

# Measuring the Happiness, Health, and Stories of Populations

IPAM Workshop, Cultural Patterns, May 2016

Peter Sheridan Dodds | @peterdodds

Computational Story Lab | Vermont Complex Systems Center  
Department of Mathematics & Statistics  
Vermont Advanced Computing Core | University of Vermont



Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References



# Outline

## Happiness

- Hedonometer

- Geography

- Literature

## Panometrics

## Various things

## Pollyanna Principle

- English

- 10 languages

## Stories

## More things

## References

## Measuring Happiness

### Happiness

- Hedonometer

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- Literature

### Panometrics

### Various things

### Pollyanna

### Principle

- English

- 10 languages

### Stories

### More things


### References





## Last time at IPAM (2008)—Heretical declarations:



“Optimal Form of Branching Supply and  
Collection Networks” 

Peter Sheridan Dodds,  
Phys. Rev. Lett., **104**, 048702, 2010. <sup>[10]</sup>



## Drawing and talk therapy:

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

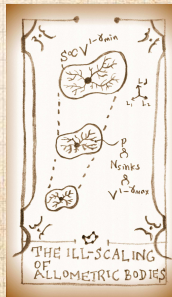
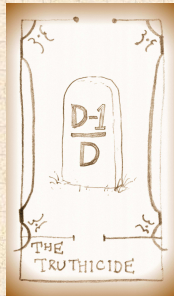
Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Vermont Complex Systems Center—Misfit toys:



Peter Dodds,  
Math/Stats



Josh Bongard,  
CS



Chris  
Danforth,  
Math/Stats



Maggie  
Eppstein, CS



Hugh  
Garavan,  
Neuro/Psychiatry



Yves Dubief,  
ME



Jim Bagrow,  
Math/Stats



Mads  
Almassalkhi,  
EE



Paul Hines, EE



Brian Tivnan,  
MITRE



Sam Scarpino,  
Math/Stats



Puck  
Rombach,  
Math/Stats

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





## Educational mission:

- Graduate Certificate in Complex Systems.
- New: MS in Complex Systems and Data Science.



## Educational mission:

- Graduate Certificate in Complex Systems.
- New: MS in Complex Systems and Data Science.
- Next: PhD in The Study of Interesting Things.





Peter Dodds



Andy Reagan



Nick Allgaier



Eitan Pechenick



Mark Ibrahim



Chris Danforth



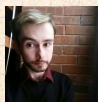
Tyler Gray



Emily Cody



Chris Fusting



Ryan Gallagher



Aaron Schwartz



Dilan Kiley



Tom McAndrew



Eric Clark



Cathy Bliss, UVM Lecturer



Morgan Frank  
MIT PhD Student



compstorylab.org



Lewis Mitchell  
Adelaide Faculty



Jake Williams  
Drexel Faculty



Isabel Kloumann  
Facebook  
Data Scientist



Ross Lieb-Lappen  
Dartmouth  
PhD Student



Sharon Alajajian  
Research Scientist  
Univ of Pennsylvania



Kameron Harris  
Washington  
PhD Student



Paul Lessard  
Colorado  
PhD Student



Suma Desu  
Apple  
Data Scientist



Mike Foley  
Northeastern  
PhD Student

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

+ Brian Tivnan's MITRE team;

Funding: NSF, NASA, MITRE; [YOUR WONDERFUL FUNDING  
AGENCY HERE]



Adjacent: Strava Story Lab team











# Courses:







 CSYS/MATH 300: Principles of Complex Systems (@pocsvox )



 CSYS/MATH 303: Complex Networks (@networksvox )

 MATH 124/122: Matrixology (Linear Algebra) (@matrixologyvox and @svdthematrices )

 MATH 237: Numerical Analysis (@MachEps237 )

 MATH 266: Chaos, fractals & dynamical systems (@NonperiodicFlow )

 MATH 330: Ordinary Differential Equations (@dallthethingsdt )

 Research incubators and have helped generate many papers  (35+)

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

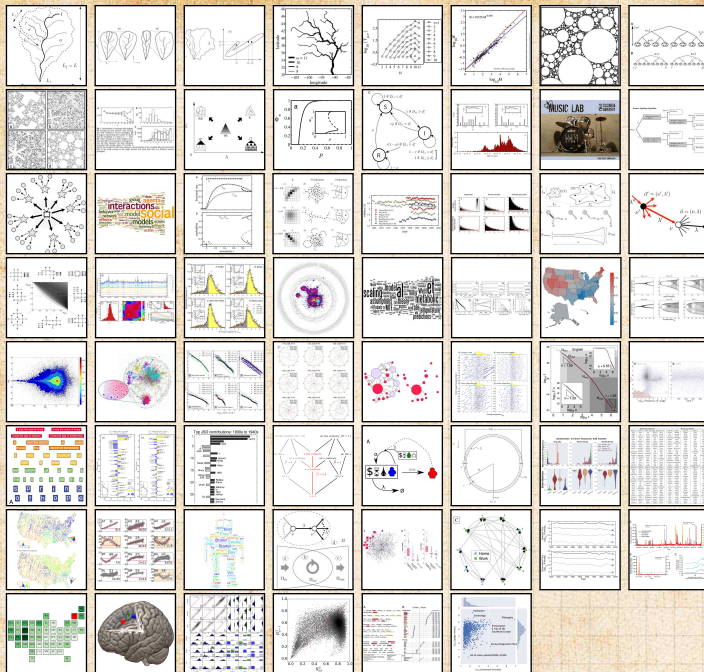
English  
10 languages

Stories

More things

References





Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Economics, Schmeconomics

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

Alan Greenspan (September 18, 2007):



<http://wikipedia.org>





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

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"I've been dealing with these big mathematical models of forecasting the economy ...



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

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I don't need any of this other stuff.



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If I could figure out a way to determine whether or not people are more fearful or changing to more euphoric,

I don't need any of this other stuff.

I could forecast the economy better than any way I know."



<http://wikipedia.org>



# Economics, Schmeconomics

Greenspan continues:

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



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Greenspan continues:

"The trouble is that we can't figure that out. I've been in the forecasting business for 50 years.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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## Greenspan continues:

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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

## Greenspan continues:



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## Jon Stewart:

"You just bummed the @\*!# out of me."



wildbluffmedia.com

 From [the Daily Show](#)  (September 18, 2007; @5:13)

 The full interview is [here](#) .

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

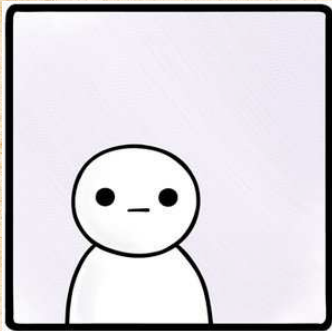
### Pollyanna Principle

English  
10 languages

### Stories

### More things

### References



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## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

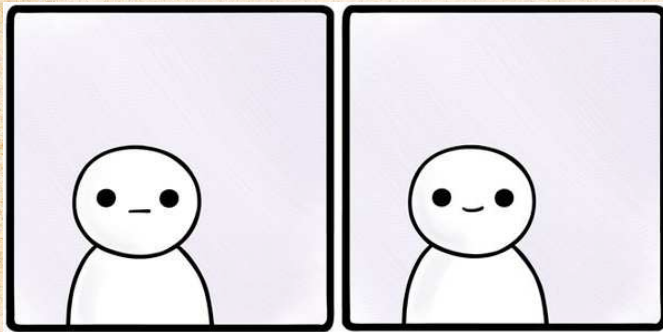
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English  
10 languages

### Stories

### More things

### References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

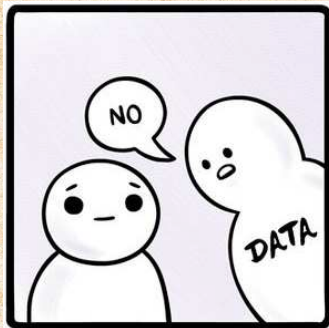
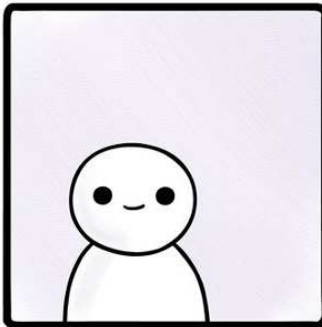
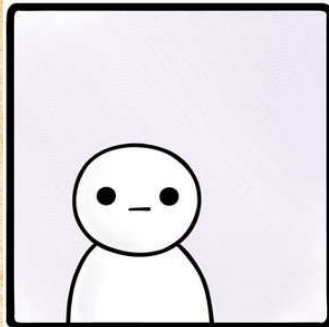
Pollyanna  
Principle

English  
10 languages

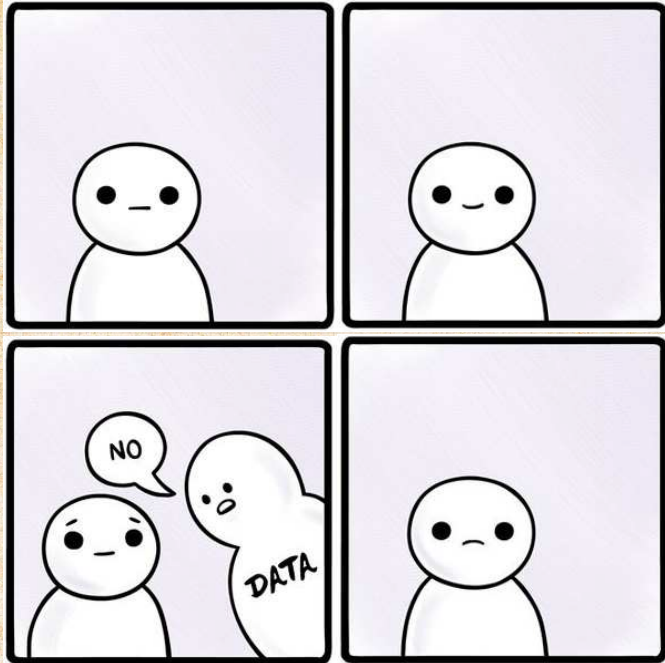
Stories

More things

References







Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories


More things

References



## Three kinds of lexical meters:

### 1. Principled lexical meters.

 The Hedonometer.

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories



More things

References



## Three kinds of lexical meters:

### 1. Principled lexical meters.

-  The Hedonometer.
-  The Lexicocalorimeter.



## Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories



More things

References





## Three kinds of lexical meters:

### 1. Principled lexical meters.

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### 2. Ground truth lexical meters.

-  Insomniometer.
-  Hangoverometer.





## Three kinds of lexical meters:



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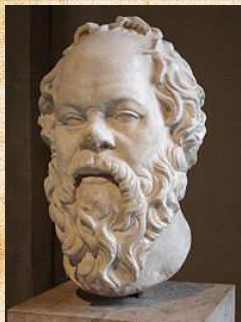
-  Insomniometer.
-  Hangoverometer.

### 3. Bootstrap lexical meters.

-  Boredometer.
-  Hashtagometers.

# Measuring Happiness:

Measuring  
Happiness



Socrates et al.:  
eudaimonia<sup>[17]</sup>



Bentham:  
hedonistic  
calculus



Jefferson:  
...the pursuit of  
happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





## Early drafts:

that among these are:

Life, ✓

Liberty, ✓ and ?? ~~Money?~~

~~Libations~~

~~Alcohol~~

~~Property~~

~~Foot-the-ball~~

~~Beer~~

Happiness  
✓✓

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

## Stories

## More things

## References



# Desiring happiness—not just for boffins:

Average people routinely report being happy is what they want most in life <sup>[20, 21, 9]</sup>

And it matters: “Happy people live longer:...”  
Survey by Diener and Chan. <sup>[9]</sup>

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



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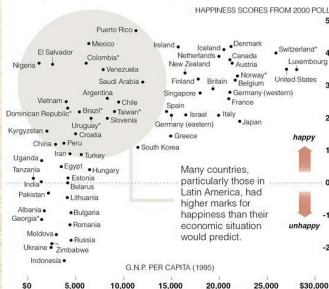


And it matters: “Happy people live longer:...”  
Survey by Diener and Chan. <sup>[9]</sup>

## A Plateau of Happiness

A country's wealth may not always dictate the happiness of its people.

As part of the World Values Survey project, inhabitants of different countries and territories were asked how happy or satisfied they were. Below is a sampling of happiness rankings, along with economic status.



\*Poll results for these countries were from 1995.

Source: Ronald Inglehart, "Human Beliefs and Values: A Cross-Cultural Sourcebook Based on the 1989-2002 Values Surveys"

## National indices of well-being:



Bhutan



UK



France



Australia

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

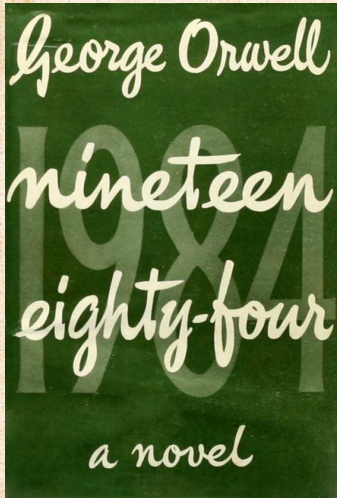
More things

References

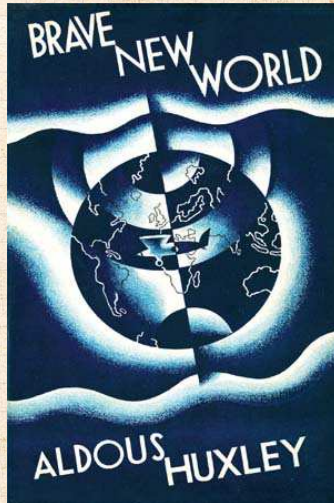




# Some easy knocks:



Science



Policy

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Some easy knocks:

Colbert: "Happiness is totally overrated ..."



Full interview with Jennifer Senior [here](#) (2014/02/03)

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Some easy knocks:

Colbert: "Happiness is totally overrated ..."

"Happiness is for the weak."



Full interview with Jennifer Senior [here](#) (2014/02/03)

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# 30 Rock, S7E8:

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



# Outline

## Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna Principle

English

10 languages

Stories

More things

References

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References



We'd like to build an 'hedonometer':



An instrument to 'remotely-sense' emotional states and levels, in real time or post hoc.

Ideally:



Transparent



Fast



Based on written expression



Uses human evaluation



Non-reactive



Complementary to self-reported measures



Improvable

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

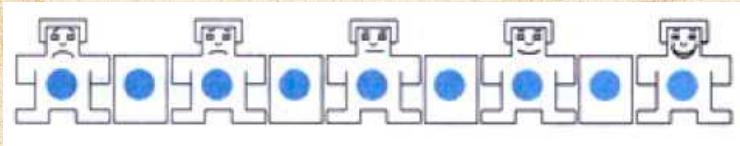
References





# 1999 ANEW study—three 1–9 scales: [3]

valence:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

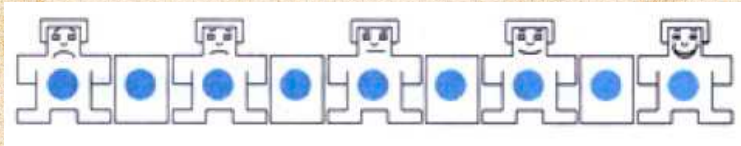
More things

References

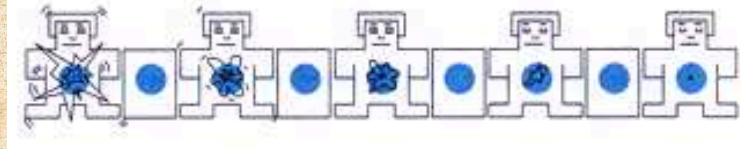


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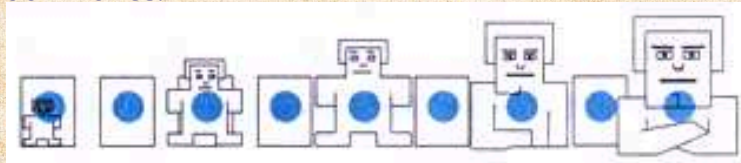
valence:



arousal:



dominance:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Measuring the happiness of a text:



Lyrics for  
Michael Jackson's Billie Jean

"She was more like a beauty queen  
from a movie scene.

⋮

And mother always told me,  
be careful who you love.  
And be careful of what you do  
'cause the lie becomes the truth.

Billie Jean is not my lover,  
She's just a girl who claims  
that I am the one.

⋮

ANEW  
words

k=1. love  
2. mother  
3. baby  
4. beauty  
5. truth  
6. people  
7. strong  
8. young  
9. girl  
10. movie  
11. perfume  
12. queen  
13. name  
14. lie

$v_k$

8.72  
8.39  
8.22  
7.82  
7.80  
7.33  
7.11  
6.89  
6.87  
6.86  
6.76  
6.44  
5.55  
2.79

$f_k$

1  
1  
3  
1  
1  
2  
1  
2  
4  
1  
1  
1  
1  
1

$$v_{\text{text}} = \frac{\sum_k v_k f_k}{\sum_k f_k}$$



$$\Rightarrow v_{\text{Billie Jean}} = 7.1$$

$$v_{\text{Thriller}} = 6.3$$

$$v_{\text{Michael Jackson}} = 6.4$$



Temperature-like measure—large numbers only.



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ANEW  
words

$k$	$v_k$	$f_k$
1. love	8.72	1
2. mother	8.39	1
3. baby	8.22	3
4. beauty	7.82	1
5. truth	7.80	1
6. people	7.33	2
7. strong	7.11	1
8. young	6.89	2
9. girl	6.87	4
10. movie	6.86	1
11. perfume	6.76	1
12. queen	6.44	1
13. name	5.55	1
14. lie	2.79	1

$$v_{\text{text}} = \frac{\sum_k v_k f_k}{\sum_k f_k}$$



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Not meant to be used at level of sentence,  
paragraph, song, tweet, ...

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k=1.	love
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3.	baby
4.	beauty
5.	truth
6.	people
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8.	young
9.	girl
10.	movie
11.	perfume
12.	queen
13.	name
14.	lie

$v_k$      $f_k$

8.72	1
8.39	1
8.22	3
7.82	1
7.80	1
7.33	2
7.11	1
6.89	2
6.87	4
6.86	1
6.76	1
6.44	1
5.55	1
2.79	1

$$v_{\text{text}} = \frac{\sum_k v_k f_k}{\sum_k f_k}$$



➡  $v_{\text{Billie Jean}} = 7.1$

-----  
 $v_{\text{Thriller}} = 6.3$

$v_{\text{Michael Jackson}} = 6.4$

🧱 Temperature-like measure—large numbers only.

🧱 Not meant to be used at level of sentence, paragraph, song, tweet, ...

🧱 Later: see instrument is tunable.





# Song Lyrics—average happiness

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

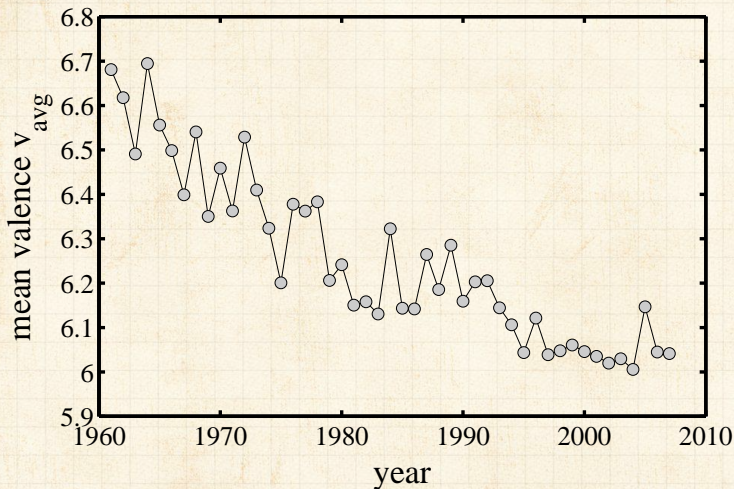
Pollyanna  
Principle

English  
10 languages

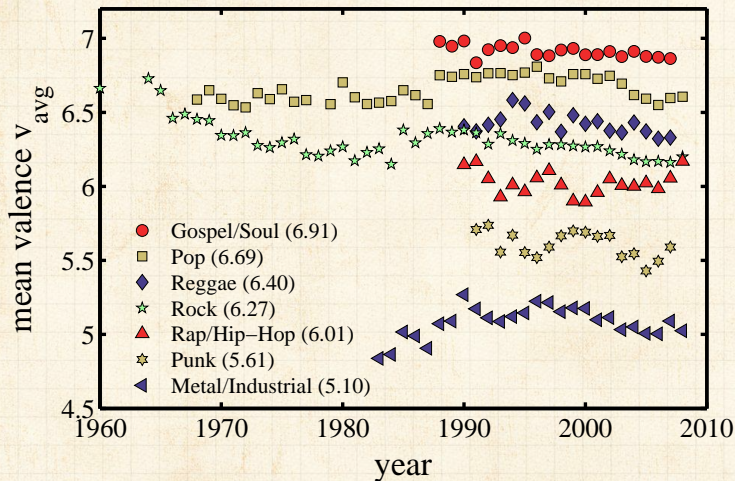
Stories

More things

References



# Song Lyrics—average happiness of genres:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

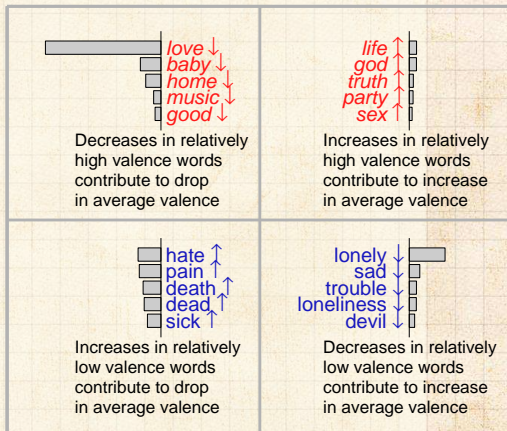


# Happiness Word Shift Graph:

Per word drop in valence of lyrics from 1980–2007 relative to valence of lyrics from 1960



Key:





# Top 16 of $\approx 20,000$ artists:

Measuring  
Happiness

Rank	Artist	Valence
1	All-4-One	7.15
2	Luther Vandross	7.12
3	S Club 7	7.05
4	K Ci & JoJo	7.04
5	Perry Como	7.04
6	Diana Ross & The Supremes	7.03
7	Buddy Holly	7.02
8	Faith Evans	7.01
9	The Beach Boys	7.01
10	Jon B	6.98
11	Dru Hill	6.96
12	Earth Wind & Fire	6.95
13	Ashanti	6.95
14	Otis Redding	6.93
15	Faith Hill	6.93
16	NSync	6.93

(criteria:  $\geq 50$  songs and  $\geq 1000$  ANEW words)

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References



# Bottom 16 of $\approx 20,000$ artists:

Rank	Artist	Valence
1	Slayer	4.80
2	Misfits	4.88
3	Staind	4.93
4	Slipknot	4.98
5	Darkthrone	4.98
6	Death	5.02
7	Black Label Society	5.05
8	Pig	5.08
9	Voivod	5.14
10	Fear Factory	5.15
11	Iced Earth	5.16
12	Simple Plan	5.16
13	Machine Head	5.17
14	Metallica	5.19
15	Dimmu Borgir	5.20
16	Mudvayne	5.21

(criteria:  $\geq 50$  songs and  $\geq 1000$  ANEW words)

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References



## Lexicon Valley, Episode #62, June 17, 2015



Mike Vuolo and Bob Garfield.



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

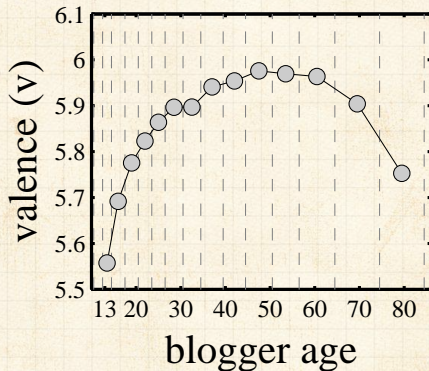
More things

References



Language has a Positivity Bias. How did we measure that?





Average happiness as a function of the age bloggers report they will turn in the year of their posting.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

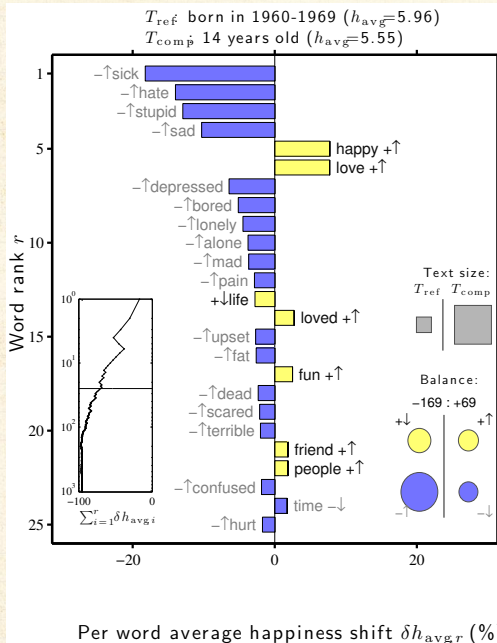
English  
10 languages

Stories

More things

References





# labMT 1.0: language assessment by Mechanical Turk

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things





Pollyanna  
Principle  
English  
10 languages

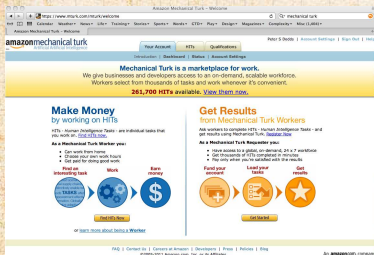
Stories



More things

References

## Four corpora:

-  Twitter
-  Google Books
-  Music Lyrics
-  New York Times



-  5000 most frequently used words for each corpus.
-  10,222 words, 50 evaluations each, 1–9 scale: <sup>[22]</sup>





valence rank	word	valence	std dev	twitter rank	g-books rank	nyt rank	lyrics rank
1	laughter	8.50	0.93	3600	-	-	1728
2	happiness	8.44	0.97	1853	2458	-	1230
3	love	8.42	1.11	25	317	328	23
4	happy	8.30	0.99	65	1372	1313	375
5	laughed	8.26	1.16	3334	3542	-	2332
6	laugh	8.22	1.37	1002	3998	4488	647
7	laughing	8.20	1.11	1579	-	-	1122
8	excellent	8.18	1.10	1496	1756	3155	-
9	laughs	8.18	1.16	3554	-	-	2856
10	joy	8.16	1.06	988	2336	2723	809
11	successful	8.16	1.08	2176	1198	1565	-
12	win	8.12	1.08	154	3031	776	694
13	rainbow	8.10	0.99	2726	-	-	1723
14	smile	8.10	1.02	925	2666	2898	349
15	won	8.10	1.22	810	1167	439	1493
16	pleasure	8.08	0.97	1497	1526	4253	1398
17	smiled	8.08	1.07	-	3537	-	2248
18	rainbows	8.06	1.36	-	-	-	4216
19	winning	8.04	1.05	1876	-	1426	3646
20	celebration	8.02	1.53	3306	-	2762	4070
21	enjoyed	8.02	1.53	1530	2908	3502	-
22	healthy	8.02	1.06	1393	3200	3292	4619
23	music	8.02	1.12	132	875	167	374
24	celebrating	8.00	1.14	2550	-	-	-
25	congratulations	8.00	1.63	2246	-	-	-
26	weekend	8.00	1.29	317	-	833	2256
27	celebrate	7.98	1.15	1606	-	3574	2108
28	comedy	7.98	1.15	1444	-	2566	-
29	jokes	7.98	0.98	2812	-	-	3808
30	rich	7.98	1.32	1625	1221	1469	890
:	:	:	:	:	:	:	:

## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

### Pollyanna Principle

English  
10 languages

### Stories

### More things

### References



valence rank	word	valence	std dev	twitter rank	g-books rank	nyt rank	lyrics rank
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
10193	violence	1.86	1.05	4299	1724	1238	2016
10194	cruel	1.84	1.15	2963	-	-	1447
10195	cry	1.84	1.28	1028	3075	-	226
10196	failed	1.84	1.00	2645	1618	1276	2920
10197	sickness	1.84	1.18	4735	-	-	3782
10198	abused	1.83	1.31	-	-	-	4589
10199	tortured	1.82	1.42	-	-	-	4693
10200	fatal	1.80	1.53	-	4089	-	3724
10201	killings	1.80	1.54	-	-	4914	-
10202	murdered	1.80	1.63	-	-	-	4796
10203	war	1.80	1.41	468	175	291	462
10204	kills	1.78	1.23	2459	-	-	2857
10205	jail	1.76	1.02	1642	-	2573	1619
10206	terror	1.76	1.00	4625	4117	4048	2370
10207	die	1.74	1.19	418	730	2605	143
10208	killing	1.70	1.36	1507	4428	1672	998
10209	arrested	1.64	1.01	2435	4474	1435	-
10210	deaths	1.64	1.14	-	-	2974	-
10211	raped	1.64	1.43	-	-	-	4528
10212	torture	1.58	1.05	3175	-	-	3126
10213	died	1.56	1.20	1223	866	208	826
10214	kill	1.56	1.05	798	2727	2572	430
10215	killed	1.56	1.23	1137	1603	814	1273
10216	cancer	1.54	1.07	946	1884	796	3802
10217	death	1.54	1.28	509	307	373	433
10218	murder	1.48	1.01	2762	3110	1541	1059
10219	terrorism	1.48	0.91	-	-	3192	-
10220	rape	1.44	0.79	3133	-	4115	2977
10221	suicide	1.30	0.84	2124	4707	3319	2107
10222	terrorist	1.30	0.91	3576	-	3026	-

## Measuring Happiness

### Happiness

#### Hedonometer

Geography

Literature

### Panometrics

### Various things

### Pollyanna

#### Principle

English

10 languages

### Stories

### More things

### References



# Measuring Happiness

std dev rank	word	valence	std dev	twitter rank	g-books rank	nyt rank	lyrics rank
1	ff@king	4.64	2.93	448	-	-	620
2	f★kin	3.86	2.74	1077	-	-	688
3	f★ked	3.56	2.71	1840	-	-	904
4	pussy	4.80	2.66	2019	-	-	949
5	whiskey	5.72	2.64	-	-	-	2208
6	slut	3.57	2.63	-	-	-	4071
7	cigarettes	3.31	2.60	-	-	-	3279
8	f★k	4.14	2.58	322	-	-	185
9	mortality	4.38	2.55	-	3960	-	-
10	cigarette	3.09	2.52	-	-	-	2678
11	motherf★kers	2.51	2.47	-	-	-	1466
12	churches	5.70	2.46	-	2281	-	-
13	motherf★king	2.64	2.46	-	-	-	2910
14	capitalism	5.16	2.45	-	4648	-	-
15	porn	4.18	2.43	1801	-	-	-
16	summer	6.40	2.39	896	1226	721	590
17	beer	5.92	2.39	839	4924	3960	1413
18	execution	3.10	2.39	-	2975	-	-
19	wines	6.28	2.37	-	-	3316	-
20	zombies	4.00	2.37	4708	-	-	-
21	aids	4.28	2.35	2983	3996	1197	-
22	capitalist	4.84	2.34	-	4694	-	-
23	revenge	3.71	2.34	-	-	-	2766
24	mcdonalds	5.98	2.33	3831	-	-	-
25	beatles	6.44	2.33	3797	-	-	-
26	islam	4.68	2.33	-	4514	-	-
27	pay	5.30	2.32	627	769	460	499
28	alcohol	5.20	2.32	2787	2617	3752	3600
29	muthaf★kin	3.00	2.31	-	-	-	4107
30	christ	6.16	2.31	2509	909	4238	1526
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

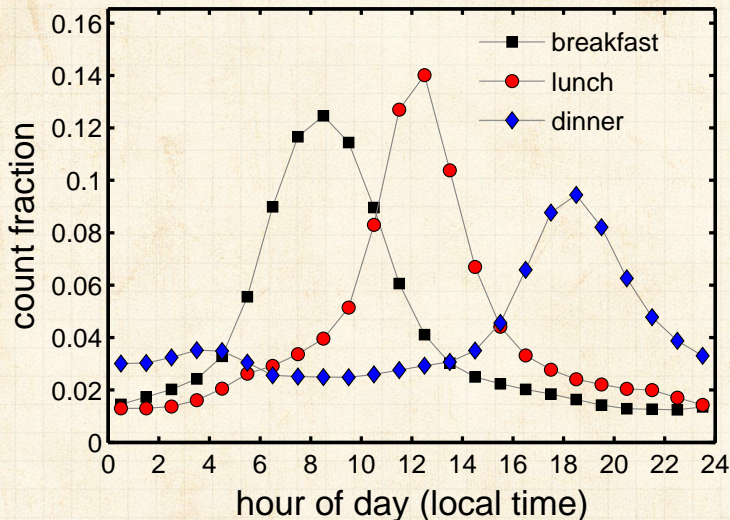
References





# Twitter—living in the now:

Measuring  
Happiness



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

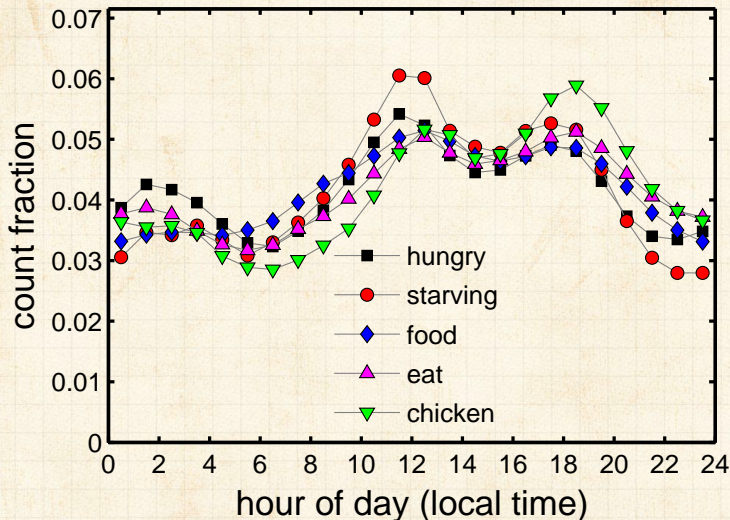


Quantifying the quotidian.



# Twitter—living in the now:

Measuring  
Happiness



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

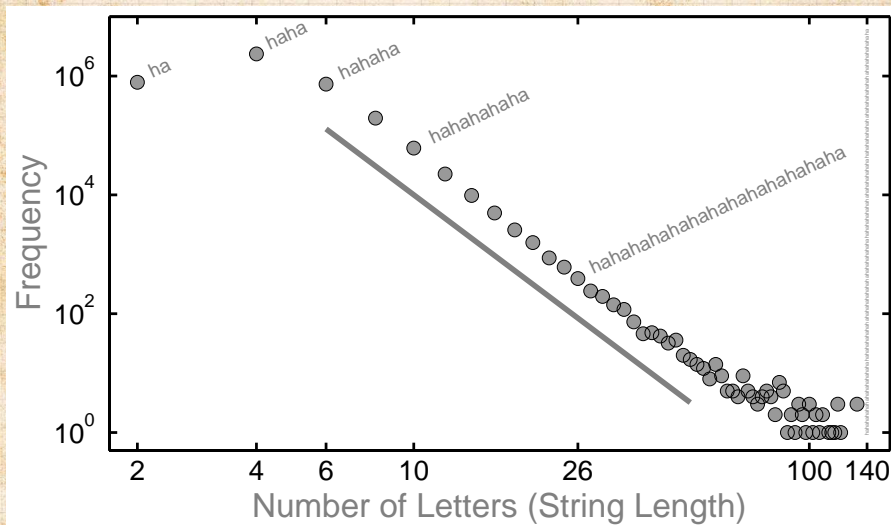
More things

References



Makes the unexpected believable...

# The happiest distribution:

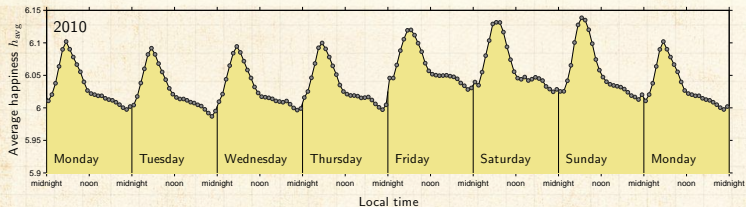


Work by Tyler Gray, Northeast Kingdom → MIT → UVM



# The daily unravelling of the human mind:

Measuring  
Happiness



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

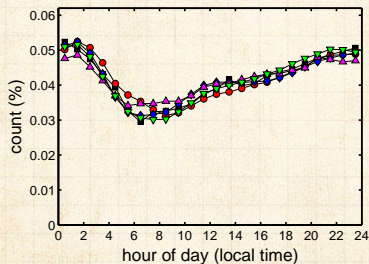
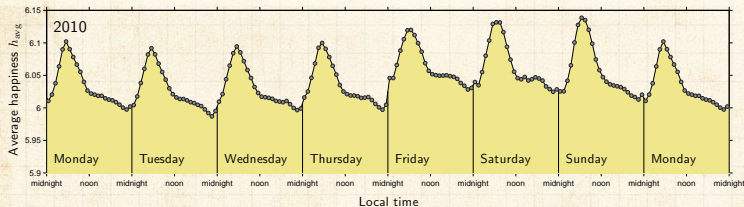
More things

References



# The daily unravelling of the human mind:

Measuring  
Happiness



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Measuring Happiness

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

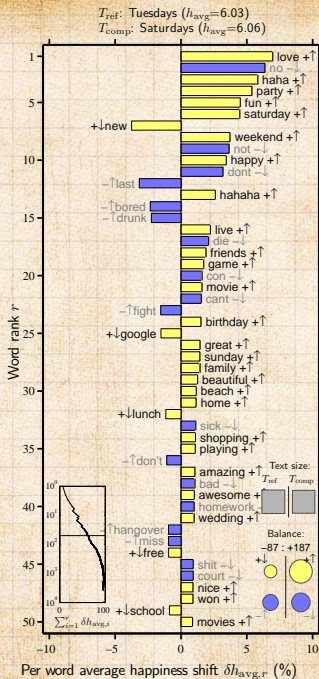
## Pollyanna Principle

English  
10 languages

## Stories


## More things

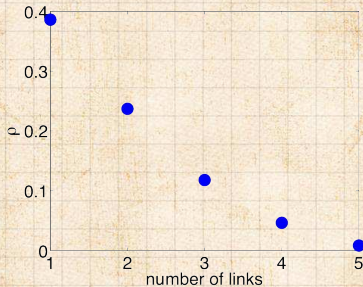
## References







"Twitter reciprocal reply networks exhibit assortativity with respect to happiness"   
Bliss, Kloumann, Harris, Danforth, and Dodds.  
Journal of Computational Science, **3**, 388–397,  
2012. [2]



Decay in happiness correlation in social network.



Not a test of contagion ...

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

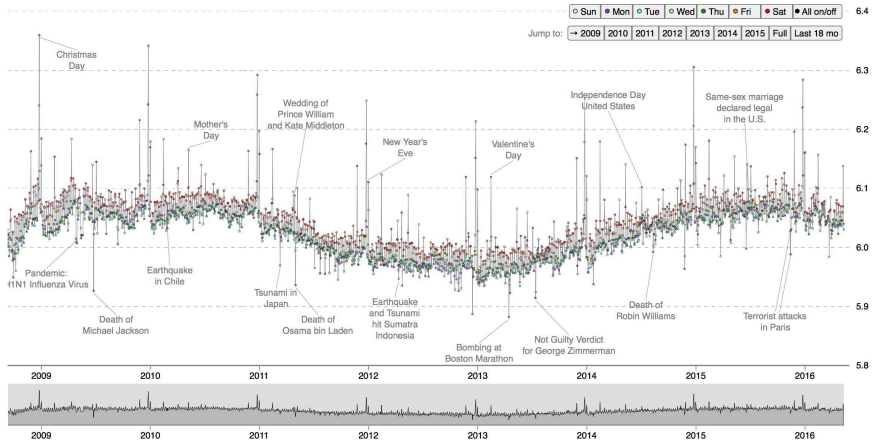
More things

References





## Average Happiness for Twitter

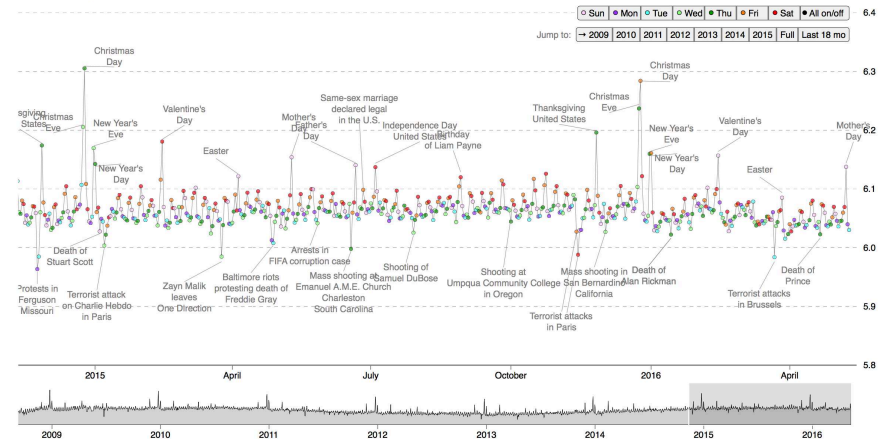


Machine: [@andyreagan](#)

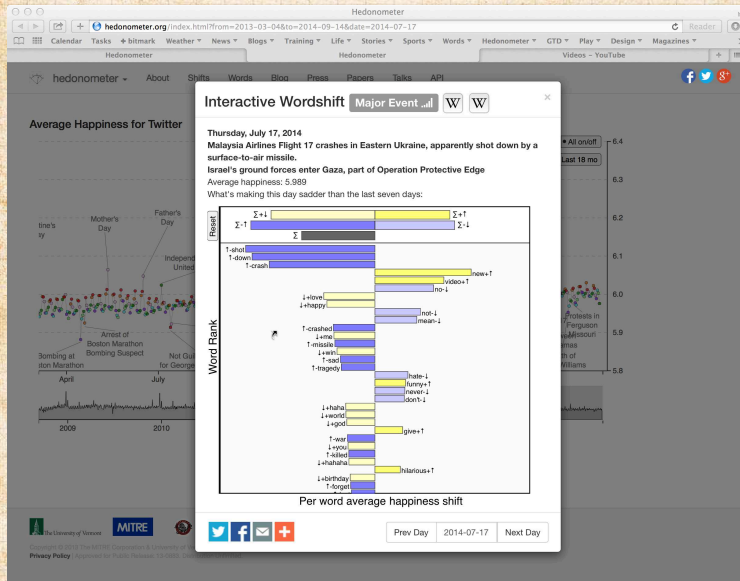


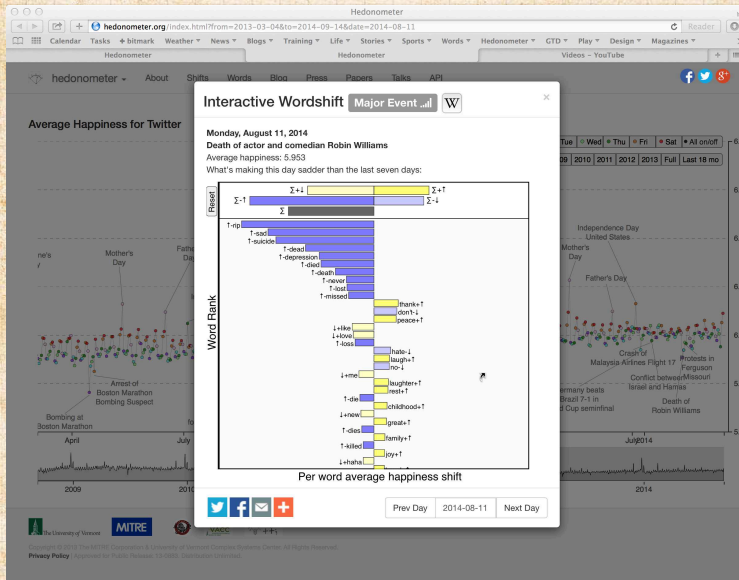
Planned happiness versus tragedies.

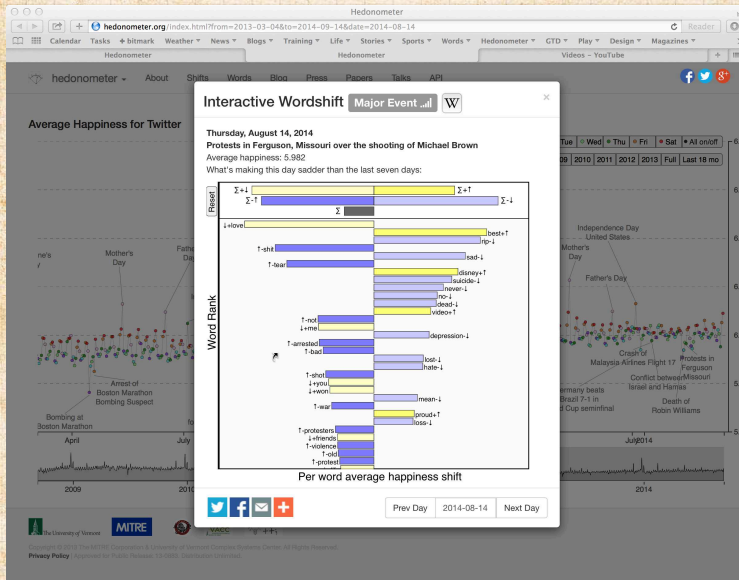
## Average Happiness for Twitter



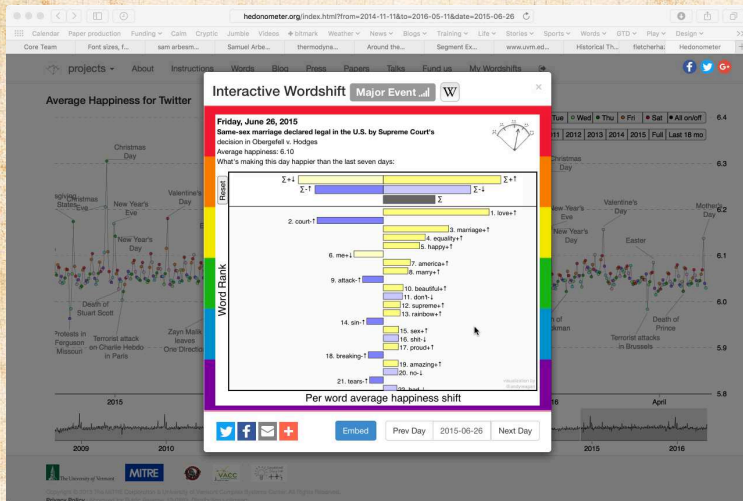


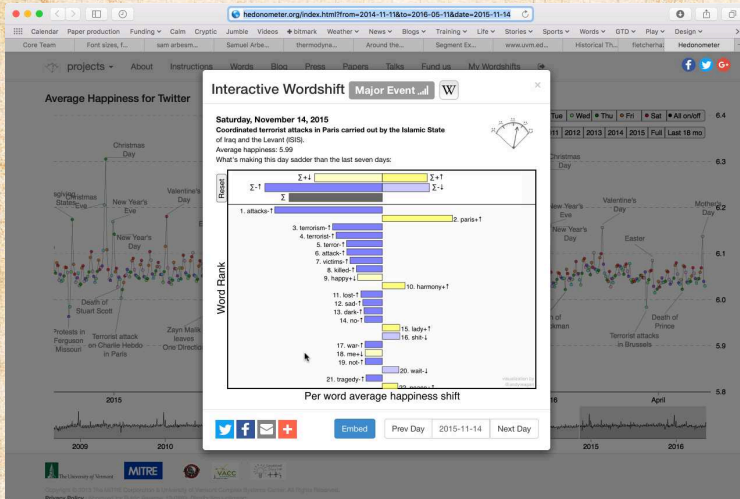




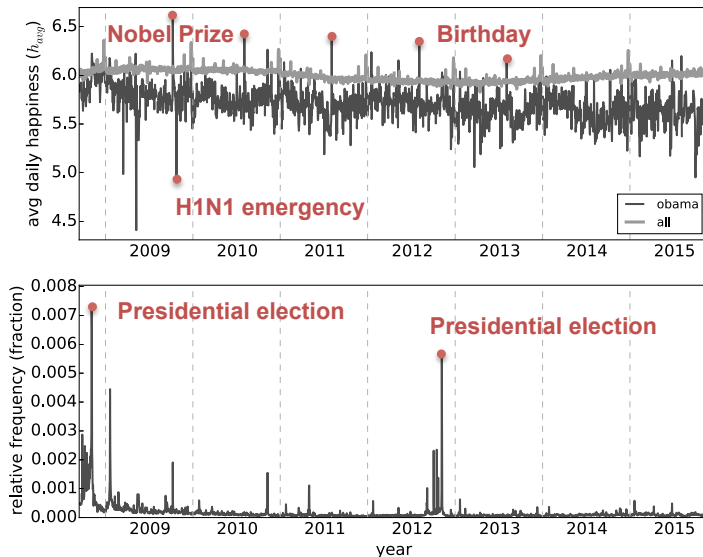








# Ambient happiness for "Obama":



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

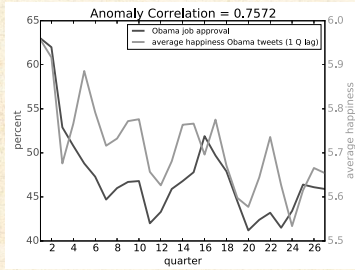
More things

References

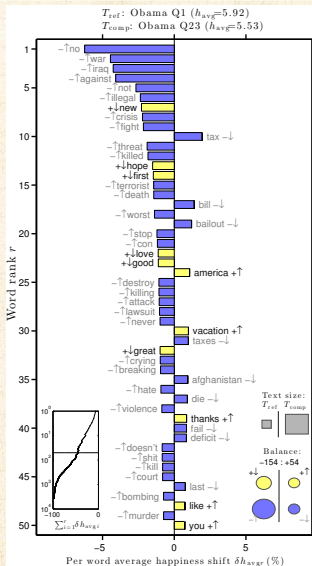




## Measuring Happiness



Cody et al., in preparation



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

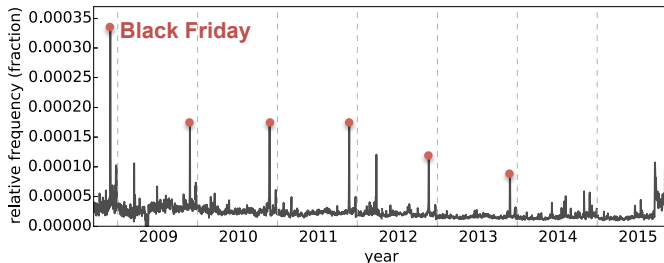
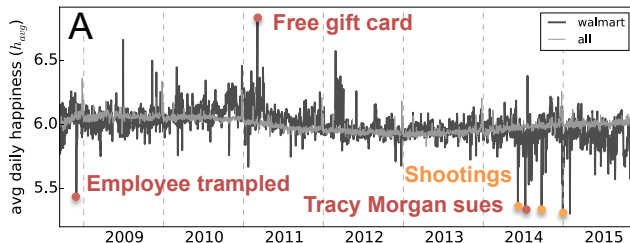
## Stories

## More things

## References



# Ambient happiness for "Walmart":



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

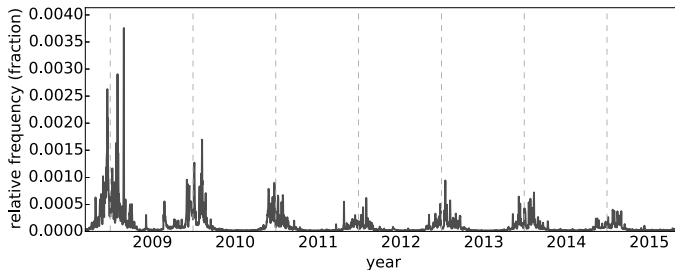
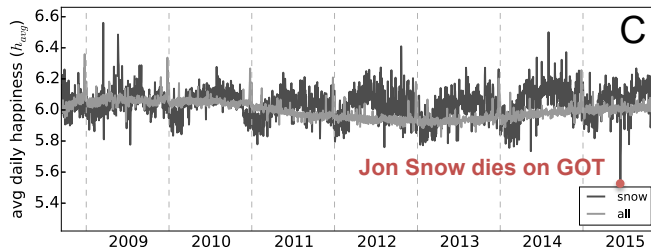
Stories

More things

References



# Ambient happiness for “snow”:



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



Word	$h_{avg}^{(amb)}$	Total Tweets	$h_{avg}^{(norm)}$	Word	$h_{avg}^{(amb)}$	Total Tweets	$h_{avg}^{(norm)}$
1. happy	+0.430	1.65e+07 (13)	+1.104 (1)	51. snow	-0.051	2.60e+06 (49)	+0.083 (39)
2. Christmas	+0.404	4.89e+06 (35)	+0.953 (3)	52. Jon Stewart	-0.052	5.21e+04 (97)	-0.024 (48)
3. vegan	+0.315	1.84e+05 (90)	-0.015 (46)	53. school	-0.056	9.26e+06 (24)	+0.050 (42)
4. :)	+0.274	1.04e+07 (20)	+0.630 (12)	54. Lehman Brothers	-0.078	8.50e+03 (100)	-0.721 (79)
5. family	+0.251	5.01e+06 (32)	+0.716 (7)	55. them	-0.090	1.54e+07 (15)	-0.280 (60)
6. :-)	+0.228	1.67e+06 (60)	+0.560 (16)	56. right	-0.090	1.92e+07 (10)	+0.126 (35)
7. our	+0.207	1.41e+07 (16)	+0.159 (33)	57. woman	-0.115	2.54e+06 (51)	+0.202 (30)
8. win	+0.204	7.98e+06 (26)	+0.924 (4)	58. left	-0.118	4.89e+06 (34)	-0.383 (63)
9. vacation	+0.200	9.35e+05 (67)	+0.817 (5)	59. me	-0.119	1.44e+08 (4)	+0.160 (32)
10. party	+0.170	6.44e+06 (29)	+0.679 (9)	60. election	-0.127	5.60e+05 (75)	-0.306 (61)
11. love	+0.164	4.67e+07 (6)	+0.977 (2)	61. Sarah Palin	-0.128	2.26e+05 (87)	-0.681 (76)
12. friends	+0.155	7.67e+06 (27)	+0.685 (8)	62. no	-0.132	9.51e+07 (5)	-1.415 (90)
13. hope	+0.149	1.18e+07 (18)	+0.515 (19)	63. rain	-0.134	3.23e+06 (41)	+0.050 (44)
14. coffee	+0.147	2.80e+06 (46)	+0.518 (18)	64. climate	-0.135	3.64e+05 (80)	-0.160 (51)
15. cash	+0.146	1.28e+06 (63)	+0.601 (14)	65. gay	-0.152	2.73e+06 (47)	-0.552 (72)
16. sun	+0.144	2.39e+06 (52)	+0.737 (6)	66. lose	-0.157	2.06e+06 (55)	-1.181 (86)
17. income	+0.137	5.10e+05 (76)	+0.621 (13)	67. they	-0.159	2.74e+07 (8)	-0.208 (58)
18. summer	+0.135	3.00e+06 (43)	+0.221 (29)	68. oil	-0.162	1.38e+06 (62)	-0.411 (65)
19. church	+0.131	1.81e+06 (58)	-0.016 (47)	69. cold	-0.162	3.67e+06 (36)	-0.546 (71)
20. Valentine	+0.127	2.47e+05 (84)	+0.593 (15)	70. I feel	-0.173	5.17e+06 (31)	-0.129 (50)
21. Stephen Colbert	+0.126	2.38e+04 (99)	+0.001 (45)	71. man	-0.175	1.59e+07 (14)	-0.163 (52)
22. USA	+0.113	2.16e+06 (54)	+0.325 (26)	72. Republican	-0.181	2.30e+05 (86)	-0.539 (70)
23. !	+0.106	3.44e+06 (40)	+0.195 (31)	73. sad	-0.187	3.56e+06 (38)	-1.366 (89)
24. winter	+0.101	1.26e+06 (64)	+0.050 (43)	74. gas	-0.193	1.02e+06 (65)	-0.471 (67)
25. God	+0.099	8.58e+06 (25)	+0.468 (20)	75. economy	-0.203	6.09e+05 (73)	-0.525 (69)
26. :)	+0.095	7.12e+06 (28)	-0.172 (54)	76. Obama	-0.205	2.98e+06 (44)	-0.173 (55)
27. .	+0.094	2.61e+06 (48)	+0.326 (25)	77. Democrat	-0.226	9.32e+04 (93)	-0.384 (64)
28. Jesus	+0.094	2.03e+06 (56)	+0.247 (28)	78. Congress	-0.231	3.92e+05 (79)	-0.580 (74)
29. today	+0.092	2.56e+07 (9)	+0.126 (36)	79. hell	-0.250	6.27e+06 (30)	-1.551 (96)
30. kiss	+0.072	1.70e+06 (59)	+0.632 (11)	80. sick	-0.262	3.58e+06 (37)	-1.630 (97)
31. yes	+0.056	1.16e+07 (19)	+0.321 (27)	81. Muslim	-0.262	2.15e+05 (88)	-0.569 (73)
32. tomorrow	+0.054	1.04e+07 (21)	+0.086 (38)	82. war	-0.270	1.96e+06 (57)	-2.040 (100)
33. you	+0.052	1.73e+08 (3)	+0.111 (37)	83. Pope	-0.277	1.52e+05 (91)	-0.316 (62)
34. heaven	+0.041	7.42e+05 (71)	+0.674 (10)	84. hate	-0.282	9.65e+06 (23)	-1.520 (94)
35. :-)	+0.041	9.39e+05 (66)	+0.395 (23)	85. Glenn Beck	-0.282	1.14e+05 (92)	-0.776 (82)
36. we	+0.035	3.91e+07 (7)	+0.146 (34)	86. Islam	-0.299	1.87e+05 (89)	-0.710 (78)
37. yesterday	+0.033	3.08e+06 (42)	-0.168 (53)	87. George Bush	-0.333	3.23e+04 (98)	-0.747 (80)
38. dark	+0.031	1.58e+06 (61)	-0.766 (81)	88. Goldman Sachs	-0.337	5.27e+04 (96)	-0.984 (84)
39. ?	+0.030	2.32e+06 (53)	-0.503 (68)	89. depressed	-0.339	2.81e+05 (82)	-1.541 (95)
40. RT	+0.028	3.39e+08 (1)	-0.443 (66)	90. Senate	-0.340	4.48e+05 (78)	-0.601 (75)
41. Michael Jackson	+0.018	8.26e+05 (70)	-0.213 (59)	91. BP	-0.355	5.82e+05 (74)	-0.902 (83)
42. night	+0.014	1.71e+07 (12)	+0.074 (40)	92. gun	-0.367	6.81e+05 (72)	-1.476 (93)
43. life	+0.012	1.40e+07 (17)	+0.422 (22)	93. drugs	-0.382	5.10e+05 (77)	-1.452 (91)
44. health	-0.000	2.58e+06 (50)	+0.447 (21)	94. headache	-0.437	8.57e+05 (69)	-1.881 (98)
45. sex	-0.008	3.55e+06 (39)	+0.542 (17)	95. :-(	-0.455	3.40e+05 (81)	-1.174 (85)
46. work	-0.010	1.84e+07 (11)	-0.174 (56)	96. :(	-0.472	2.89e+06 (45)	-1.288 (88)
47. girl	-0.010	1.01e+07 (22)	+0.331 (24)	97. Afghanistan	-0.703	2.74e+05 (83)	-1.458 (92)
48. boy	-0.026	4.93e+06 (33)	+0.062 (41)	98. mosque	-0.709	6.98e+04 (95)	-0.694 (77)
49. I	-0.048	3.08e+08 (2)	-0.062 (49)	99. flu	-0.735	9.01e+05 (68)	-1.912 (99)
50. commute	-0.048	9.01e+04 (94)	-0.206 (57)	100. Iraq	-0.773	2.39e+05 (85)	-1.282 (87)

## Measuring Happiness

### Happiness

#### Hedonometer

#### Geography

#### Literature

### Panometrics

### Various things

### Pollyanna

### Principle

#### English

#### 10 languages

### Stories

### More things

### References





Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle


English  
10 languages

Stories

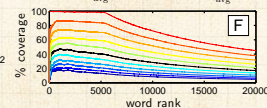
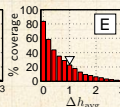
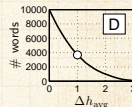
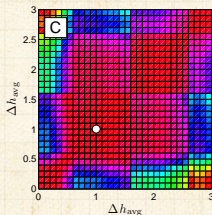
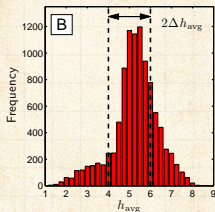
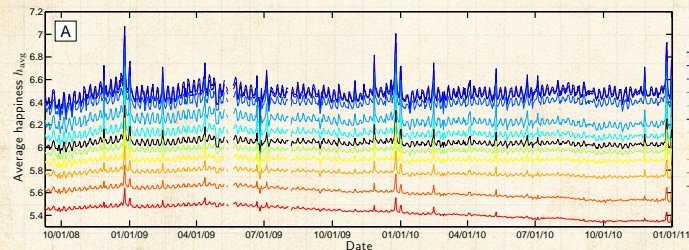
More things

References



 Tweets containing "ISIL" relative to all Arabic tweets over four days at the end of March, 2016.

# The very surprising tunable hedonometer:



Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References

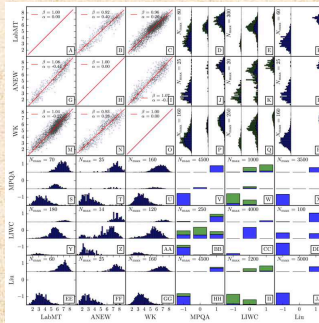




# “Benchmarking sentiment analysis methods for large-scale texts: A case for using continuum-scored words and word shift graphs”

Reagan, Tivnan, Williams, Danforth, and Dodds.

Available online at <https://arxiv.org/abs/1512.00531>, 2016. [26]



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



Upshots: (1) do use wordshifts, and (2) do not use LIWC ...







Quokka Labs

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# Outline

## Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna Principle

English

10 languages

Stories

More things

References

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References



# The Geography of Happiness:

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

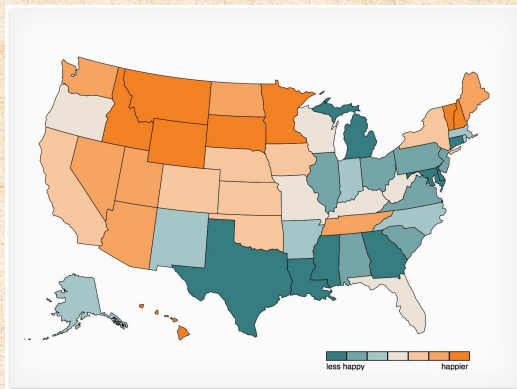
English

10 languages

Stories

More things

References



 Mitchell et al., PLoS ONE, 2013. <sup>[24]</sup>

 It's a paper that tweets: [@geographyofhapp](https://twitter.com/geographyofhapp) 

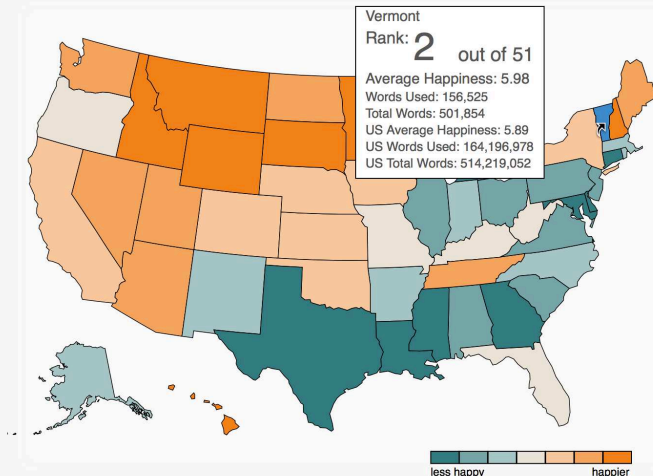
 Online **Appendices** 

 Much interesting and amusing press ...

 Online, interactive US map at [hedonometer.org](http://hedonometer.org) 



Average Happiness of United States for Last 30 Days



Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



# Measuring Happiness

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

## Stories

## More things

## References

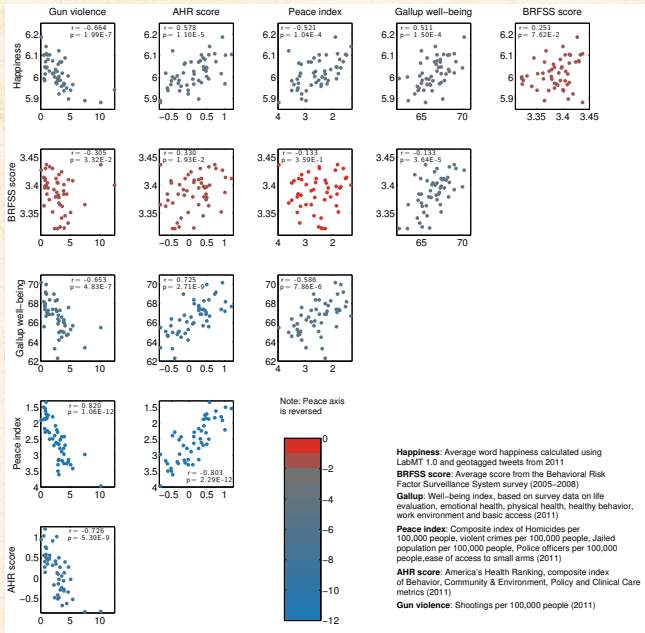
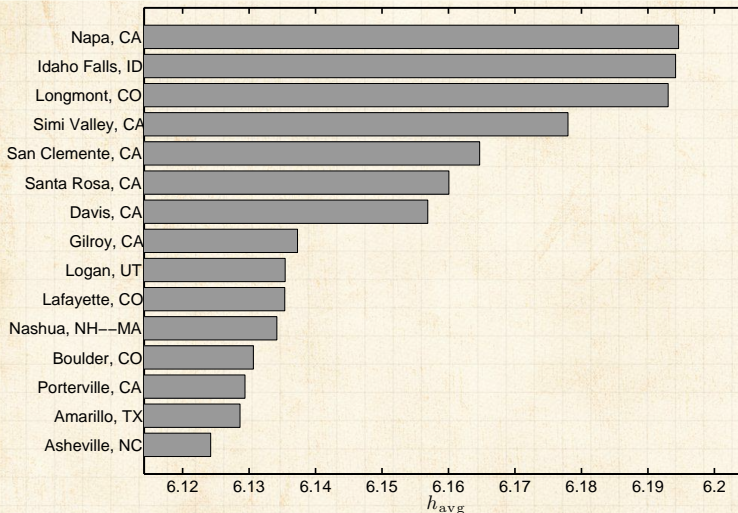


FIG. 2: Scatter plot matrix of correlations between different well-being measures. Points are colored by  $p$ -value, statistically insignificant correlations above  $p = 0.01$  are shown in red. Spearman's  $r$  and  $p$ -value are reported in the inset.



# Happiest Cities:



Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

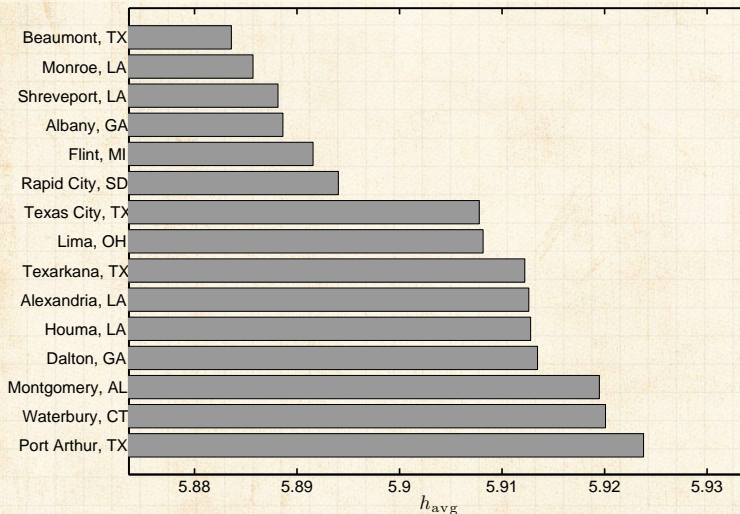
Stories

More things

References



## Saddest Cities (Sorry Beaumont):



Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References



## A reaction:

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Tuesday, February 19, 2013

70°F Beaumont, TX  
Clear

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Index

Check it out: The ME! | College football | Enlarged photo gallery | Southeast Texas nightlife | Were you Seen? | I like it on Facebook

## The Bayou

Biting satire, commentary & opinion Southeast-Texas style

Email | [Twitter](#) | [Facebook](#)



## Eggheads find Beaumont IS the 'saddest city'

February 19, 2013 at 10:41 am by [gaur](#)

Comments(3) | [E-mail](#) | [Print](#)

[Tweet](#) 0

[Recommend](#) 0

[+1](#) 0

That's what some eggheads at the Department of Mathematics and Statistics at the University of Vermont have determined.

The method to their madness? [Twitter](#). They say they plotted 10 million geotagged Tweets in 2011.

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### Categories

General |

### Beaumont Enterprise Blogs



The Bayou  
Biting satire, Southeast Texas style



Newsworthy  
Breaking news for Southeast Texas



Whaddya Think?  
We want to hear from you



The Huddle



**rednnneecckckkkkkkk**

2013/02/18 at 8:53 pm (Edit)



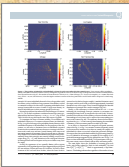
I've lived in quite a few places. The most recently Beaumont, TX. Its a pure hellhole. Hot, humid, trashy, terrible schools, corrupt government, lots of crime, no public parks or activities, terrible culture (other than crawfish boils), completely lacks diversity. This study confirms my suspicions that cities don't get any more miserable than this.

[Reply](#)

Blog post: [Where is the happiest city in the US?](#)



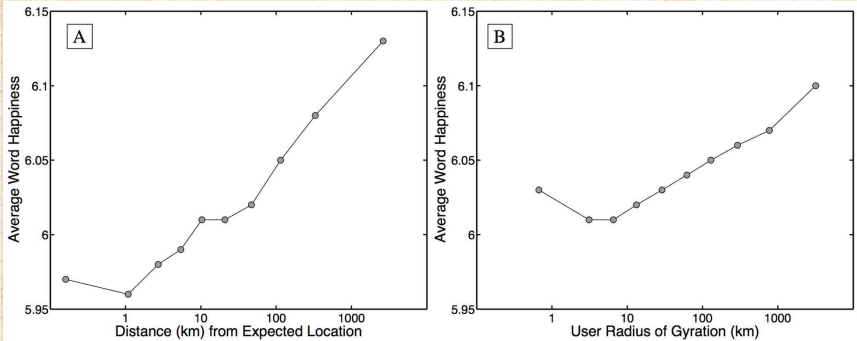




# "Happiness and the Patterns of Life: A Study of Geolocated Tweets"

Frank, Mitchell, Dodds, and Danforth.

Nature Scientific Reports, **3**, 2625, 2013. <sup>[15]</sup>

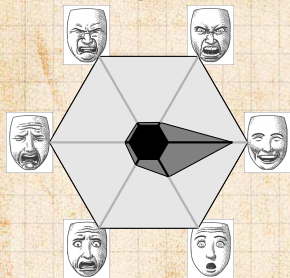


**Figure 6** | (A) Average happiness of words written as a function of distance from an author's expected location, with tweets grouped into ten equally populated bins. Expressed happiness grows logarithmically with distance distance from expected location. (B) A similar trend is observed when individuals are grouped into ten equally populated bins according to their gyradius. Both trends persist through variations in binning and different measures of mobility.

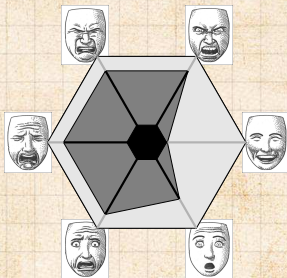


We grow fonder as we wander.

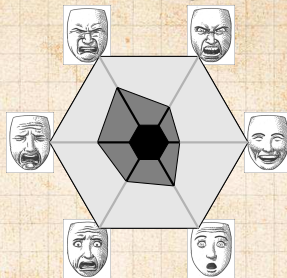
laughter:



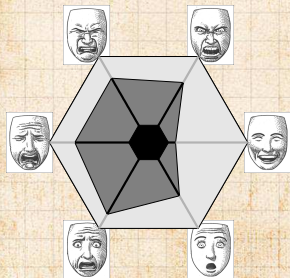
war:



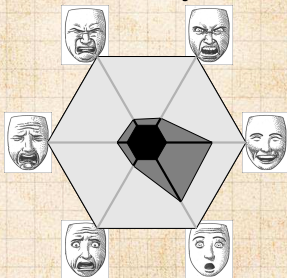
rotting:



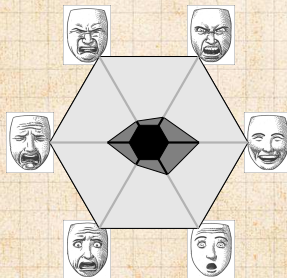
tortured:



lottery:



veterans:





# Outline

## Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna Principle

English

10 languages

Stories

More things

References

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories

More things

References



Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

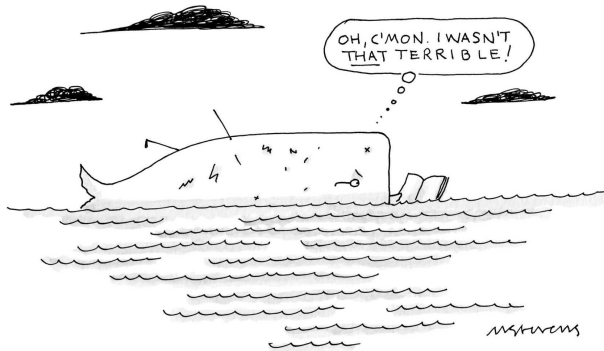
Stories

More things

References

Kurt Vonnegut on the Shapes of Stories ↗





The New Yorker, December 16, 2013, p. 56.

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



# Ron Swanson on metaphors:

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References





# The emotional shapes of stories—Moby Dick:

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

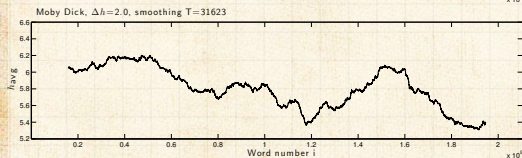
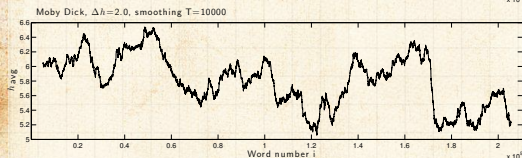
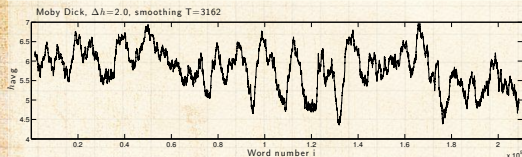
Pollyanna  
Principle

English  
10 languages

Stories

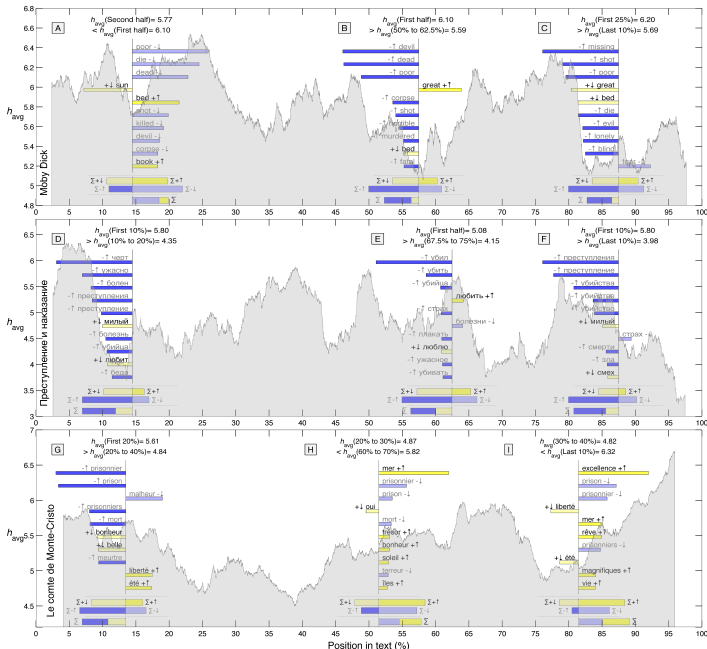
More things

References



Ⓒ  $h_{avg}(\text{Last } 10\%)=5.69$   
 $< h_{avg}(\text{First } 25\%)=6.20$





## Measuring Happiness

### Happiness

Hedonometer  
 Geography  
 Literature

### Panometrics

### Various things

### Pollyanna Principle

English  
 10 languages

### Stories

### More things

### References



# Online, interactive Emotional Shapes of Stories for 10,000+ books:

## Frankenstein; Or the Modern Prometheus [\(wiki\)](#)

by Mary Shelley

Search Gutenberg Corpus

by Title ▾

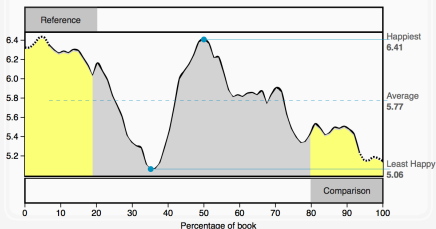
Classics ▾

Harry Potter ▾

Random

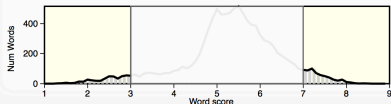
### Book happiness time series:

Explore the work's emotional dynamics by sliding and resizing the reference and comparison sections.



### Lens (for advanced users):

Slide and resize the stop-window to change the lens:

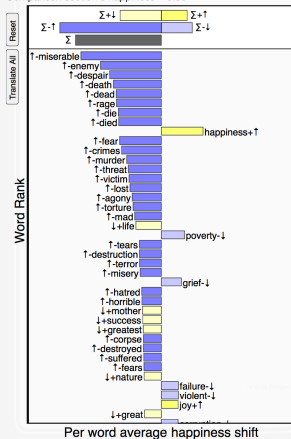


### Word Shift:

Why comparison section is less happy than the reference one

Reference sections's happiness = 6.31

Comparison section's happiness = 5.35



# Online, interactive Emotional Shapes of Stories for 10,000+ books:

## Harry Potter (all books together)

by J.K. Rowling

Search Gutenberg Corpus

by Title ▾

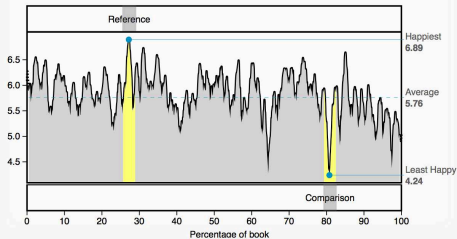
Classics ▾

Harry Potter ▾

Random

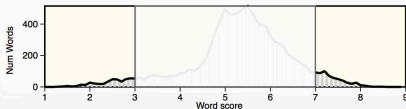
### Book happiness time series:

Explore the work's emotional dynamics by sliding and resizing the reference and comparison sections.



### Lens (for advanced users):

Slide and resize the stop-window to change the lens:

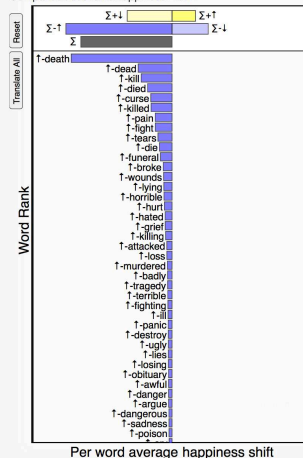


### Word Shift:

Why comparison section is less happy than the reference one

Reference sections's happiness = 6.13

Comparison section's happiness = 5.14





# Online, interactive Emotional Shapes of Stories ↗ for 1,000+ movie scripts:

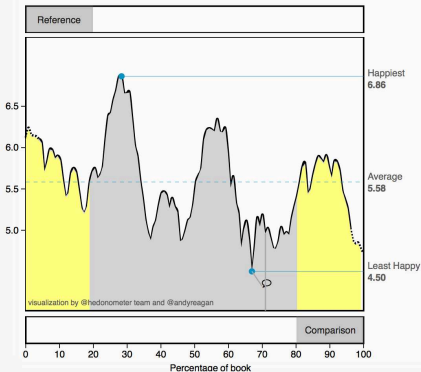
## Pulp Fiction

directed by Quentin Tarantino

[Classics ▾](#)[Team Picks ▾](#)[Random](#)

### Movie happiness time series:

Explore the work's emotional dynamics by sliding and resizing the reference and comparison sections.



### Movie script:

Portion of script scored for each point in timeseries.

Zed takes the chair, sits it in front of the two prisoners, then lowers into it. Maynard hands The Gimp's leash to Zed, then backs away.

**MAYNARD**  
(to The Gimp)  
Down!

The Gimp gets on its knees.

Maynard hangs back while Zed appraises the two men.

**MAYNARD**  
Who's first?

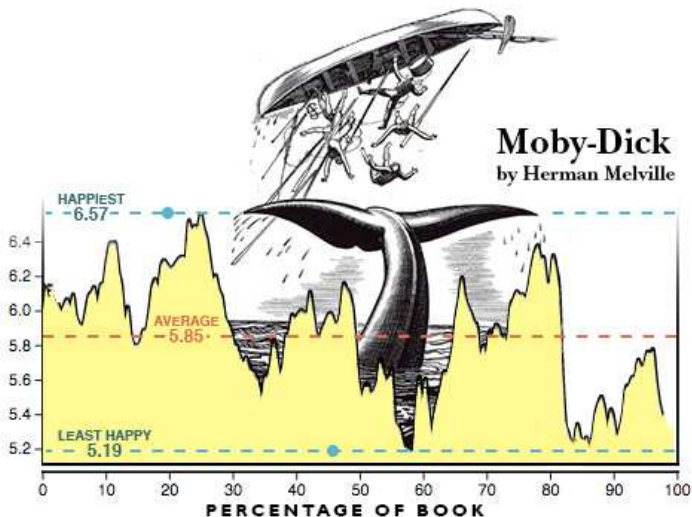
**ZED**  
I ain't fer sure yet.

Then with his little finger, Zed does a silent "Eenie, meeny, miney, moe..." just his mouth mouthing the words and his finger going back and forth between the two.

Butch and Marsellus are terrified.

Maynard looks back and forth at the victims.

The Gimp's eyes go from one to the other inside the mask.

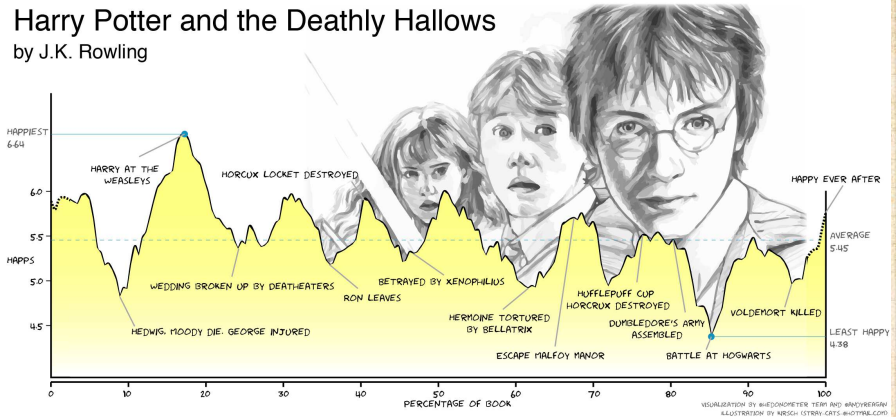


Moby-Dick illustration by Rockwell Kent, 1930

<http://whyfiles.org/2015/in-10-languages-happy-words-beat-sad-ones/>

# Harry Potter and the Deathly Hallows

by J.K. Rowling



Reagan et al. in preparation, 2016.

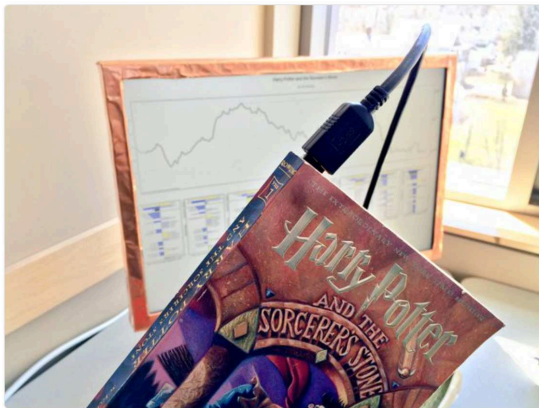


**UVM**   
@uvmvermont



Following

USB in a book? What is this wizardry? Check it out at the Student Research Conference creative lounge. [#uvmresearch](#)



RETWEETS

8

LIKES

14



9:30 AM - 28 Apr 2016

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

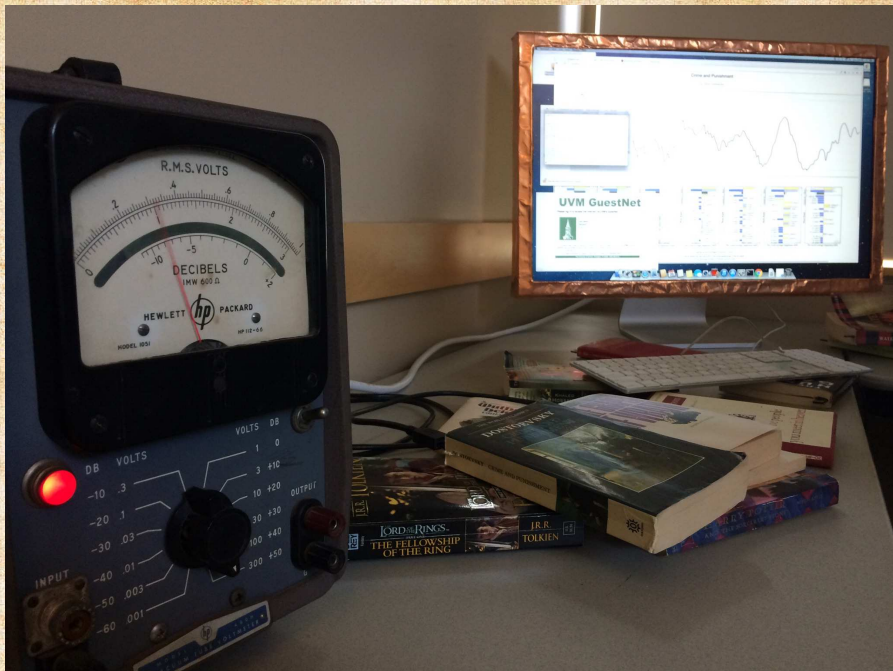
Stories

More things

References







Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



# The taxonomy of stories:

## Fundamental arcs:



Kill the Monster.

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



# The taxonomy of stories:

## Fundamental arcs:



Kill the Monster.



Rags to Riches (and Riches to Rags—*Metamorphosis*).

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things




References





# The taxonomy of stories:

## Fundamental arcs:

-  Kill the Monster.
-  Rags to Riches (and Riches to Rags—*Metamorphosis*).
-  The Journey: a Search or a Quest.

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories





More things

References



# The taxonomy of stories:

## Fundamental arcs:

-  Kill the Monster.
-  Rags to Riches (and Riches to Rags—*Metamorphosis*).
-  The Journey: a Search or a Quest.
-  Romance.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories






More things

References



# The taxonomy of stories:

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-  Narratives in Left Nullspace: All Stories of The Many.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things






References





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## The three fundamental events of non-clone life:

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# The taxonomy of stories:

## Fundamental arcs:

- 🧱 Kill the Monster.
- 🧱 Rags to Riches (and Riches to Rags—*Metamorphosis*).
- 🧱 The Journey: a Search or a Quest.
- 🧱 Romance.
- 🧱 Narratives in Left Nullspace: All Stories of The Many.

## The three fundamental events of non-clone life:

- 🧱 Hatchings, Matchings, and Dispatchings.

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna

Principle

English

10 languages

Stories






More things

References





# The taxonomy of stories:

## Fundamental arcs:

-  Kill the Monster.
-  Rags to Riches (and Riches to Rags—*Metamorphosis*).
-  The Journey: a Search or a Quest.
-  Romance.
-  Narratives in Left Nullspace: All Stories of The Many.

## The three fundamental events of non-clone life:

-  Hatchings, Matchings, and Dispatchings.
-  Stories = survival algorithms.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

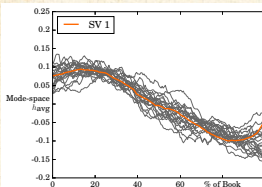
English  
10 languages

Stories

More things

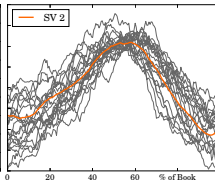
References





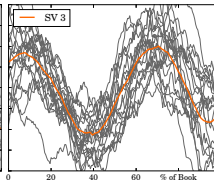
Top Stories:

- 1: Alice's Adventures Under Ground : Being a facsimil... (19002)
- 2: Dreams (1439)
- 3: The Human Comedy: Introductions and Appendix (1968)
- 4: The History Of The Decline And Fall Of The Roman ... (25717)
- 5: The Ballad of Reading Gaol (301)



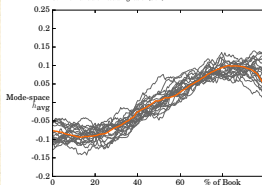
Top Stories:

- 1: Typhoon (1142)
- 2: Principles of Orchestration, with Musical Example... (33900)
- 3: How to Sing: (Meine Gesangskunst) (19116)
- 4: Hand-Loom Weaving: A Manual for School and Home (31630)
- 5: Self-Instructor in the Art of Hair Work, Dressing... (38658)



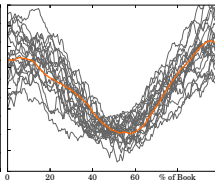
Top Stories:

- 1: The Consolation of Philosophy (14328)
- 2: The Scarecrow of Oz (957)
- 3: A Christmas Carol (24022)
- 4: Sophist (1735)
- 5: A Christmas Carol in Prose; Being a Ghost Story e... (46)



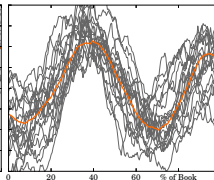
Top Stories:

- 1: A Primary Reader: Old-time Stories, Fairy Tales a... (7841)
- 2: The House of the Vampire (17144)
- 3: Savrola: A Tale of the Revolution in Lussurania (50906)
- 4: The Dance by An Aniquary: Historic Illustration... (17289)
- 5: Romeo and Juliet (1777)



Top Stories:

- 1: The Yoga Suttas of Putanjali: The Book of the Spi... (2526)
- 2: Stories from Hans Andersen (17860)
- 3: Poems (38877)
- 4: Bennett's Small House Catalog 1920 (51205)
- 5: How to Read Human Nature: Its Inner States and Ou... (41501)



Top Stories:

- 1: The Wonder Book of Bible Stories (16042)
- 2: The Serpent River (50923)
- 3: Pragmatism: A New Name for Some Old Ways of Thinking (5116)
- 4: A Hero of Our Time (913)
- 5: On the Nature of Things (785)






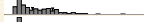















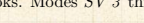

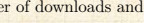
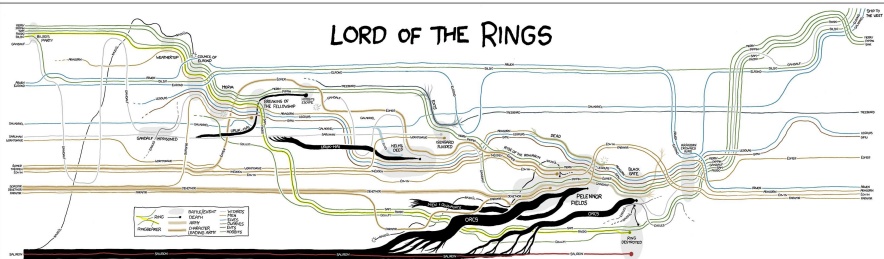
Mode	Mode Arc	$N_m$	$N_m/N$	DL Median ▼	DL Mean ▽	DL Variance	Download Distribution
SV 1		263	15.1%	295.0	644.3	2207201	
-SV 1		442	25.3%	337.5	636.0	913464	
SV 2		230	13.2%	314.0	630.3	1058916	
-SV 2		169	9.7%	296.0	569.1	780365	
SV 3		104	6.0%	298.0	874.5	7826797	
-SV 3		108	6.2%	298.0	748.7	2517822	
SV 4		108	6.2%	316.0	848.8	2763060	
-SV 4		50	2.9%	292.0	770.7	1546202	
SV 5		48	2.7%	280.0	421.7	182443	
-SV 5		48	2.7%	263.5	462.0	211259	

FIG. 6: Download statistics for SVD Modes with more than 2.5% of books. Modes *SV 3* through *-SV 4* (both polarities of modes 3 and 4) exhibit a higher average number of downloads and more variance than the rest.



THESE CHARTS SHOW MOVIE CHARACTER INTERACTIONS.  
THE HORIZONTAL AXIS IS TIME. THE VERTICAL GROUPING OF THE  
LINES INDICATES WHICH CHARACTERS ARE TOGETHER AT A GIVEN TIME.

## LORD OF THE RINGS



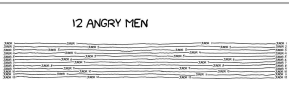
## STAR WARS (ORIGINAL TRILOGY)



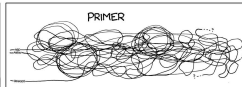
## JURASSIC PARK



## 12 ANGRY MEN



## PRIMER





# Plotted: A Literary Atlas

by Andrew DeGraff (2015). <sup>[8]</sup>

Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

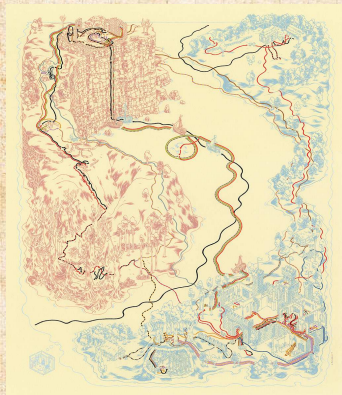
English

10 languages

Stories

More things

References



<http://www.andrewdegraff.com/moviemaps/> 





## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

### Various things

### Pollyanna Principle

English  
10 languages

### Stories

### More things

### References



Word	$\rho$	$p$ -value
cafe	-0.509	$6.07 \times 10^{-14}$
sushi	-0.487	$9.93 \times 10^{-13}$
brewery	-0.469	$8.67 \times 10^{-12}$
restaurant	-0.448	$8.93 \times 10^{-11}$
bar	-0.435	$3.59 \times 10^{-10}$
banana	-0.434	$3.77 \times 10^{-10}$
apple	-0.408	$5.22 \times 10^{-9}$
fondue	-0.403	$8.34 \times 10^{-9}$
wine	-0.400	$1.08 \times 10^{-8}$
delicious	-0.392	$2.17 \times 10^{-8}$
dinner	-0.386	$3.85 \times 10^{-8}$
coffee	-0.384	$4.51 \times 10^{-8}$
bakery	-0.383	$5.12 \times 10^{-8}$
bean	-0.378	$7.88 \times 10^{-8}$
espresso	-0.377	$8.47 \times 10^{-8}$
cuisine	-0.376	$8.82 \times 10^{-8}$
foods	-0.374	$1.07 \times 10^{-7}$
tofu	-0.372	$1.27 \times 10^{-7}$
brunch	-0.368	$1.79 \times 10^{-7}$
veggie	-0.364	$2.46 \times 10^{-7}$
organic	-0.361	$3.13 \times 10^{-7}$
booze	-0.360	$3.34 \times 10^{-7}$
grill	-0.354	$5.4 \times 10^{-7}$
chocolate	-0.351	$6.77 \times 10^{-7}$
#vegan	-0.350	$7.47 \times 10^{-7}$

mcdonalds	0.246	$6.18 \times 10^{-4}$
eat	0.241	$8.22 \times 10^{-4}$
wings	0.222	$2.13 \times 10^{-3}$
hungry	0.210	$3.65 \times 10^{-3}$
heartburn	0.194	$7.37 \times 10^{-3}$
ham	0.177	$1.45 \times 10^{-2}$



# "The Lexicocalorimeter: Gauging public health through caloric input and output on social media"

Alajajian, Williams, Reagan, Alajajian, Frank, Mitchell, Lahne, Danforth, and Dodds.

Available at <http://arxiv.org/abs/1507.05098>, 2016.<sup>[1]</sup>

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

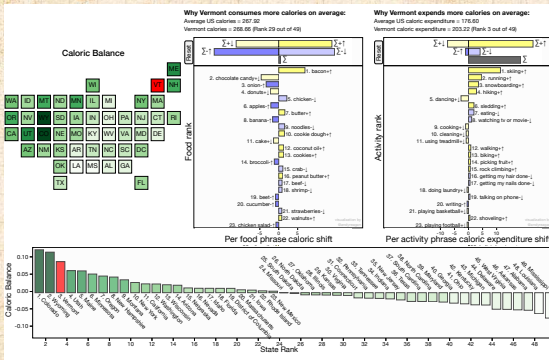
Pollyanna  
Principle

English  
10 languages

Stories

More things

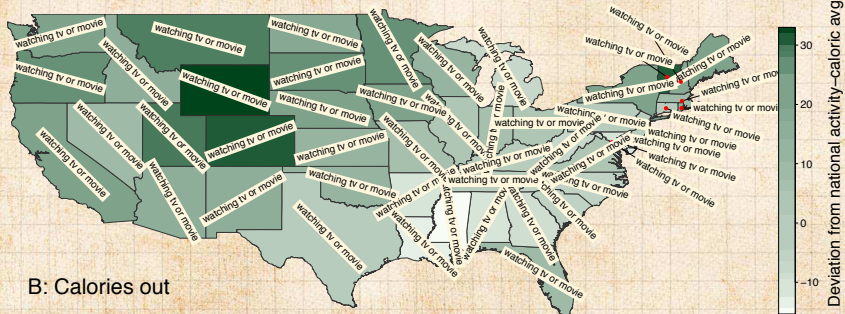
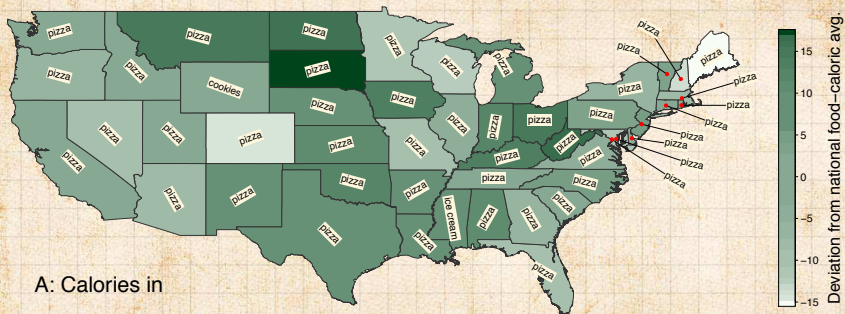
References



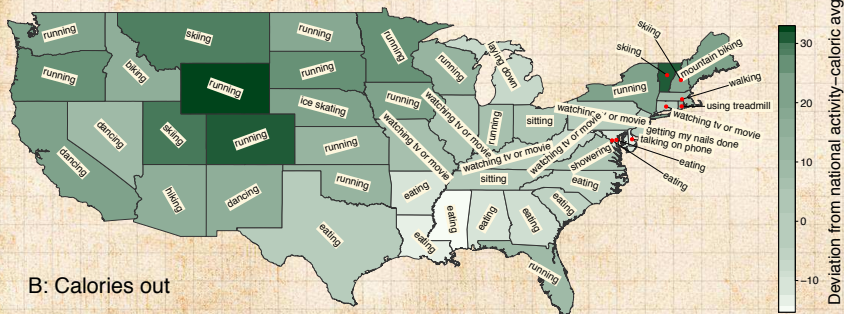
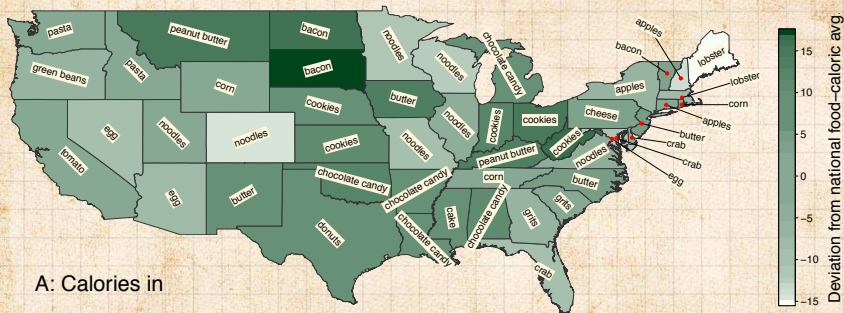
<http://panometer.org/instruments/lexicocalorimeter/>



# The Lexicocalorimeter:



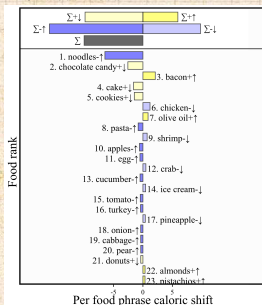
# The Lexicocalorimeter:



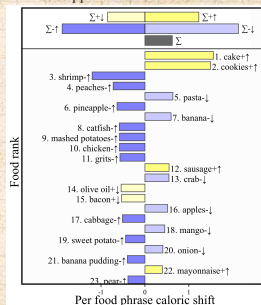
# The Lexicocalorimeter:

Measuring  
Happiness

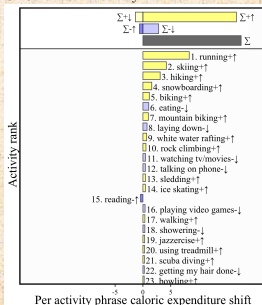
A. Colorado—food:



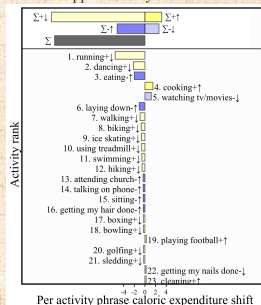
B. Mississippi—food:



C. Colorado—activity:



D. Mississippi—activity:



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

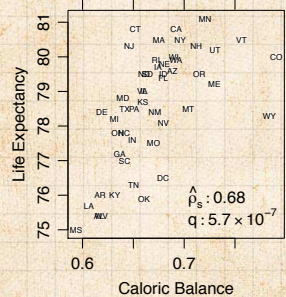
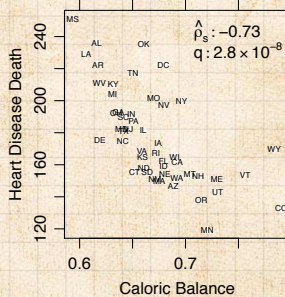
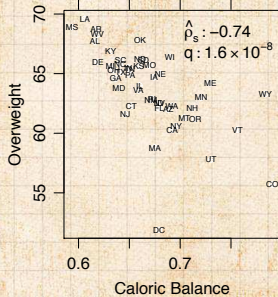
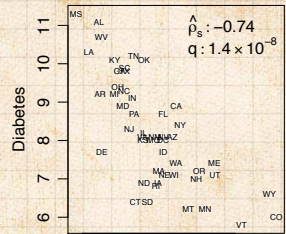
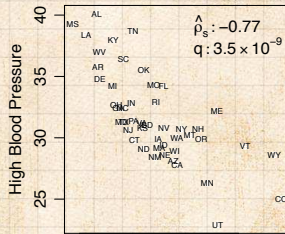
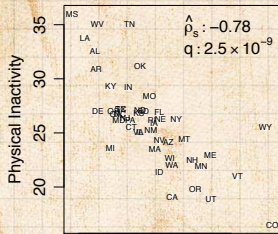
More things

References





# The Lexicocalorimeter:



# The Insomniometer:

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

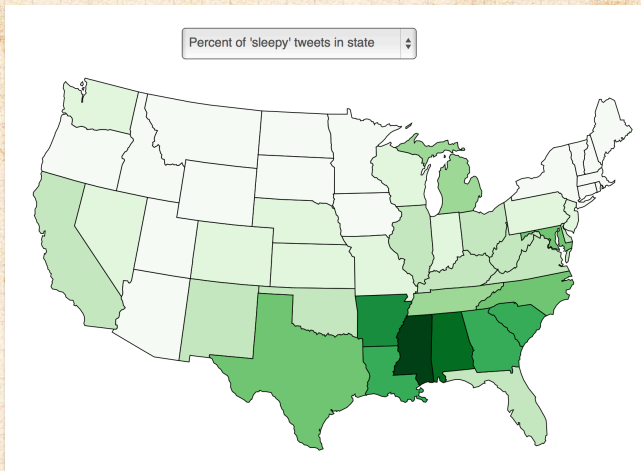
Pollyanna  
Principle

English  
10 languages

Stories

More things

References



Correlation with CDC's Sleep Insufficiency measure [↗](#):

$$r_s = .48, p = 5.3 \times 10^{-4}.$$

# The Hangoverometer:

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

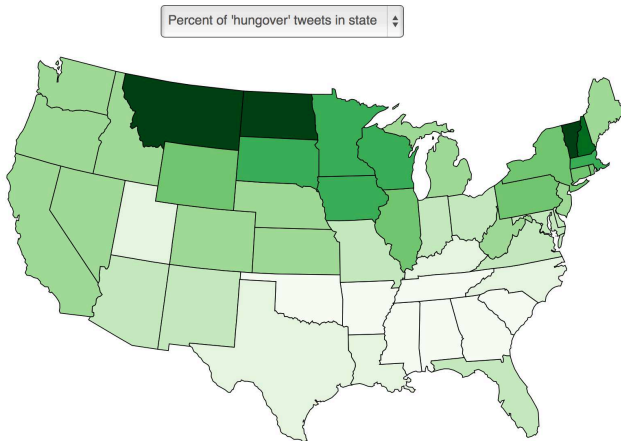
Pollyanna  
Principle

English  
10 languages

Stories

More things

References



Correlation with Binge drinking estimates:  $r_s = .72$ ,  
 $p = 5.8 \times 10^{-9}$ .

## Concept hierarchy:

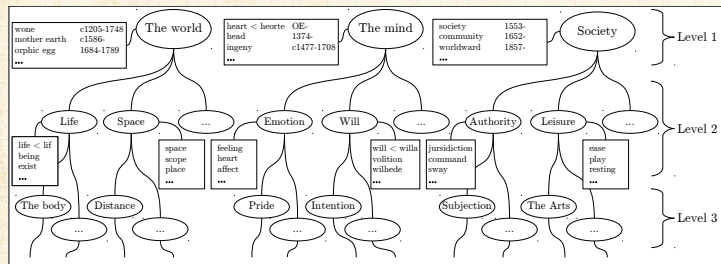


FIG. 1. Top of the category hierarchy in the Historical Thesaurus. Shown are three categories at level one: **The world**<sup>1</sup>, **the mind**<sup>1</sup>, and **Society**<sup>1</sup> and several of the descendants of those categories appear in lower levels. All categories are in ellipses and word lists of synonyms for the category title appear in rectangular boxes.



Hazelhurst et al., 2006, In preparation.



Explore online: <http://fletcherhaz.github.io/sorel/> 

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# Level two categories:

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

Rank	Old English	1200	1300	1400	1500
1	Action/operation (3,543)	Action/operation (986)	Action/operation (2,011)	Action/operation (4,288)	Action/operation (5,539)
2	Emotion (2,917)	Emotion (735)	Emotion (1,432)	Emotion (2,840)	Space (3,540)
3	Space (2,407)	Space (658)	Space (1,224)	Space (2,680)	Emotion (3,501)
4	Faith (1,875)	Mental capacity (545)	Movement (987)	Mental capacity (2,192)	Mental capacity (2,868)
5	Movement (1,859)	Faith (499)	Mental capacity (925)	Movement (2,025)	Food and drink (2,853)
6	Life (1,859)	Life (497)	Life (844)	Curious, inquisitive (1,903)	Authority (2,564)
7	Mental capacity (1,836)	Movement (486)	Life (842)	Authority (1,794)	Curious, inquisitive (2,559)
8	Authority (1,770)	Food and drink (449)	Authority (822)	Faith (1,727)	Movement (2,433)
9	Food and drink (1,707)	Authority (432)	Curious, inquisitive (742)	Life (1,697)	Faith (2,317)
10	Curious, inquisitive (1,684)	The earth (381)	Food and drink (709)	Food and drink (1,681)	Life (2,093)

Rank	1600	1700	1800	1900	2000
1	Action/operation (9,819)	Action/operation (13,470)	Action/operation (14,525)	Leisure (18,904)	Leisure (26,131)
2	Space (6,848)	Mental capacity (9,923)	Mental capacity (10,937)	Action/operation (18,191)	Action/operation (20,903)
3	Emotion (6,192)	Space (9,322)	Space (10,505)	Animals (17,578)	Animals (19,596)
4	Mental capacity (6,065)	Emotion (8,538)	Emotion (9,539)	Mental capacity (14,978)	Mental capacity (18,153)
5	Curious, inquisitive (5,318)	Curious, inquisitive (7,628)	Leisure (9,314)	Food and drink (14,690)	Health and disease (18,011)
6	Food and drink (4,731)	Leisure (6,907)	Food and drink (8,660)	Space (13,477)	Food and drink (17,692)
7	Authority (4,520)	Food and drink (6,839)	Curious, inquisitive (8,412)	Plants (13,322)	Life (16,048)
8	Leisure (4,197)	Authority (6,508)	Animals (7,988)	Health and disease (13,276)	Occupation and work (15,665)
9	Movement (4,041)	Health and disease (6,327)	Plants (7,830)	Emotion (12,352)	Plants (14,476)
10	Plants (3,989)	Animals (5,629)	Health and disease (7,349)	Occupation and work (11,855)	The earth (14,449)

TABLE I. The top ten categories ranked by category size (number of words) at each century and in Old English. Numbers in parentheses reflect the category sizes.



Hazelhurst et al., 2006, In preparation.

Explore the "leisure" category here:

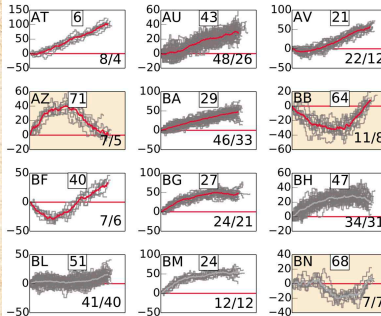
[http://fletcherhaz.github.io/sorel/words.html#2/2000/Leisure\\_\(n\)](http://fletcherhaz.github.io/sorel/words.html#2/2000/Leisure_(n))





# "The game story space of professional sports: Australian Rules Football" ↗ Kiley, Kiley, and Kiley.

Draft version of the present paper using pure random walk null model. Available online at <http://arxiv.org/abs/1507.03886v1>. Accessed January 17, 2016, 2015. <sup>[18]</sup>



Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# "Sifting robotic from organic text: A natural language approach for detecting automation on Twitter"

Clark, Williams, Galbraith, Jones, Danforth, and Dodds.

Preprint available at

<http://arxiv.org/abs/1505.04342>, 2015. <sup>[5]</sup>

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

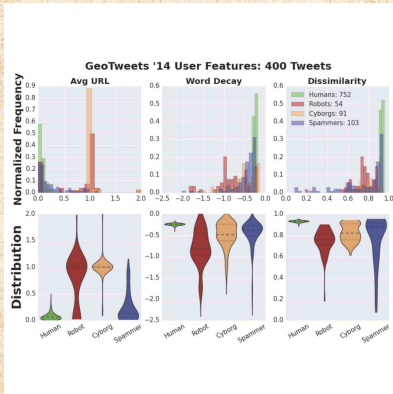
Pollyanna  
Principle

English  
10 languages

Stories

More things

References



**Figure 1** (a) The number of genes in the same cluster. (b) The number of genes in the same cluster. (c) The number of genes in the same cluster.

Available online at

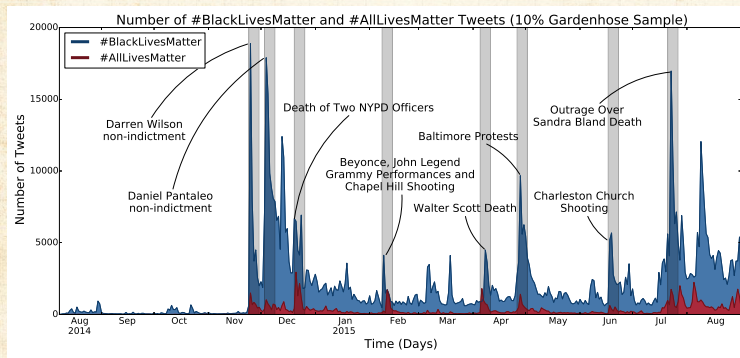
[illegible]



# #BlackLivesMatter

Measuring  
Happiness

## Protest and counter-protest:



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



"Divergent Discourse Between Protests and Counter-Protests: #BlackLivesMatter and #AllLivesMatter."

Gallagher et al. In Preparation, 2016.



## Measuring Happiness

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

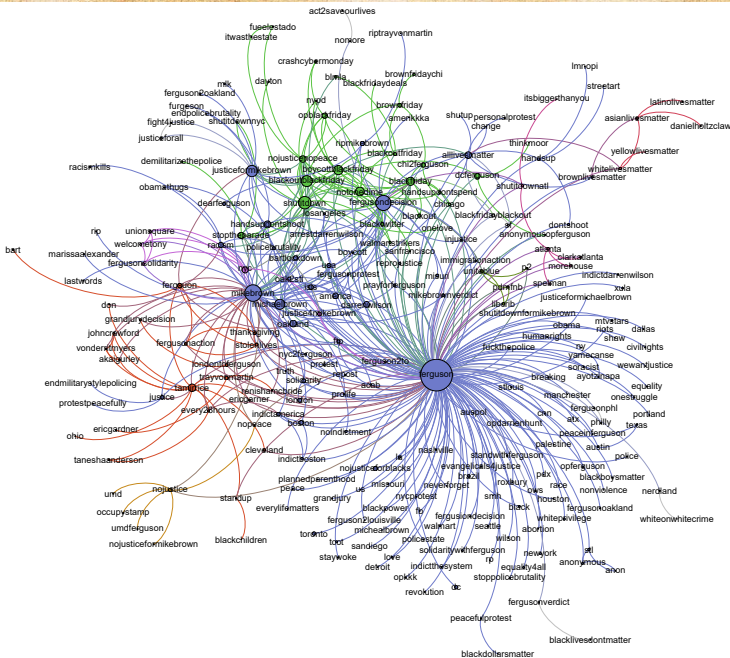
## Pollyanna Principle

English  
10 languages

## Stories

## More things

## References





# “Climate change sentiment on Twitter: An unsolicited public opinion poll” Cody, Reagan, Mitchell, Dodds, and Danforth. PLoS ONE, **10**, e0136092, 2015. [6]

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

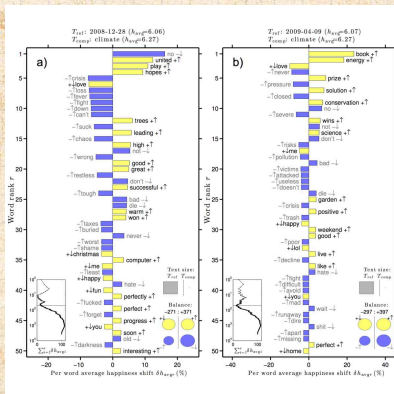
Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References





# "Transitions in climate and energy discourse between Hurricanes Katrina and Sandy"

Cody, Stephens, Bagrow, Dodds, and Danforth.  
Journal of Environmental Studies and Sciences ,  
,, 2016. [7]

Hurricane Katrina					Hurricane Sandy				
topic 7	topic 8	topic 12	topic 13	topic 14	topic 0	topic 1	topic 2	topic 3	topic 7
bodi	price	red	famili	gras	power	obama	climat	hous	train
death	oil	cross	home	mardi	util	romney	flood	home	author
offici	percent	donat	children	french	servic	presid	chang	water	station
state	energ	relief	day	restaur	compani	campaign	protect	beach	line
home	gas	organ	live	parad	author	elect	build	car	servic
die	gasolin	volunt	back	street	electr	state	rise	live	tunnel
victim	rate	victim	school	back	island	republi	sea	flood	jersey
peopl	market	fund	mother	peopl	custom	vote	water	peopl	gas
famili	week	peopl	friend	quarter	state	polit	risk	point	transport
parish	product	million	peopl	time	system	governor	level	fire	power
st	month	chariti	im	home	grid	voter	energ	street	damag
louisiana	cosum	dissat	call	day	long	natur	atur	rockway	subway
identifi	report	american	hou	citi	verdon	pol	power	back	street
identifi	economi	money	stay	make	nation	democrat	weather	manhattan	offici
relat	compani	group	time	club	work	peopl	develop	insur	transit
coron	increas	rais	dont	louisiana	phone	debate	make	damag	long
dr	gulf	effort	work	cook	commis	candid	cost	resid	system
dead	fuel	food	life	krew	network	presidenti	state	work	day
found	expect	org	son	hotel	con	time	plan	famili	island
remain	gallos	shelter	left	celebe	on	edison	nation	surge	neighborhood
topic 16	topic 18	topic 21	topic 26	topic 4	topic 8	topic 9	topic 12	topic 13	topic 17
music	ship	insur	hou	guard	hospit	insur	wind	show	water
jazz	airlin	flood	evacue	nation	home	compani	power	time	system
band	show	damag	fema	state	patient	percent	day	stewart	state
musician	sweat	billitari	health	troop	health	month	clo	million	million
art	time	state	offici	troop	medic	market	weather	make	flood
cultur	northrop	compani	home	offici	nurs	coast	photo	live	plant
network	loss	houston	feder	unit	evacu	busi	expect	car	cost
museum	mississipp	hous	agru	fee	emerg	increas	servic	twitter	car
perform	travel	home	hotel	feder	center	million	travel	work	sewag
play	air	hous	trailer	louisiana	dr	loss	area	news	river
festiv	million	pay	claim	famili	peopl	home	offici	stori	peopl
artist	broadcast	cost	shelter	equip	citi	report	state	inform	dutch
song	report	abc	effect	island	resid	expect	damag	magazin	project
work	cruis	area	emerg	presid	relief	billion	flood	work	build
show	time	program	louisiana	live	day	rate	nation	photograph	gotherm
concert	includ	flam	industri	apart	case	retail	nussachusetts	design	park
orchestra	channel	televis	feder	govern	bird	report	center	post	area
event	record	navi	polici	assist	mayor	claim	hour	print	engin

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References







"Zipf's law holds for phrases, not words" ↗

Williams, Lessard, Desu, Clark, Bagrow,  
Danforth, and Dodds.

Nature Scientific Reports, **5**, 12209, 2015. [29]

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

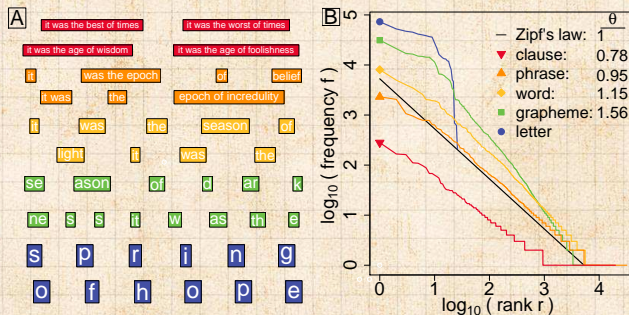
Pollyanna  
Principle

English  
10 languages

Stories

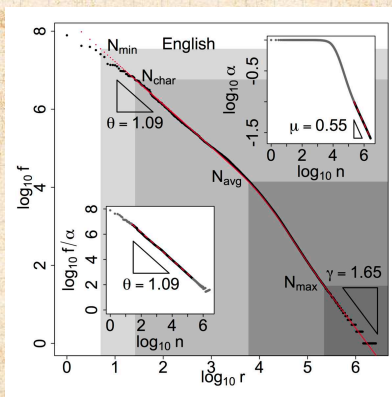
More things

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“Text mixing shapes the anatomy of  
rank-frequency distributions”  
Williams, Bagrow, Danforth, and Dodds.  
Physical Review E, **91**, 052811, 2015. [27]





"Identifying missing dictionary entries with frequency-conserving context models"   
 Williams, Clark, Bagrow, Danforth, and Dodds.  
 Available online at  
<http://arxiv.org/abs/1503.02120>, 2015. [28]

Measuring  
Happiness

Happiness  
Hedonometer  
Geography  
Literature

Panometrics

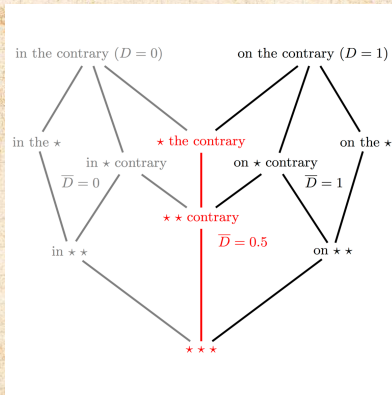
Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

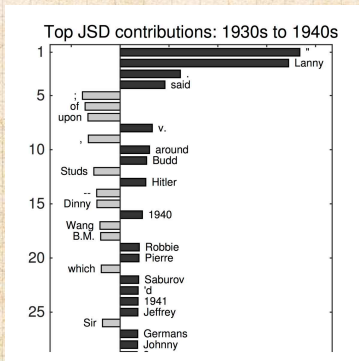
References





# "Characterizing the Google Books corpus: Strong limits to inferences of socio-cultural and linguistic evolution"

Pechenick, Danforth, and Dodds.  
PLoS ONE, **10**, e0137041, 2015. <sup>[25]</sup>



Measuring  
Happiness

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna  
Principle

English

10 languages

Stories

More things

References



Upshot: Google Books needs a lot more metadata.





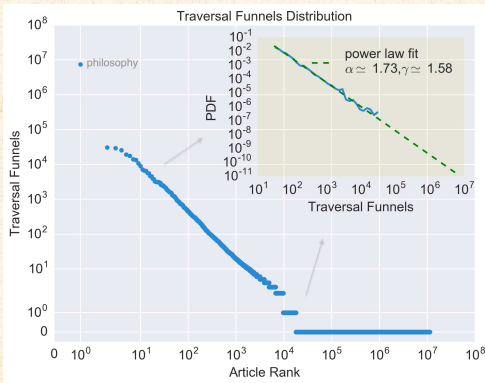
# All roads lead to Philosophy



“Connecting every bit of knowledge: The structure of Wikipedia’s First Link Network” ↗

Ibrahim, Danforth, and Dodds,

Available online at <https://arxiv.org/abs/1605.00309>, 2016. [16]



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

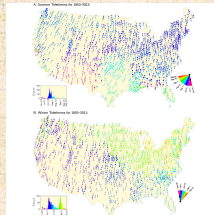




# "Tracking the Teletherms: The spatiotemporal dynamics of the hottest and coldest days of the year"


Dodds, Dodds, and Danforth.

PLoS ONE, **11**, e0154184, 2016. <sup>[14]</sup>



Follow [@teletherm](https://twitter.com/teletherm) .



Coming soon: Explore Teletherms online at <http://teletherm.org> .



The wrongness: 6000 Figures/300MB of Supplementary Information.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Outline

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna Principle

English

10 languages

Stories

More things

References

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

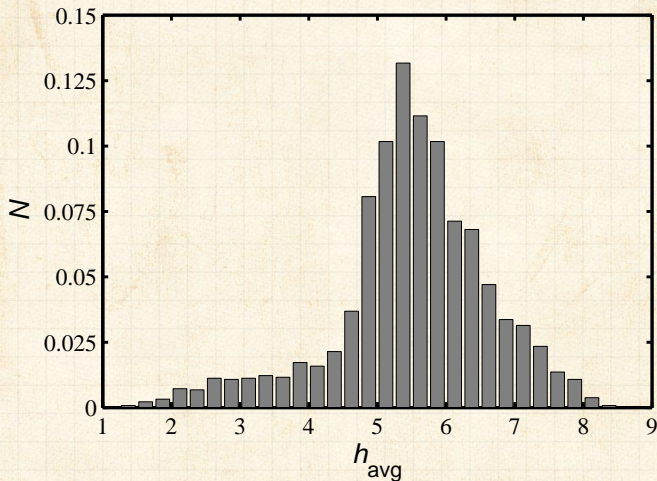
More things

References





## English's scale-invariant, positive bias: [19]



Social organism story manifested in language.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

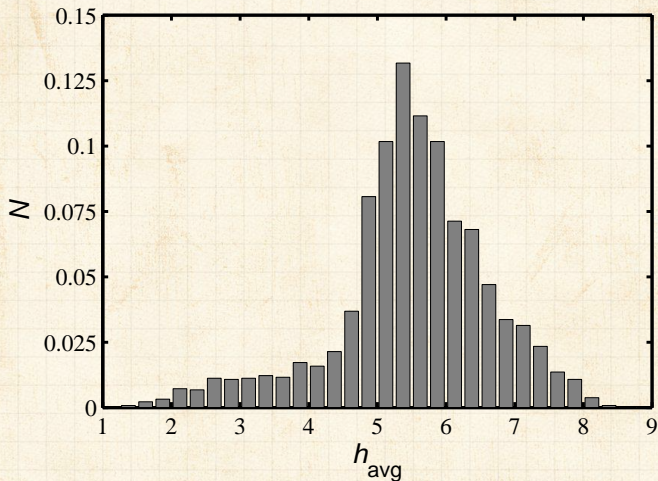
More things

References





## English's scale-invariant, positive bias: [19]



Social organism story manifested in language.



But: must account for frequency of word usage ...

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

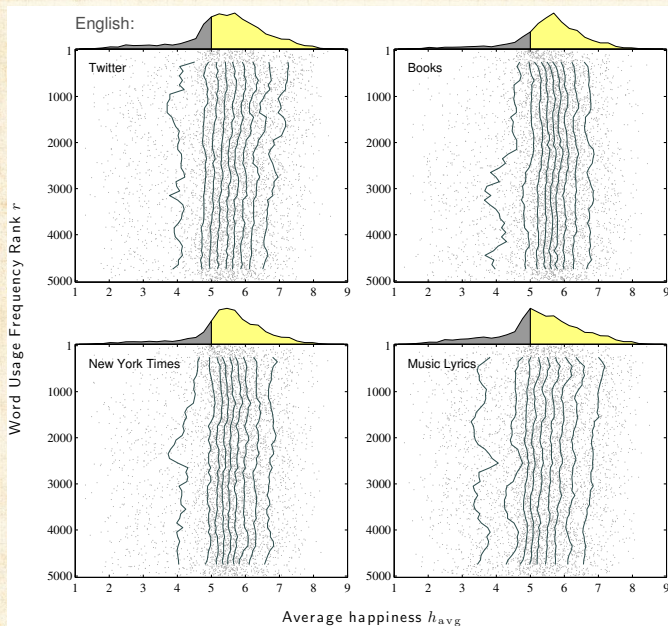
More things

References



# Jellyfish plots:

Measuring  
Happiness



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

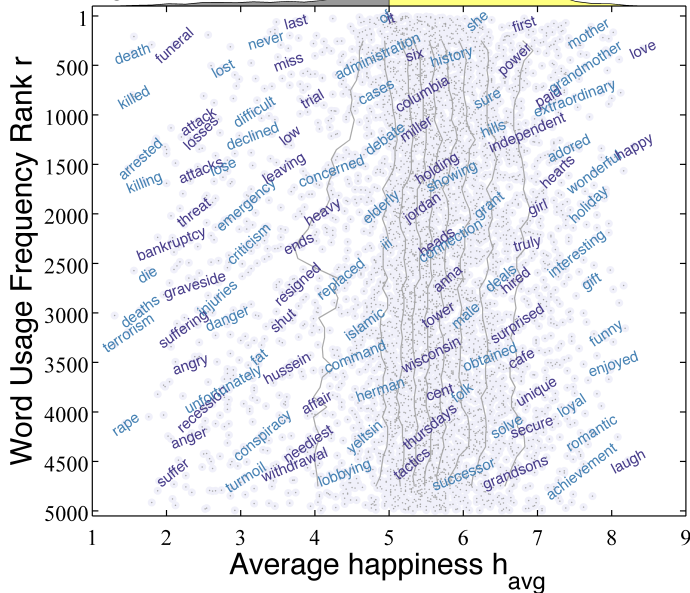
Stories

More things

References



English: New York Times



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

### Pollyanna Principle

English  
10 languages

## Stories

### More things

## References



# Outline

Happiness

Hedonometer

Geography

Literature

Panometrics

Various things

Pollyanna Principle

English

10 languages

Stories

More things

References

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

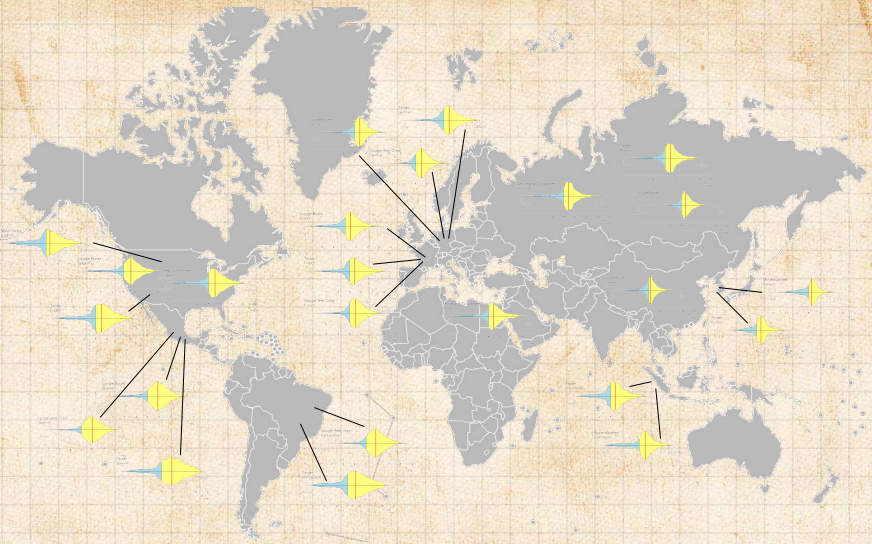
Stories

More things

References

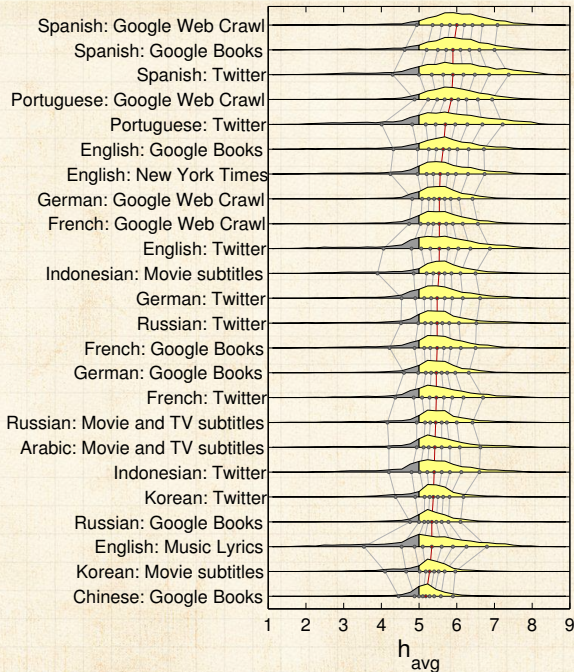






Dodds/Tivnan/Danforth et al.,  
Proc. Natl. Acad. Sci. 2015,  
"Human language reveals a universal positivity bias." [11]





## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

### Pollyanna Principle

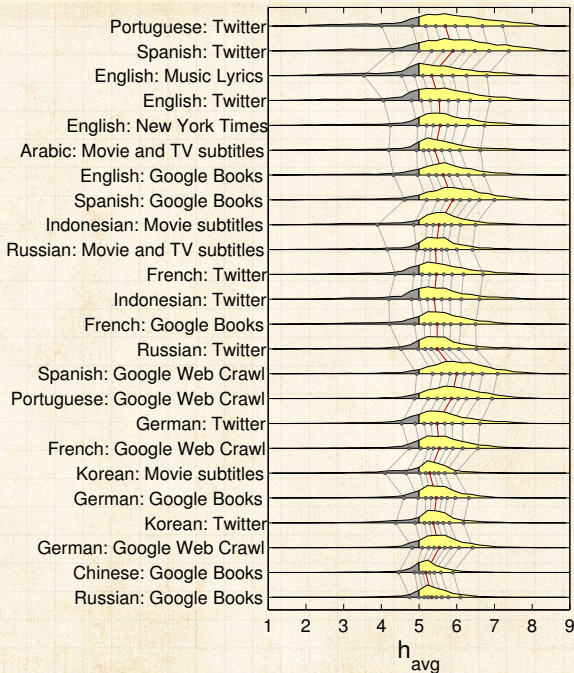
English  
10 languages

### Stories

### More things

### References





## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

### Pollyanna Principle

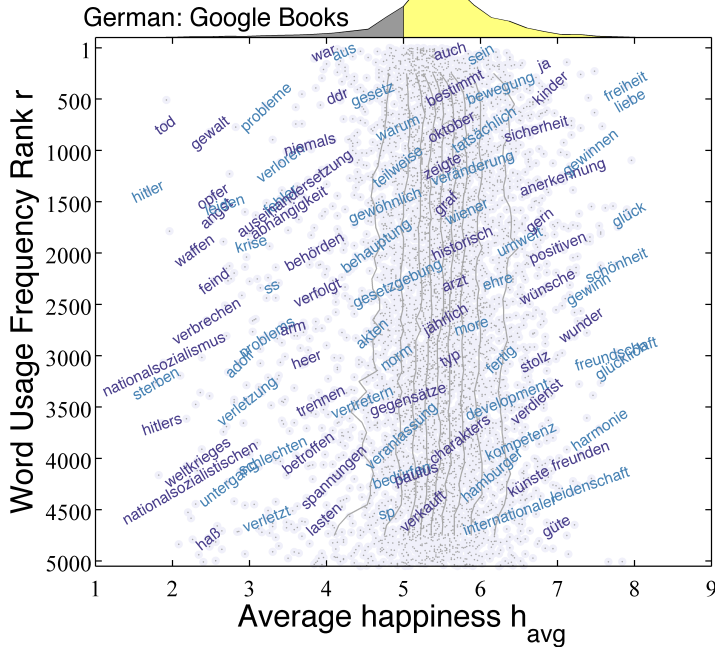
English  
10 languages

### Stories

### More things

### References





## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

## Stories

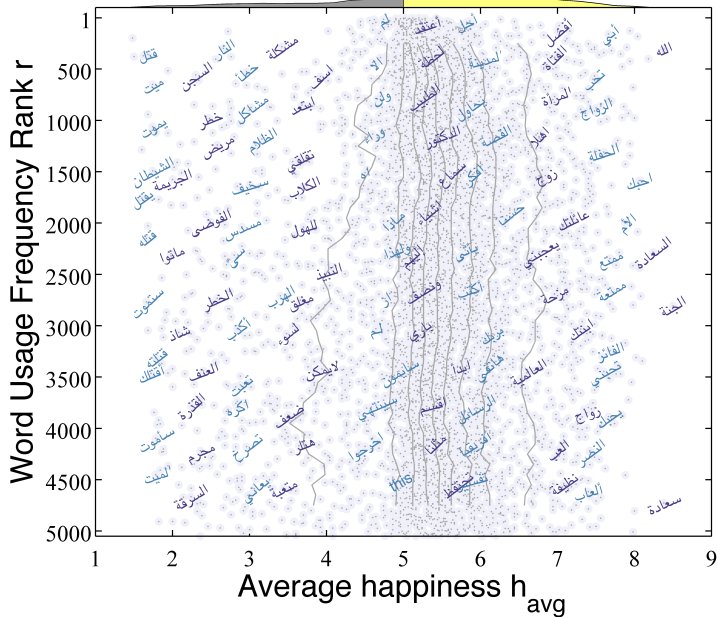
## More things

## References





# Arabic: Movie and TV subtitles



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

## Stories

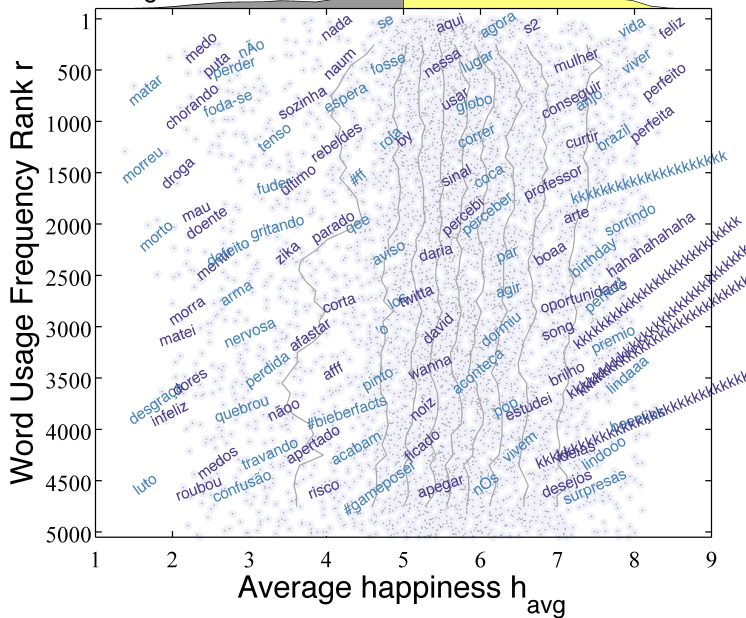
## More things

## References





## Portuguese: Twitter



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

## Stories

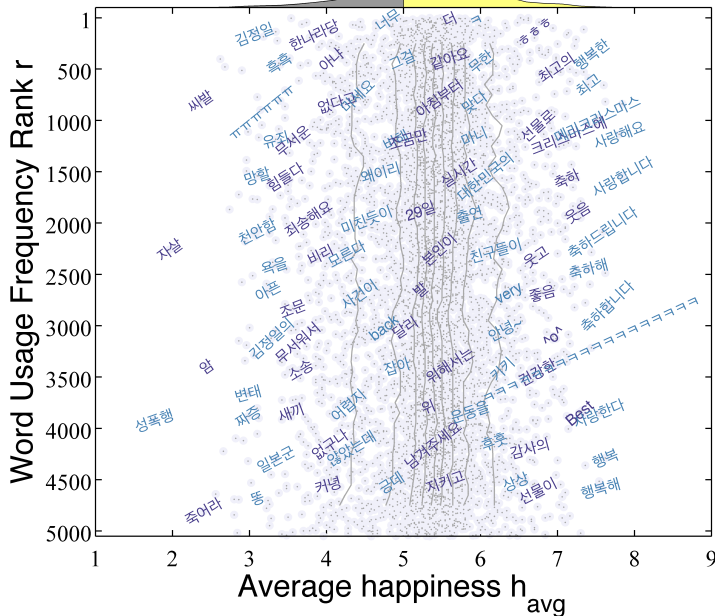
## More things

## References





# Korean: Twitter





# Measuring Happiness

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

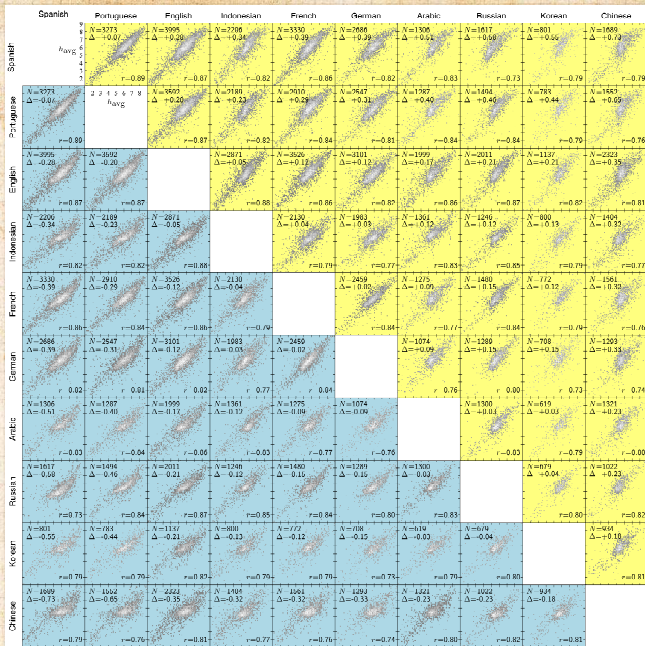
## Pollyanna Principle

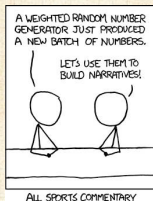
English  
10 languages

## Stories

## More things

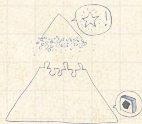
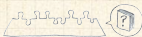
## References





Homo narrativus —we run on stories.

<http://xkcd.com/904/>



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

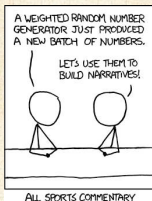
English  
10 languages

## Stories

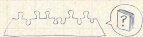
## More things

## References





<http://xkcd.com/904/>



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Extraction of metaphors, frames, narratives, and stories from large-scale text.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

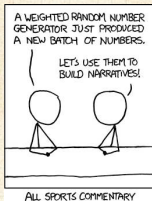
English  
10 languages

Stories

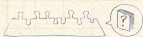
More things

References





<http://xkcd.com/904/>



Homo narrativus —we run on stories.



Extraction of metaphors, frames, narratives, and stories from large-scale text.



The narrative hierarchy: Scalability of stories.

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

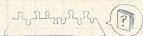
Stories

More things

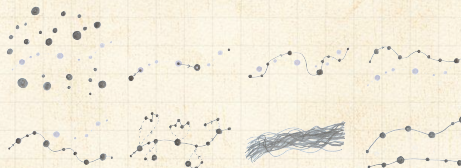
References

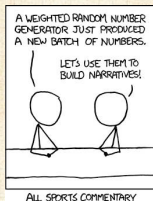




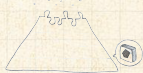
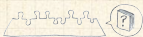


- Adjacent narratives, mistruths, and conspiracy theories.





<http://xkcd.com/904/>



Homo narrativus —we run on stories.



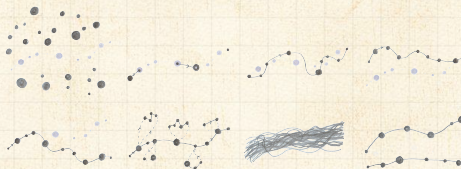
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The narrative hierarchy: Scalability of stories.



Adjacent narratives, mistruths, and conspiracy theories.



Our struggles with stories of the many.

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

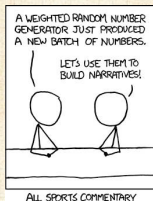
English  
10 languages

Stories

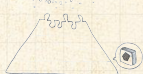
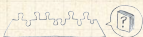
More things

References





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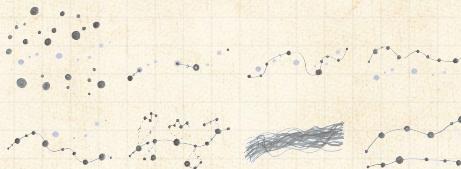
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The narrative hierarchy: Scalability of stories.



Adjacent narratives, mistruths, and conspiracy theories.



Our struggles with stories of the many.



The taxonomy of human stories.



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

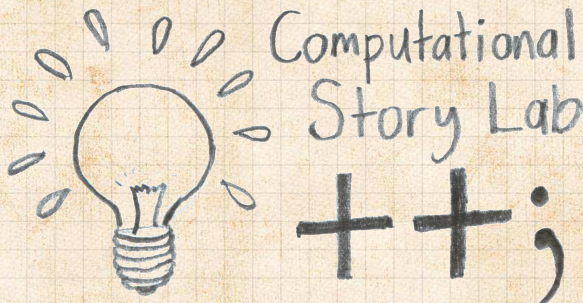
Pollyanna  
Principle

English  
10 languages

Stories

More things

References





## Training with stories as fuel:



Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



# Cryolimnonaut EVA:





"Temporal patterns of happiness and information in a global social network: Hedonometrics and Twitter" ↗

Dodds et al.,  
PLOS ONE, **6**, e26752, 2011. [13]

Much better version here: <http://arxiv.org/abs/1101.5120> ↗



"Twitter reciprocal reply networks exhibit assortativity with respect to happiness" ↗

Bliss et al.,  
Journal of Computational Science, **3**, 388–397,  
2012. [2]



"Positivity of the English language" ↗

Kloumann et al.,  
PLOS ONE, **7**, e29484, 2012. [19]

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References







"Measuring the happiness of large-scale  
written expression: Songs, blogs, and  
presidents." ↗

Dodds and Danforth,  
Journal of Happiness Studies, **11**, 441–456,  
2009. <sup>[12]</sup>



language assessment by Mechanical Turk  
(labMT 1.0)







☼ "According to the words, the news is actually good" by John Tierney, New York Times, February 2015. [↗](#)

☼ "Social Scientists waded into the Tweet stream" by Greg Miller, Science, **333**, 1814–1815, 2011 <sup>[23]</sup>

☼ "Does a Nation's Mood Lurk in Its Songs and Blogs?" by Benedict Carey New York Times, August 2009. [↗](#)

☼ More here: <http://www.uvm.edu/~pdodds/research/> [↗](#)



## Anger:

word	avg	$\sigma$
war	4.16	1.01
torture	3.92	1.16
murdered	3.84	1.14
motherf☆☆ker	3.82	1.29
anger	3.80	1.26
killer	3.78	1.38
fury	3.63	1.56
bombing	3.58	1.39
:	:	:
play	1.06	0.31
idea	1.06	0.31
daughter-in-law	1.06	0.24
piano	1.06	0.31
stars	1.06	0.24
tasty	1.04	0.20
thankful	1.02	0.14
happy	1.00	0.00

## Disgust:

word	avg	$\sigma$
war	4.16	1.01
tortured	3.74	1.28
whore	3.67	1.39
murdered	3.66	1.41
asshole	3.56	1.28
killer	3.55	1.50
motherf☆☆ker	3.54	1.36
died	3.48	1.43
holocaust	3.40	1.64
:	:	:
hawaii	1.06	0.24
arts	1.06	0.42
joy	1.04	0.20
relaxing	1.04	0.28
foundation	1.04	0.20
relax	1.04	0.20
piano	1.04	0.28
presence	1.00	0.00

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

Pollyanna  
Principle

English  
10 languages

## Stories

## More things

## References



## Surprise:

## Fear:

word	avg	$\sigma$
war	4.20	1.02
tortured	4.18	1.39
death	4.18	1.21
killer	4.11	1.37
murdered	4.06	1.10
jail	3.90	1.08
:	:	:
banana	1.08	0.34
right	1.08	0.34
properties	1.08	0.27
cute	1.06	0.24
topic	1.06	0.24
active	1.06	0.24
wonderful	1.06	0.31
dear	1.06	0.31
bath	1.02	0.14

word	avg	$\sigma$
motherf☆☆ker	3.93	1.35
murdered	3.66	1.37
bombing	3.52	1.49
death	3.50	1.51
fatal	3.50	1.43
lottery	3.46	1.54
torture	3.42	1.54
slap	3.41	1.49
died	3.38	1.47
earthquake	3.32	1.54
:	:	:
flag	1.30	0.67
doors	1.30	0.64
b/c	1.28	0.75
stuart	1.26	0.63
pro	1.24	0.59
beans	1.24	0.59
johnson	1.18	0.65

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

Pollyanna  
Principle

English  
10 languages

## Stories

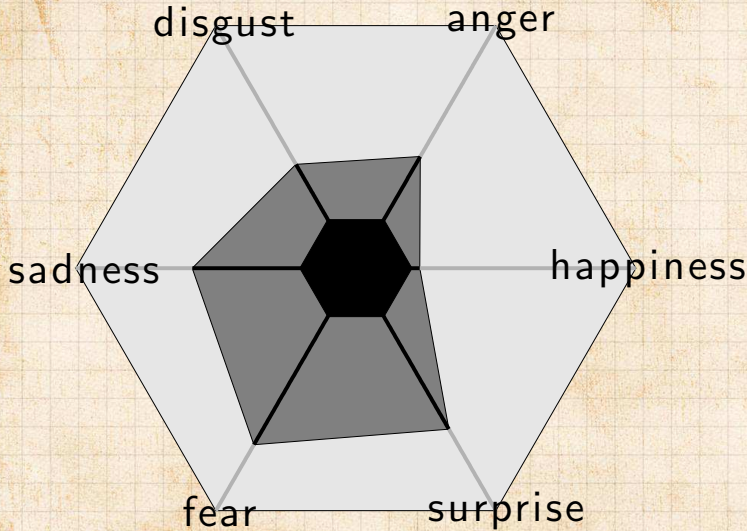
## More things

## References





# earthquake:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

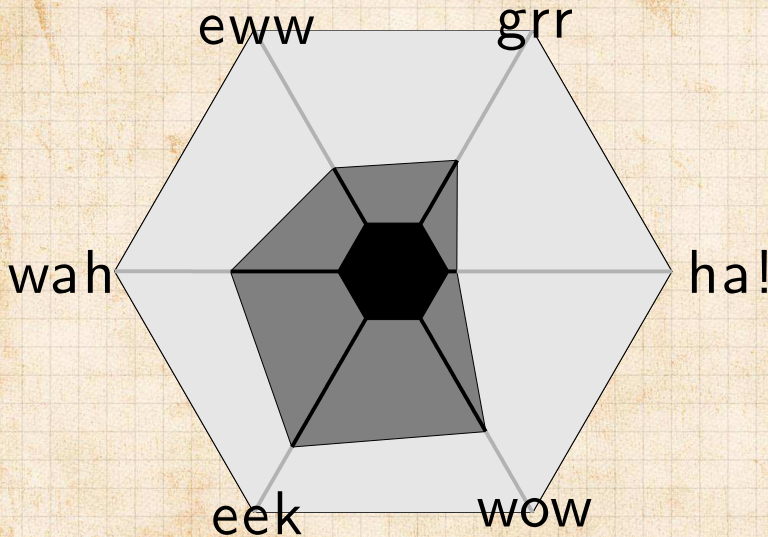
More things

References





# earthquake:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

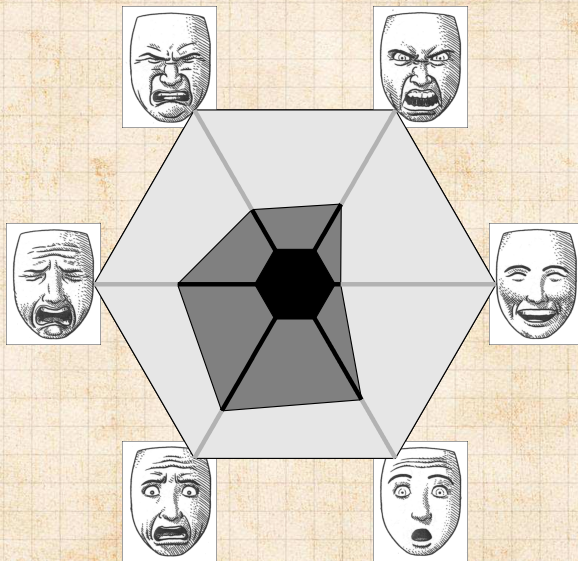
Stories

More things

References



# earthquake:



Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

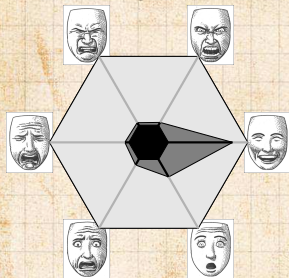
References



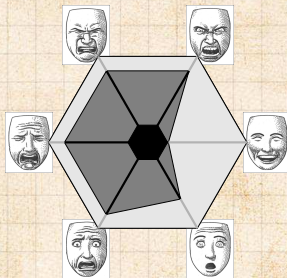
Images from Scott McCloud's "Making Comics." [22]



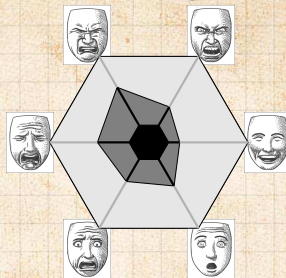
laughter:



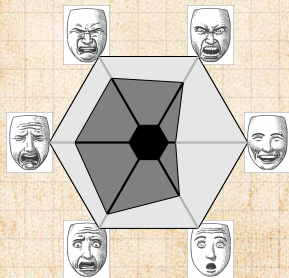
war:



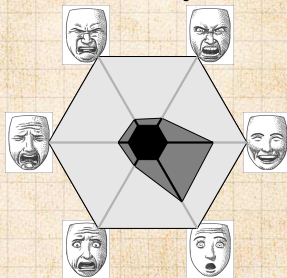
rotting:



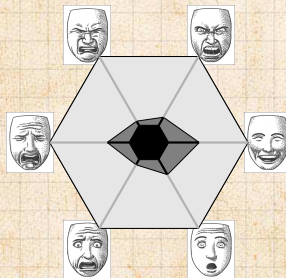
tortured:

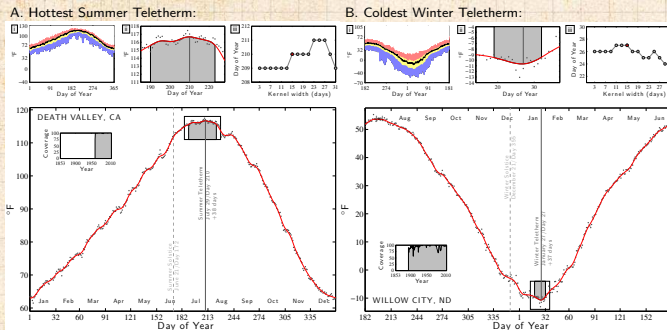


lottery:



veterans:







# Measuring Happiness

## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

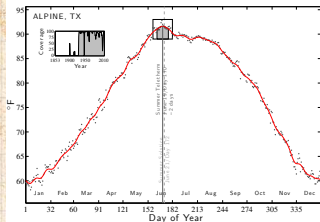
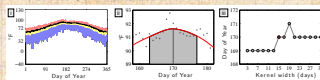
## Stories

## More things

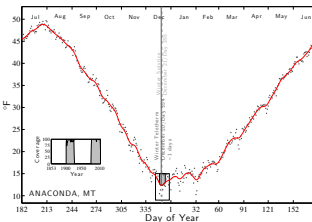
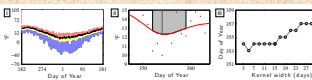
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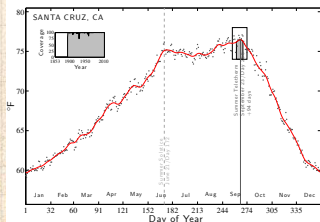
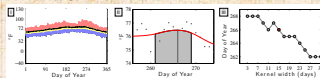
### A. Earliest Summer Teletherm:



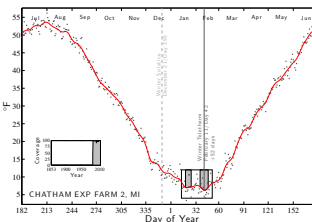
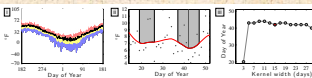
### B. Earliest Winter Teletherm:



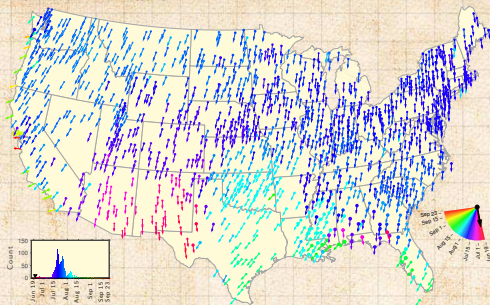
### C. Latest Summer Teletherm:



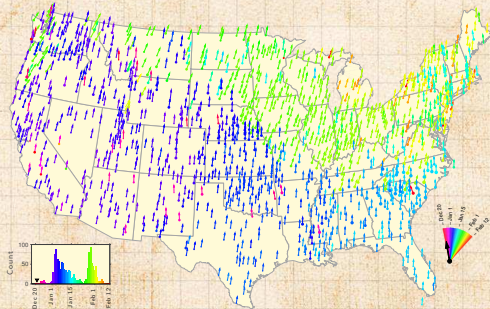
### D. Latest Winter Teletherm:



A. Summer Teletherms for 1853–2012:



B. Winter Teletherms for 1853–2011:



## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

### Pollyanna Principle

English  
10 languages

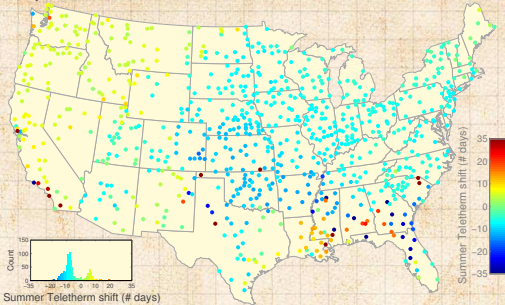
### Stories

### More things

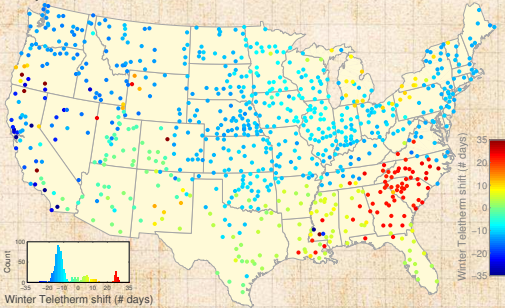
### References



A. 50 year Summer Teletherm shifts for 1963–2012 relative to 1913–1962:



B. 50 year Winter Teletherm shifts for 1962–2011 relative to 1912–1961:



## Measuring Happiness

### Happiness

Hedonometer  
Geography  
Literature

### Panometrics

### Various things

### Pollyanna Principle

English  
10 languages

### Stories

### More things

### References





Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

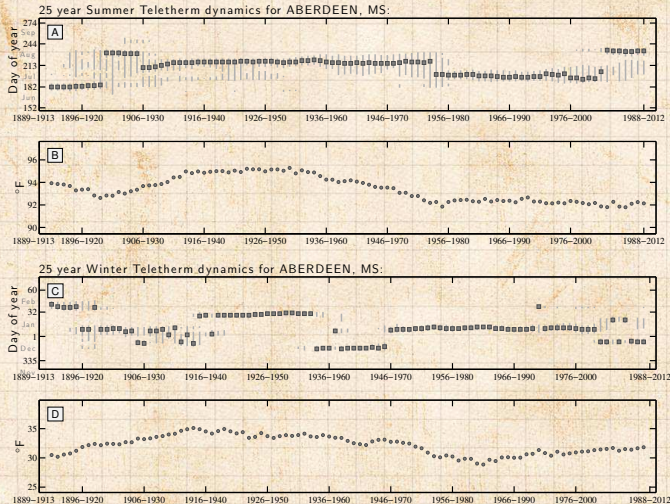
Pollyanna  
Principle

English  
10 languages

Stories

More things

References





## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

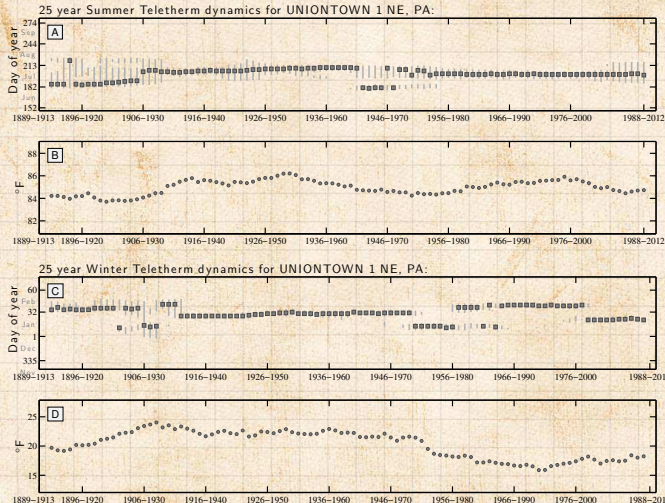
## Pollyanna Principle

English  
10 languages

## Stories

## More things

## References



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

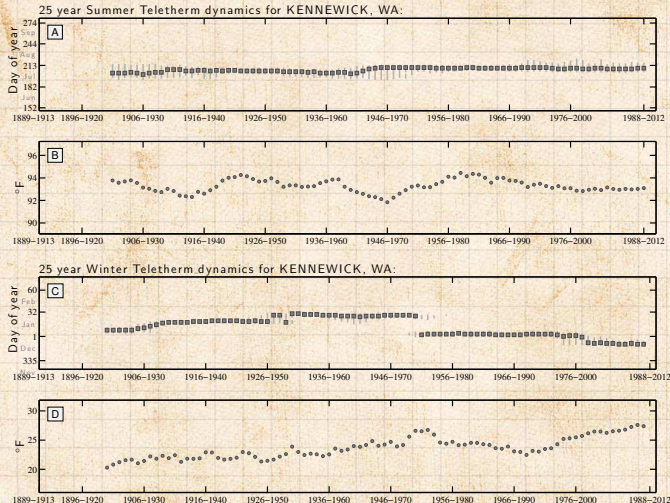
Pollyanna  
Principle

English  
10 languages

## Stories

## More things

## References



## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

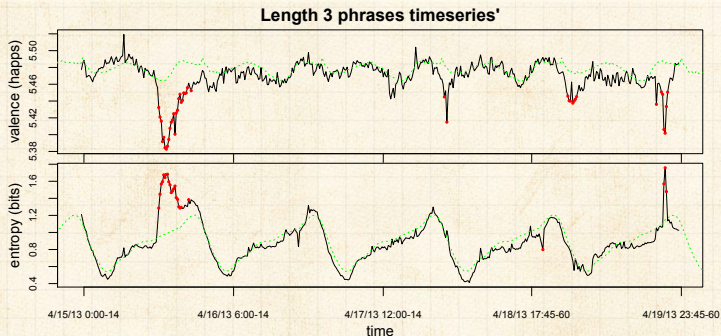
## Pollyanna Principle

English  
10 languages

## Stories

## More things

## References





## Happiness

Hedonometer  
Geography  
Literature

## Panometrics

## Various things

## Pollyanna Principle

English  
10 languages

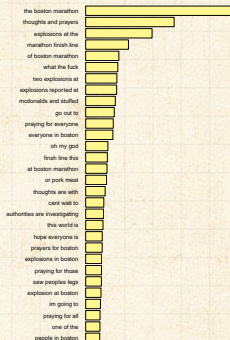
## Stories

## More things

## References



3-entropy Contributors: 13.04.15.15-2



-5.5224 Percent contribution 5.5224

5-valence Contributors: 13.04.19.19-1



-0.0882 Percent contribution 0.0882



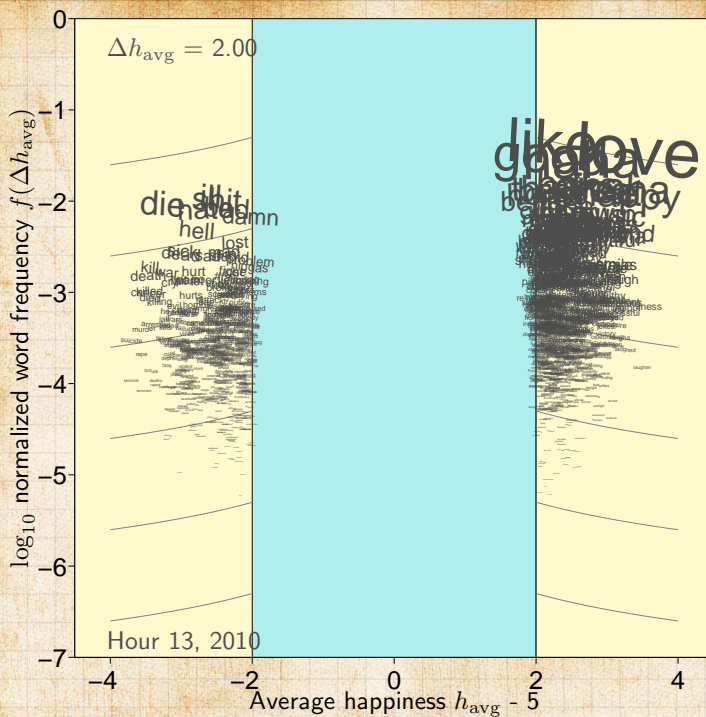












Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things


References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things


References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





# References VI

Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle  
English  
10 languages

Stories

More things

References

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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References





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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References



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Measuring  
Happiness

Happiness

Hedonometer  
Geography  
Literature

Panometrics

Various things

Pollyanna  
Principle

English  
10 languages

Stories

More things

References

