The emotional content of large-scale texts: The happiness of bloggers, song lyrics, and presidents.

Workshop on Challenges and Visions in the Social Sciences
ETH Zurich, August 18–23, 2008

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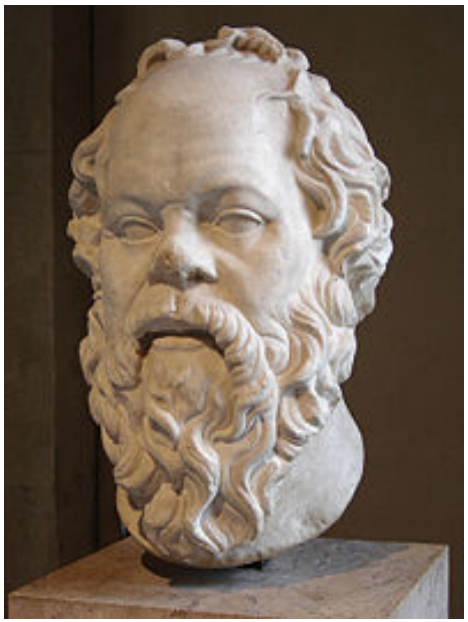
Outline

Happiness:



http://wikipedia.org

- Greek philosophers held Eudaimonia as highest good. [9]
- $\simeq$ flourishing, well-being, pleasure, ...
- Socrates, Plato, Aristotle, Epicurus, ...

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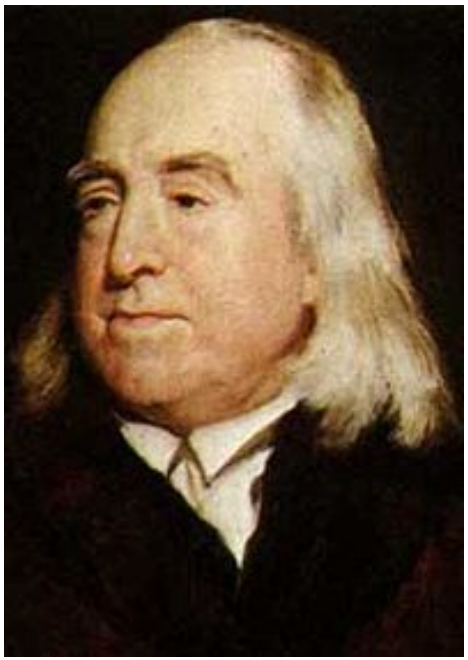

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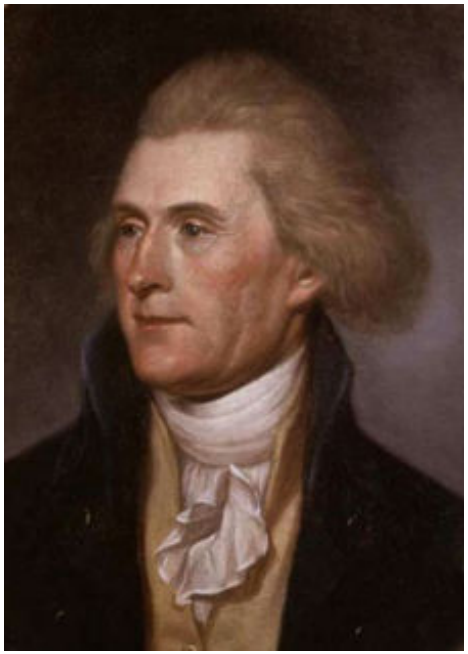
Bentham's hedonistic calculus:

"[t]he greatest happiness of the greatest number is the foundation of morals and legislation" [17]

Priestly, John Stuart Mill, ...

United States' Declaration of Independence:



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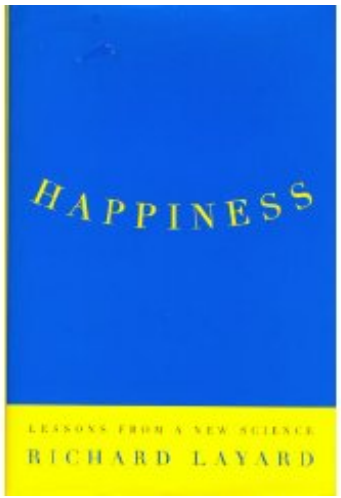
"We hold these truths to be sacred & undeniable; that all men are created equal & independent, that from that equal creation they derive rights inherent & inalienable, among which are the preservation of life, & liberty, & the pursuit of happiness;"

Happiness:

Even the odd modern economist likes happiness:

"Happiness" by Richard Layard [11]



What makes us happy?

Layard's summary:

Dominant factors:

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

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Unimportant factors:

- Age
- Gender
- Education
- Inherent intelligence
- Looks

Desiring happiness—not just for boffins:

- Average people routinely report being happy is what they want most in life [11, 12]

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National indices of well-being:

- Bhutan
- France
- Australia

Emotional content

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2. levels of other emotions?

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- Experience sampling [4, 6, 5] (Csikszentmihalyi et al.)
- Day reconstruction [10] (Kahneman et al.)

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- Day reconstruction [10] (Kahneman et al.)

But self-reporting has drawbacks...

- relies on memory and self-perception
- induces misreporting [13]
- costly

Measuring Emotional Content

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

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Some possibilities:

- Natural language processing (e.g., OpinionFinder)
- Declared mood levels in blogs (e.g., Livejournal) [14]

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- Examples:
  - hate $\leftrightarrow$ love
  - rough $\leftrightarrow$ smooth
  - up $\leftrightarrow$ down
- Osgood et al. (1957) [15] identified a basis of 3 semantic differentials:
  - Valence: bad $\leftrightarrow$ good
  - Dominance: weak $\leftrightarrow$ strong
  - Arousal: passive $\leftrightarrow$ active

  (also often: Evaluation, Potency, and Activity)

ANEW study

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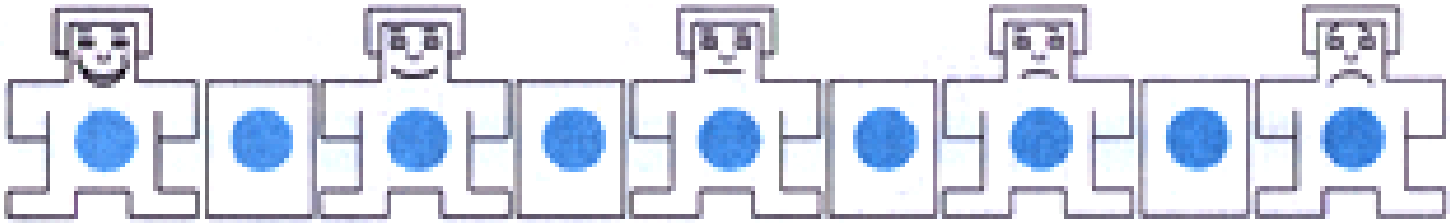
- $N = 1034$ words—previously identified as bearing emotional weight
- Participants = College students (*cough*)
- Results published by Bradley and Lang (1999) [2]

ANEW study—three 1–9 scales:

valence:



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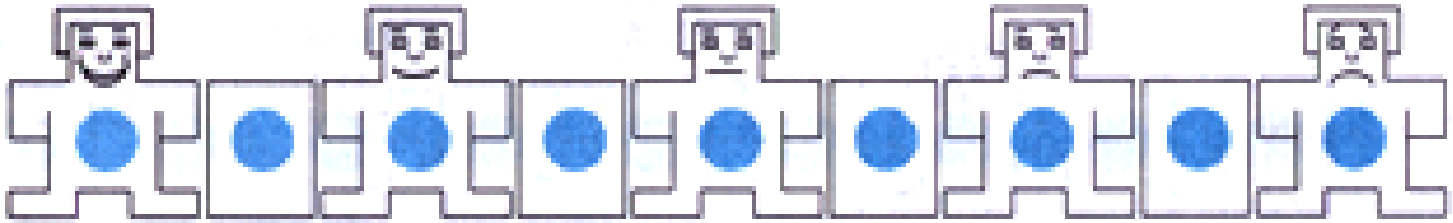
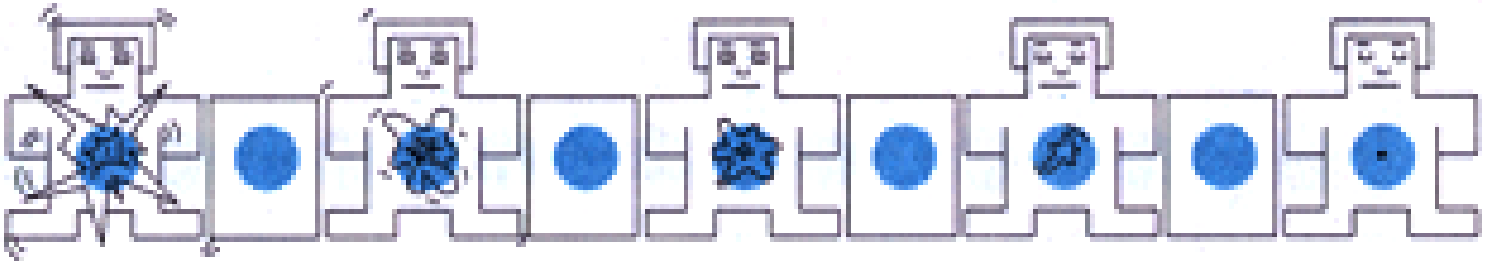
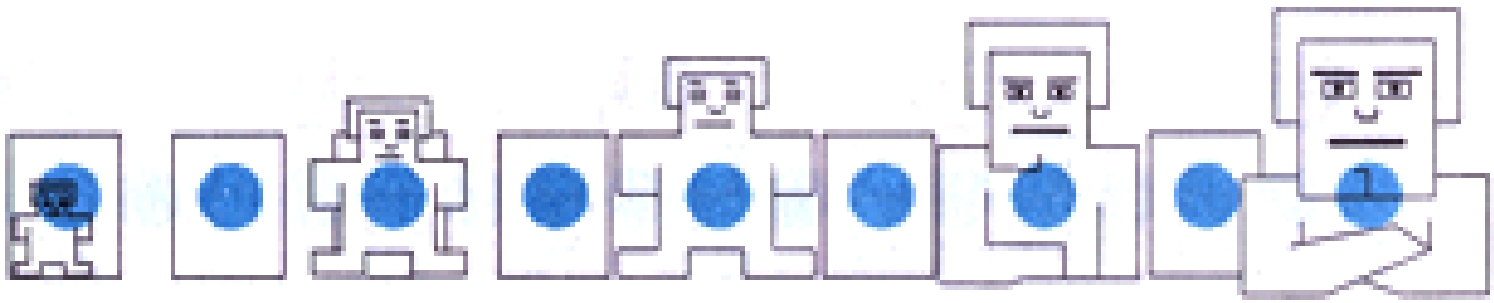


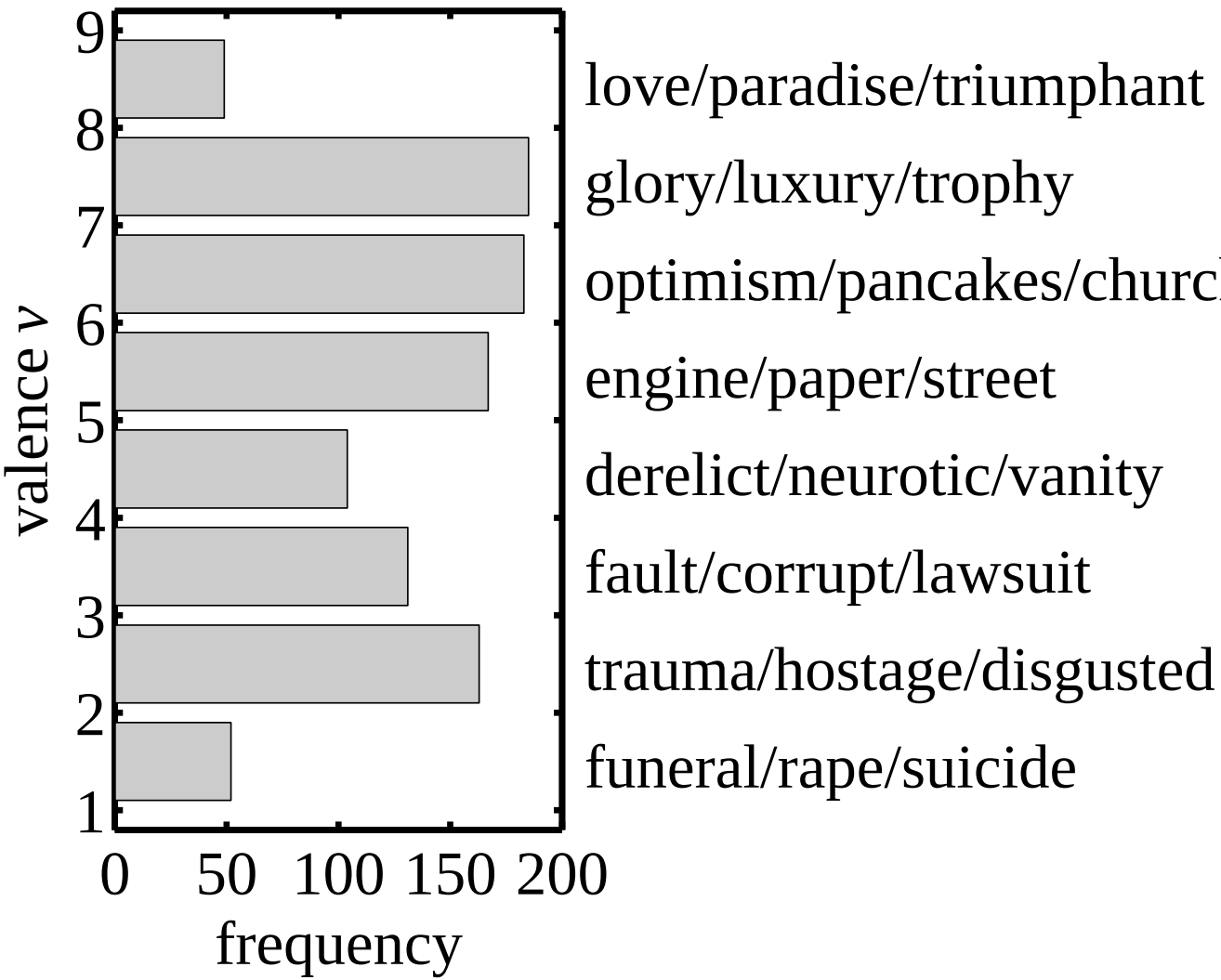
arousal:



dominance:



ANEW words—examples



Analysing text:

- Simplest measure for a text:

$$\theta_{\text{avg}} = \sum_{i=1}^{N} p_i \theta_i$$

  where p_i is fractional abundance of word i and θ is average valence, arousal, or dominance for word i.
- Focus on valence, $\theta = v$.
- Average valence typically falls between 5 and 7.

Unhappiness:

Some obvious problems/issues:

- Partial coverage of all words.
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Clearly:

- Only suitable for large-scale texts.

Data sets:

Texts:

1. Song lyrics (1960–2007)
2. Song titles (1960–2008)
3. State of the Union (SOTU) Addresses (1790–2008)

Sources:

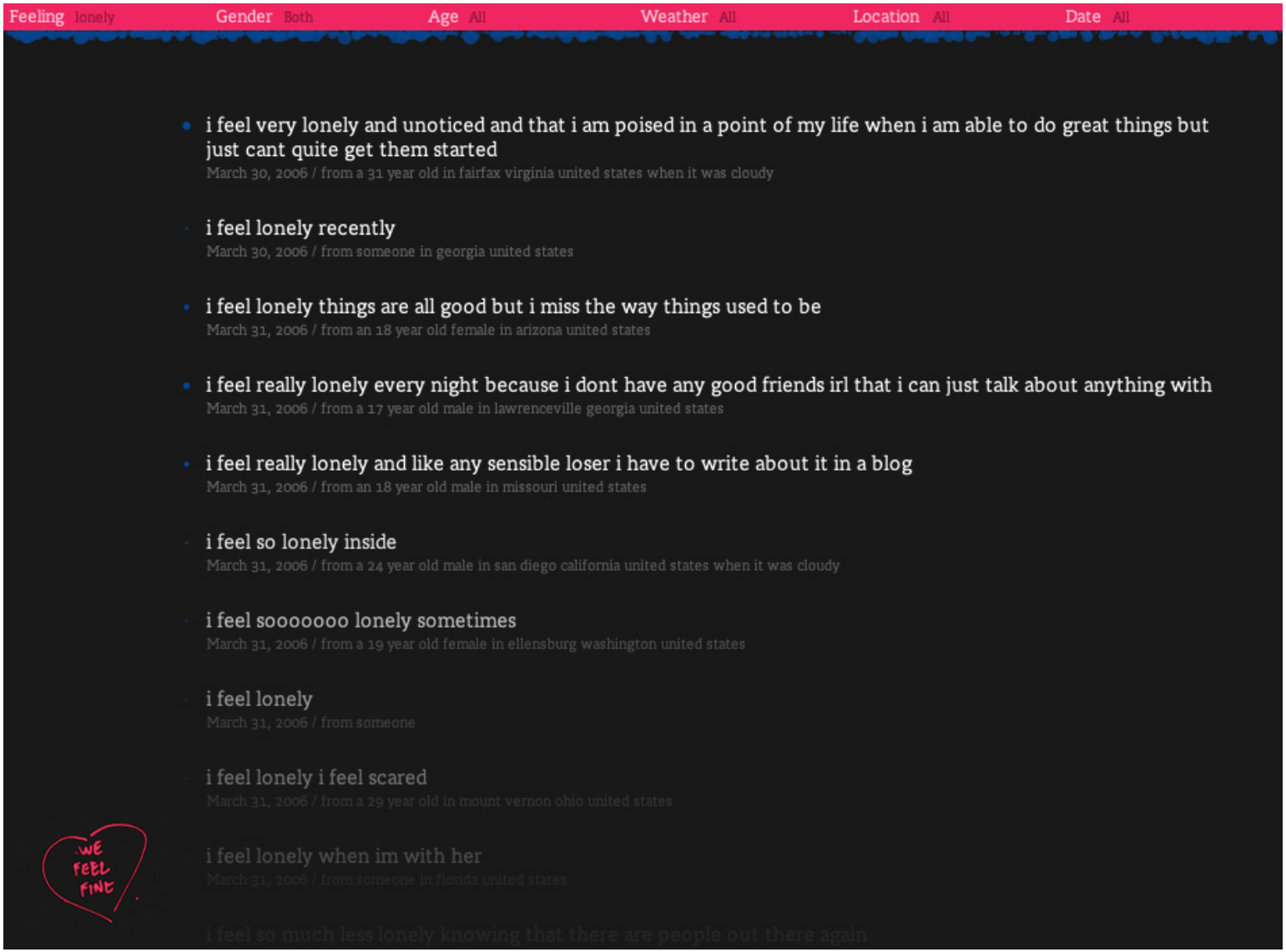
- hotlyrics.com (⊞)
- freedb.com (⊞)
- American Presidency Project: www.presidency.ucsb.edu (⊞).

Data sets:

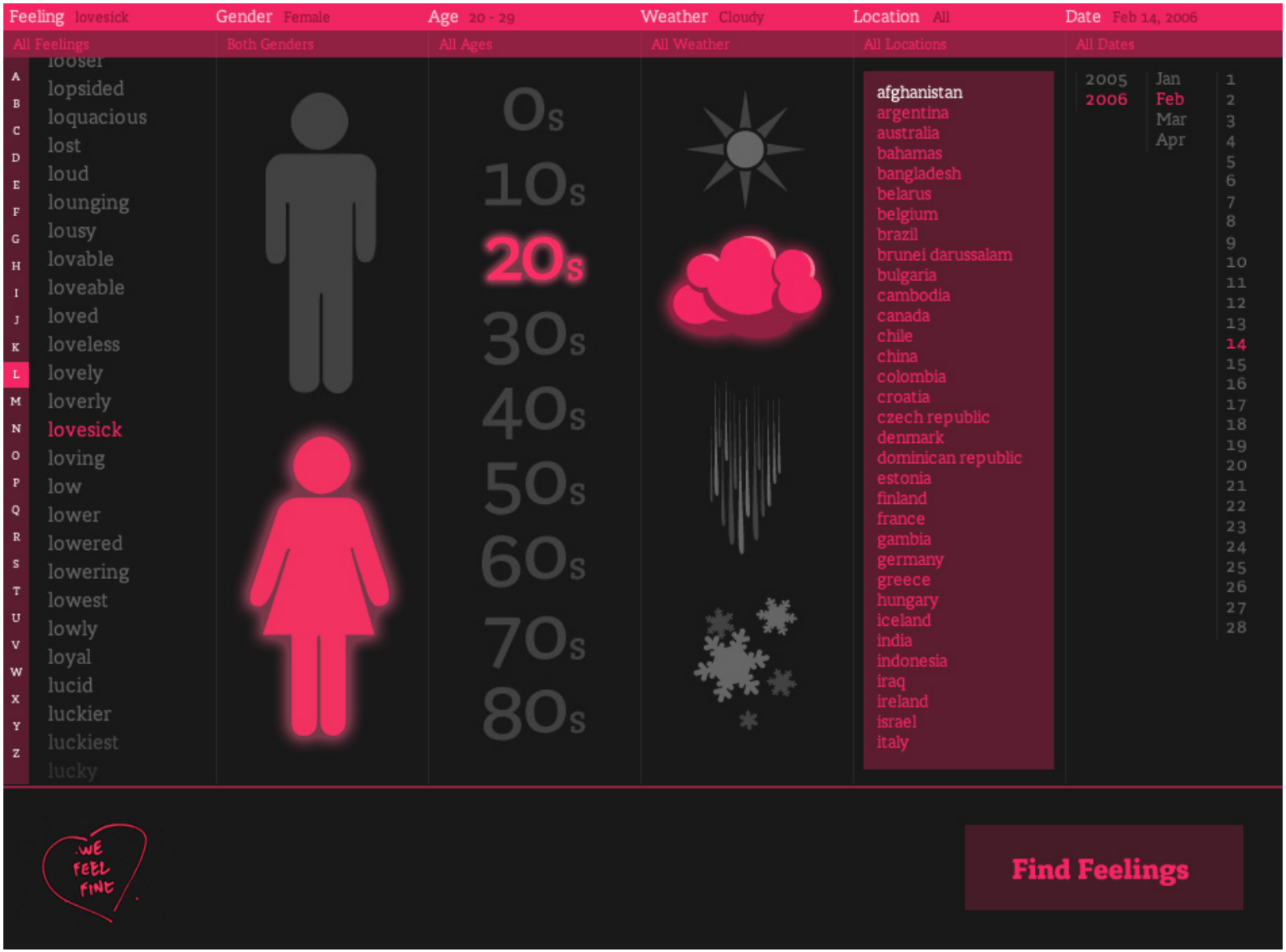
4 Blog phrases beginning with “I feel...” or “I am feeling” taken from wefeelfine.org (⊞) (2005–2008)

Created by Jonathan Harris and Sep Kamvar

wefeelfine.org:



wefeelfine.org:



Some demographics for blog sentences:

Breakdown by # of sentences:

Country	Percentage
United States	82.3
Canada	6.1
United Kingdom	4.8
Australia	3.7
Philippines	0.4
Germany	0.2

Some numbers:

Counts	Song lyrics	Song titles
All words	58,610,849	60,867,223
ANEW words	3,477,575 (5.9%)	5,612,708 (9.2%)
Individuals	$\sim$ 20,000	$\sim$ 632,000

Counts	Weblogs	SOTU
All words	148,231,294	1,796,763
ANEW words	8,176,669 (5.5%)	61,926 (3.5%)
Individuals	$\sim$ 2,148,000	43

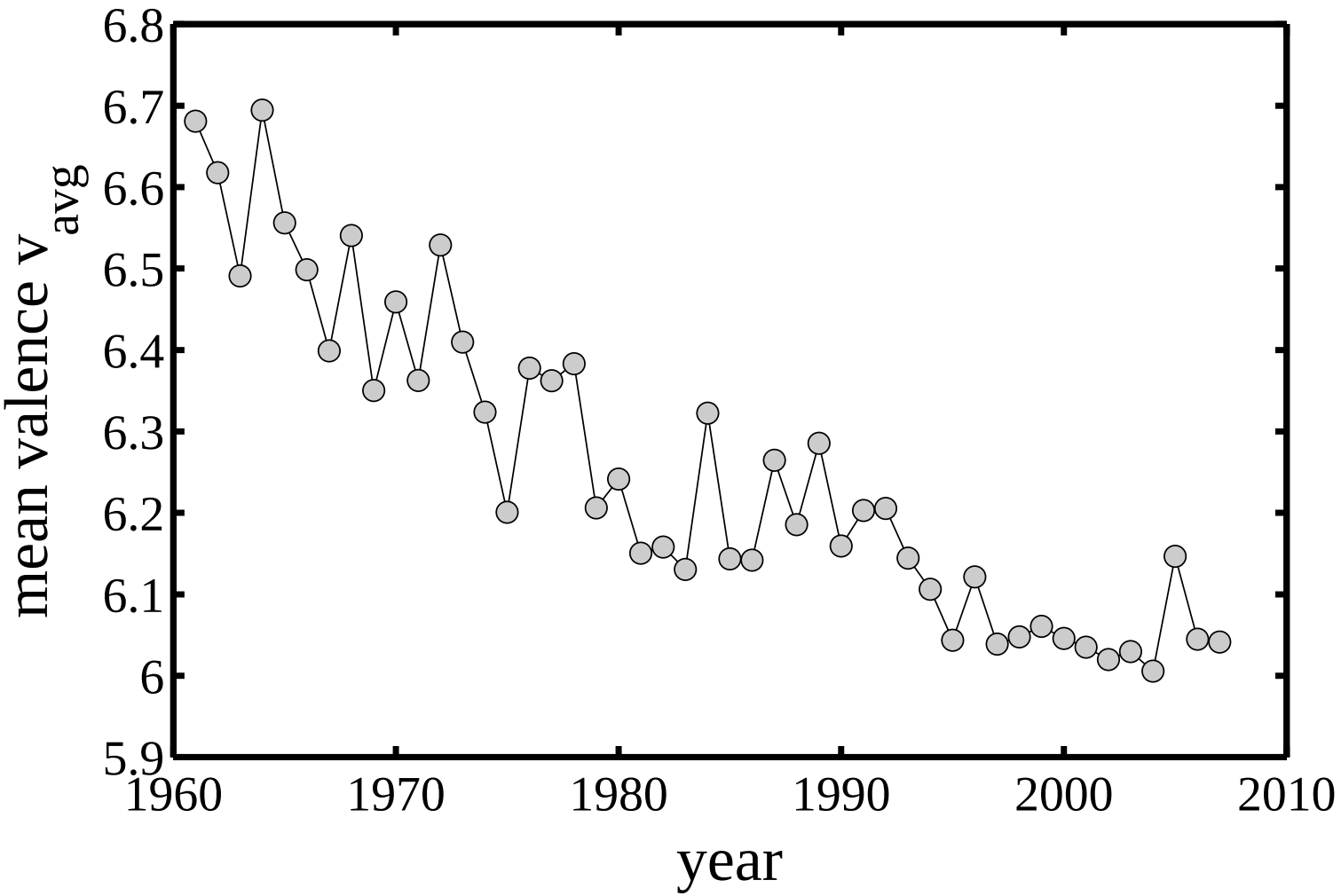
Most frequent ANEW words:

Rank	Song lyrics	Song titles
1	love (7.37%)	love (7.39%)
2	time (4.18%)	time (4.19%)
3	baby (2.75%)	baby (2.75%)
4	life (2.59%)	life (2.60%)
5	heart (2.14%)	heart (2.15%)

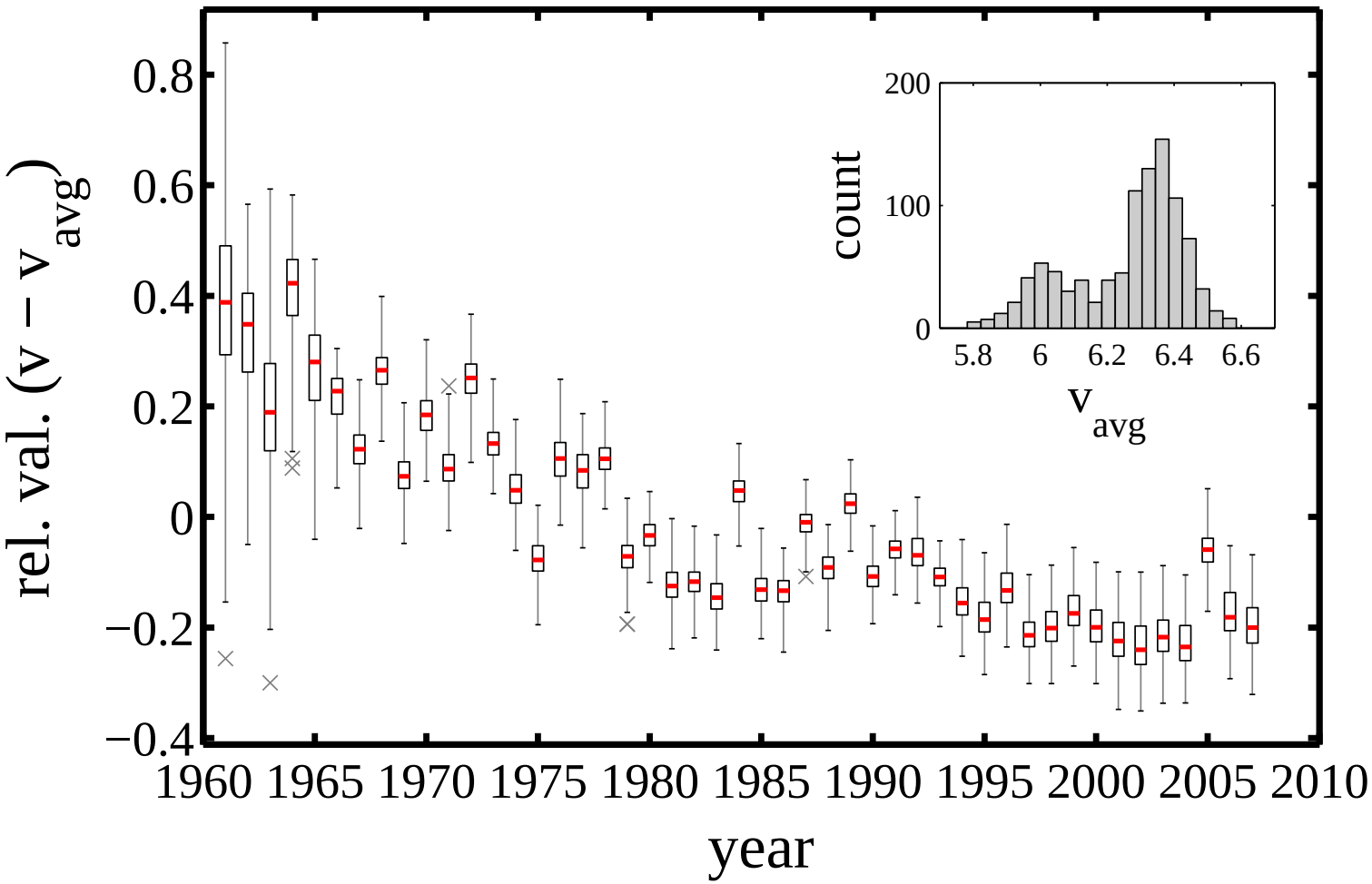
Rank	Weblogs	SOTU
1	good (4.89%)	people (5.49%)
2	time (4.72%)	time (4.09%)
3	people (3.94%)	present (3.45%)
4	love (3.31%)	world (3.10%)
5	life (3.13%)	war (2.98%)

Outline

Lyrics—average valence

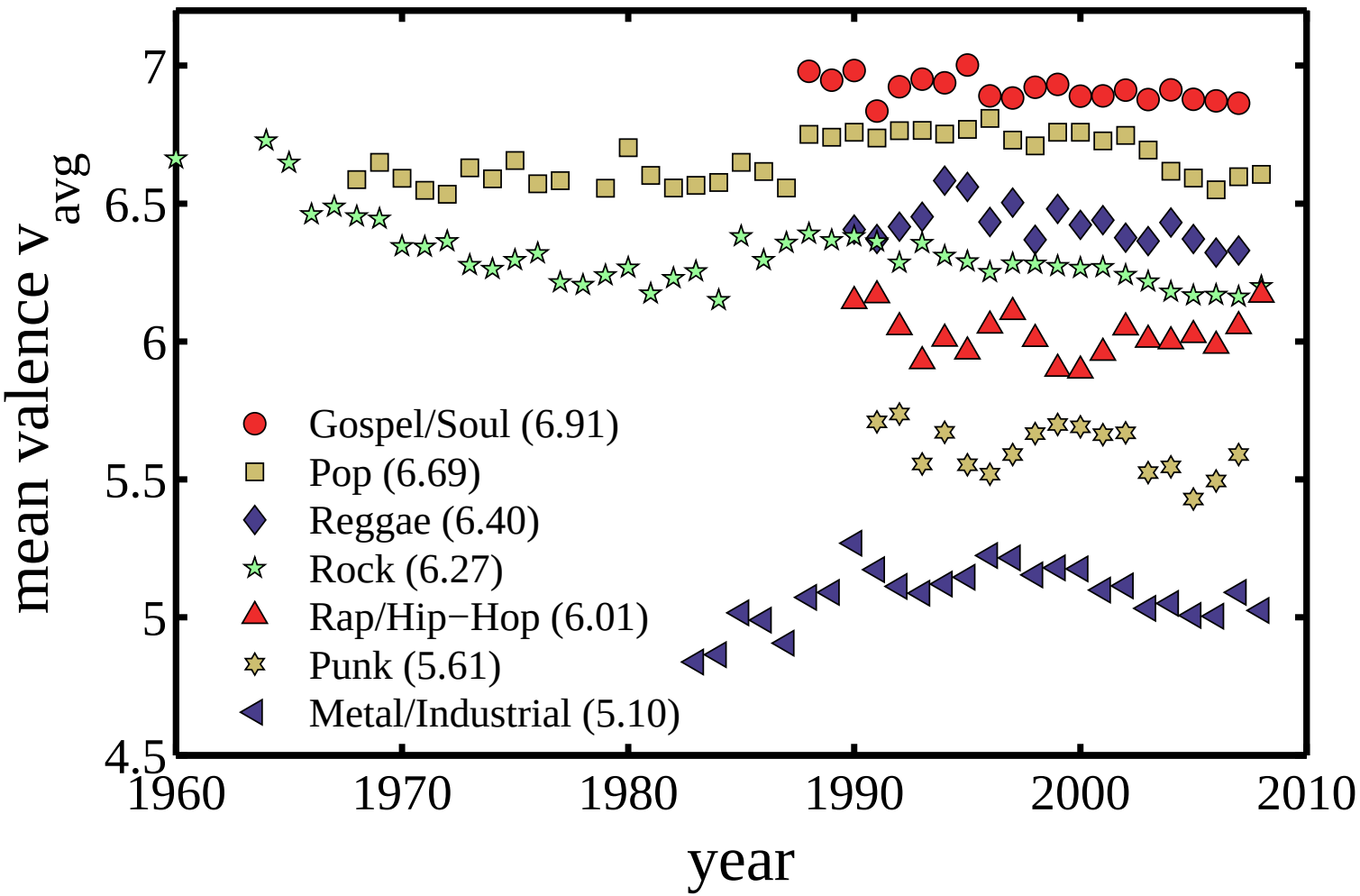


Lyrics—measurement robustness



100 random subsets of 750 ANEW words

Lyrics—average valence of genres:



Valence shift details:

Given two texts *a* and *b*:

- Measure difference in average valence: $v_{avg}^{(b)} - v_{avg}^{(a)}$

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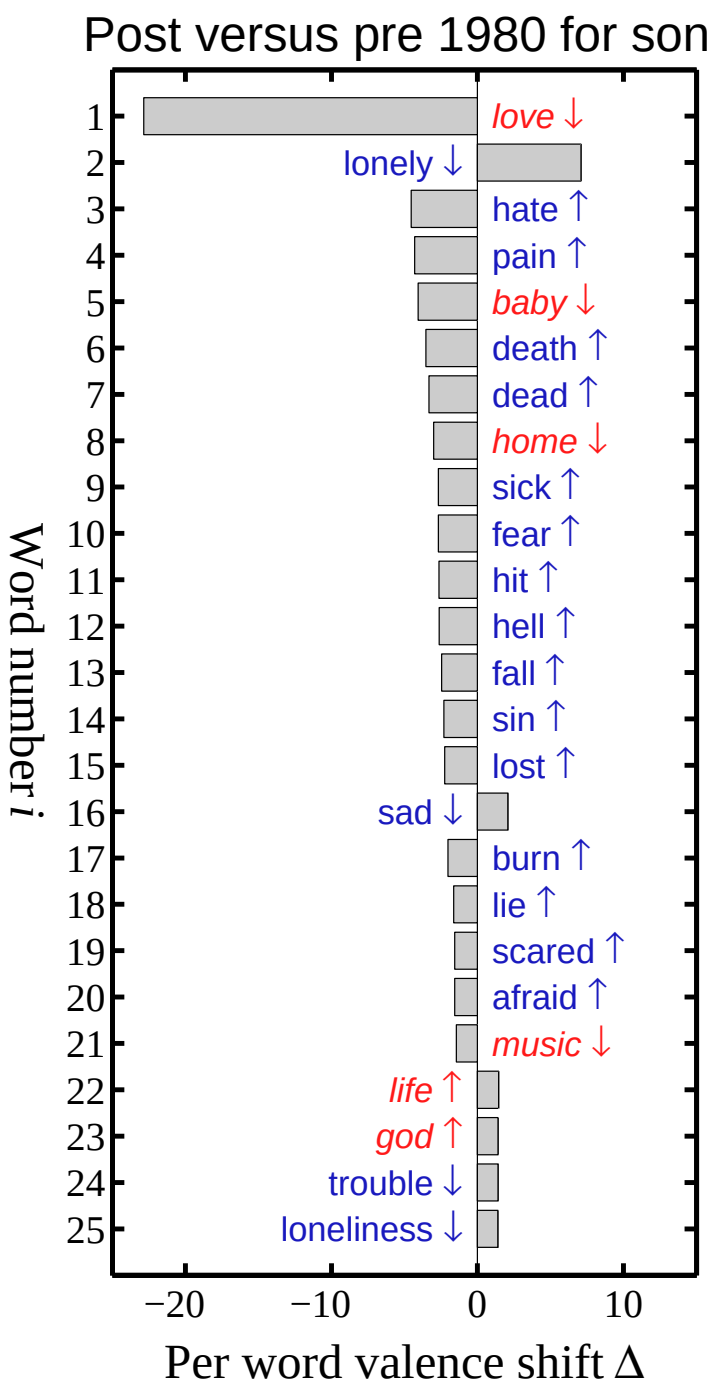
- Break difference down by contributions from individual words:

$$\Delta_i = 100 \times [p_{i,b} - p_{i,a}] \frac{[v_i - v_{\text{avg}}^{(a)}]}{[v_{\text{avg}}^{(b)} - v_{\text{avg}}^{(a)}]}$$

$$\sum_i \Delta_i = v_{avg}^{(b)} - v_{avg}^{(a)}$$

- Rank words by $|\Delta_i|$

Valence Shift Word Graph:



Top 50 of $\simeq$ 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

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

Bottom 50 of $\simeq$ 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

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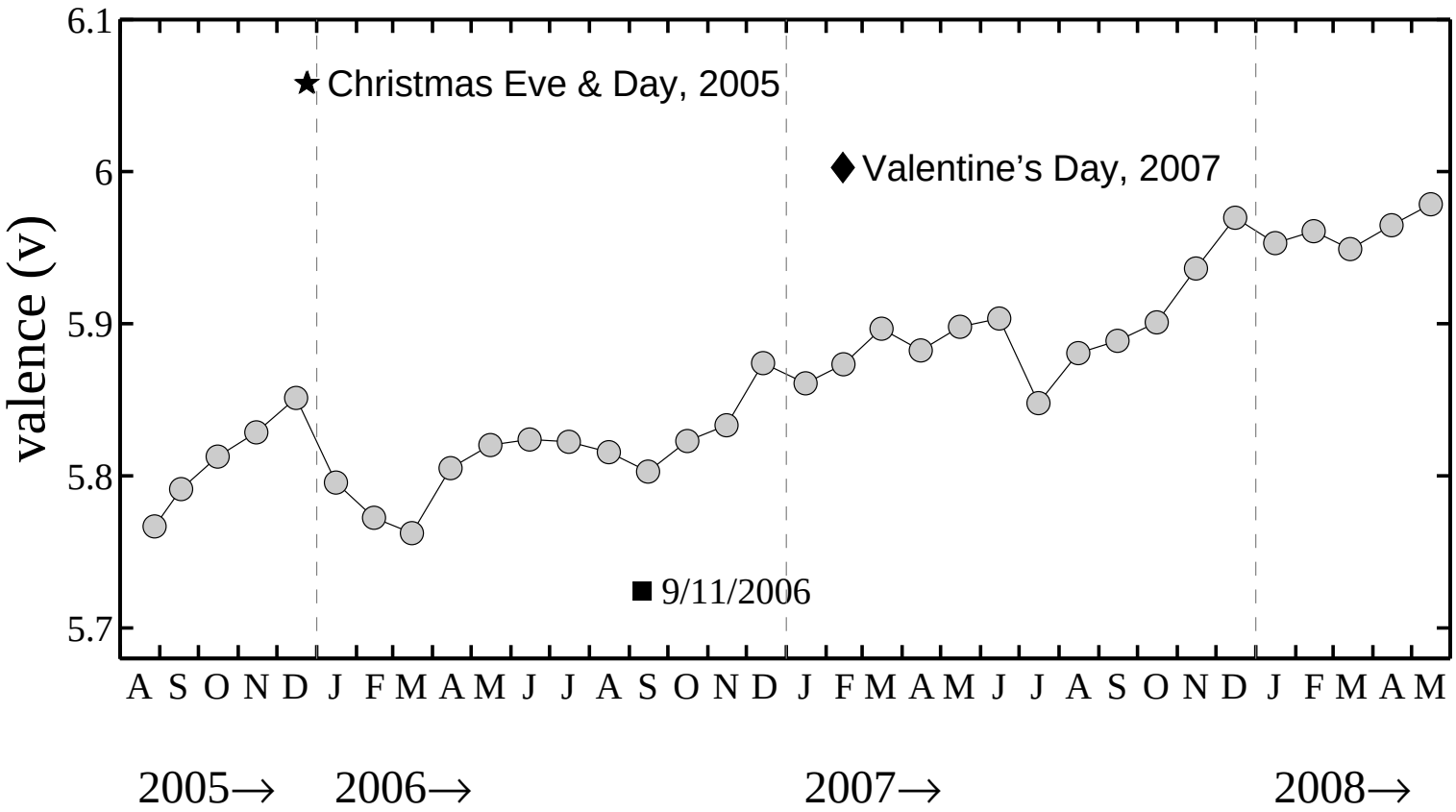
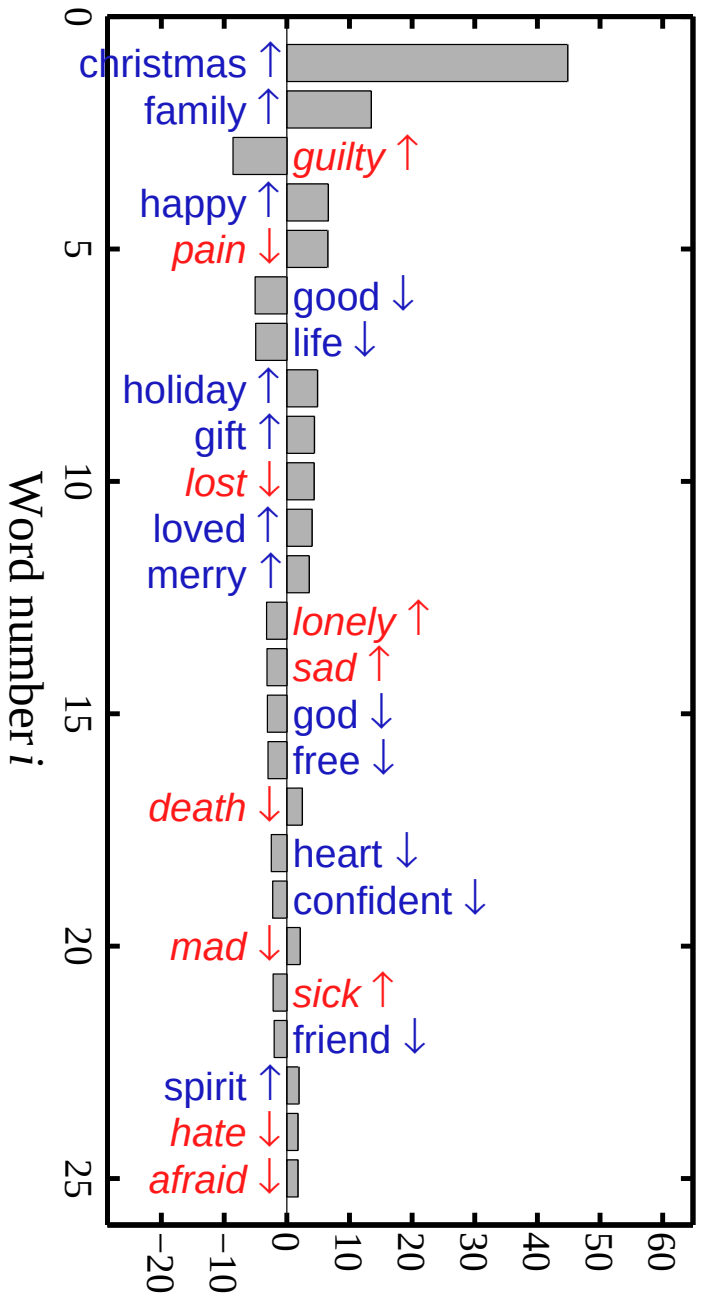
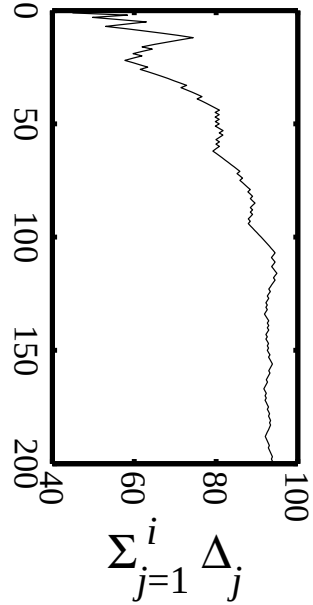
Blogs—Overall trend



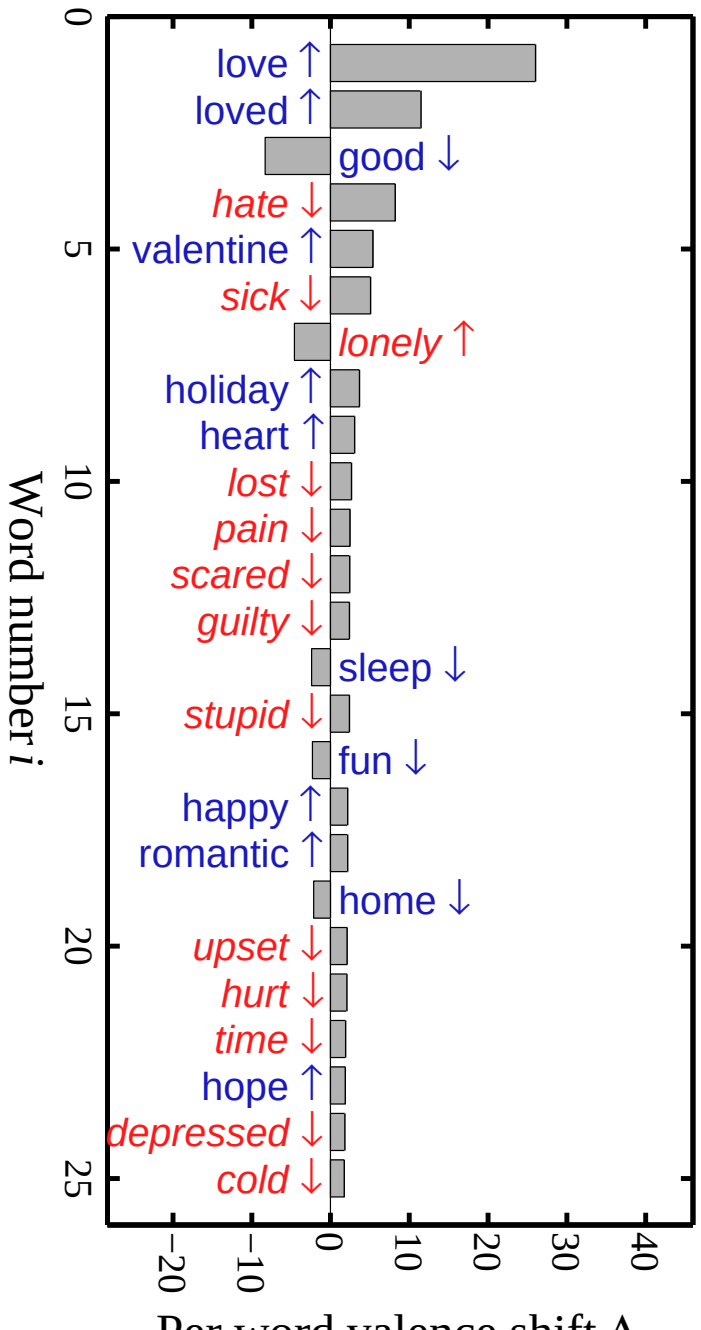
2005/12/25 compared to 2005/12

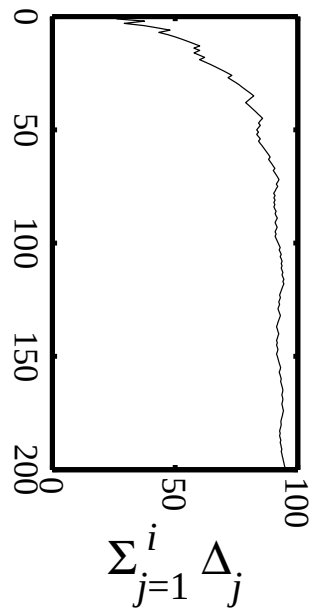




Mean valence:
6.06 vs. 5.86

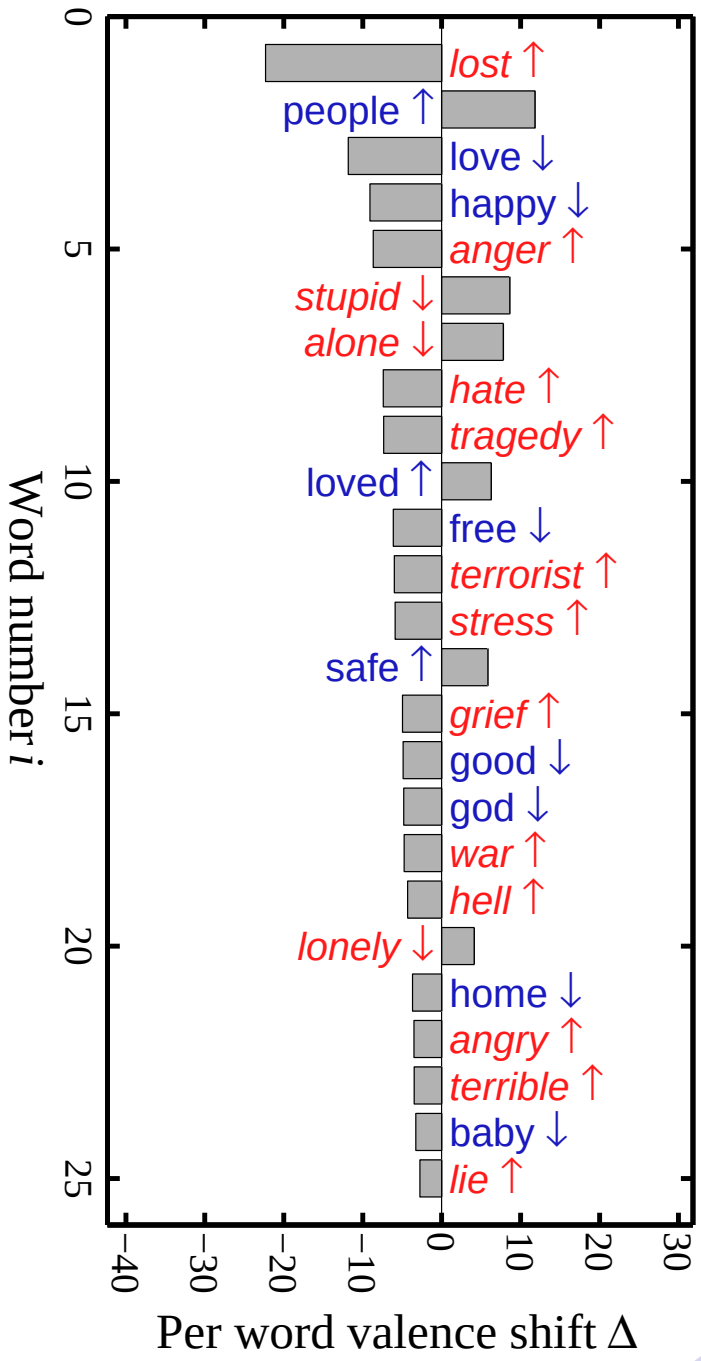
2007/02/14 compared to 2007/02

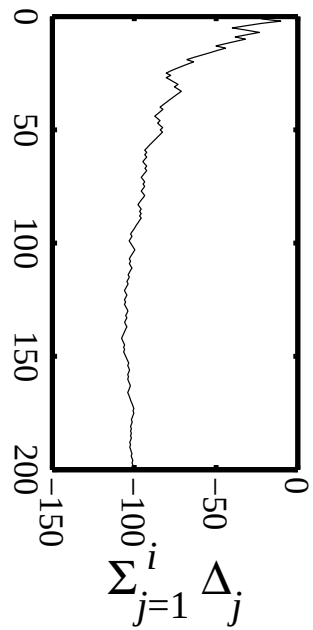




Mean valence:
6.00 vs. 5.83

2006/09/11 compared to 2006/09





Mean valence:
5.72 vs. 5.81

Blogs—Age

- Self-report studies find little variation in happiness with age [7, 8]

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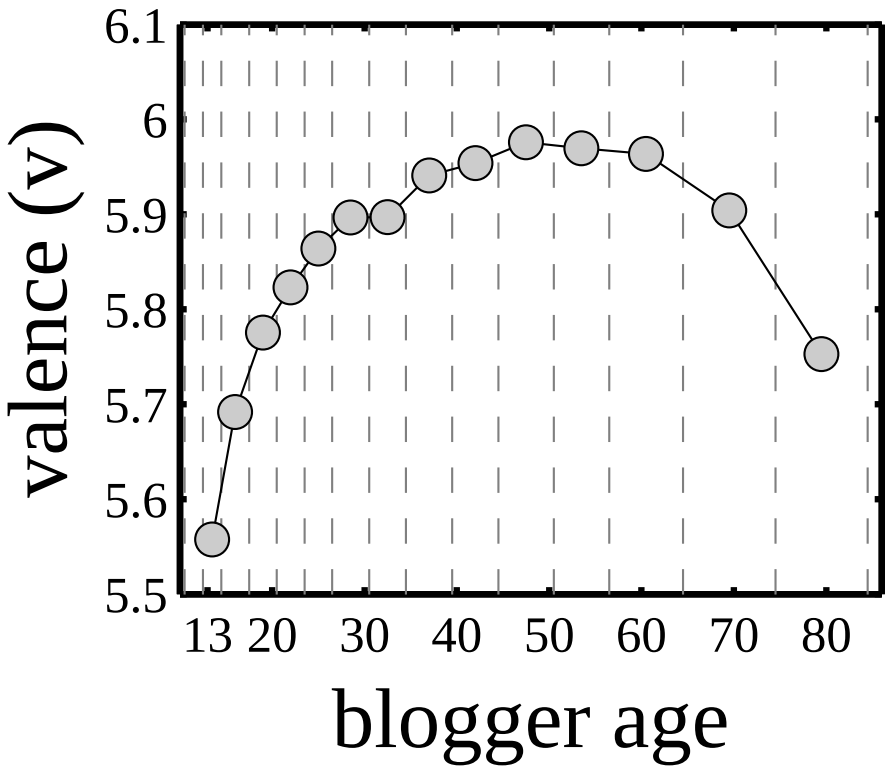
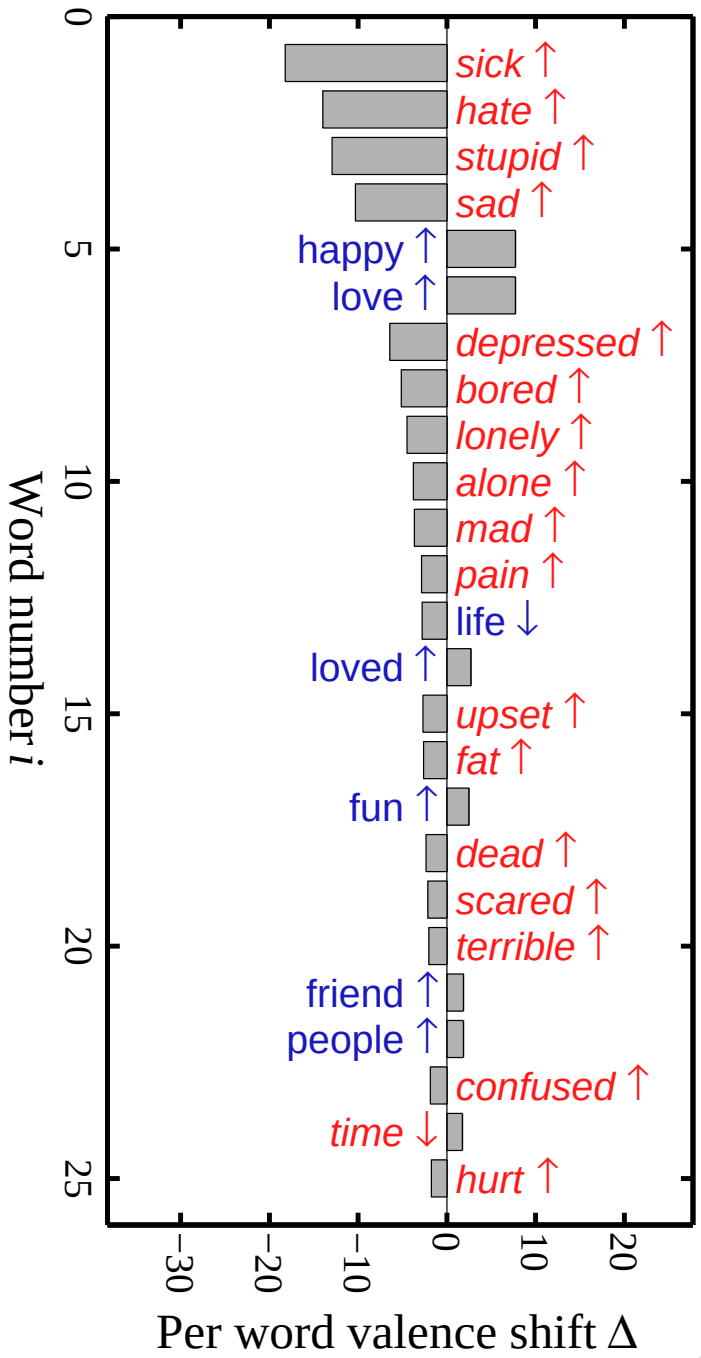
- Surprising: Expect a rise and fall.
- A ‘challenge’ for theory...
- Related to the Easterlin Paradox: Money doesn’t buy happiness
- But maybe it does a little bit—Veenhoven & Hagerty (2003) and Wolfers & Stevenson (2008).

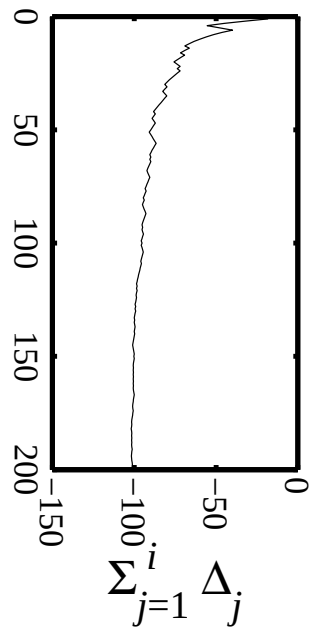
Blogs



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

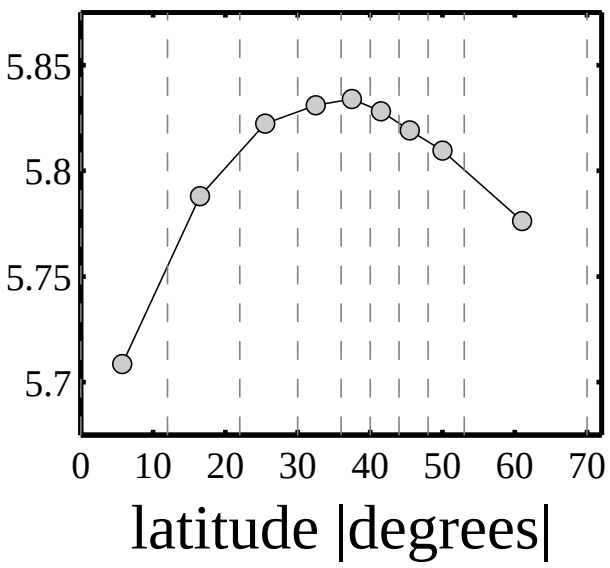
14 year olds compared to born 1960−1969





Mean valence:
5.55 vs. 5.96

Blogs—Latitude



Near equator—social factors

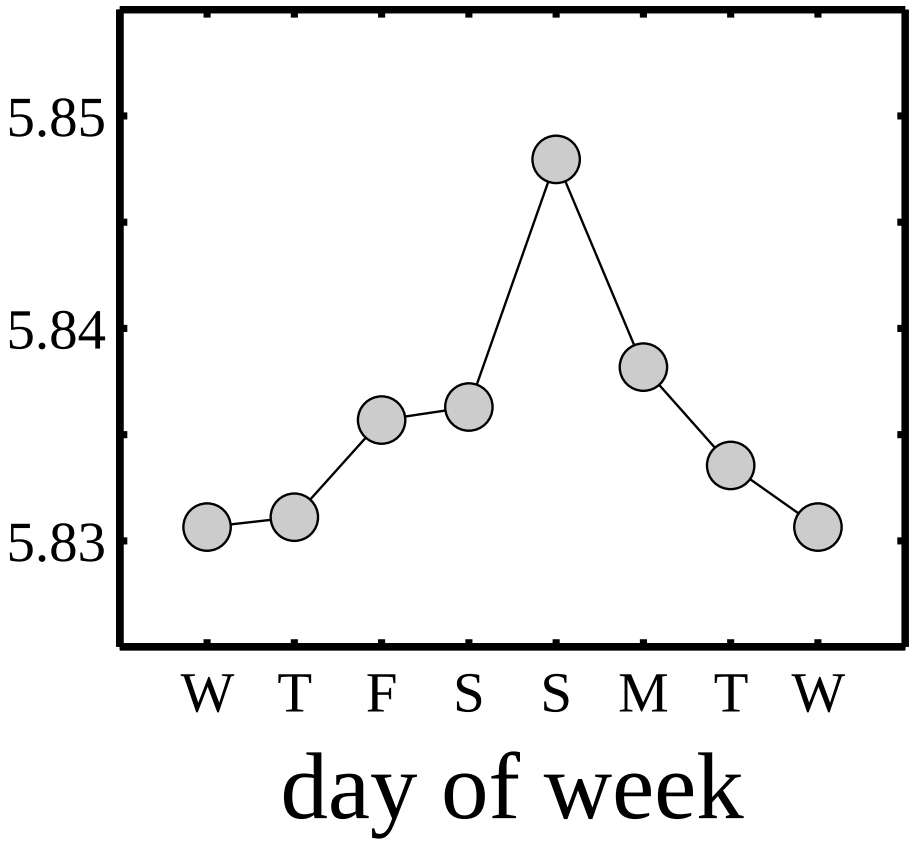
- Increase in ‘sad’, ‘bored’, ‘lonely’, ‘stupid’, ‘guilty’
- Decrease in ‘good’ and ‘people’

Near poles—social/psychological/climate

- Increase in ‘sick’, ‘guilty’, ‘cold’, ‘depressed’, and ‘headache’ and decrease of ‘love’ and ‘life.’
- Offset by decrease in ‘hurt’ and ‘pain.’
- More ‘bed’ and ‘sleep.’

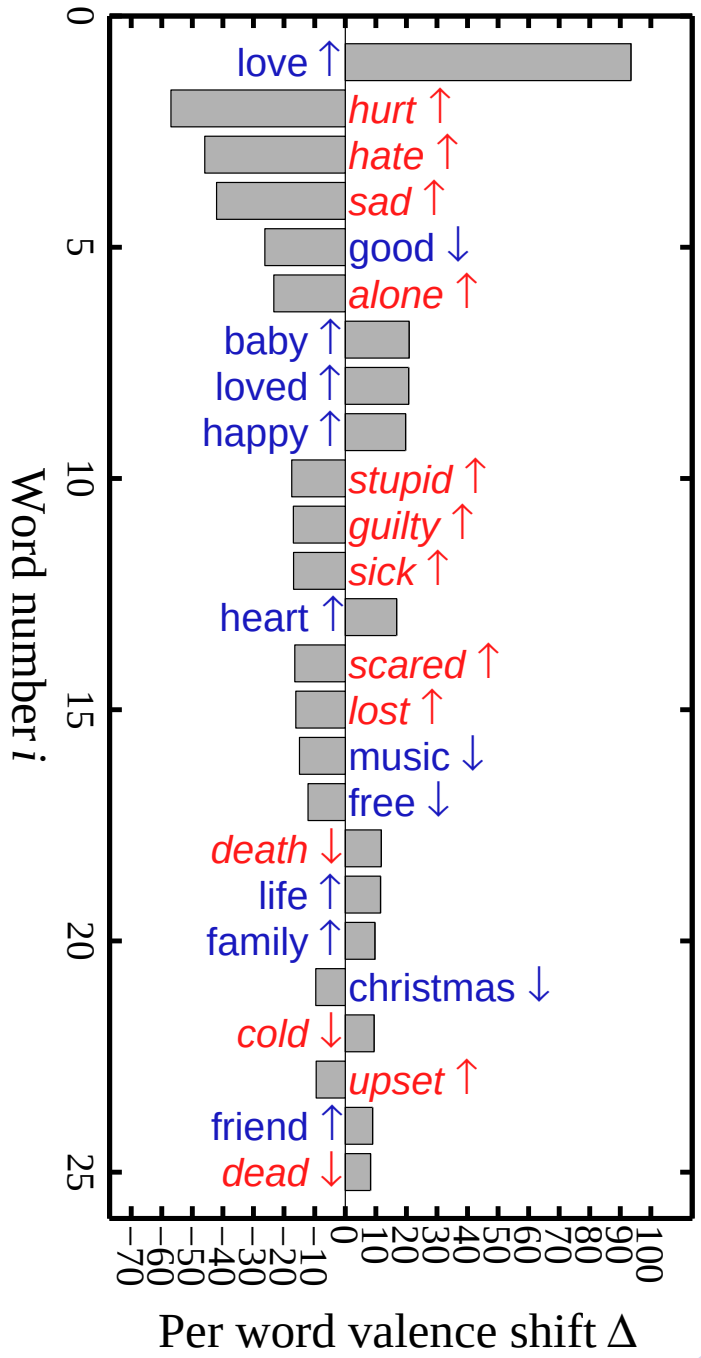
Blogs—day of the week

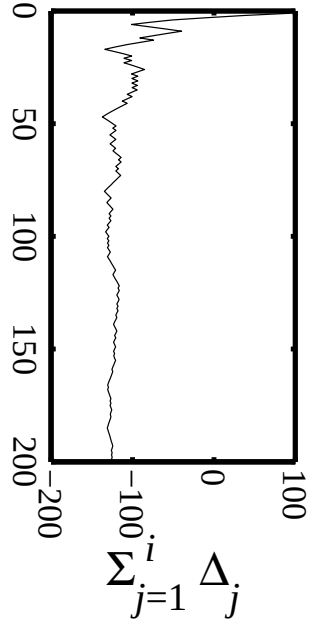
Very gentle weekly cycle:



Monday is not so bad for bloggers...

Female compared to Male

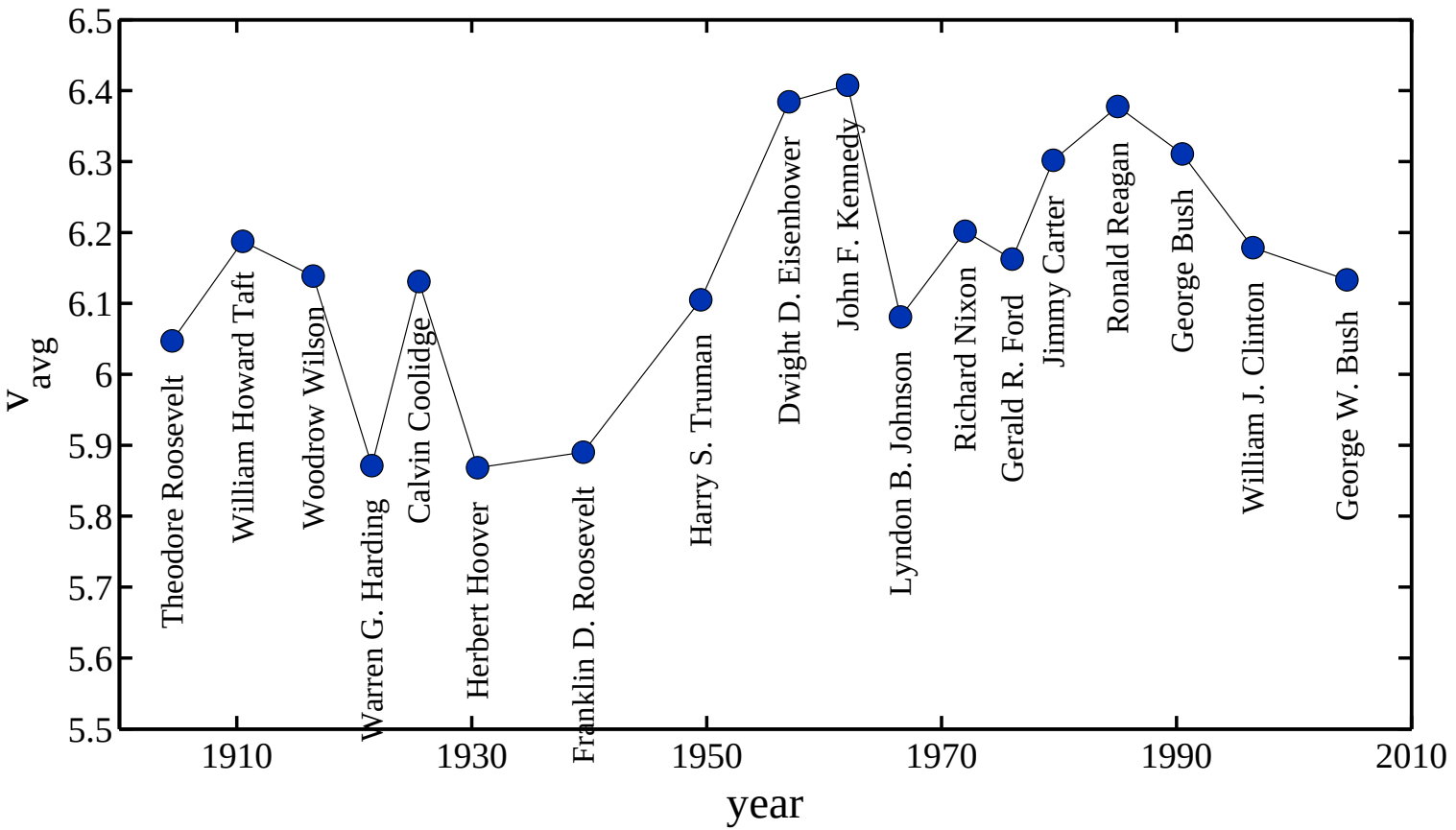




Mean valence:
5.89 vs. 5.91

Outline

Presidential happiness:



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Goal: Improve on ANEW study

- Perform survey as an online game.
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  - Global: open on the Web

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Measure emotional content of

- Many more words
- Phonemes and letters
- Sentences

Where do superstars come from?

Rosen (1981): "The Economics of Superstars"

Examples:

- Full-time Comedians ($\approx$ 200)
- Soloists in Classical Music
- Economic Textbooks (the usual myopic example)

- Highly skewed distributions (again)...

Superstars

Rosen's theory:

- Individual quality q maps to reward $R(q)$
- $R(q)$ is 'convex' ($\mathrm{d}^2R/\mathrm{d}q^2 > 0$)
- Two reasons:
  1. Imperfect substitution:
     A very good surgeon is worth many mediocre ones
  2. Technology:
     Media spreads & technology reduces cost of reproduction of books, songs, etc.
- No social element—success follows 'inherent quality'

Superstars

Adler (1985): “Stardom and Talent”

- Assumes extreme case of equal ‘inherent quality’
- Argues desire for coordination in knowledge and culture leads to differential success
- Success is then purely a social construction

Dominance hierarchies

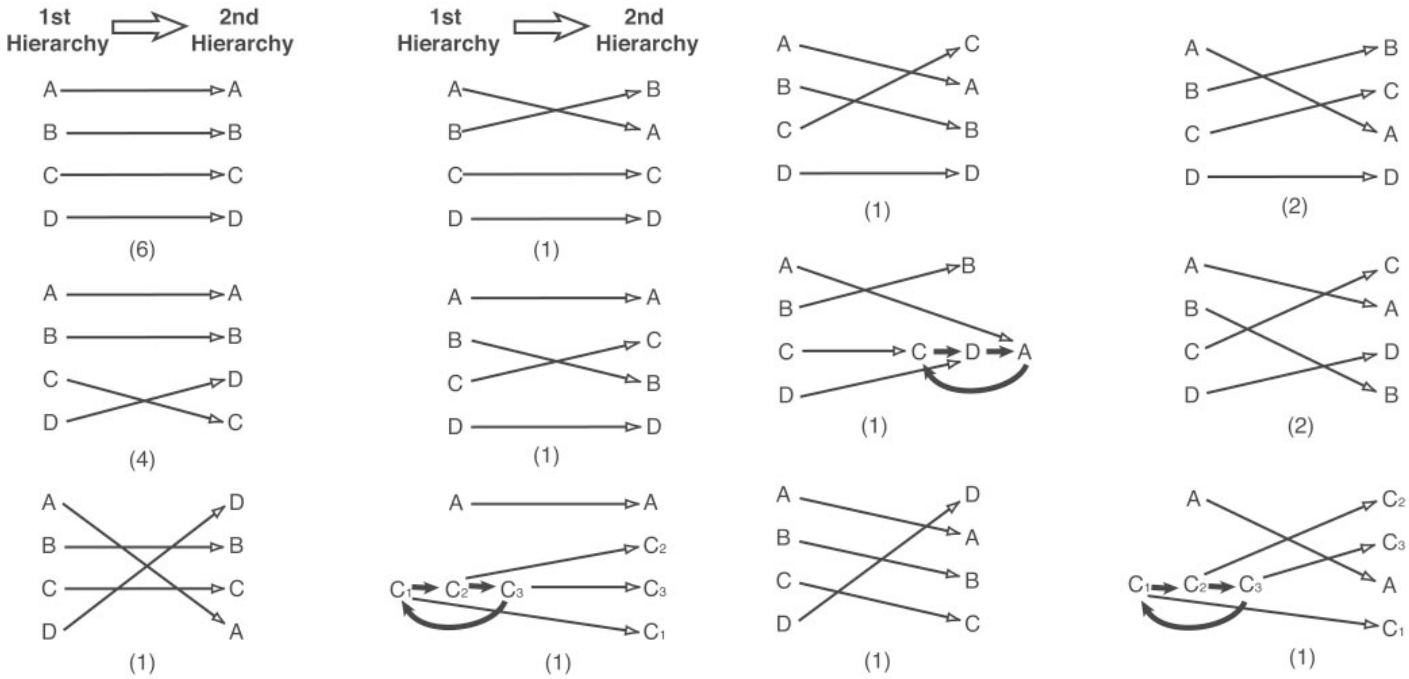
Chase et al. (2002): "Individual differences versus social dynamics in the formation of animal dominance hierarchies" [3]

The aggressive female Metriaclima zebra (⊞):

Pecking orders for fish...

Dominance hierarchies

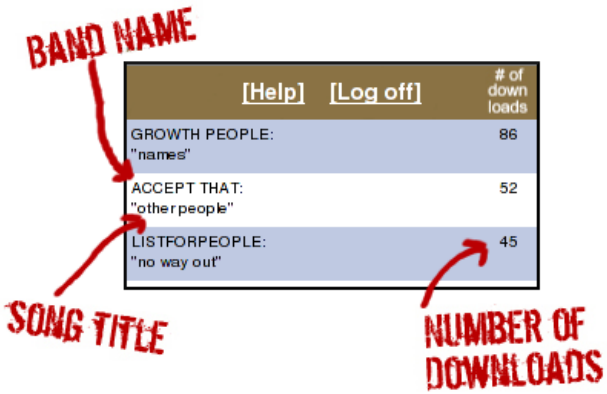
- Fish forget—changing of dominance hierarchies:



- 22 observations: about 3/4 of the time, hierarchy changed

Music Lab Experiment

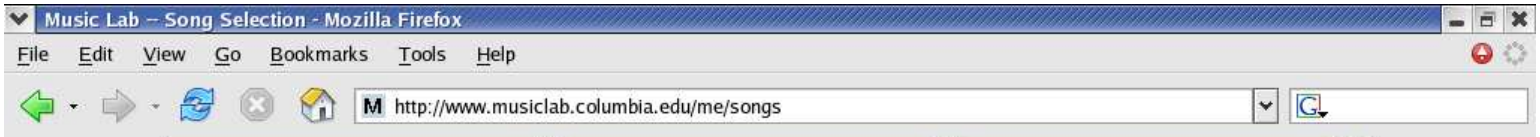
48 songs
30,000 participants



multiple 'worlds'
Inter-world variability

Salganik, Dodds, and Watts (2006)
"An experimental study of inequality and unpredictability in an artificial cultural market" [18]

Music Lab Experiment

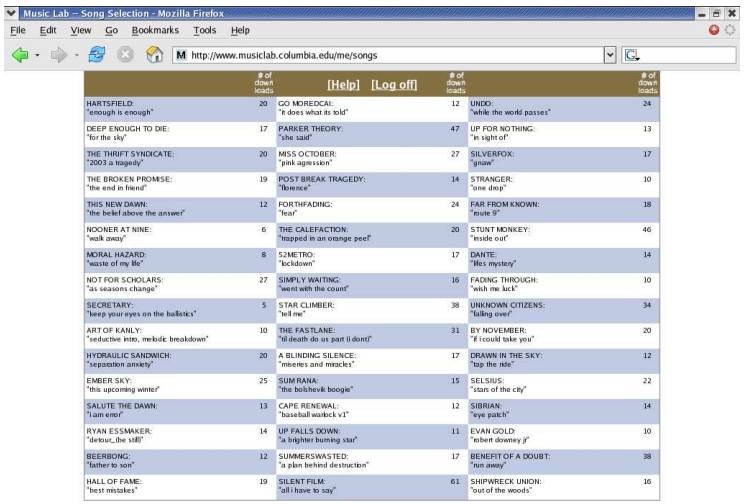


[Help] [Log off]

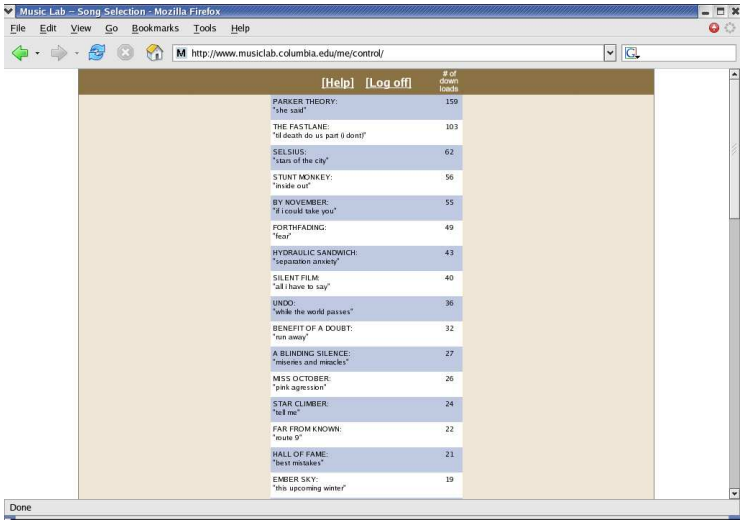
	# of down loads		# of down loads		# of down loads
HARTSFIELD: "enough is enough"	20	GO MOREDCAI: "it does what its told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "she said"	47	UP FOR NOTHING: "in sight of"	13
THE THRIFT SYNDICATE: "2003 a tragedy"	20	MISS OCTOBER: "pink agression"	27	SILVERFOX: "gnaw"	17
THE BROKEN PROMISE: "the end in friend"	19	POST BREAK TRAGEDY: "florence"	14	STRANGER: "one drop"	10
THIS NEW DAWN: "the belief above the answer"	12	FORTHFADING: "fear"	24	FAR FROM KNOWN: "route 9"	18
NOONER AT NINE: "walk away"	6	THE CALEFACTION: "trapped in an orange peel"	20	STUNT MONKEY: "inside out"	46
MORAL HAZARD: "waste of my life"	8	52METRO: "lockdown"	17	DANTE: "lifes mystery"	14
NOT FOR SCHOLARS: "as seasons change"	27	SIMPLY WAITING: "went with the count"	16	FADING THROUGH: "wish me luck"	10
SECRETARY: "keep your eyes on the ballistics"	5	STAR CLIMBER: "tell me"	38	UNKNOWN CITIZENS: "falling over"	34
ART OF KANLY: "seductive intro, melodic breakdown"	10	THE FASTLANE: "til death do us part (i dont)"	31	BY NOVEMBER: "if i could take you"	20
HYDRAULIC SANDWICH: "separation anxiety"	20	A BLINDING SILENCE: "miseries and miracles"	17	DRAWN IN THE SKY: "tap the ride"	12
EMBER SKY: "this upcoming winter"	25	SUM RANA: "the bolshevik boogie"	15	SELSIUS: "stars of the city"	22
SALUTE THE DAWN: "i am error"	13	CAPE RENEWAL: "baseball warlock v1"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "detour_(be still)"	14	UP FALLS DOWN: "a brighter burning star"	11	EVAN GOLD: "robert downey jr"	10
BEERBONG: "father to son"	12	SUMMERSWASTED: "a plan behind destruction"	17	BENEFIT OF A DOUBT: "run away"	38
HALL OF FAME: "best mistakes"	19	SILENT FILM: "all i have to say"	61	SHIPWRECK UNION: "out of the woods"	16

Music Lab Experiment

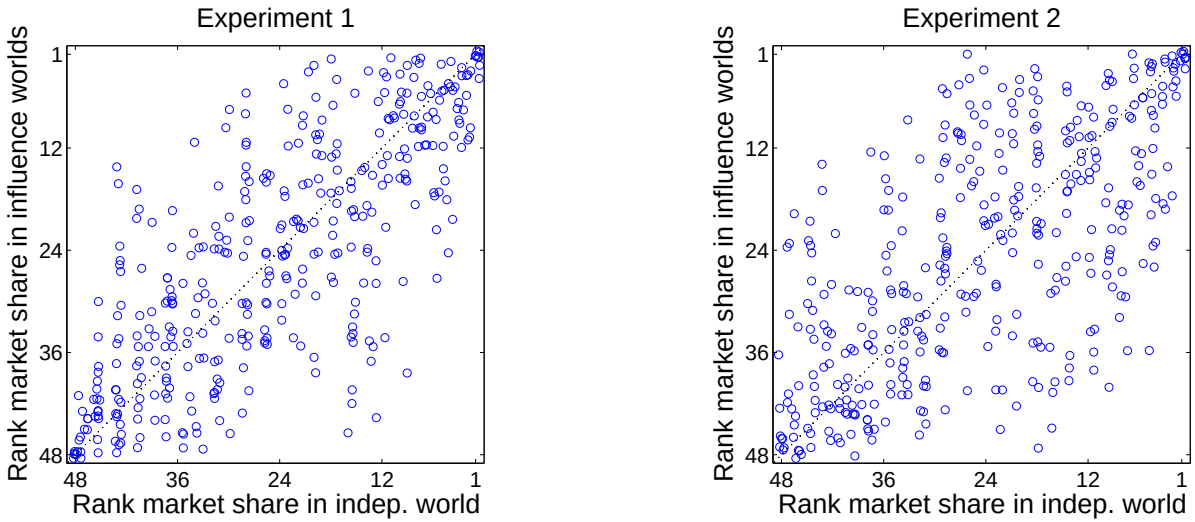
Experiment 1



Experiments 2–4

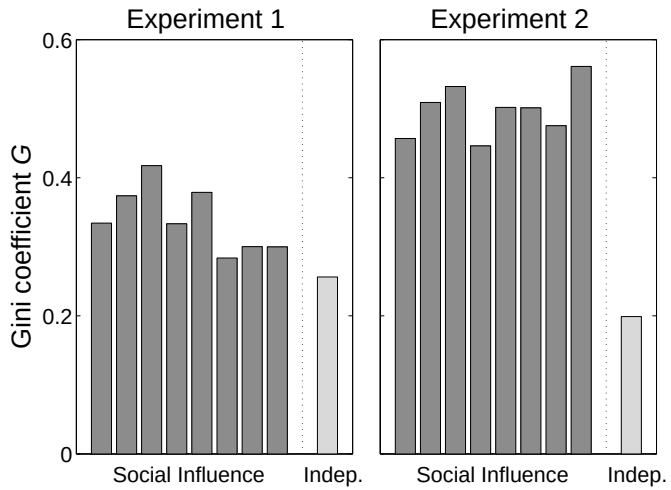


Music Lab Experiment



- Variability in final rank.

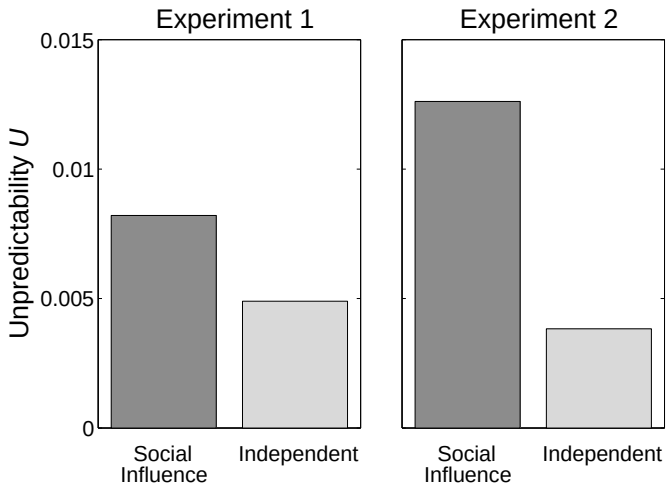
Music Lab Experiment



- Inequality as measured by Gini coefficient:

$$G = \frac{1}{(2N_s - 1)} \sum_{i=1}^{N_s} \sum_{j=1}^{N_s} |m_i - m_j|$$

Music Lab Experiment



- Unpredictability

$$U = \frac{1}{N_S \binom{N_W}{2}} \sum_{i=1}^{N_S} \sum_{j=1}^{N_W} \sum_{k=j+1}^{N_W} |m_{i,j} - m_{i,k}|$$

Music Lab Experiment

Sensible result:

- Stronger social signal leads to greater following and greater inequality.

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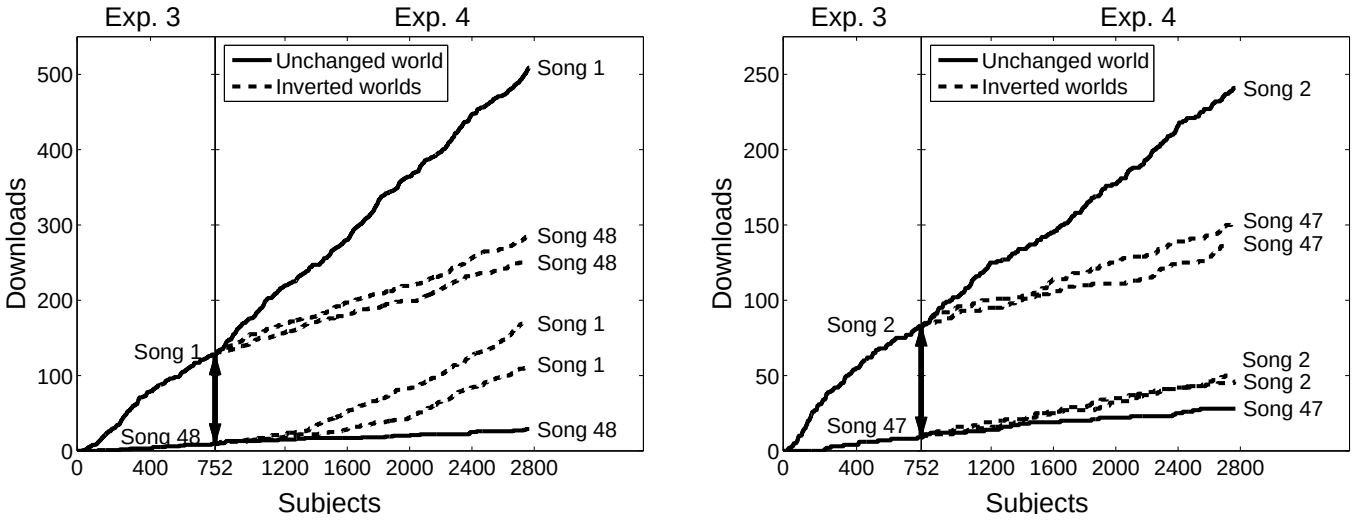
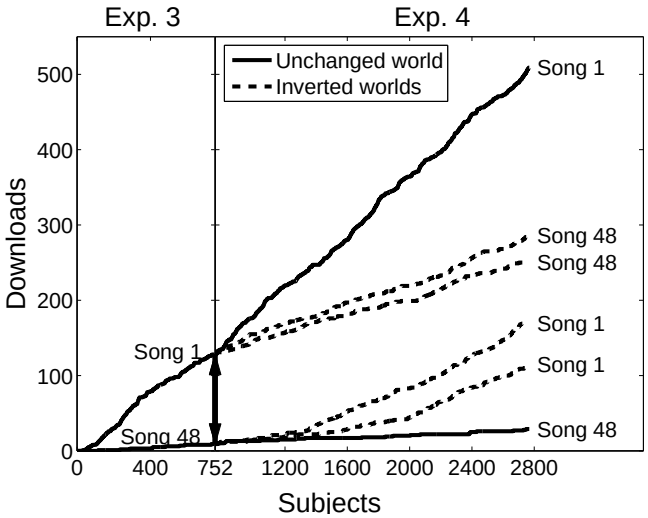
- 'Payola' leads to poor system performance.

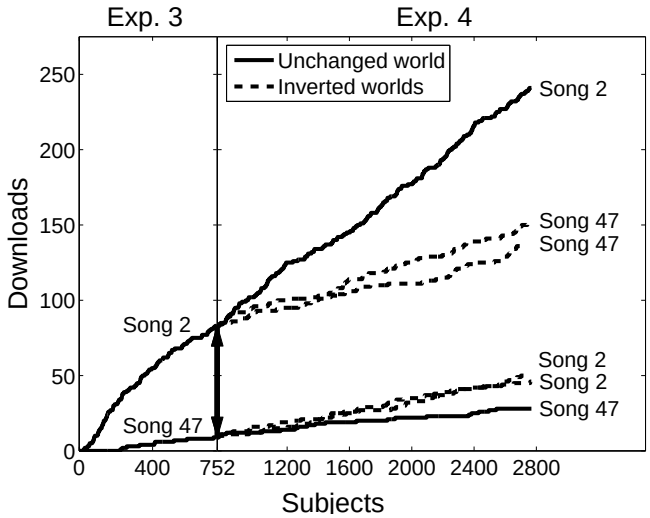
Music Lab Experiment—Sneakiness



- Inversion of download count

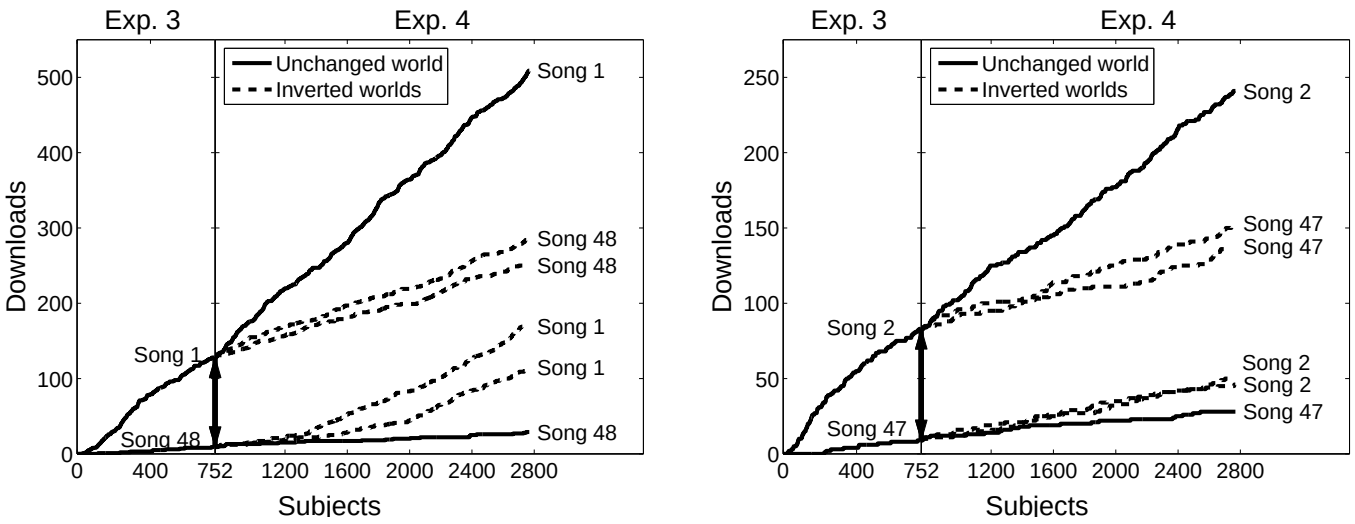
Music Lab Experiment—Sneakiness





- Inversion of download count
- The ‘pretend rich’ get richer ...

Music Lab Experiment—Sneakiness



- Inversion of download count
- The ‘pretend rich’ get richer ...
- ... but at a slower rate

Closing aside on Prediction:

Alan Greenspan (September 18, 2007):

http://wikipedia.org

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http://wikipedia.org

Economics, Schmeconomics

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Jon Stewart:

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

wildbluffmedia.com

- From the Daily Show (⊞) (September 18, 2007)

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