

Finding Happiness

Principles of Complex Systems
CSYS/MATH 300, Spring, 2013 | #SpringPoCS2013

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Measuring Happiness

Data sets

Blogs

Twitter

Geography

Health

Demographics

Movement

Networks

Phrases

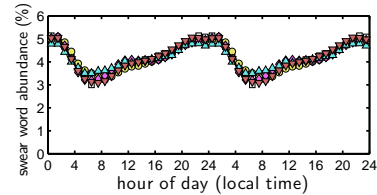
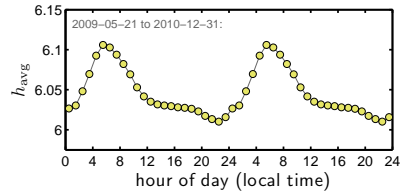
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The daily unravelling of the human mind:



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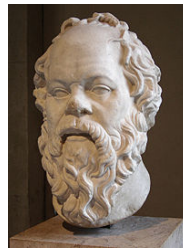
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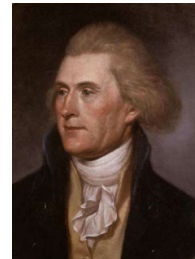
Happiness:



Socrates et al.:
eudaimonia^[11]



Bentham:
hedonistic calculus



Jefferson:
... the pursuit of happiness

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Outline

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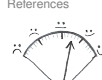
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Early drafts:

that among these are:
Life, Liberty, and ?? Money?
~~Libations~~ ... Alcohol
~~Property~~ Foot-the-ball
~~Beer~~
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Happiness:

Even the odd modern economist is happy:
 "Happiness" by Richard Layard [15]



[amazon] (B)

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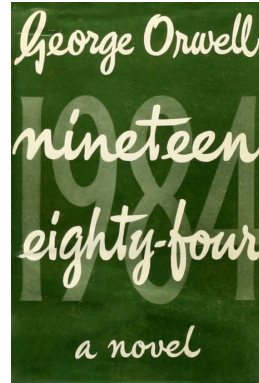
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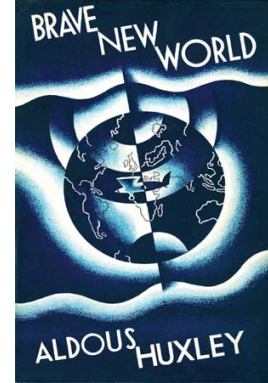
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An easy knock:



Science = Orwell



Policy = Brave New World

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What makes us happy?

Layard's summary:

Dominant factors:

- Family relationships
- Financial situation
- Work
- Community and Friends
- Health
- Personal Values
- Personal Freedom

Unimportant factors:

- Age
- Gender
- Education
- Inherent intelligence
- Looks

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Emotional content

So how does one measure

- happiness?
- levels of other emotional states?

Just ask people how happy they are.

- Experience sampling [3, 5, 4] (Csikszentmihalyi et al.)
- Day reconstruction [12] (Kahneman et al.)

But self-reporting has some drawbacks:

- relies on memory and self-perception
- induces misreporting [17]
- costly

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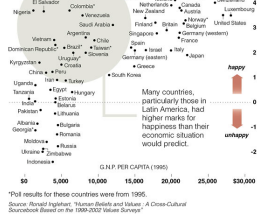
Desiring happiness—not just for boffins:

- Average people routinely report being happy is what they want most in life [15, 16, 6]
- And it matters: "Happy people live longer:..." Survey by Diener and Chan. [6]

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.



National indices of well-being:

- Bhutan
- France
- Australia



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Happiness, attention, and doing:

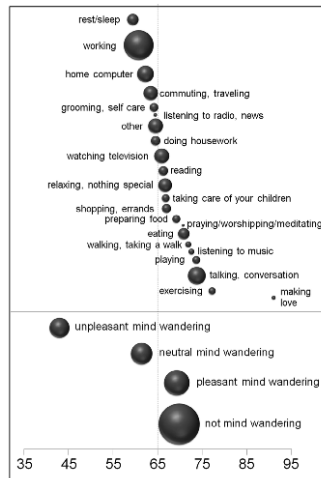


Fig. 1. Mean happiness reported during each activity (top) and while mind wandering to unpleasant topics, neutral topics, pleasant topics or not mind wandering (bottom). Dashed line indicates mean of happiness across all samples. Bubble area indicates the frequency of occurrence. The largest bubble ("not mind wandering") corresponds to 53.1% of the samples, and the smallest bubble ("praying/worshipping/meditating") corresponds to 0.1% of the samples.

Killingsworth and Gilbert, Science, 2010 [13]

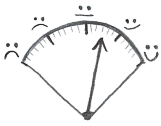
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We'd like to build an 'hedonometer':



- ▶ 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

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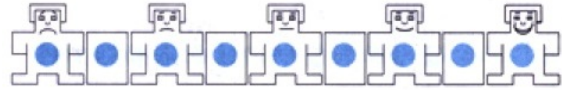
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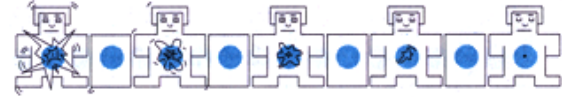
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1999 ANEW study—three 1–9 scales: [2]

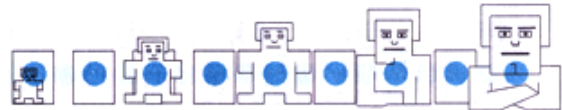
valence:



arousal:



dominance:



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Measuring Emotional Content

- ▶ **Idea:** Build on measures of the emotional content of individual words.
- ▶ Osgood et al. (1957) [20] identified a basis of three psychological variables as semantic differentials:
 - ▶ **Valence:** bad ↔ good
 - ▶ **Dominance:** weak ↔ strong
 - ▶ **Arousal:** passive ↔ active

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ANEW study:

Valence = Happiness:

- ▶ Valence scale presented to participants as a 'happy-unhappy scale.'
- ▶ Participants were further told:
 - “At one extreme of this scale, you are happy, pleased, satisfied, contented, hopeful. . . .
 - The other end of the scale is when you feel completely unhappy, annoyed, unsatisfied, melancholic, despaired, or bored.”

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ANEW study

- ▶ ANEW = “Affective Norms for English Words”
- ▶ Study: participants shown lists of isolated words
- ▶ Asked to grade each word's valence, arousal, and dominance level
- ▶ Integer scale of 1–9
- ▶ $N = 1034$ words—previously identified as bearing emotional weight
- ▶ Participants = College students (*cough*)
- ▶ Results published by Bradley and Lang (1999) [2]

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Top and Bottom 5 words by valence

1	triumphant (8.82)	rape (1.25)
2	paradise (8.72)	suicide (1.25)
3	love (8.72)	funeral (1.39)
4	loved (8.64)	cancer (1.50)
5	miracle (8.60)	rejected (1.50)

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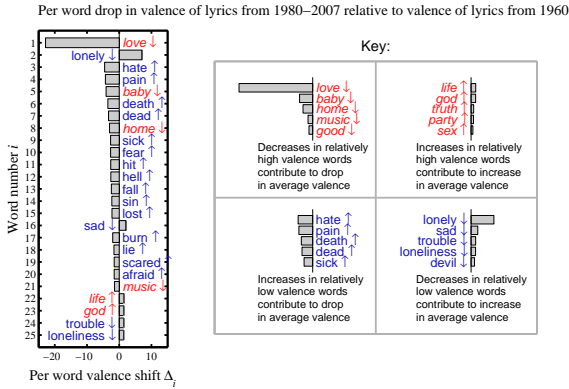
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Happiness Word Shift Graph:



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Data sets:

Texts:

- ▶ Song lyrics and titles (1960–2008)
- ▶ State of the Union (SOTU) Addresses (1790–2008)
- ▶ Twitter, 2008—
- ▶ Blogs (wefeelfine.org)
- ▶ New York Times (20 years)
- ▶ Gutenberg.org
- ▶ Google Books: <http://ngrams.googlelabs.com/> (田)
- ▶ BBC transcripts

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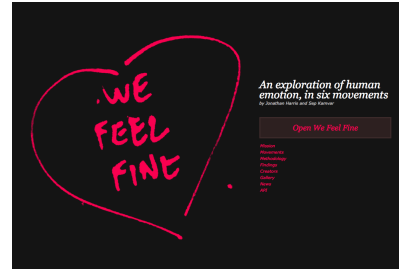
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Data sets:

- ▶ Blog phrases containing “I feel...”, “I am feeling”, etc., taken from wefeelfine.org (田) (API, 2005–2010)



▶ Created by Jonathan Harris & Sep Kamvar

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

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: ≥ 50 songs and ≥ 1000 ANEW words)

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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: ≥ 50 songs and ≥ 1000 ANEW words)

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Jonathan Harris, wefeelfine.org

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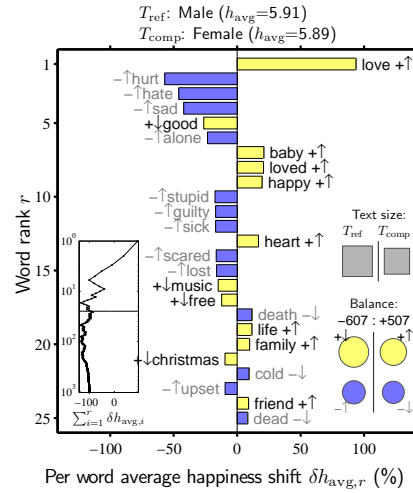
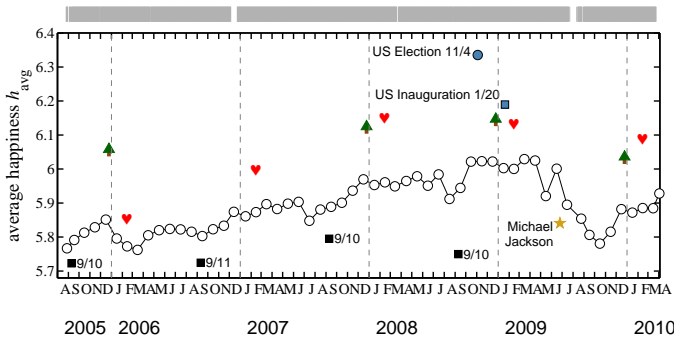
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Blogs—Overall trend



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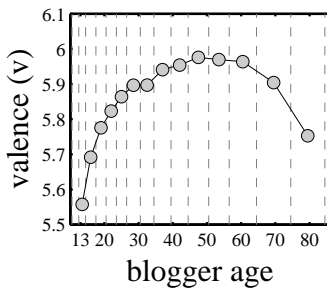
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Blogs—Age:



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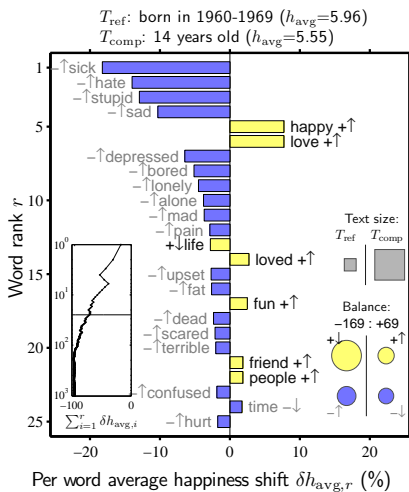
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- Average happiness as a function of the age bloggers report they will turn in the year of their posting.



labMT 1.0: language assessment by Mechanical Turk

- Twitter, Google Books, Music Lyrics, and the New York Times.
- 5000 most frequency used words for each corpus.
- 10,222 words, 50 evaluations each.



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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
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
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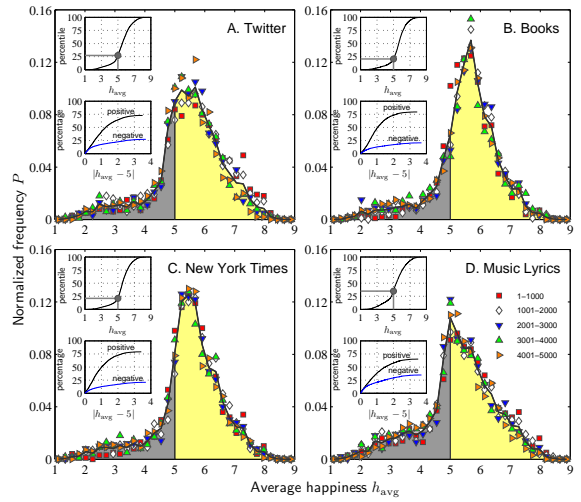
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valence rank	word	valence	std dev	twitter rank	g-books rank	nyt rank	lyrics rank
10193	violence	1.86	1.05	4299	1724	1238	2016
10194	cruel	1.84	1.15	2963	—	—	1447
10195	cry	1.84	1.28	1028	3075	—	226
10196	failed	1.84	1.00	2645	1618	1276	2920
10197	sickness	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	1894	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	—

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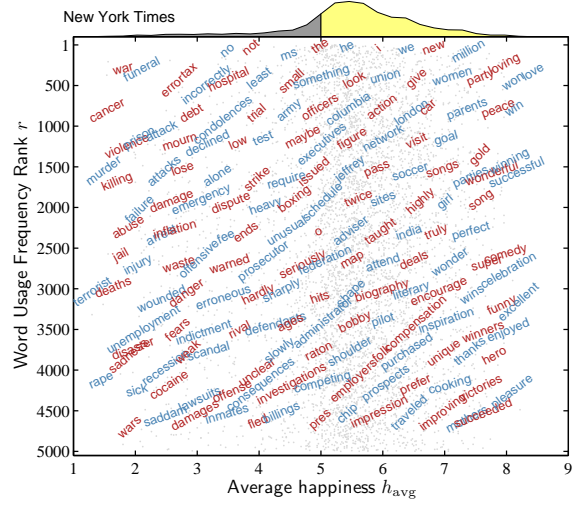
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std dev rank	word	valence	std dev	twitter rank	g-books rank	nyt rank	lyrics rank
1	ff@king	4.64	2.93	448	—	—	620
2	fx*kin	3.86	2.74	1077	—	—	688
3	fx*ked	3.56	2.71	1840	—	—	904
4	pussy	4.80	2.66	2019	—	—	949
5	whiskey	5.72	2.64	—	—	—	2208
6	slut	3.57	2.63	—	—	—	4071
7	cigarettes	3.31	2.60	—	—	—	3279
8	fx*kk	4.14	2.58	322	—	—	185
9	mortality	4.38	2.55	—	3960	—	—
10	cigarette	3.09	2.52	—	—	2678	—
11	motherfx*kers	2.51	2.47	—	—	1466	—
12	churches	5.70	2.46	—	2281	—	—
13	motherfx*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

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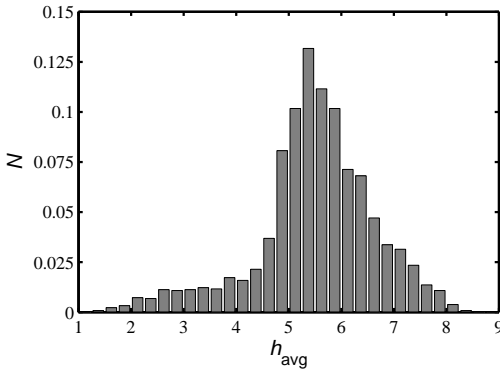


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- Data sets
- Twitter
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- The End
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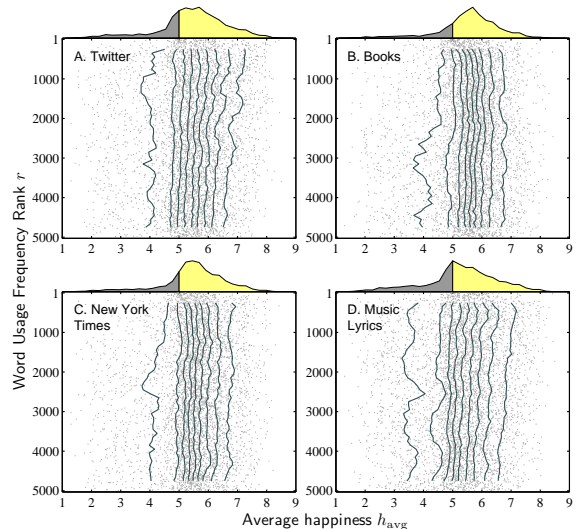
English's scale-invariant, positive bias:^[14]



► Social organism story manifested in language.

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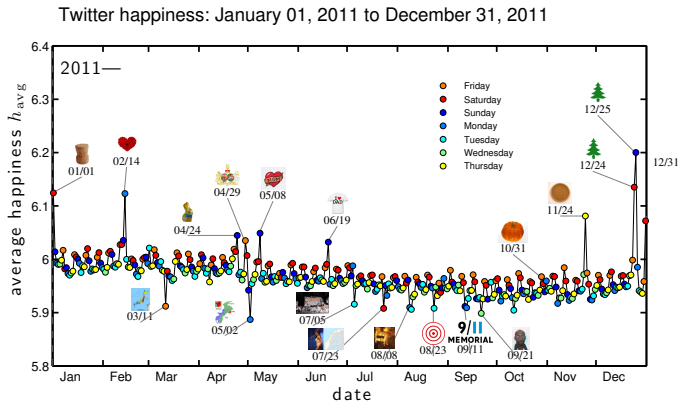


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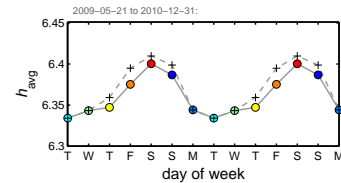
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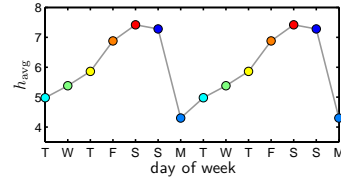
Twitter—weekly time series:



What people say:

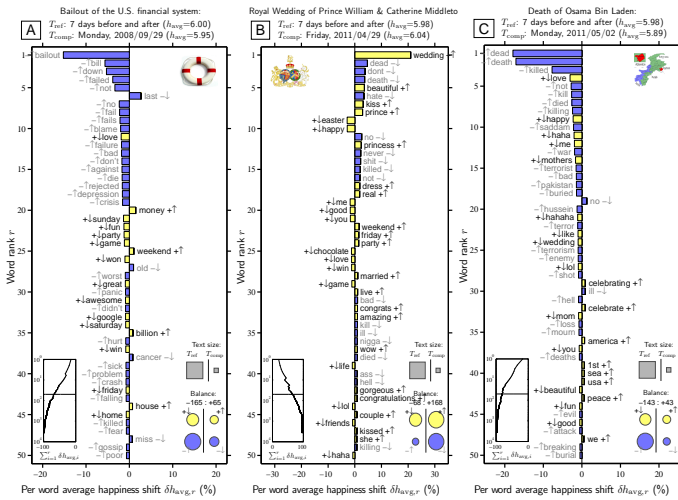


What people think:



► Inflation: NYT piece (田) on the blueness of Tuesdays.

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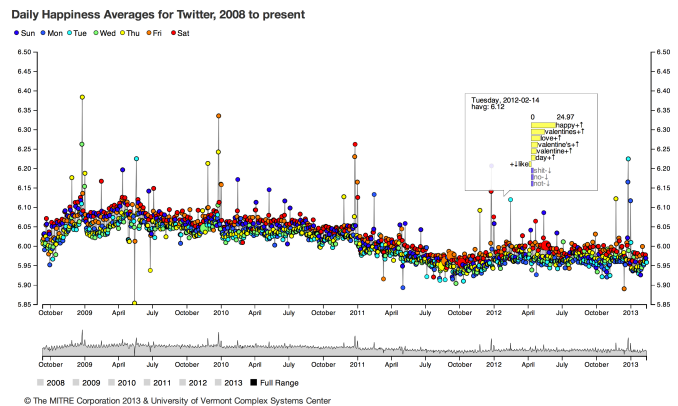


Word	Δh_{avg}	Total Tweets	$\Delta h_{avg,r}$	Word	Δh_{avg}	Total Tweets	$\Delta h_{avg,r}$
1. happy	+0.430	1.65e+07 (13)	+1.104 (1)	51. snow	-0.051	2.00e+06 (49)	+0.083 (30)
2. christmas	+0.404	4.50e+06 (52)	+0.513 (3)	52. Jon Stewart	+0.052	2.21e+04 (97)	+0.024 (48)
3. vegas	+0.315	1.84e+05 (90)	-0.015 (46)	53. school	-0.056	9.20e+06 (24)	+0.050 (42)
4. i	+0.274	1.04e+07 (20)	+0.039 (12)	54. Lehman Brothers	-0.078	8.20e+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	1.07e+06 (60)	-0.500 (16)	56. right	-0.094	1.92e+07 (10)	+0.126 (55)
7. our	+0.207	1.41e+07 (16)	+0.159 (33)	57. woman	-0.115	2.54e+06 (51)	+0.202 (30)
8. sin	+0.200	7.30e+06 (38)	+0.024 (4)	58. left	-0.118	4.40e+06 (34)	+0.383 (33)
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 (25)	-0.029 (9)	60. abortion	-0.128	3.00e+05 (75)	-0.306 (81)
11. love	+0.164	4.47e+07 (6)	+0.577 (2)	61. Sarah Palin	-0.129	2.20e+05 (87)	-0.681 (76)
12. friends	+0.155	7.07e+06 (27)	-0.085 (8)	62. no	-0.132	9.31e+07 (5)	-1.415 (90)
13. hope	+0.149	1.18e+07 (18)	+0.515 (19)	63. rain	-0.134	4.23e+06 (41)	+0.050 (44)
14. outfit	+0.147	2.50e+06 (46)	+0.518 (18)	64. climate	-0.135	3.64e+05 (84)	+0.100 (51)
15. cash	+0.146	1.28e+06 (63)	-0.601 (14)	65. gay	-0.152	2.73e+06 (47)	-0.552 (72)
16. son	+0.144	1.23e+06 (52)	-0.737 (6)	66. lose	-0.155	2.66e+06 (52)	-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	3.03e+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	3.07e+06 (36)	-0.546 (71)
20. husband	+0.127	2.47e+05 (84)	-0.503 (15)	70. I feel	-0.178	5.17e+06 (31)	+0.129 (50)
21. Stephen Colbert	+0.126	2.08e+04 (99)	-0.001 (45)	71. man	-0.179	1.30e+07 (14)	-0.163 (52)
22. USA	+0.113	1.21e+09 (24)	+0.355 (26)	72. Republican	-0.184	1.30e+05 (86)	-0.539 (70)
23. i	+0.106	3.44e+06 (40)	-0.195 (31)	73. sad	-0.187	3.56e+06 (38)	-1.306 (89)
24. winter	+0.101	1.20e+06 (64)	-0.050 (43)	74. gas	-0.188	3.02e+06 (52)	-0.471 (67)
25. God	+0.099	8.58e+06 (25)	-0.468 (20)	75. economy	-0.205	6.09e+05 (73)	-0.525 (69)
26. hot	+0.095	7.12e+06 (28)	-0.172 (54)	76. Obama	-0.206	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	2.96e+07 (9)	+0.126 (36)	79. hell	-0.250	6.27e+06 (30)	-1.551 (96)
30. love	+0.073	1.70e+06 (69)	-0.042 (11)	80. sock	-0.262	1.53e+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 (39)	82. war	-0.270	1.96e+06 (57)	-2.040 (100)
33. you	+0.052	1.93e+08 (3)	+0.113 (87)	83. Pope	-0.277	1.52e+05 (91)	-1.634 (92)
34. heaven	+0.041	7.42e+05 (71)	-0.074 (10)	84. base	-0.282	9.65e+06 (23)	-1.520 (94)
35. ...	+0.041	9.30e+05 (66)	+0.305 (23)	85. Glenn Beck	-0.282	1.14e+05 (92)	-0.776 (82)
36. sex	+0.035	3.51e+07 (7)	+0.146 (34)	86. Islam	-0.289	1.57e+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. drink	+0.031	1.25e+06 (63)	-0.206 (61)	88. Goldman Sachs	-0.332	2.27e+04 (96)	-0.904 (84)
39. ?	+0.030	2.32e+06 (53)	-0.503 (68)	89. depressed	-0.339	2.81e+05 (82)	-1.541 (95)
40. IT	+0.029	3.03e+08 (1)	-0.443 (66)	90. Senate	-0.340	4.48e+05 (78)	-0.601 (75)
41. Michael Jackson	+0.018	8.89e+05 (70)	-0.213 (59)	91. BP	-0.355	5.92e+05 (74)	-0.902 (83)
42. night	+0.014	1.71e+07 (12)	-0.074 (40)	92. gem	-0.367	6.81e+05 (72)	-1.476 (93)
43. life	+0.012	1.04e+07 (17)	+0.422 (22)	93. drugs	-0.382	5.10e+05 (77)	-1.452 (91)
44. health	+0.009	2.59e+06 (43)	-0.347 (21)	94. homicide	-0.442	8.57e+05 (69)	-1.281 (88)
45. sex	-0.008	3.55e+06 (39)	+0.542 (17)	95. ...	-0.453	3.40e+05 (81)	-1.174 (85)
46. work	+0.010	2.64e+07 (11)	-0.174 (65)	96. week	-0.472	2.38e+06 (42)	-1.288 (89)
47. girl	-0.010	1.01e+07 (22)	+0.331 (24)	97. Afghanistan	-0.703	2.74e+05 (83)	-1.458 (92)
48. dog	+0.020	4.03e+06 (33)	+0.062 (41)	98. mosque	-0.709	6.98e+04 (95)	-0.694 (77)
49. I	-0.016	3.00e+08 (2)	-0.602 (69)	99. Bill	-0.732	3.01e+05 (85)	-1.912 (99)
50. costume	-0.048	0.16e+04 (104)	-0.206 (107)	100. Iraq	-0.771	2.93e+05 (85)	-1.282 (87)

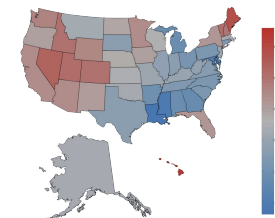
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hedonometer.org (田) (launching Tuesday, April 30, 2013)



The Geography of Happiness:

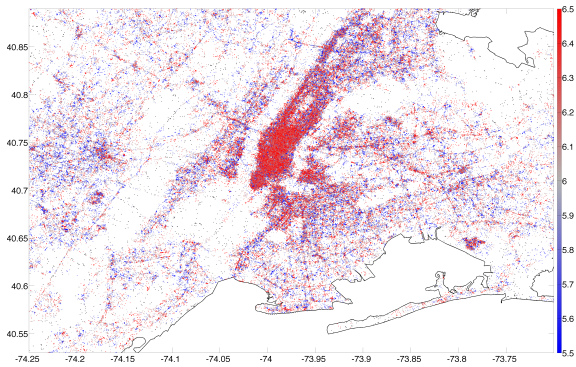


► From "The Geography of Happiness: Connecting Twitter sentiment and expression, demographics, and objective characteristics of place", Mitchell et al., 2013, to appear in PLoS ONE [19].

► See blog posts here (田), here (田), and here (田).

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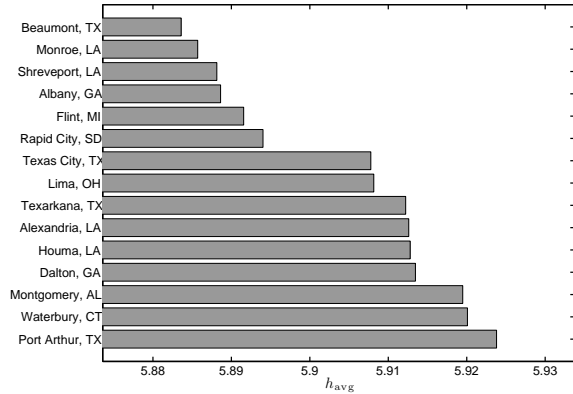


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Saddest Cities (geoprofanity):

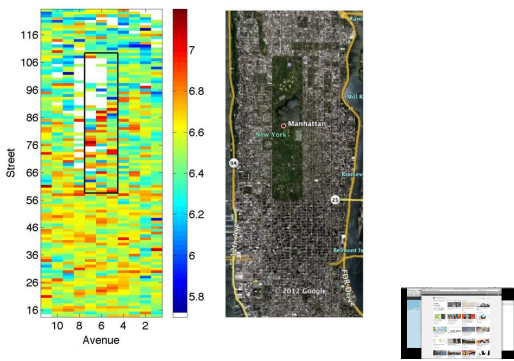


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Happiness in Manhattan:

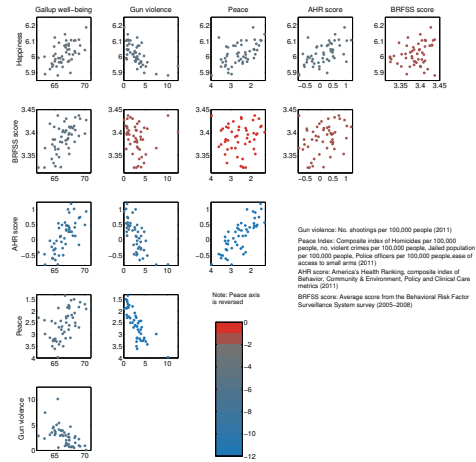


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Validity test #30,231(b):



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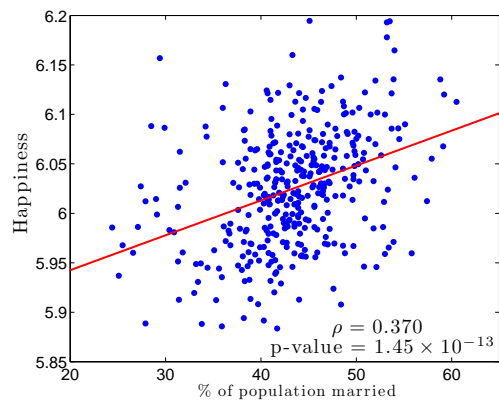


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See [Blog post](#) on [onehappybird](#) (田)

Good news for Valentine's Day:

Happiness and Marriage:

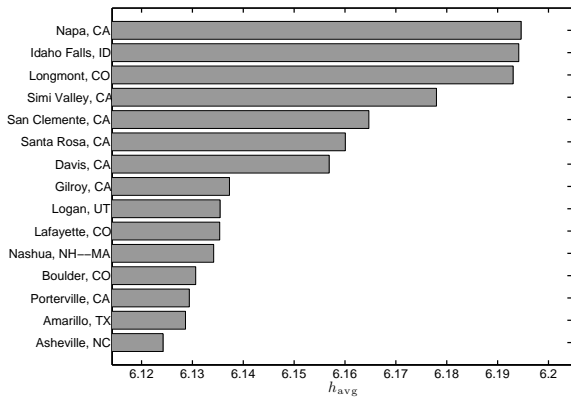


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Happiest Cities:

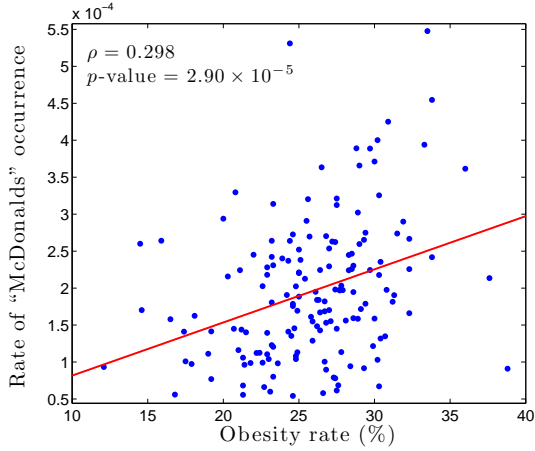


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Obesity and tweets—"McDonalds":



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Obesity rates and usage of food-related words:

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

Positive correlations

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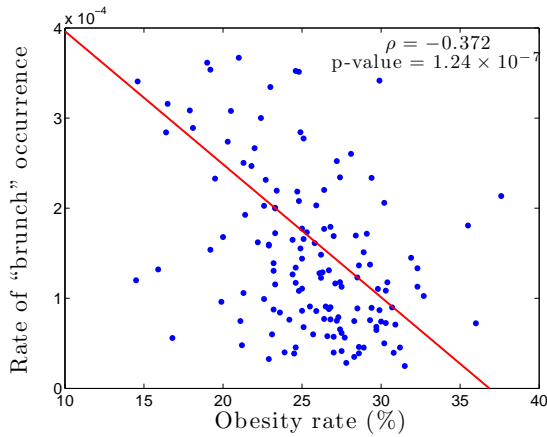
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Obesity and tweets—"Brunch":



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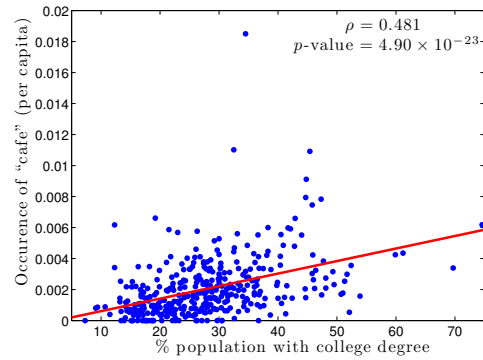
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'cafe' usage frequency vs. fraction with College degree:



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Obesity rates and usage of food-related words:

Negative correlations

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

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Word usage frequency vs. fraction with College degree:

Word	ρ	p -value	$h_{avg}(w_i)$	Word	ρ	p -value	$h_{avg}(w_i)$
cafe	0.481	4.9×10^{-23}	6.78	me	-0.393	3.26×10^{-15}	6.58
pub	0.463	3.14×10^{-21}	6.02	love	-0.389	6.51×10^{-15}	8.42
software	0.458	9.07×10^{-21}	6.30	my	-0.354	1.97×10^{-12}	6.16
yoga	0.455	1.85×10^{-20}	7.04	like	-0.346	6.04×10^{-12}	7.22
grill	0.433	1.78×10^{-18}	6.24	hate	-0.344	8.76×10^{-12}	2.34
development	0.424	1.14×10^{-17}	6.38	tired	-0.343	1×10^{-11}	3.34
emails	0.419	2.87×10^{-17}	6.54	sleep	-0.341	1.27×10^{-11}	7.16
wine	0.417	3.83×10^{-17}	6.42	stupid	-0.328	8.55×10^{-11}	2.68
library	0.414	6.47×10^{-17}	6.48	bored	-0.315	5.11×10^{-10}	3.04
art	0.414	6.8×10^{-17}	6.60	you	-0.315	5.23×10^{-10}	6.24
sciences	0.410	1.54×10^{-16}	6.30	goodnight	-0.305	1.77×10^{-9}	6.58
pasta	0.410	1.57×10^{-16}	6.86	bitch	-0.295	6.51×10^{-9}	3.14
lounge	0.409	1.68×10^{-16}	6.50	all	-0.289	1.33×10^{-8}	6.22
market	0.408	2.2×10^{-16}	6.28	lie	-0.285	2.24×10^{-8}	2.60
india	0.407	2.5×10^{-16}	6.42	mom	-0.284	2.42×10^{-8}	7.64
drinking	0.405	3.74×10^{-16}	6.14	wish	-0.271	1.05×10^{-7}	6.92
technology	0.405	3.76×10^{-16}	6.74	talk	-0.267	1.74×10^{-7}	6.06
forest	0.405	3.83×10^{-16}	6.68	she	-0.265	2.01×10^{-7}	6.18
brunch	0.405	3.89×10^{-16}	6.32	know	-0.262	2.78×10^{-7}	6.10
dining	0.403	4.92×10^{-16}	6.48	ill	-0.259	4.11×10^{-7}	2.42
supporting	0.399	1.1×10^{-15}	6.48	dont	-0.258	4.54×10^{-7}	3.70
professor	0.398	1.23×10^{-15}	6.04	well	-0.256	5.3×10^{-7}	6.68
university	0.392	3.62×10^{-15}	6.74	don't	-0.255	5.8×10^{-7}	3.70
film	0.391	4.27×10^{-15}	6.56	give	-0.255	5.84×10^{-7}	6.54
global	0.391	4.72×10^{-15}	6.00	friend	-0.255	6.27×10^{-7}	7.66

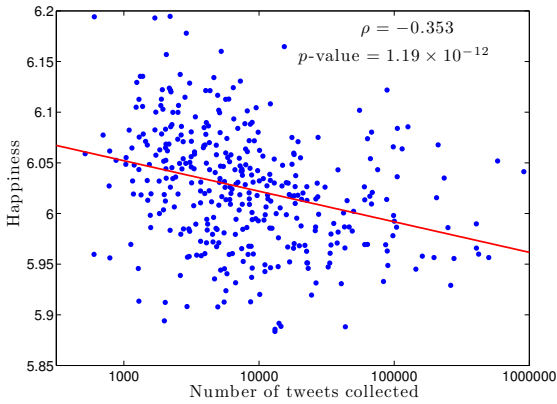
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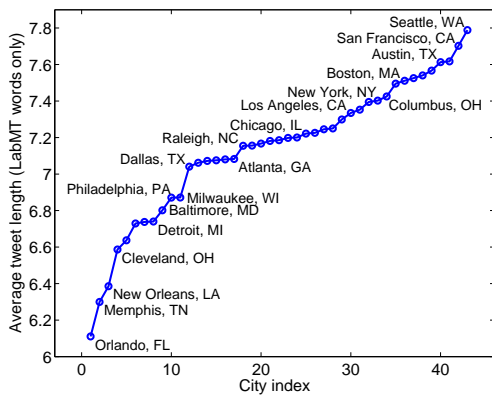
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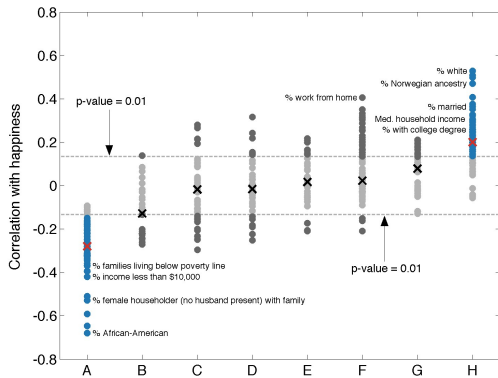


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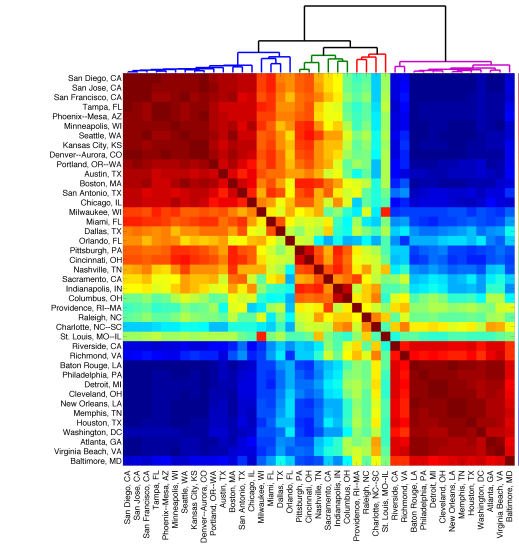
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Explore more [here](#) (田).



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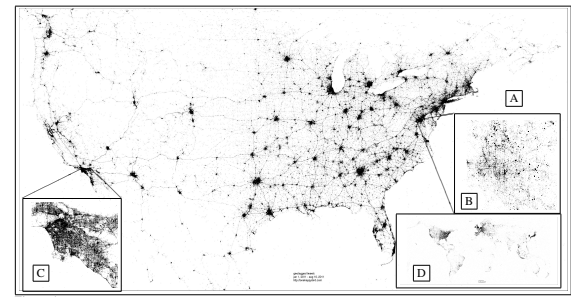


Figure 1. Each point corresponds to a geo-located tweet posted between 1/1/11 and 8/10/11. Twitter activity seems to correlate with urban areas. Note that the image contains no cartographic borders, simply a small dot for each message. Insets: A (U.S.), B (Washington, D.C.), C (Los Angeles, C.A.), and D (Earth).

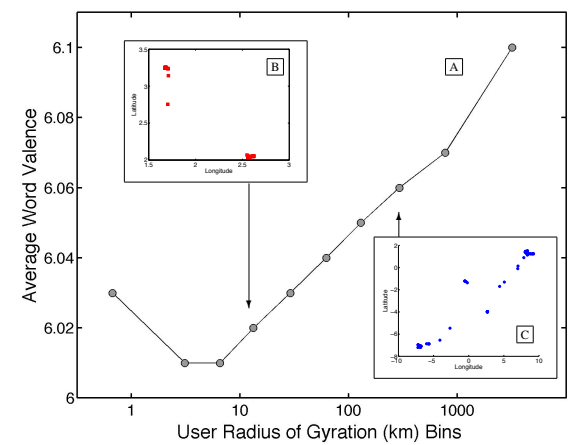
- From "Happiness and the Patterns of Life: A Study of Geolocated Tweets", Frank et al., 2013, in review [9].
- See blog post [here](#) (田).

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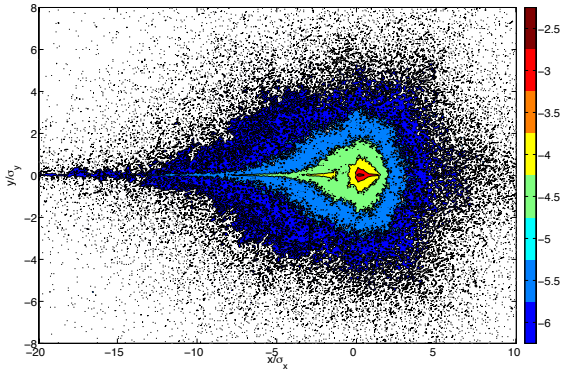


Frank et al., in preparation.

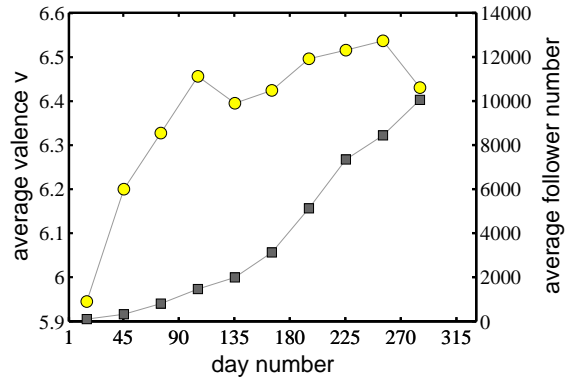
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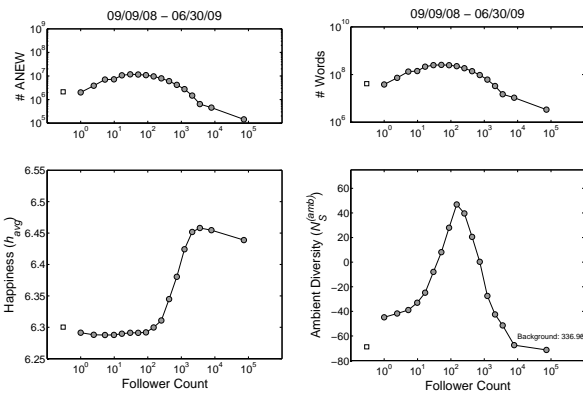


Raw movement patterns agree with cell phone data findings^[10]

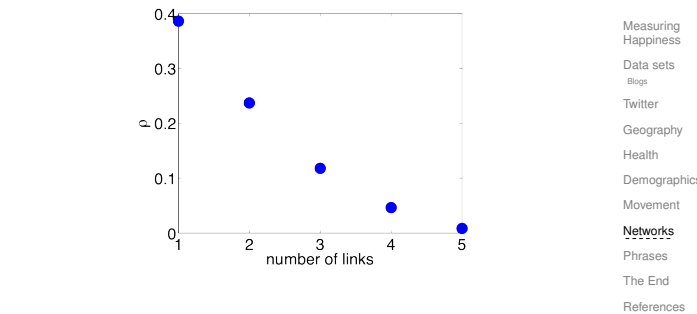


Twitter—popularity based on follower count:

Twitter—interactions:



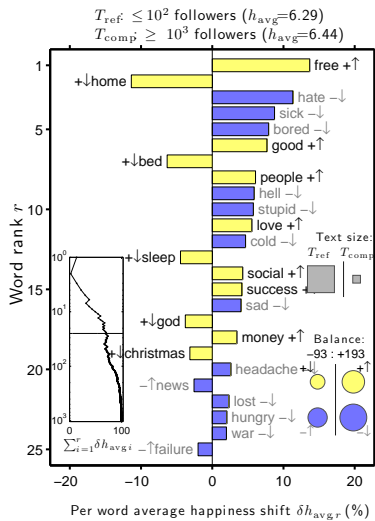
► Dunbar's number ≈ 150 .



- Decay in happiness correlation in social network.
- ρ = Spearman's correlation coefficient.
- "Twitter reciprocal reply networks exhibit assortativity with respect to happiness"

Bliss et al., Journal of Computational Science, 2012^[1]

Phrases—Music Lyrics:



rank	order=1	order=2	order=3	order=4
1	i	and i	i know you	if you want to
2	the	in the	you know i	let me tell you
3	and	if you	and i know	tell me what you
4	you	on the	this is then	don't want to be
5	a	to the	la la la	all i need is
6	to	i know	don't want to	and i know that
7	my	you know	if i could	what can i do
8	i'm	but i	can't you see	want you to know
9	it	when i	don't know what	all i want is
10	that	when you	all the time	give it to me
11	so	all the	why don't you	when it comes to
12	your	like a	as long as	how does it feel
13	me	this is	don't you know	you know that i
14	in	come on	there is no	don't you know that
15	no	to be	i know that	don't give a fuck
25	love	don't know	but i can't	all the things that
100	m	just like	in this world	woke up this morning

► J. Williams et al., in preparation.



Next for Happiness:

- ▶ hedonometer.org (田) (early 2013).
- ▶ Over 10 additional languages being scored through a new service.
- ▶ Four other emotions: surprise, fear, disgust, and anger.
- ▶ Other input streams (e.g., BBC)
- ▶ Expansion to phrase-based analysis.

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