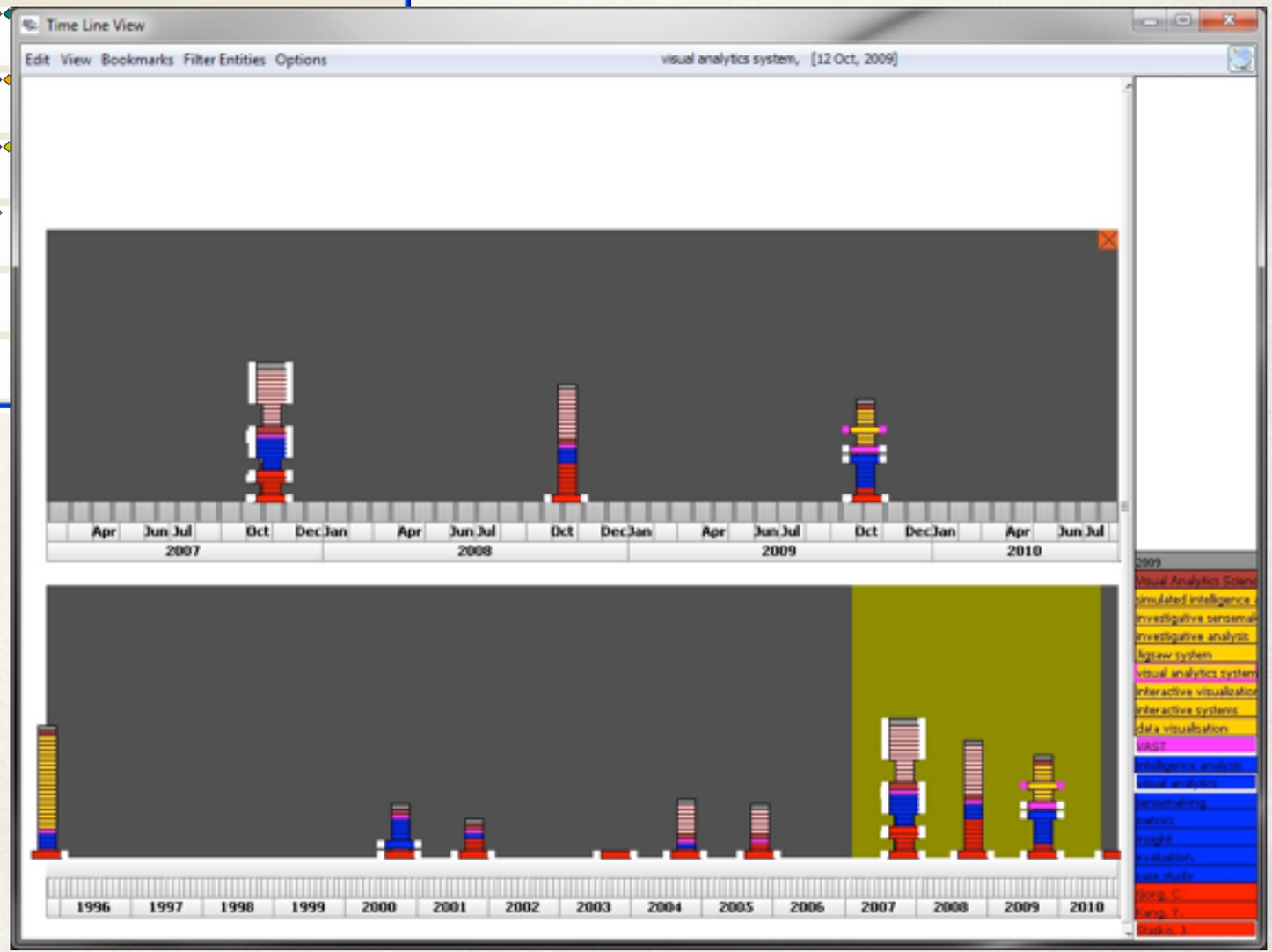




Viégas et al. ,"Studying Cooperation and Conflict between Authors with *history flow* Visualizations"

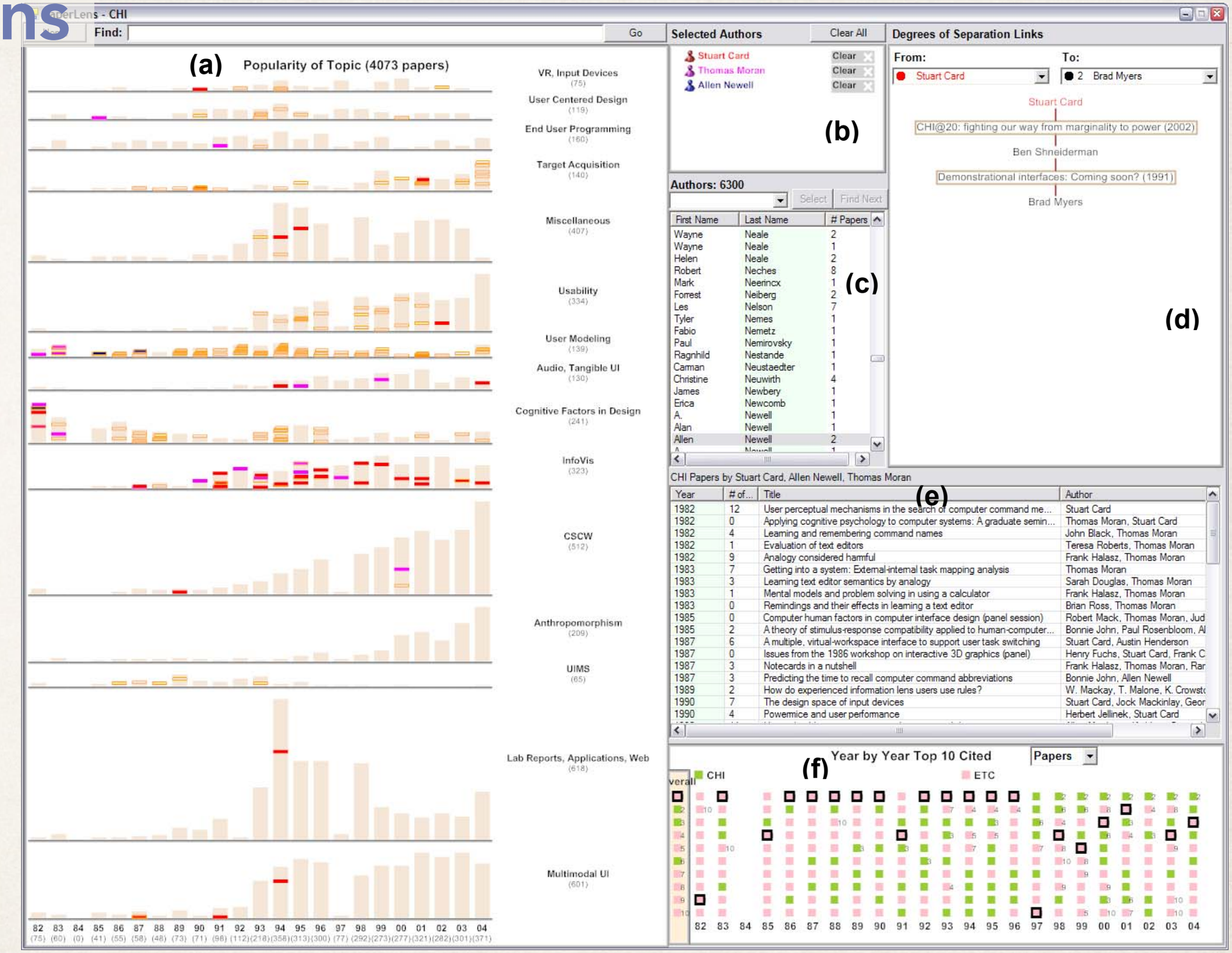
Jigsaw: Calendar and timeline views





Jigsaw

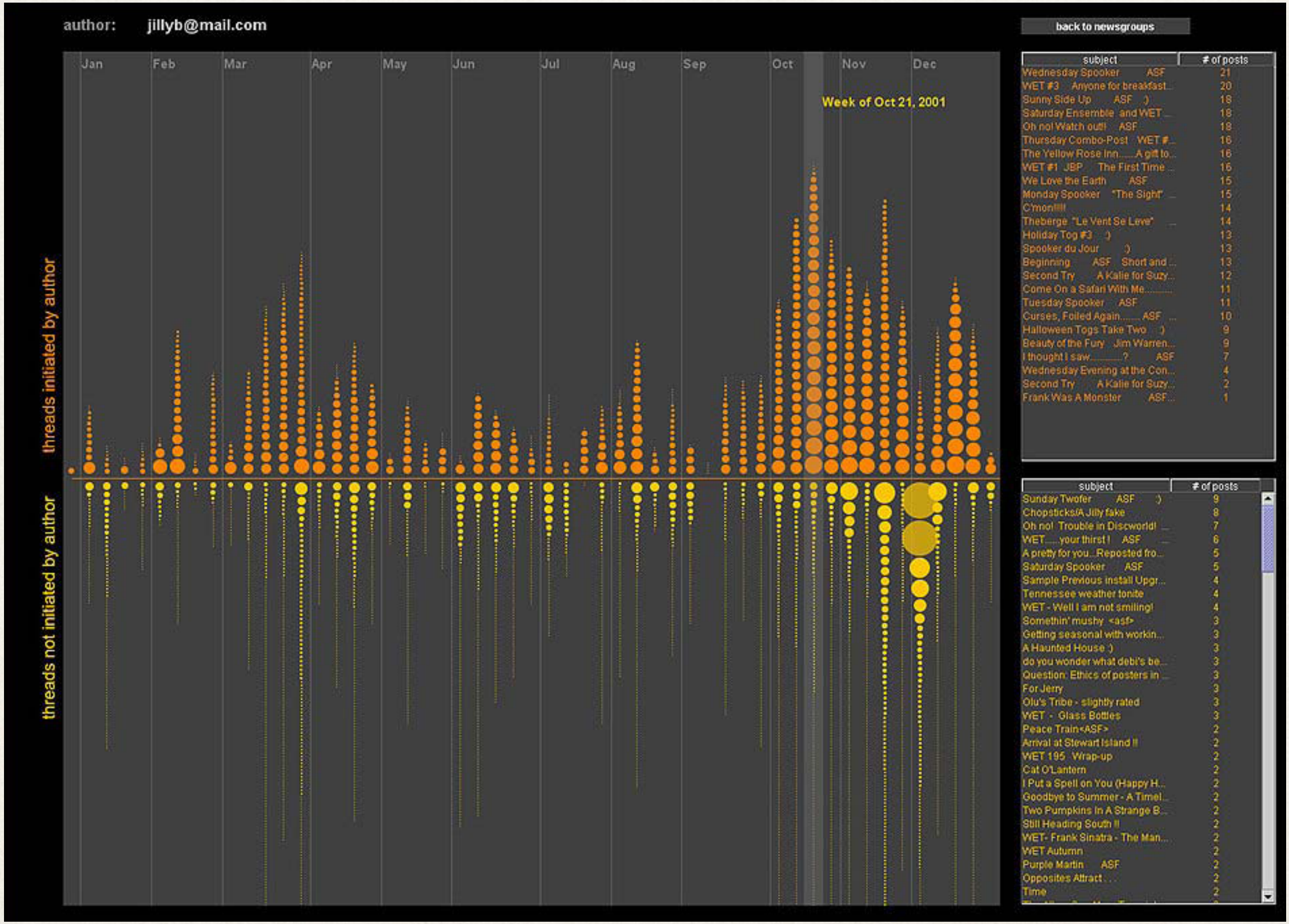
PaperLens



Lee et al., "Understanding Research Trends in Conferences using PaperLens"

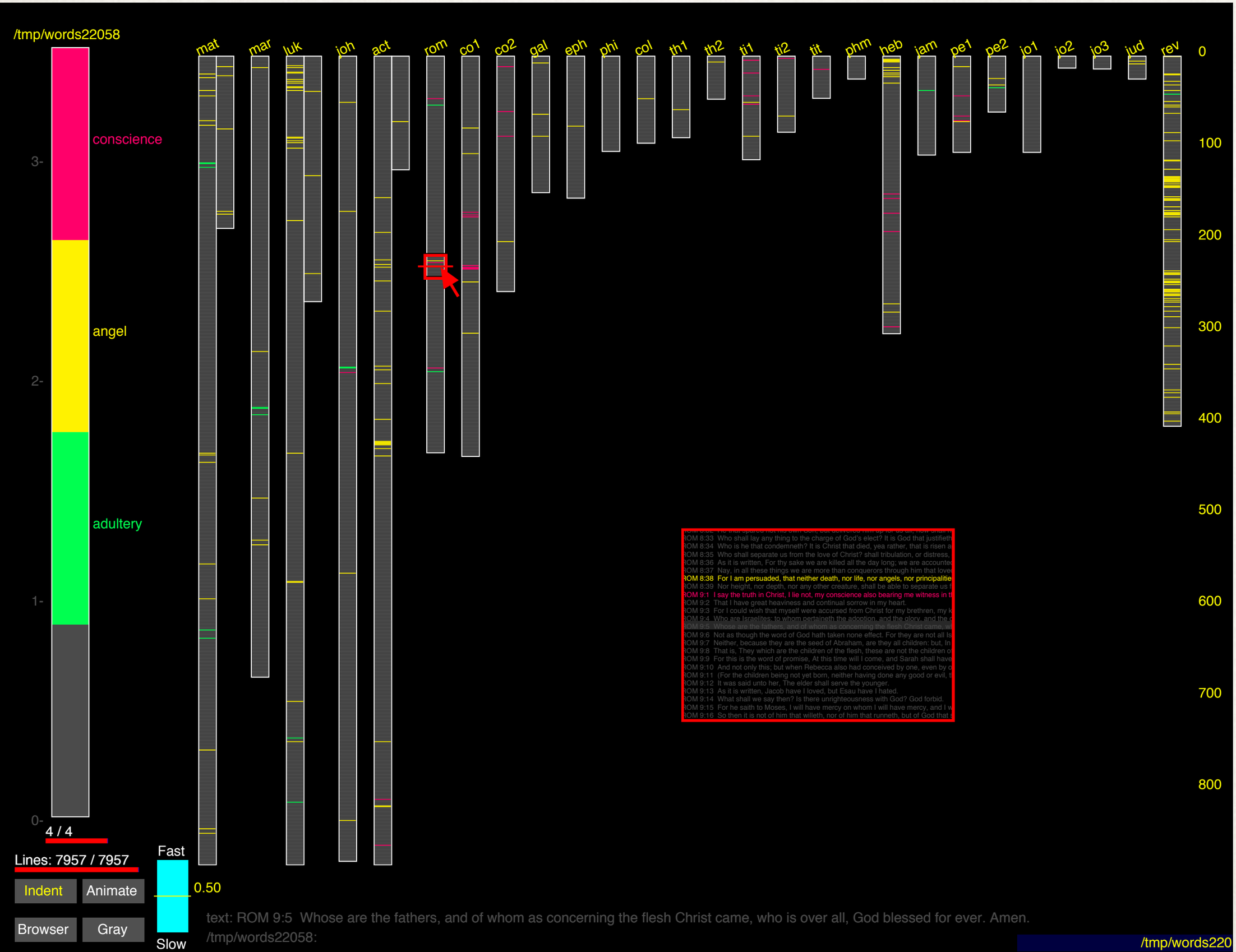
Figure 1. PaperLens tightly couples views across papers, authors, and references and consists of 6 main parts: (a) Popularity of Topic (b) Selected Authors (c) Author List (d) Degrees of Separation Links (e) Paper List (f) Year by Year Top 10 Cited Papers/Authors.

Authorlines



Viégas and Smith, "Newsgroup Crowds and Authorlines: Visualizing the Activity of Individuals in Conversational Cyberspace"

SeeSoft



Eick, "Graphically Displaying Text"

Vector Space Model / Bag of Words

	Book 1	Book 2	Book 3	Book 4
sir	481	79	118	12
about	316	175	192	61
jeeves	313	0	0	0
like	255	96	139	80
holmes	2	459	0	0
your	210	406	282	92
man	126	288	50	80
could	166	286	185	105
doctor	4	34	554	0
romana	0	0	419	0
k9	0	0	347	0
page	3	9	327	0
wizard	1	0	1	255
dorothy	0	0	0	238
jim	0	0	0	152
little	86	269	50	146
...	...	...	...	...

Weighting the vector-space

Term Frequency

$$TF_{td}(word) = count(word) \text{ in } d$$

Term Frequency by Inverse Document Frequency

$$TF.IDF_{td}(word) = TF_{td}(word) * log \frac{N}{Df(word)}$$

Df() is # of documents containing the word, N is the number of documents

Tag cloud

_ absolutely afternoon anatole angela arrived asked ass augustus aunt back bassett bed bell bertie bertram bit bloke bring brinkley business call cannes case chap child cold coming conversation country couple court cousin dahlia dash dashed day de dear deeply dinner door doubt drones eh end engaged evening expect eye eyes face fact facts fear feel feeling feet fellow felt find fine fink-nottle fire form found friend garden gave girl give glossop good great gussie hadn half hand hands happened happy hard head hear heard heart ho home hour house hullo human idea imagine jeeves juice kind knew left life long looked lost love made make making man manner market matter men met mind mine minutes miss moment morning mr newt newts night note occasion open opinion order part passed people pie place point poor position possibly pretty prizes put read remember rest room round scarcely scheme school set shark side sight simple simply sir snodsbury sort soul speak speech spoke spot stand standing start started stood story stuff suddenly suppose taking talk talking thing things thinking thought till time told tom tonight touch travers true tuppy turned uncle understand voice woman wooster word words work world wrong years young

Showing 200 out of 7355 words

ManyEyes


sir
Jeeves
like
Gussie
one
Yes
Well
know
thing
time
must
Fink-Nottle
Aunt
Dahlia
Angela
Tuppy
now
thought
Bertie
mean
something
man
right
back
good
got
old
come
seemed
well
think
see
might
much
going
just
bit
Bassett
moment
course
little
get
Oh
Mr
found
another
two
make
Uncle
take
sort
tell
girl
quite
mind
nothing
doubt
Anatole
talking
trying
looked
eyes
whole
Bertram
Miss
give
went
put
always
never
first
young
feeling
find
even
fact
hand
without
matter
great
word
day
told
rather
ever
suppose
Tom
night
heard
school
want
place
may
point
remember
came
round
long
far
Cannes
done
made
saw
gave
Court
last
let
gone
chap
still
since
Brinkley
Quite
love
look
saying
Glossop
though
along
pretty
go
away
heart
life
best
start
feel
Oh
dinner
face
Wooster
head
felt
yes
way
seen
things
house
door
better
words
stood
seem
voice
looking
able
case
bed
anything
stuff
Sir
Wordle

Right ho, Jeeves


sir
Jeeves
like
Yes
Gussie
one
Well
know
thing
right
something
man
Fink-Nottle
Aunt
Dahlia
Angela
Tuppy
Bertie
mean
time
must
now
good
think
see
might
thought
got
old
come
much
seemed
well
course
little
moment
going
back
Bertram
Bassett
just
bit
rather
suppose
may
Mr
came
point
saw
two
found
another
Oh
get
go
make
tell
take
sort
girl
quite
mind
Uncle
eyes
never
first
hand
without
matter
Tom
heard
night
young
put
always
give
way
things
Glossop
Wooster
Brinkley
look
saying
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heart
life
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Quite
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seem
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words
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school
want
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gave
Court
door
house
head
dinner
face
felt
yes
case
bed
seen
still
chap
gone
let
along
since
though
pretty
best
start
feel
Sir
far
able

Wordle


sir
Jeeves
like
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one
Yes
Well
thing
know
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something
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back
good
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well
course
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make
moment
Oh
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quite
mind
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first
rather
suppose
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Mr
saw
Glossop
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Wooster
Tom
Anatole


Jeeves
sir
know
old
one
like
Mr
thing
way
Well
think
got
back
sort
time
see
good
come
something
right
seemed
man
just
went
George
came
Yes
Bicky
Rocky
Bobbie
Corky
Clarence
Motty
Freddie
Reggie
looked
thought
morning
chappie
mean
made
uncle
day
little
girl
place
always
moment
anything
poor
want
began
dear
boy
ever
kind
quite

Wordle


sir
Jeeves
like
Gussie
one
Yes
Well
know
thing
Bertie
Angela
Aunt
Fink-Nottle
something
man
must
time
mean
good
now
Tuppy
Dahlia
little
seemed
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Bertram
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much
going
got
moment
course
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told
word
day
great
heard
night
young
anything
stuff
give
Miss
went
always
put
school
want
place
made
may
Cannes
remember
point
came
round
saw
Mr
long
two
another
found
Court
gave
words
better
stood
looking
seem
voice
talking
door
house
things
way
seen
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let
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Oh
heart
life
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feel
start
face
dinner
Wooster
head
felt
bed
case
able
far
done
gone

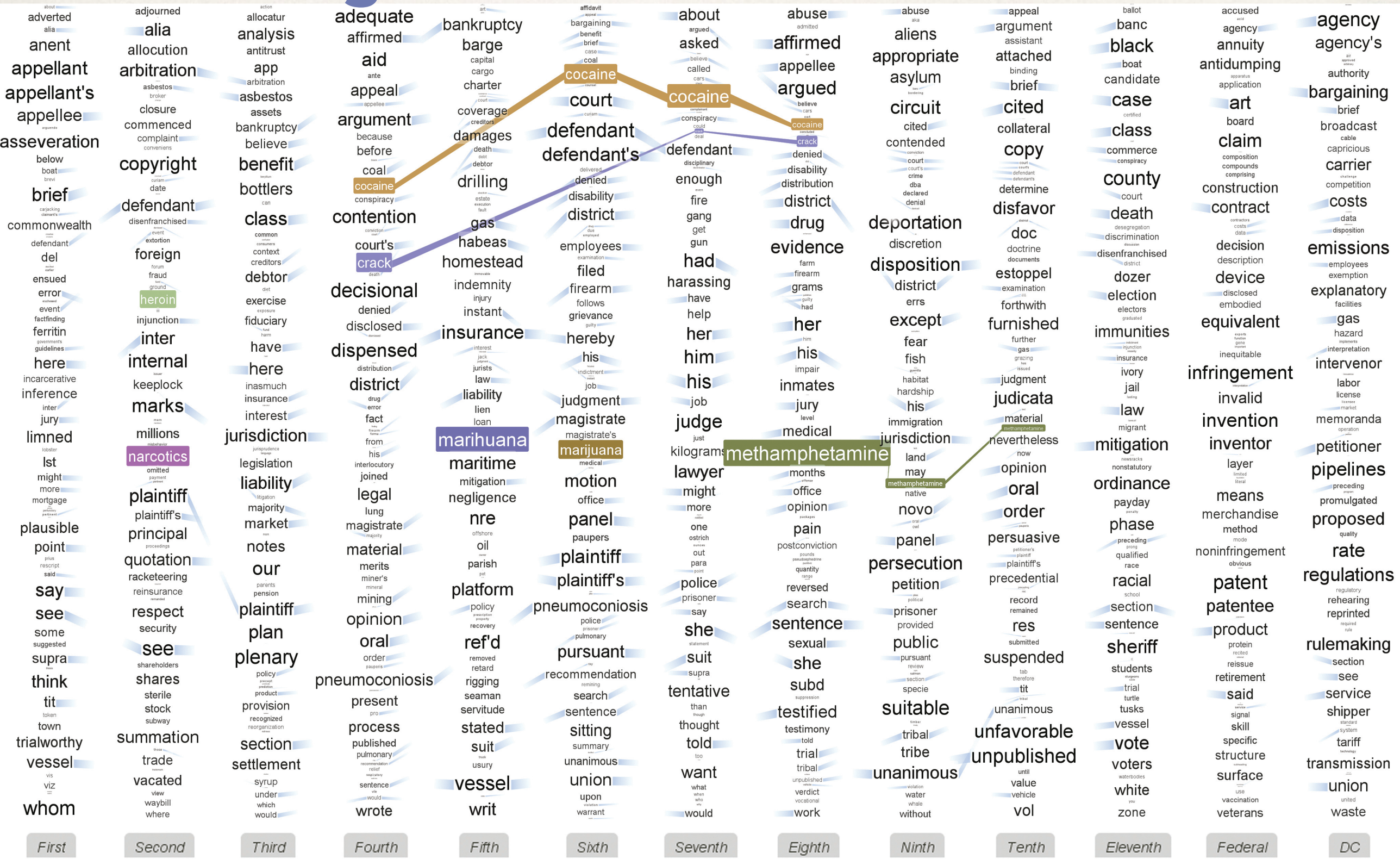
Wordle

Wordle

GOP Candidate to Obama:‘Man up’ and meet me on the basketball court

Brazil passes Bill on Internet Privacy

Parallel Tag Clouds



Collins, "Parallel Tag Clouds to Explore and Analyze Faceted Text Corpora"

Word Tree

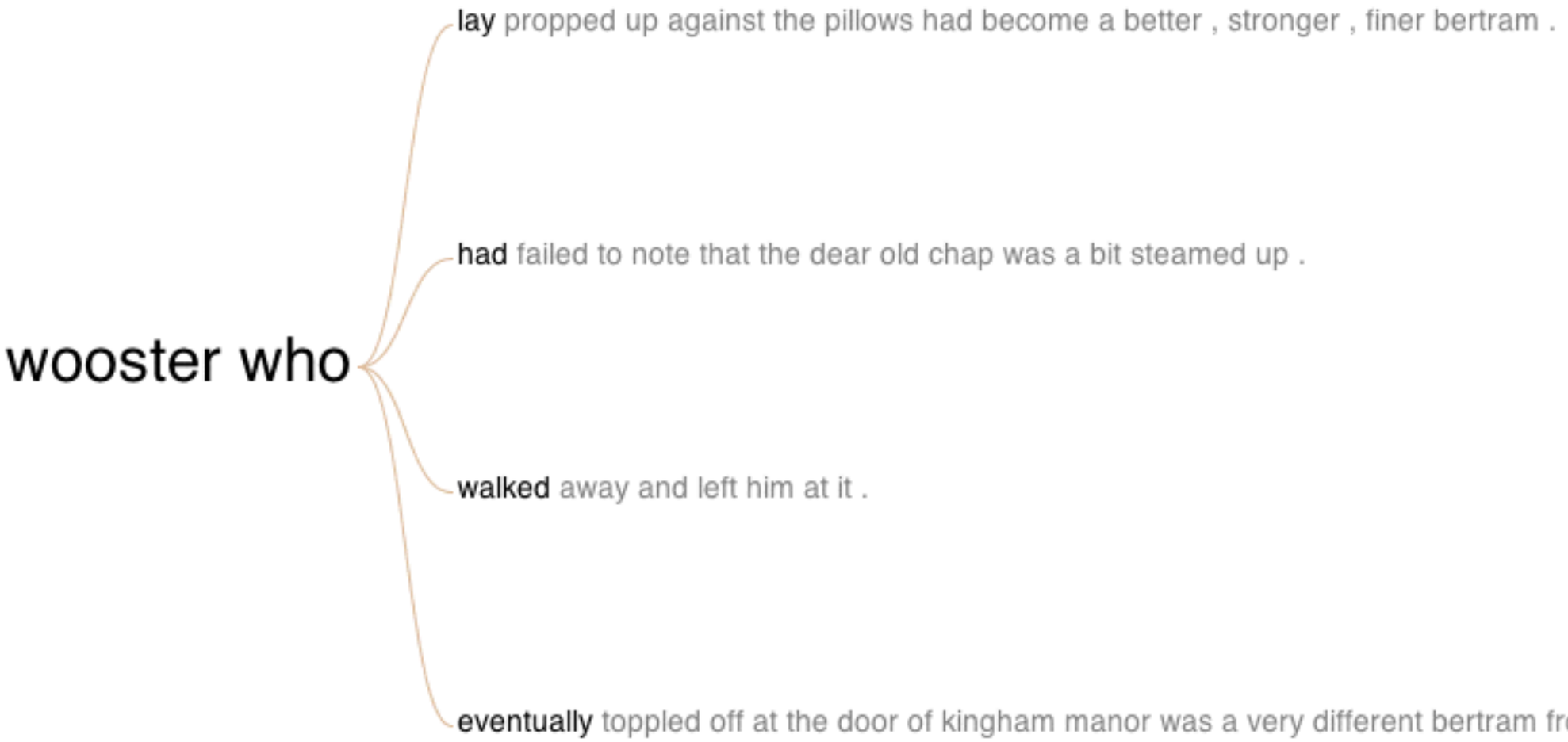
51
hits

wooster

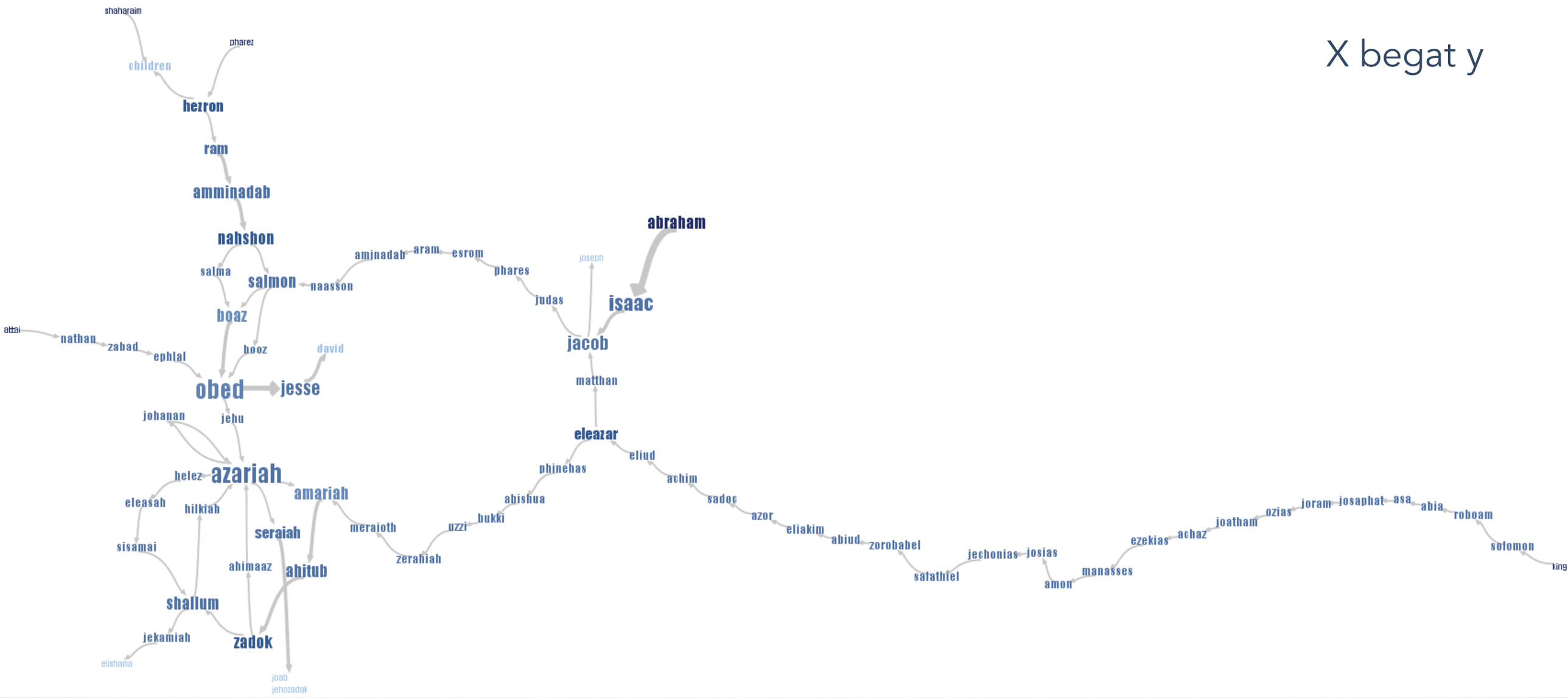
ManyEyes

Word Tree

4
hits



Phrase net

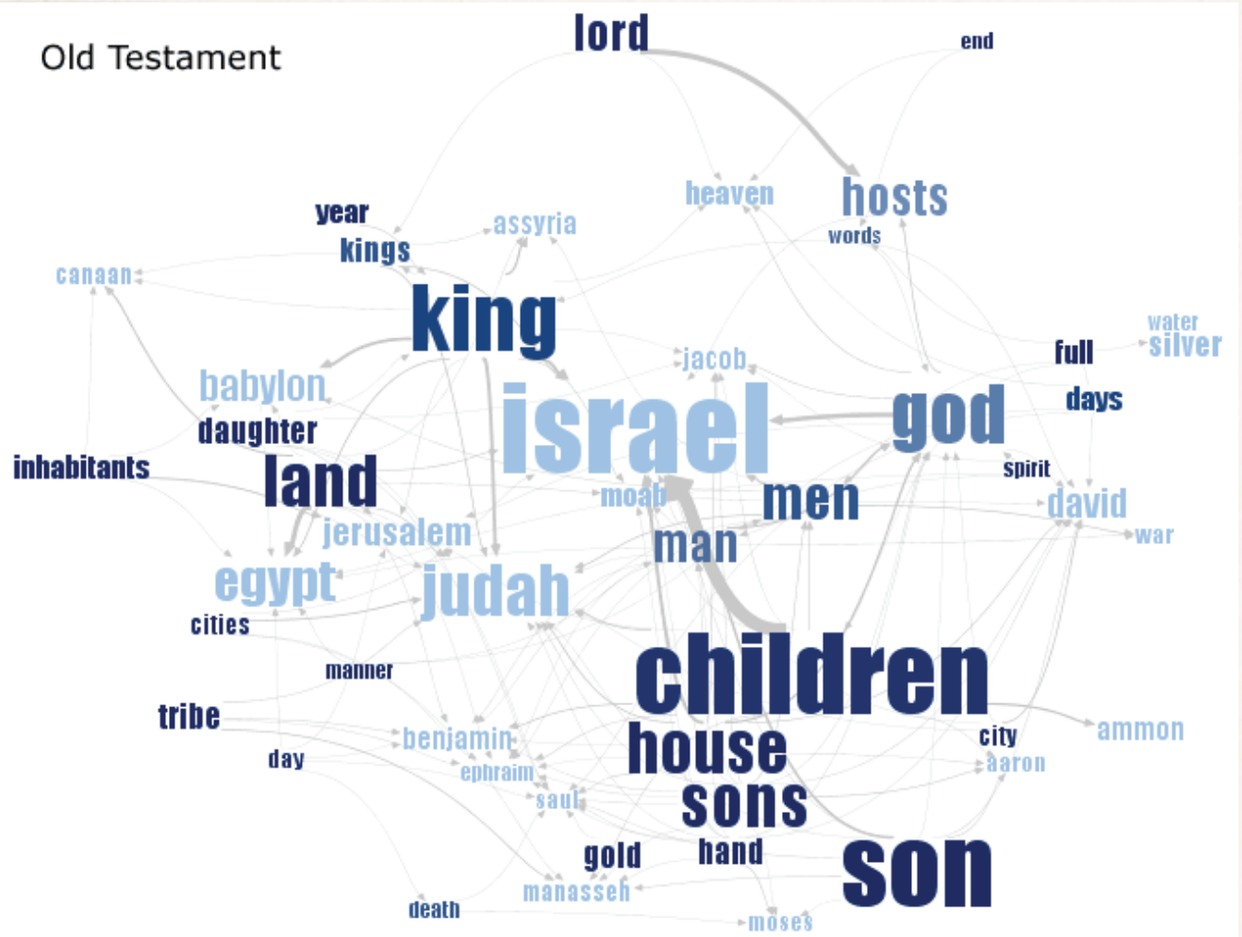


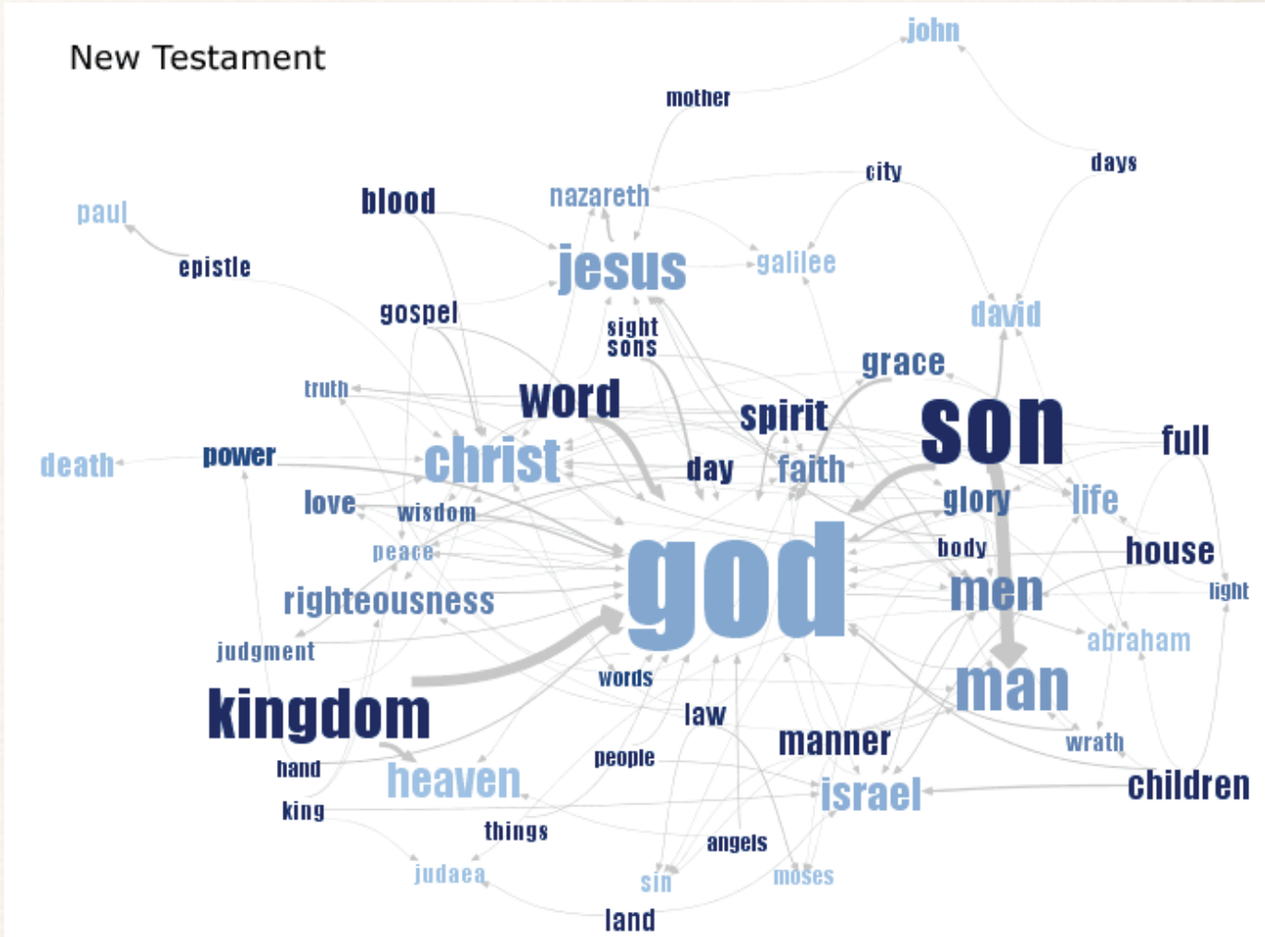
X begat y

van Ham et al. “Mapping Text with Phrase Nets”

Phrase net

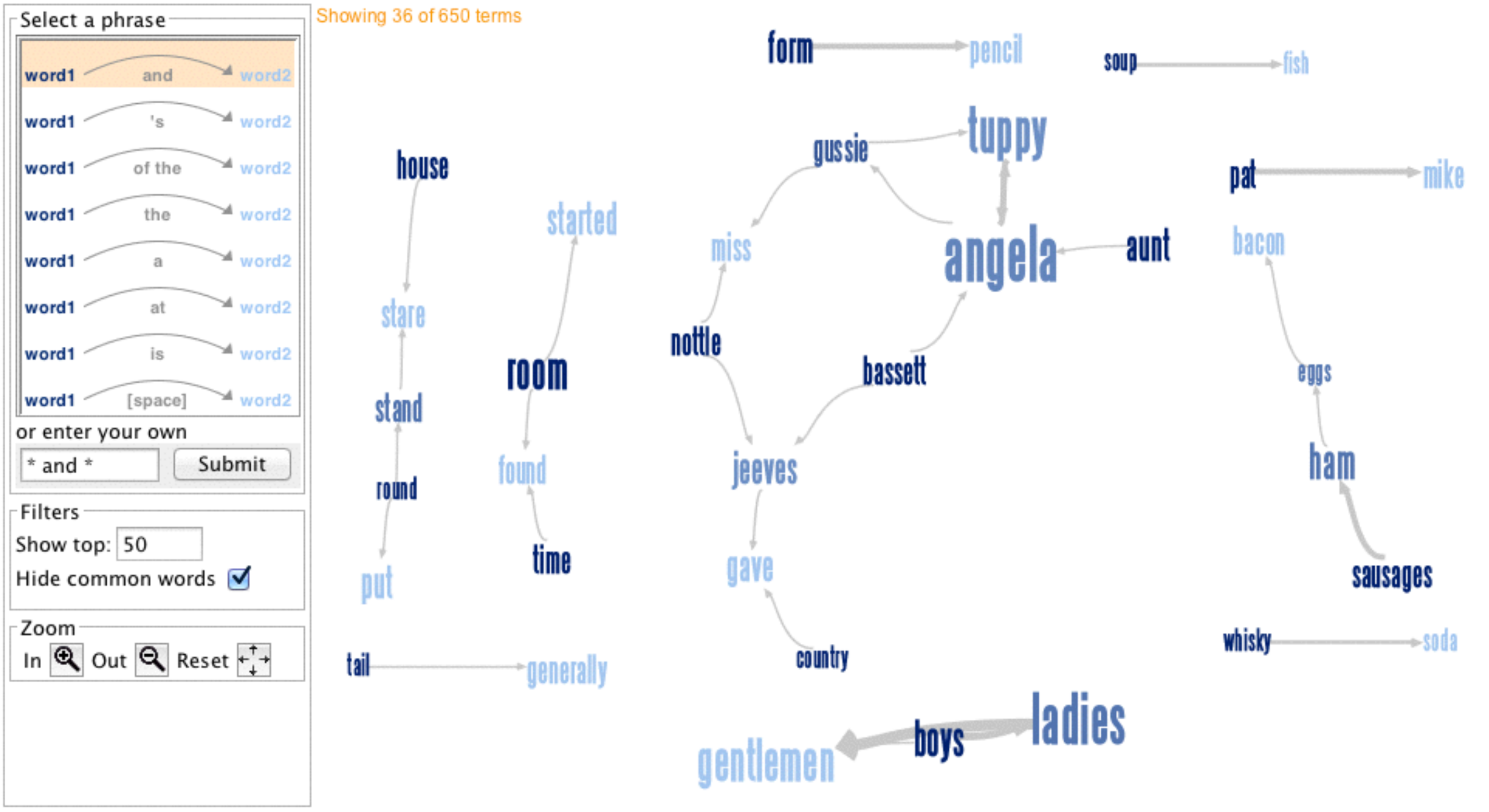
X of y





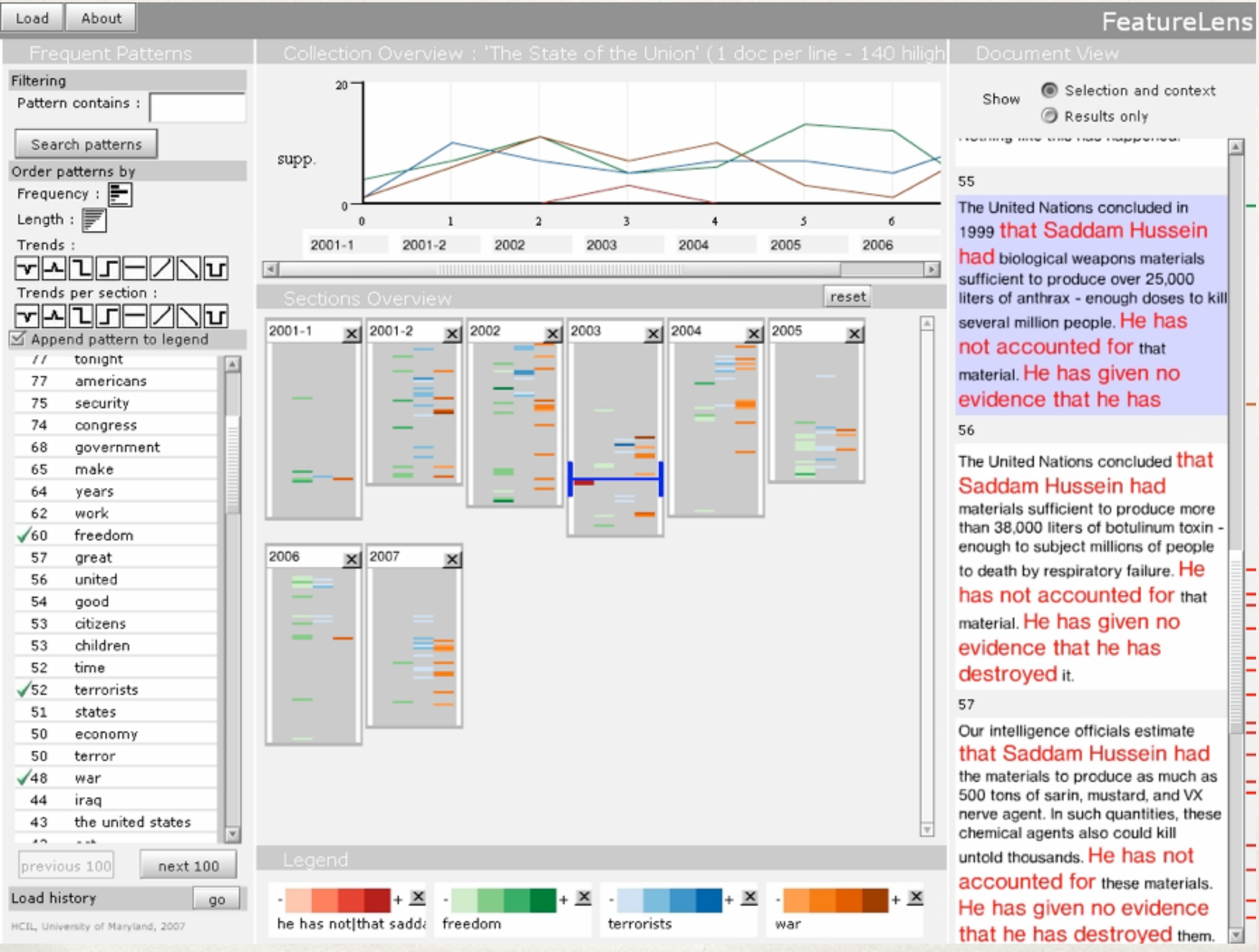
van Ham et al. “Mapping Text with Phrase Nets”

Phrase net



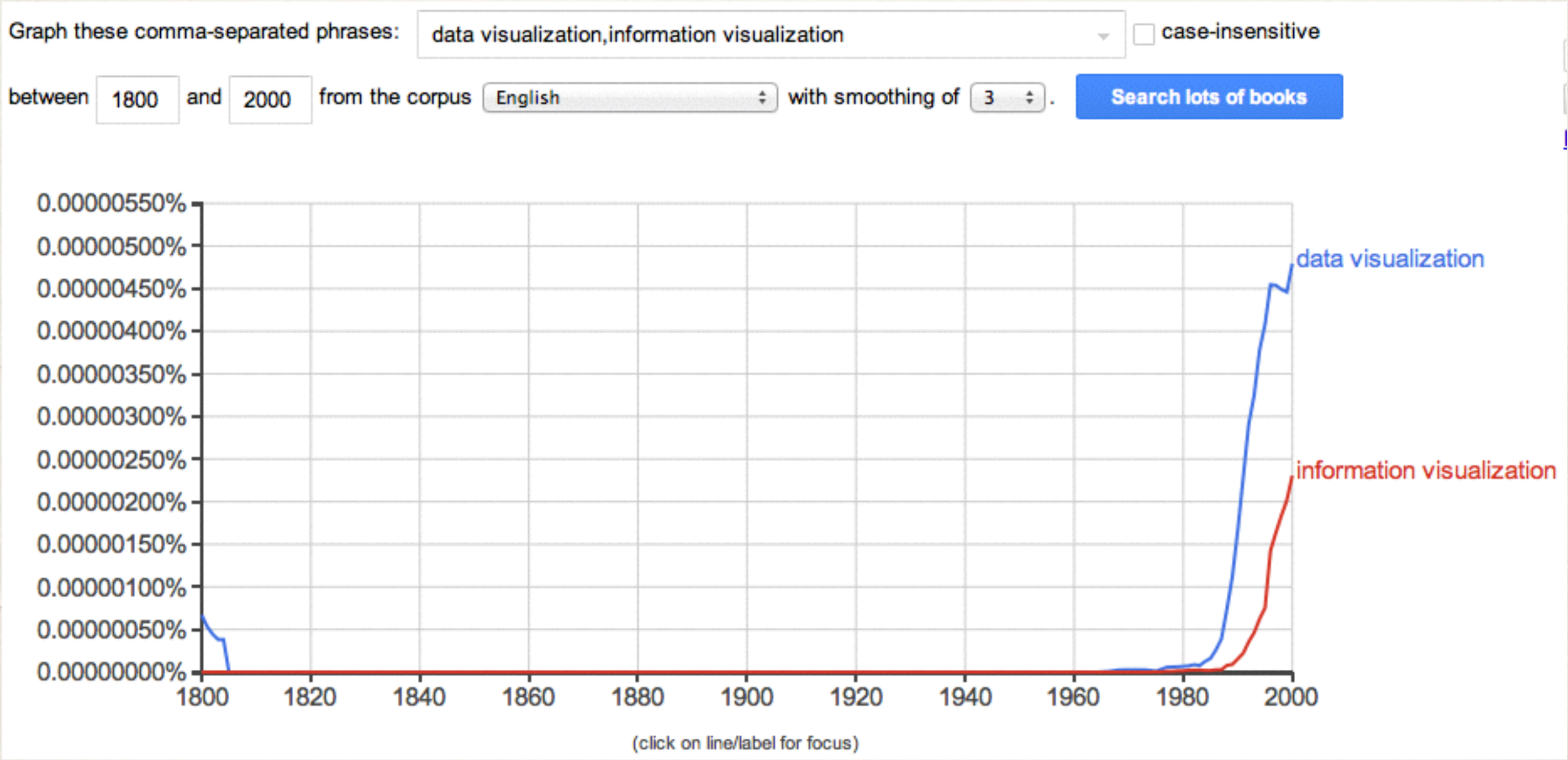
ManyEyes

FeatureLens

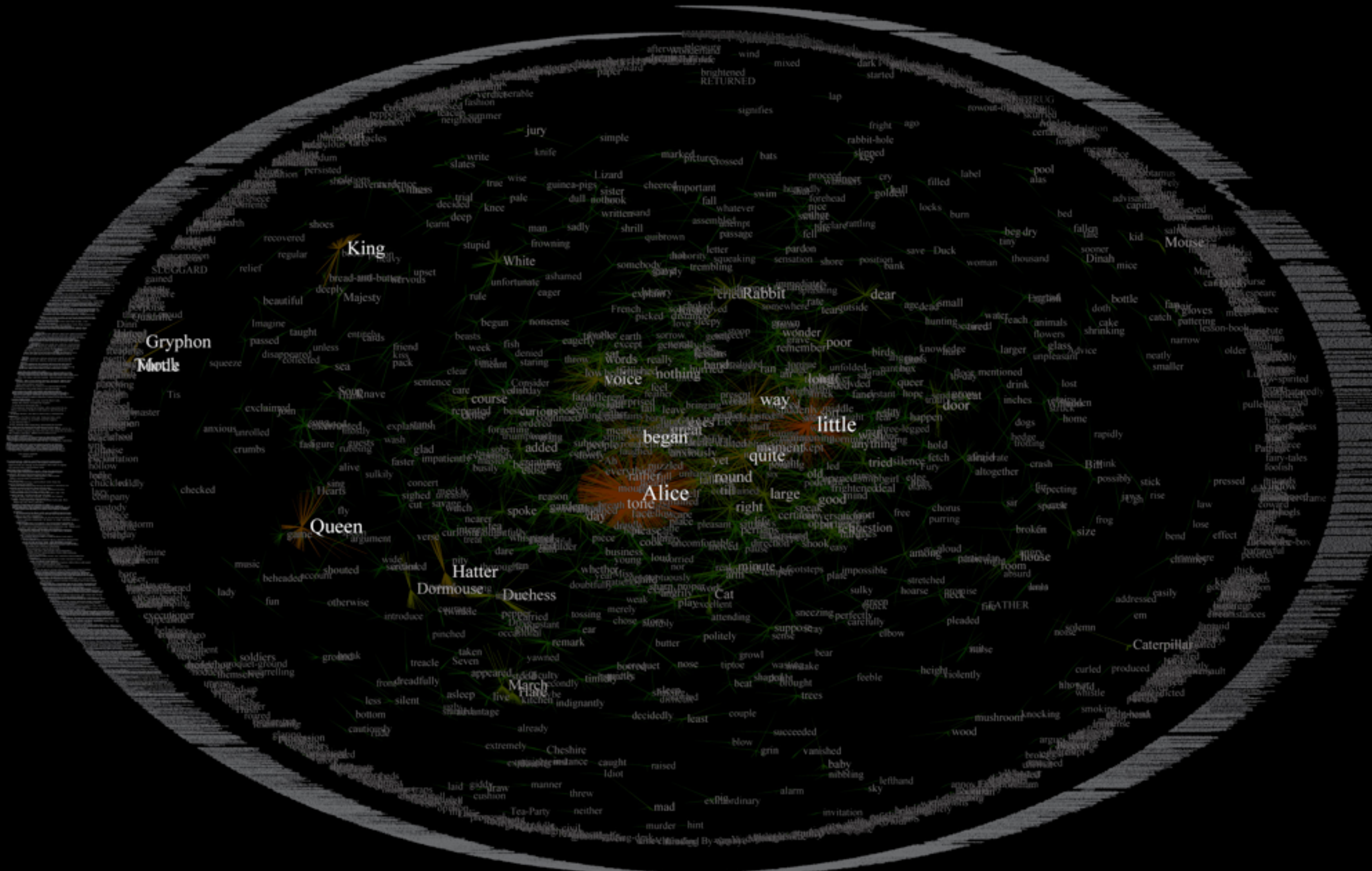


Don et al., "Discovering interesting usage patterns in text collections: integrating text mining with visualization"

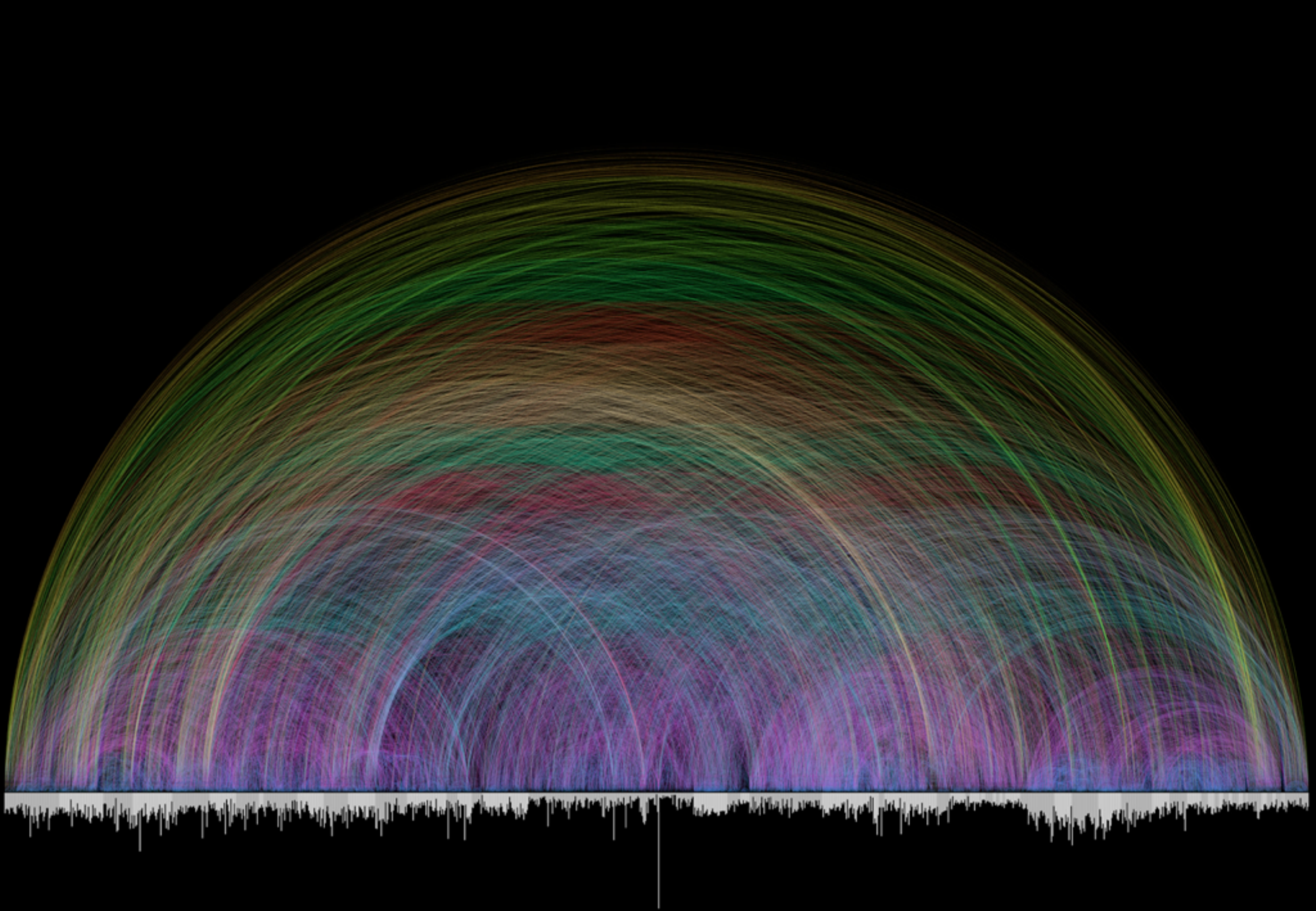
Google nGram Viewer



https://books.google.com/ngrams

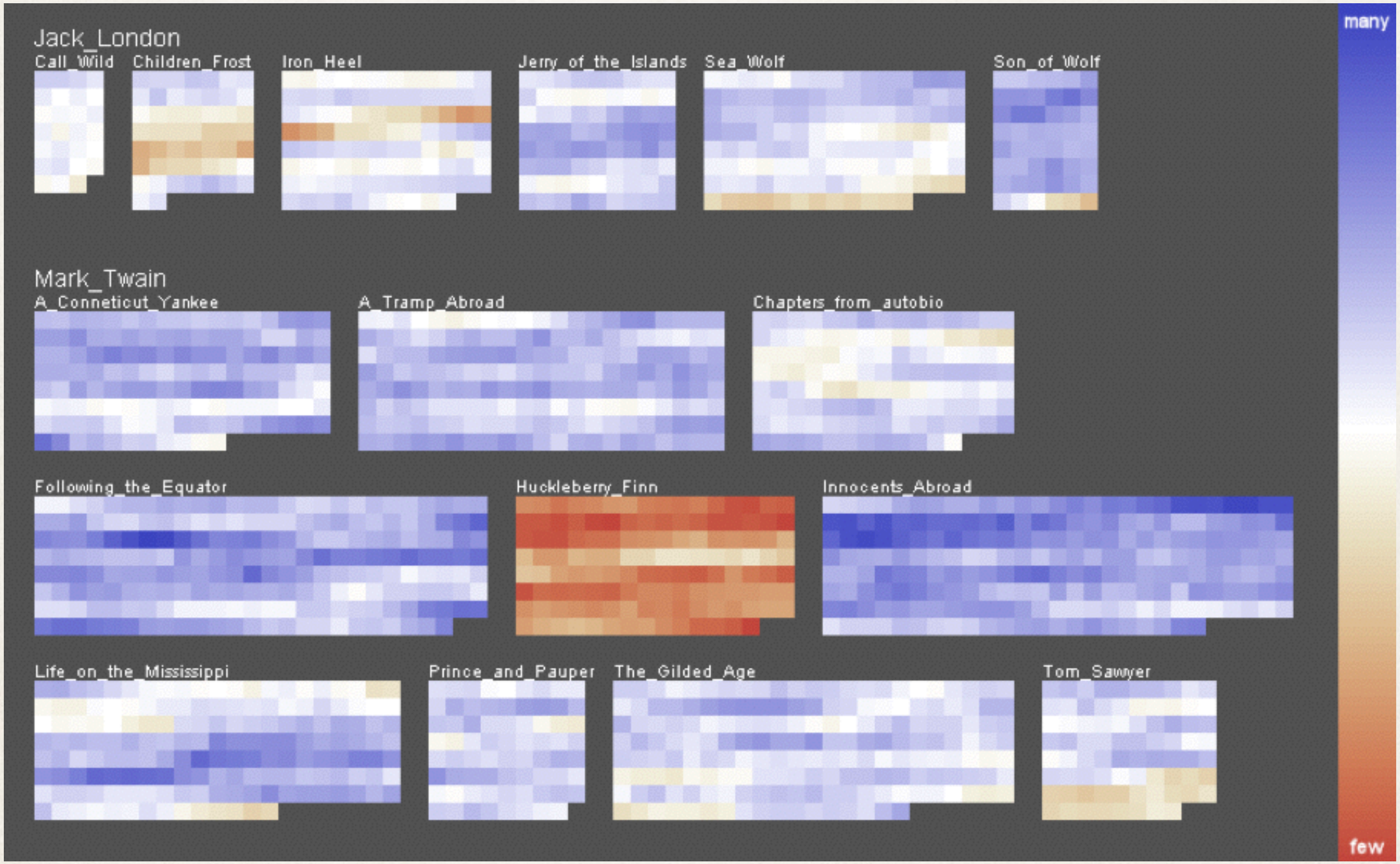

King
White
Rabbit
dear
Mouse
Gryphon
Majesty
voice
nothing
way
little
door
course
began
added
quite
Alice
round
large
good
right
Queen
spoke
Hatter
Dormouse
Duchess
Cat
March
Hare
Caterpillar
jury
Cheshire

TextArc



http://www.chrisharrison.net

Literature fingerprinting

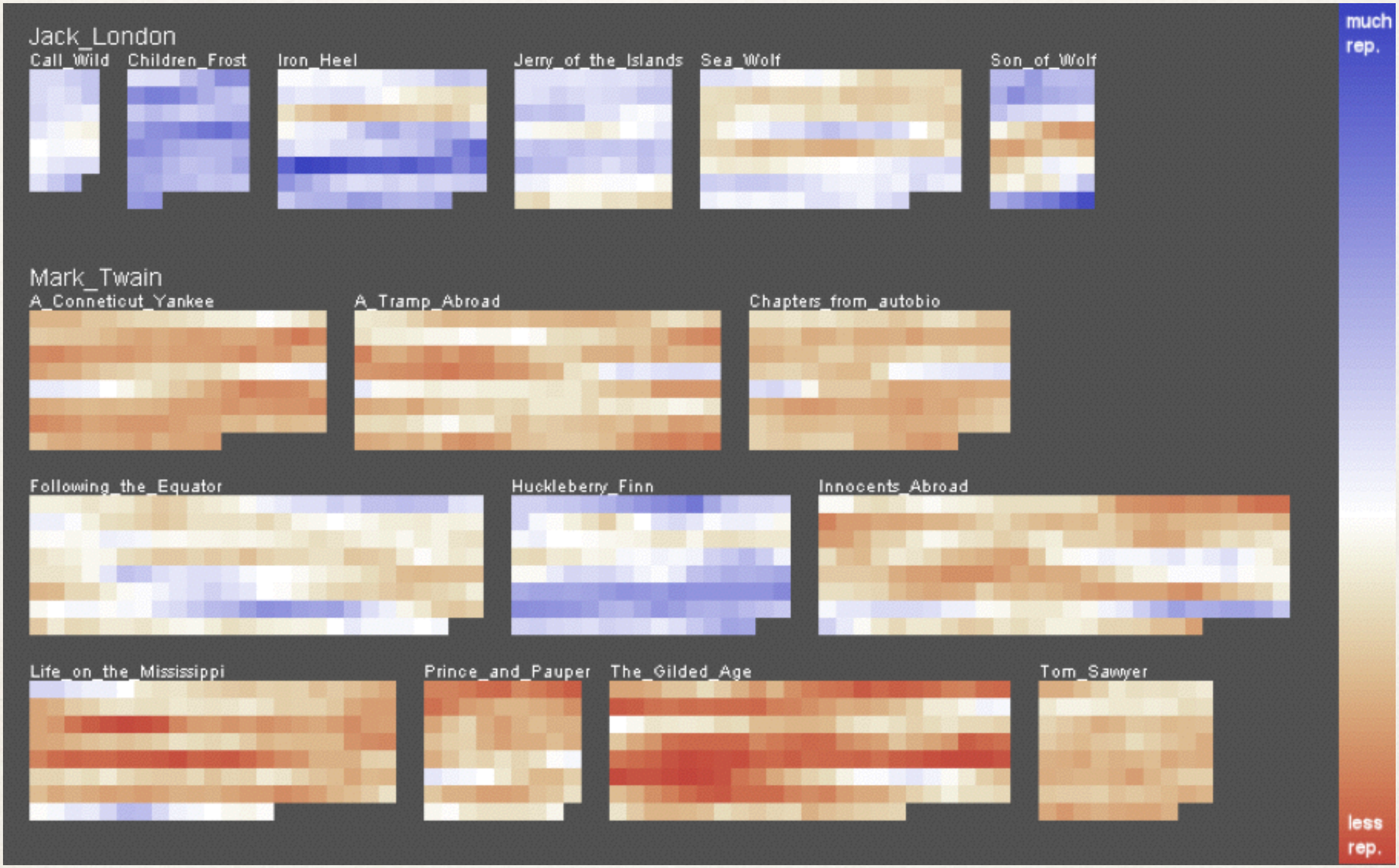


Hapax Legomena

word that appears only once

Keim, Oelke, "Literature Fingerprinting: A New Method for Visual Literary Analysis"

Literature fingerprinting

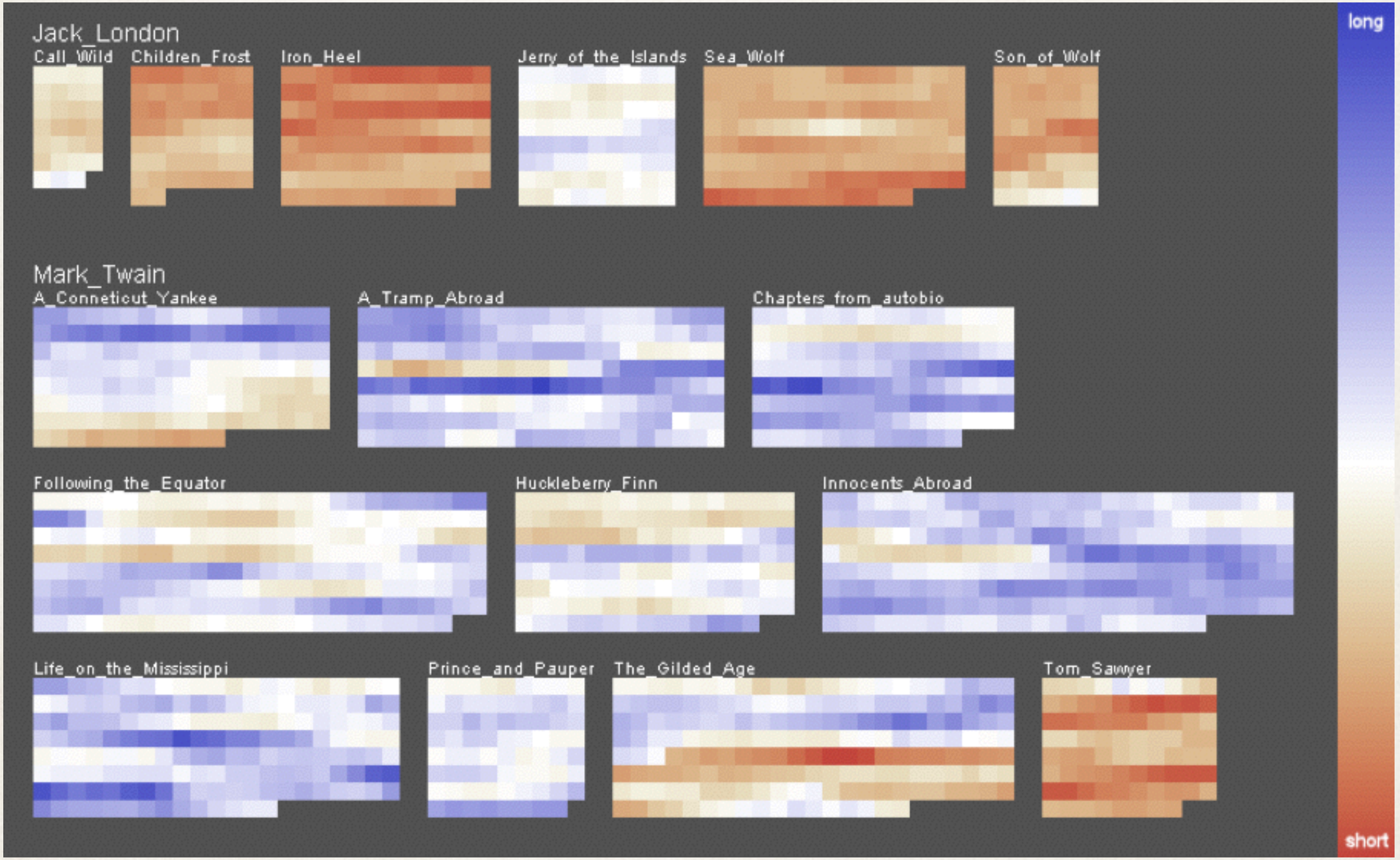


Simpson's Index

probability that a token belongs to the set

Keim, Oelke, "Literature Fingerprinting: A New Method for Visual Literary Analysis"

Literature fingerprinting



Average sentence length

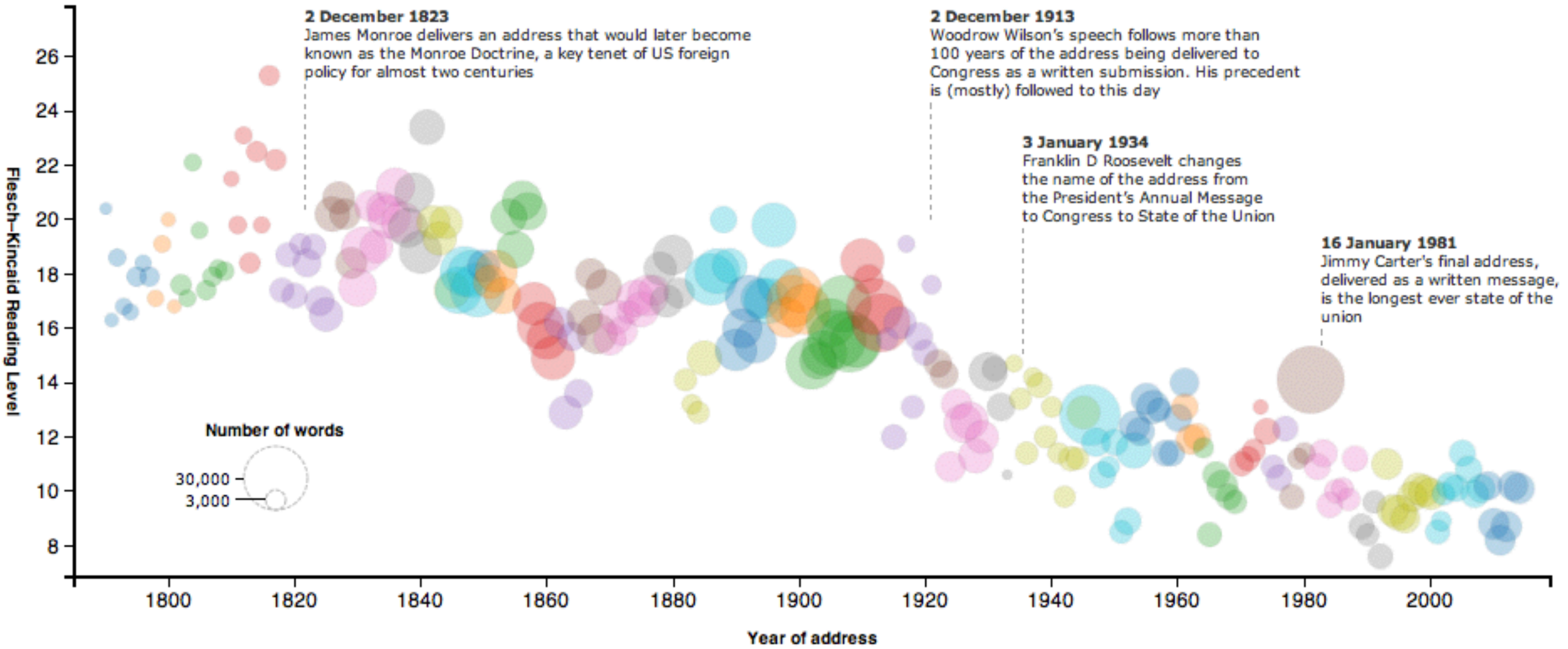
Keim, Oelke, “Literature Fingerprinting: A New Method for Visual Literary Analysis”

Reading level

The state of our union is ... dumber:

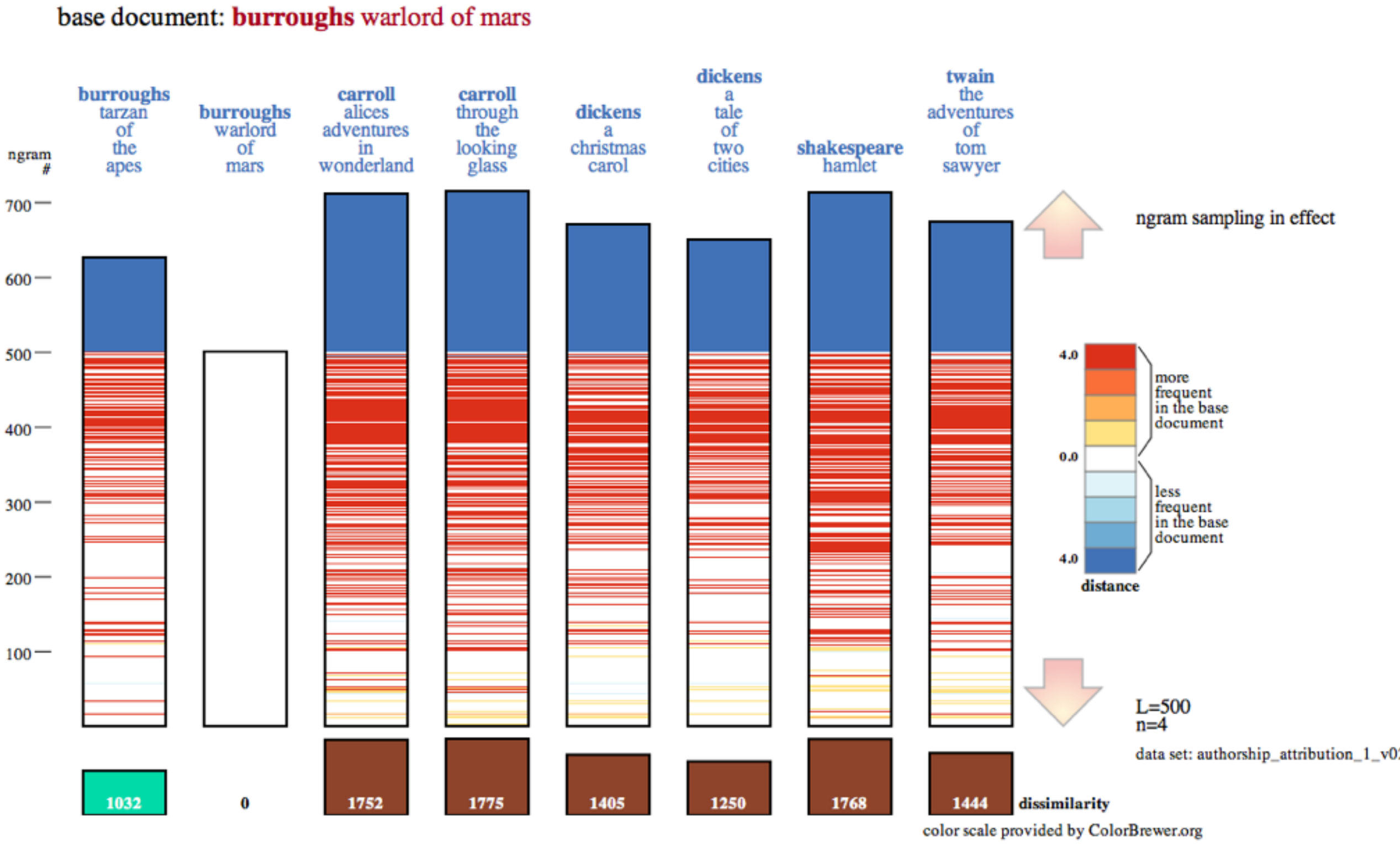
How the linguistic standard of the presidential address has declined

Using the Flesch-Kincaid readability test the Guardian has tracked the reading level of every State of the Union



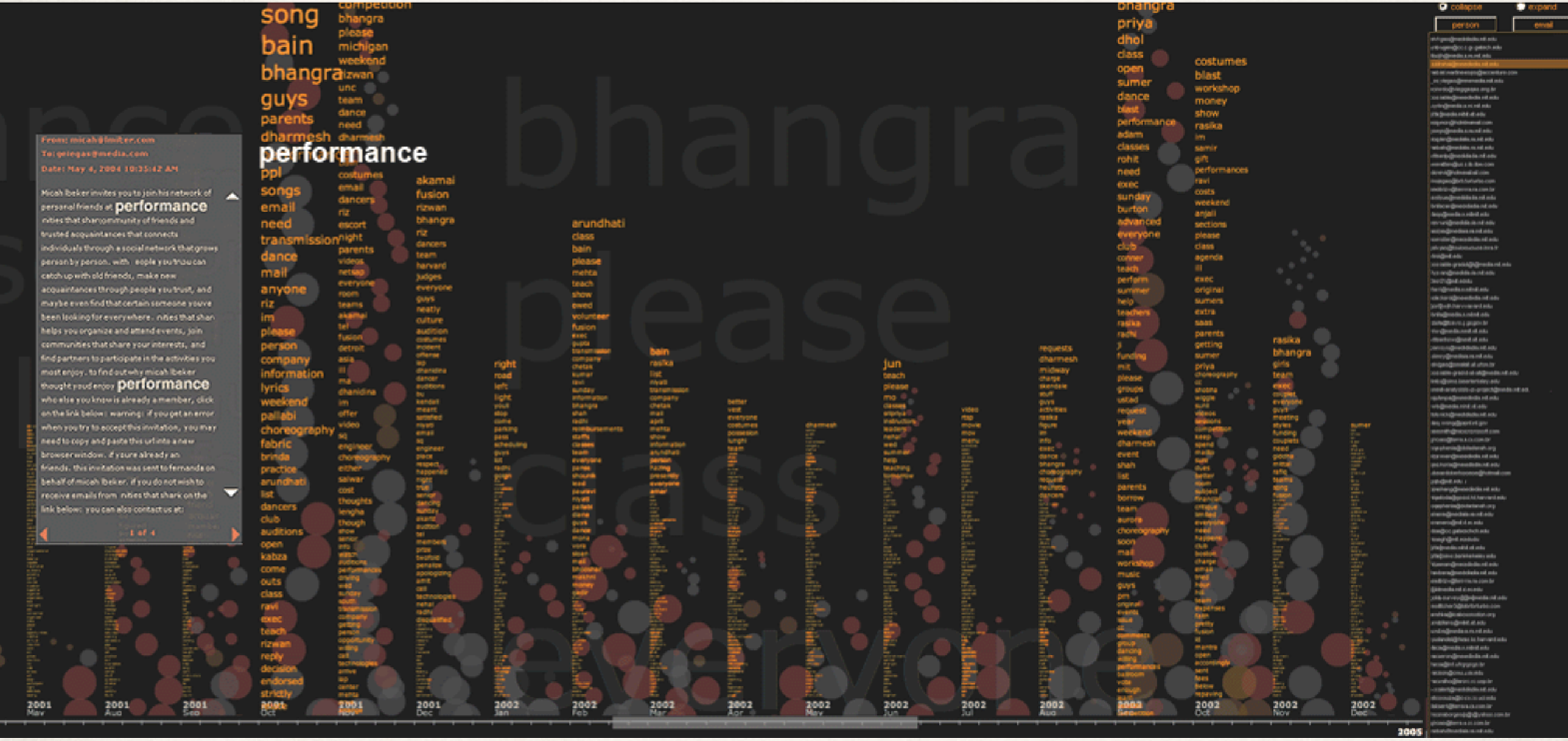
http://www.theguardian.com/world/interactive/2013/feb/12/state-of-the-union-reading-level

Relative n-gram signatures



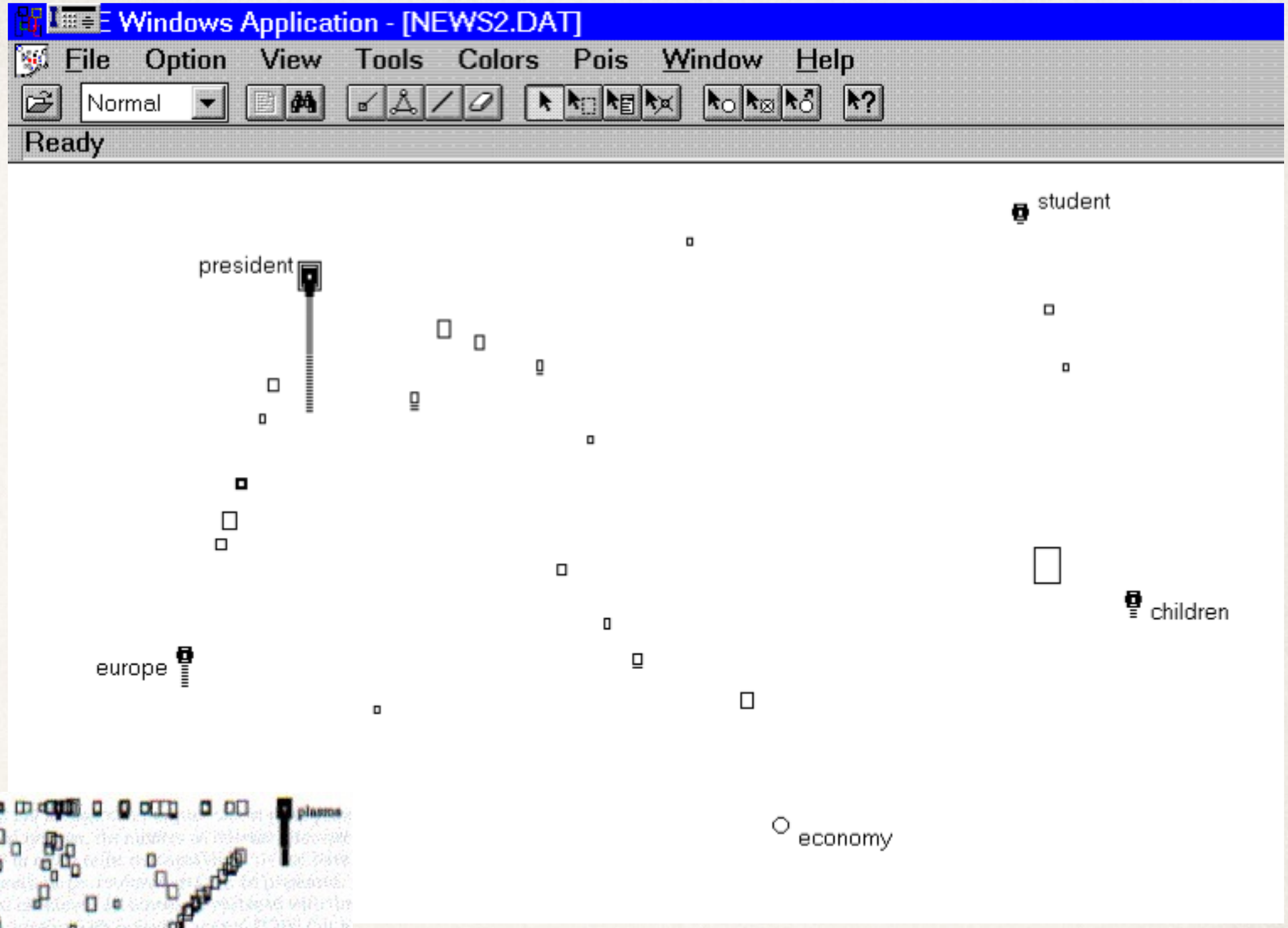
https://web.cs.dal.ca/~jankowsk/ngram_signatures/

Themail



Viégas, “Visualizing Email Content: Portraying Relationships from Conversational Histories”

VIBE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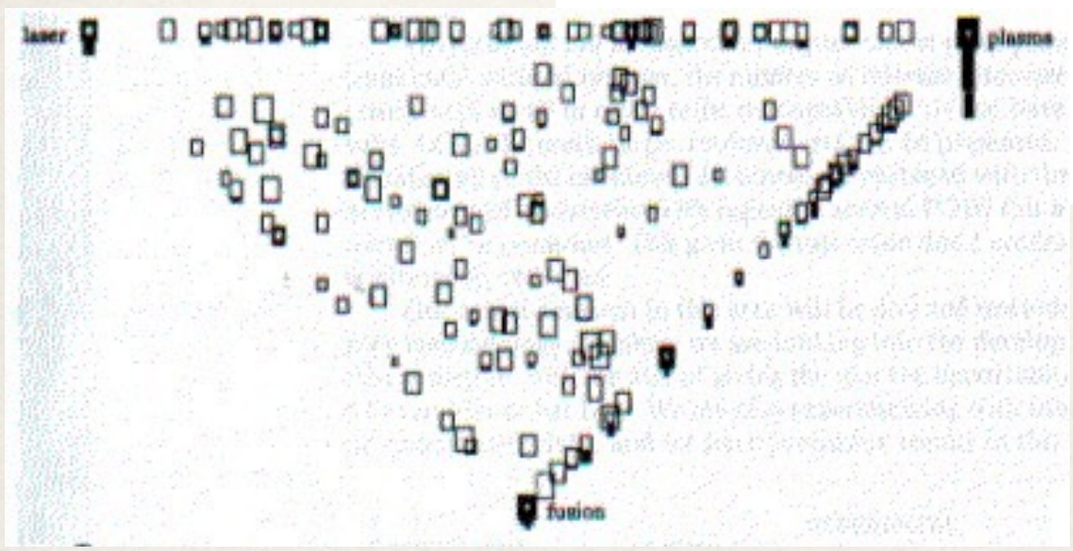
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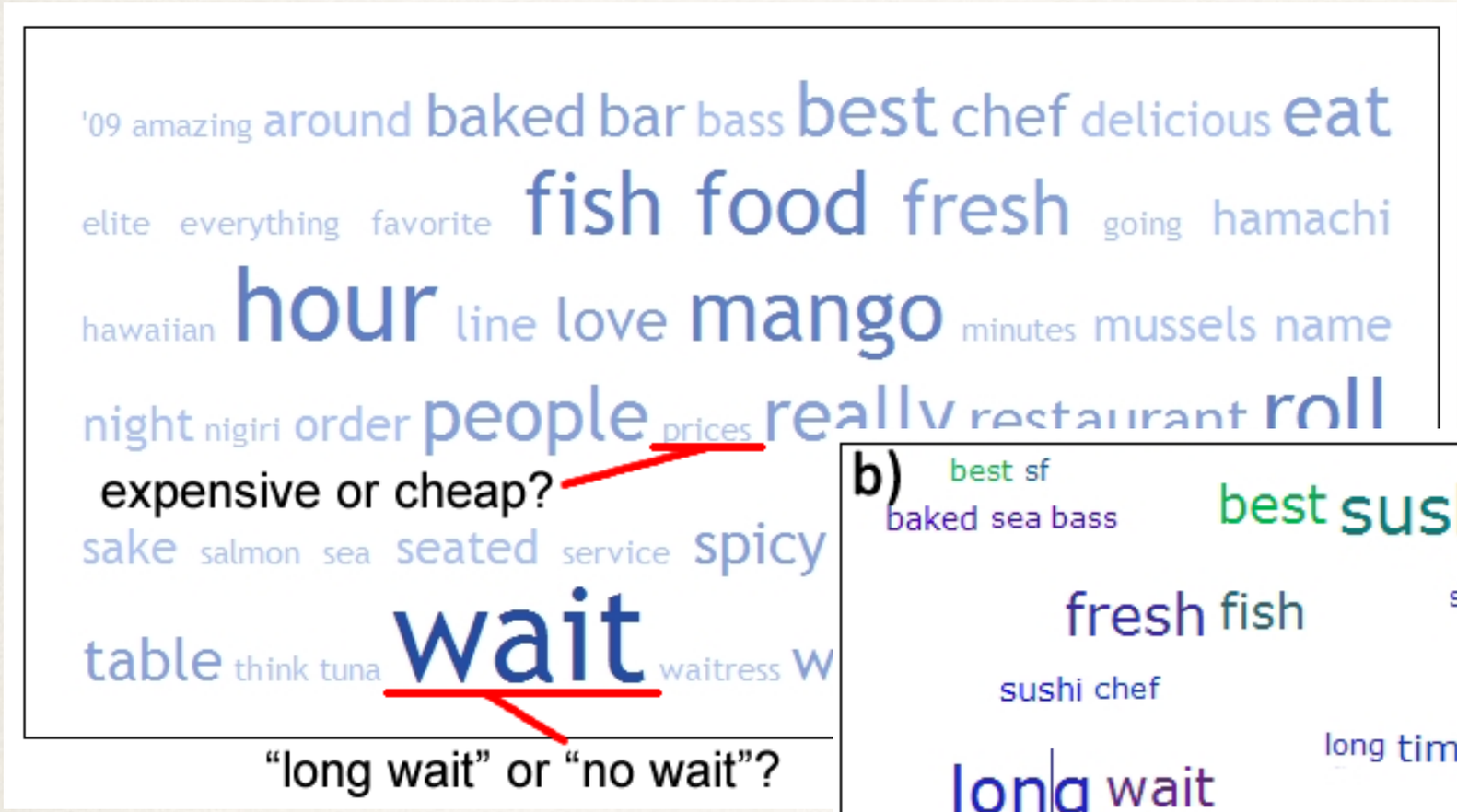
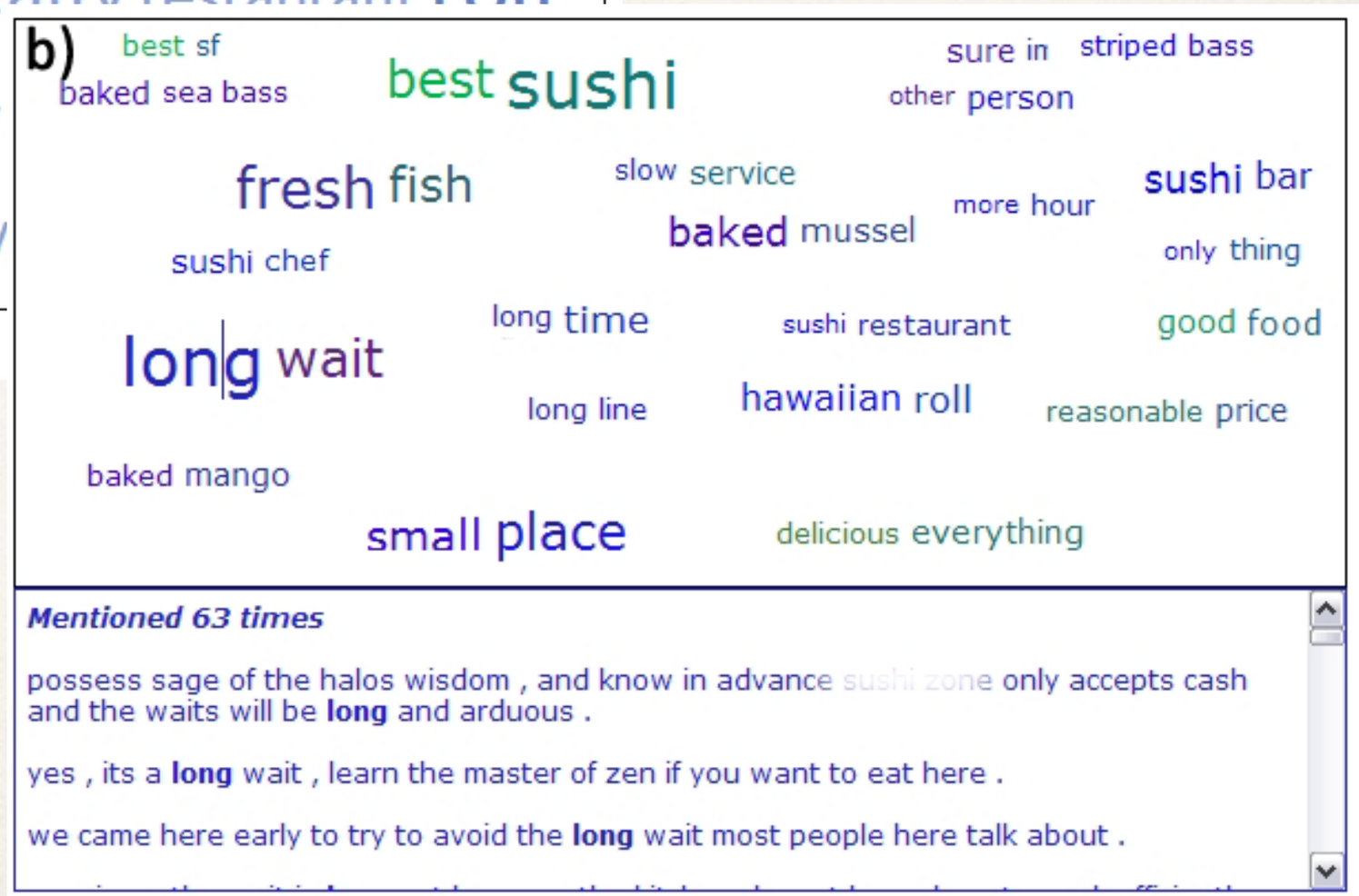
Review Spotlight





Yatani et al. "Review Spotlight: A User Interface for Summarizing user-generated Reviews Using Adjective-noun Word Pairs"

Named Entity Extraction

A senior police officer was killed near Cairo on Wednesday in a bomb attack claimed by a militant group, while security forces stormed a hideout used by another Islamist organisation near Alexandria in a raid that left an officer and a militant dead. Militant violence has spiralled since last July, when the army toppled elected head of state Mohamed Mursi and the authorities launched a fierce crackdown on his supporters in the Muslim Brotherhood and other Islamist sympathisers. The attacks underline lingering instability in Egypt ahead of a presidential election in May that Abdel Fattah al-Sisi, the former army chief who deposed Mursi, is expected to win. The prime minister said the state was in "a fierce war" on terror. The police officer killed near Cairo was named as Brigadier General Ahmed Zaki. State media said he was killed outside his home in 6th of October City, 32 km (20 miles) outside Cairo, when a bomb placed under his car went off. Two conscript policemen were wounded in the bombing. A militant group called Ajnad Misr, or Soldiers of Egypt, said it carried out the attack in a statement posted on a Facebook account in its name that has carried past statements. The post included a photo of a man said to be Zaki on his way to his vehicle, describing him as "the criminal brigadier general in the (security) force for killing protesters". Mursi's removal from power last summer after mass protests against his rule tipped Egypt into the worst internal strife of its modern history. Hundreds of his supporters were killed by security forces as they broke up their protest camps. Militant attacks since then have killed around 500 people, mostly policemen and soldiers. The threat has been compounded by a flow of weapons from neighbouring Libya. The Interior Ministry said the hideout targeted by police at dawn on Wednesday near Alexandria was used by Ansar Bayt al-Maqdis, or Supporters of Jerusalem, the group behind some of the deadliest attacks of the last nine months. The militants had opened fire on the security forces as they arrived at the hideout in Borg El Arab, some 45 km (28 miles) south-west of Alexandria. The police officer killed in the raid was named as First Lieutenant Ahmed Saad and the dead militant as Hassan Abdel Aal, a 25-year old from the Nile Delta province of Dakahlia. Two other militants were detained, the ministry spokesman, Hany Abdel Latif, said in a televised statement. Footage broadcast on state TV appeared to show the body of a militant on the ground. The militants were "among the dangerous elements of the terrorist group Ansar Bayt al-Maqdis, which was planning to target police and military facilities and the security forces", the ministry said. The police seized weapons including explosive belts, automatic weapons, hand grenades and ammunition.

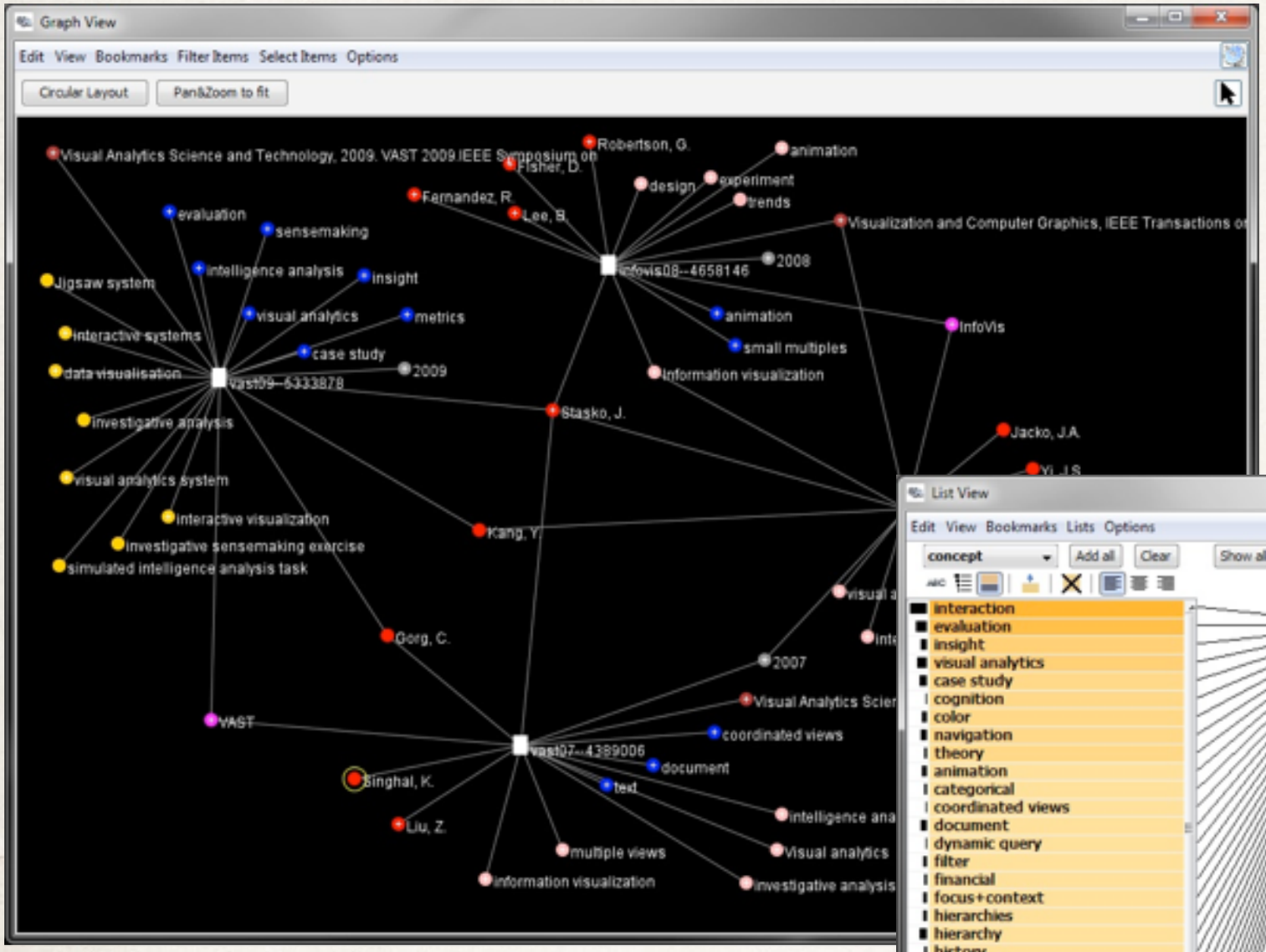
Potential tags:

- LOCATION
- TIME
- PERSON
- ORGANIZATION
- MONEY
- PERCENT
- DATE

http://uk.reuters.com/article/2014/04/23/uk-egypt-violence-idUKBREA3M1KO20140423

Stanford NLP Named Entity Tagger

Jigsaw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Visual Analytics Science and Technology, 2009. VAST 2009.IEEE Symposium on
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animation
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Visualization and Computer Graphics, IEEE Transactions o
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Time Line View
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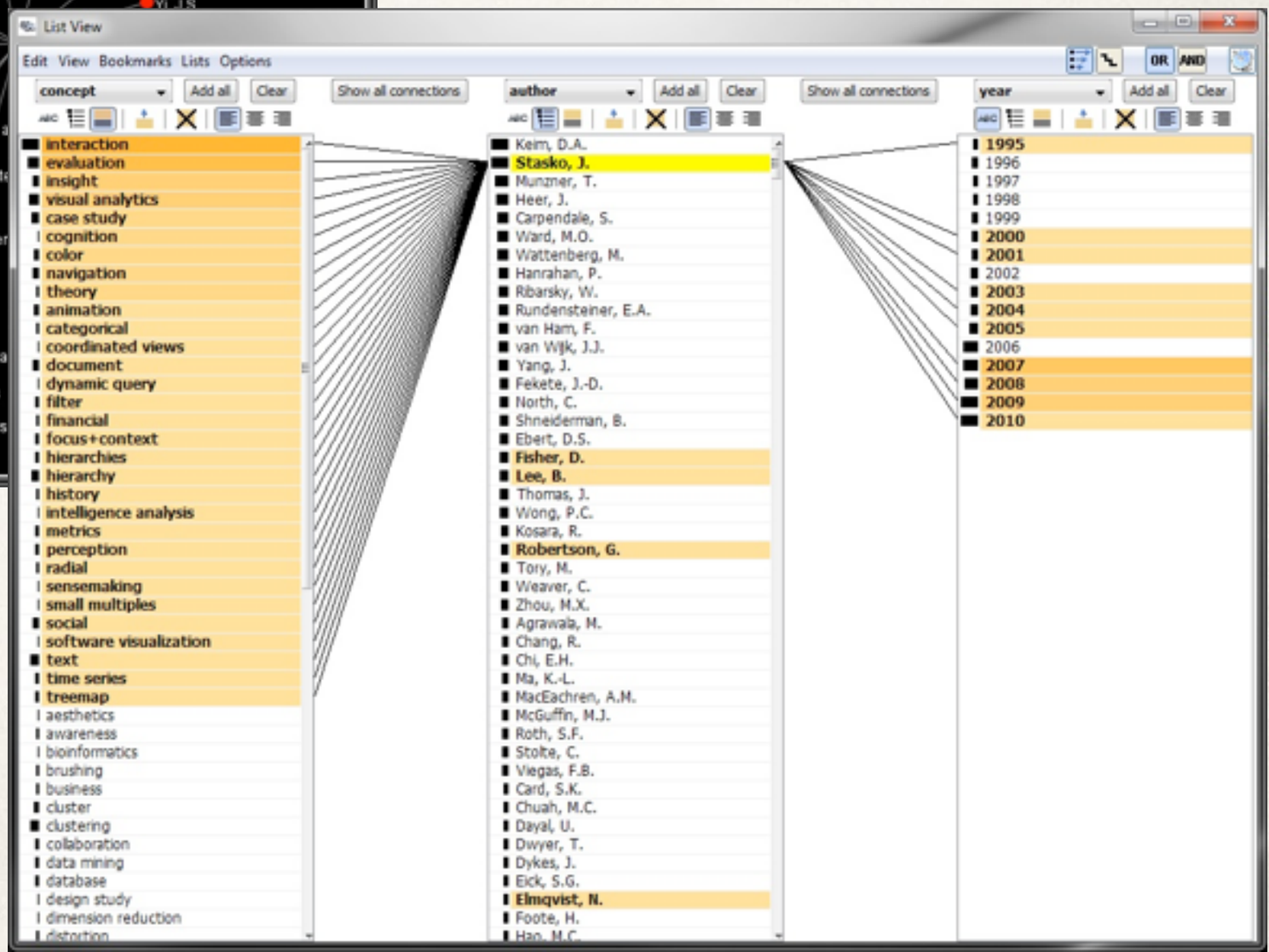
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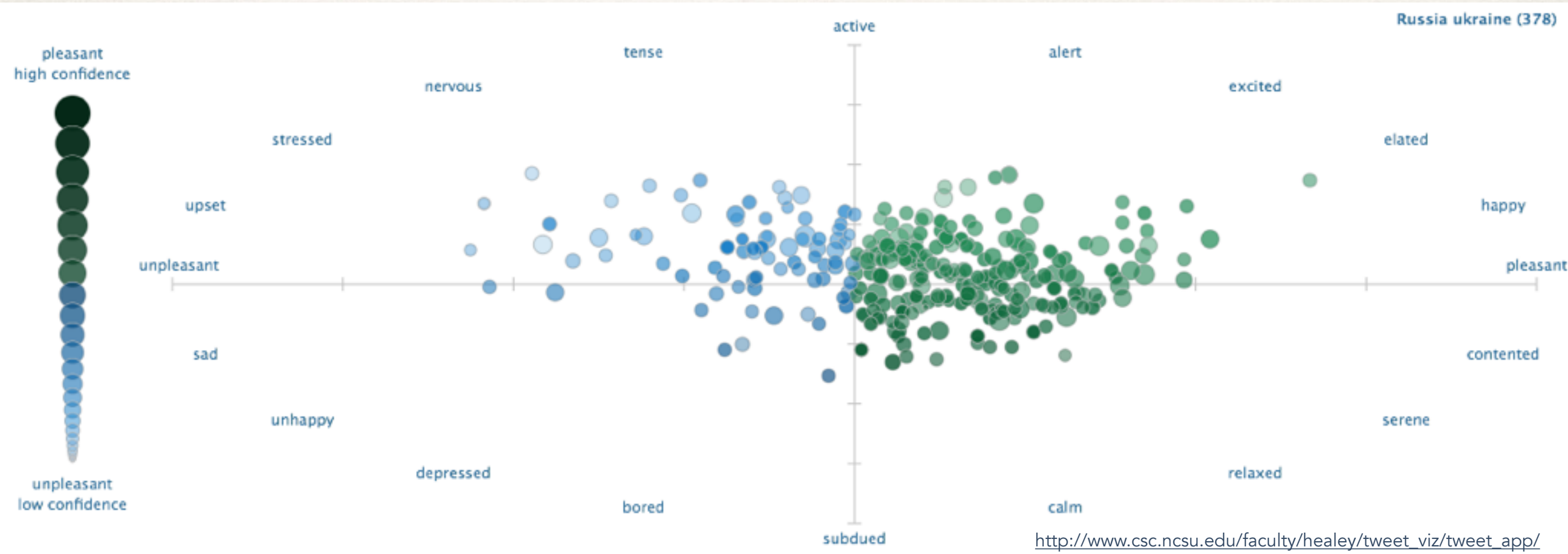
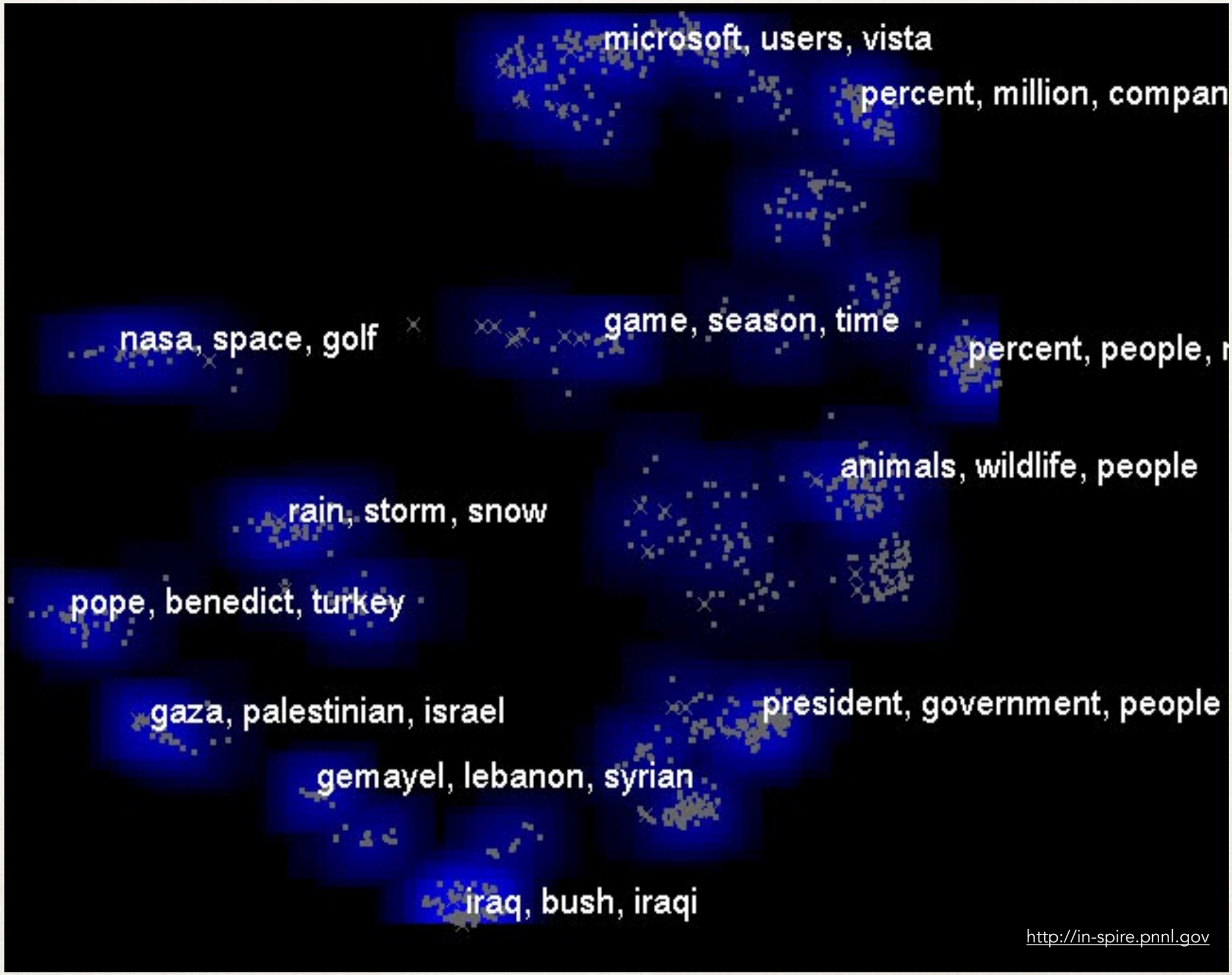
Sentiment analysis



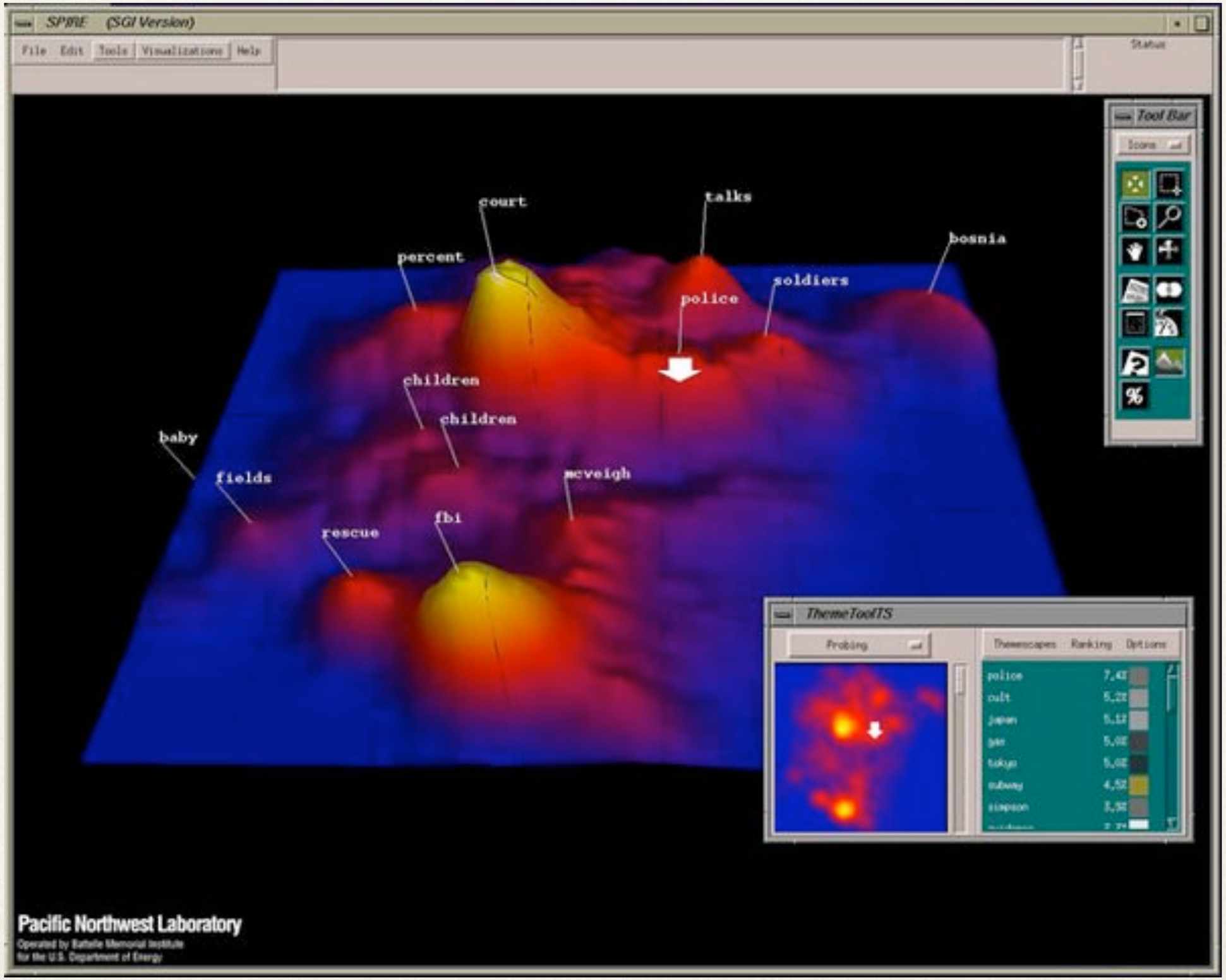
http://www.csc.ncsu.edu/faculty/healey/tweet_viz/tweet_app/

Date	User	v	a	Tweet
04-23-14 21:56	NaijaAviators	5.36	4.79	In an *apparent show* of *force* to #Russia, #U.S. troops have landed in Poland http://t.co/isDqsvkxM6 #Ukraine via @cnni @omojuwa
04-23-14 21:56	SecretNews	5.21	5.42	Sergey Lavrov: 'If Russian Troops Or *People Attacked*, We'll Retaliate': http://t.co/P2k4FCc9Nj #breakingnews,#*breaking*,#*politics*,#military
04-23-14 21:56	VNBreakingNews	5.19	5.64	Russia says it will *respond* if Ukraine *interests attacked* at http://t.co/F75YVJhklc
04-23-14 21:56	jackdrsm	5.92	3.96	RT @GregRaths: Is Ukraine the *starting point* of the next Exodus? http://t.co/KILQlcDAJp #Ukraine #Russia #america #americanidol
04-23-14 21:58	YokelChang	6.34	4.61	#YokelChang Vladimir Putin's *shopping list*: Which country could be next?: *Plenty* of Russia's neighbors are wor... http://t.co/WjPg2ARDwE
04-23-14 21:58	AndresSuurkuusk	3.88	5.35	#Ukraine Resumes *Bid* to Oust Militants Amid #Russia'n #*Threat* http://t.co/1tyBlKRqU7 via @BloombergNews
04-23-14 21:58	MockCasbah	5.87	4.94	@miodragsoric @AtlanticCouncil @MKasyanov *Well* first we need to *make sure* Ukraine *makes* it that long. Russia is *mighty hungry*.
04-23-14 21:58	SonyaHeaney	5.96	4.76	RT @peterbakernyt: *Fascinating look* at *links* btwn *mysterious* "*green men*" in Ukraine and Russian troops. @AndrewKramerNYT Higgins Gordon htt...
04-23-14 21:59	Spiritof1642	6.15	5.55	Russian *Foreign* Minister Sergey Lavrov *gives* Russia Today interview, in English, re #Ukraine. http://t.co/qSqqbo8nYT
04-23-14 21:59	tanialucyjade	5.89	5.23	RT @EuromaidanPR: #Russia Warns #Ukraine of Potential Military *Response* – *New* York *Times* http://t.co/x4iZ5C1vas @BlogsofWar | EMPR *News*
04-23-14 21:59	GregoryHSmith2	5.39	5.11	"@cnni: In an *apparent show* of *force* to Russia, U.S. troops have landed in Poland: http://t.co/Cb9vVhRxyf" *Growing risk* of violence
04-23-14 21:59	euromaidantwit	5.28	5.57	Hillary Clinton *calls* for more sanctions on Russia& she *believes* the *outcome* in #Ukraine will be a *bad one* for Russia http://t.co/ecNLRwdE4e
04-23-14 21:59	LanellePenaflor	5.04	3.89	Amid Russia *warning*, Ukraine is in a *security bind*
04-23-14 21:59	josephwosk	5.31	6.18	RT @Thoreau_H_D: Russia: Duma(*Congress*) to *recognize* the 'Independence' of Transnistria, bordering on Moldova/Ukraine. #euromaidan http:/ ...

In-Spire: Galaxy view



In-spire: Theme view [classic]



In-Spire: Theme view