

# Measuring happiness

Santa Fe Institute, June 10, 2009

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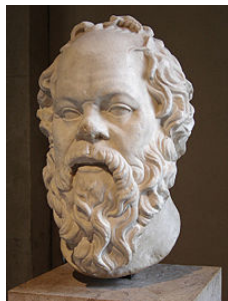
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# Happiness:



<http://wikipedia.org>

- ▶ Greek philosophers held **Eudaimonia** as highest good. [7]
- ▶  $\simeq$  flourishing, well-being, pleasure, ...
- ▶ Socrates, Plato, Aristotle, Epicurus, ...



<http://wikipedia.org>

Bentham's **hedonistic calculus**:

“[t]he greatest happiness of the greatest number is the foundation of morals and legislation”<sup>[14]</sup>

Priestly, John Stuart Mill, ...

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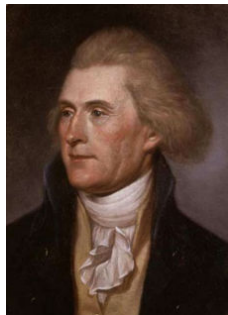
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# United States' Declaration of Independence:

Happiness



“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;**”

<http://wikipedia.org>

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# Happiness:

Even the odd modern economist likes happiness:

“Happiness” by Richard Layard [9]



<http://www.amazon.com>



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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

# 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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## Desiring happiness—not just for boffins:

- ▶ Average people routinely report being happy is what they want most in life<sup>[9, 10]</sup>

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## Desiring happiness—not just for boffins:

- ▶ Average people routinely report being happy is what they want most in life<sup>[9, 10]</sup>

## National indices of well-being:

- ▶ Bhutan
- ▶ France
- ▶ Australia

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# Emotional content

So how does one measure

1. happiness?
2. levels of other emotions?

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# Emotional content

So how does one measure

1. happiness?
2. levels of other emotions?

Just ask people how happy they are.

# Emotional content

## So how does one measure

1. happiness?
2. levels of other emotions?

## Just ask people how happy they are.

- ▶ Experience sampling <sup>[2, 4, 3]</sup> (Csikszentmihalyi et al.)
- ▶ Day reconstruction <sup>[8]</sup> (Kahneman et al.)

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# Emotional content

## So how does one measure

1. happiness?
2. levels of other emotions?

## Just ask people how happy they are.

- ▶ Experience sampling [2, 4, 3] (Csikszentmihalyi et al.)
- ▶ Day reconstruction [8] (Kahneman et al.)

## But self-reporting has drawbacks...

- ▶ relies on memory and self-perception
- ▶ induces misreporting [11]
- ▶ costly

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# Measuring Emotional Content

We'd like to build an hedonometer:

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

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- ▶ 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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Some possibilities:

- ▶ Natural language processing (e.g., OpinionFinder)
- ▶ Declared mood levels in blogs (e.g., Livejournal) <sup>[12]</sup>

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# Measuring Emotional Content

- ▶ **Idea:** Gauge emotional content of an entity through human assessment via semantic differentials.

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# Measuring Emotional Content

- ▶ **Idea:** Gauge emotional content of an entity through human assessment via semantic differentials.
- ▶ Examples:
  - ▶ hate ↔ love
  - ▶ rough ↔ smooth
  - ▶ up ↔ down

# Measuring Emotional Content

- ▶ **Idea:** Gauge emotional content of an entity through human assessment via semantic differentials.
- ▶ Examples:
  - ▶ hate ↔ love
  - ▶ rough ↔ smooth
  - ▶ up ↔ down
- ▶ Osgood et al. (1957)<sup>[13]</sup> identified a basis of 3 semantic differentials:
  - ▶ **Valence:** bad ↔ good
  - ▶ **Dominance:** weak ↔ strong
  - ▶ **Arousal:** passive ↔ active

(also often: Evaluation, Potency, and Activity)

- ▶ ANEW = “Affective Norms for English Words”

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- ▶ 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

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- ▶ 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)<sup>[1]</sup>

# ANEW study—three 1–9 scales:

valence:



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## ANEW study—three 1–9 scales:

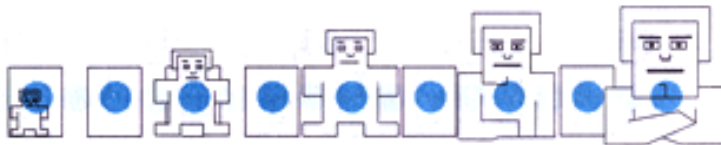
valence:



arousal:



dominance:



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# ANEW study:

- ▶ Valence scale presented to participants as a 'happy-unhappy scale.'

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# ANEW study:

- ▶ 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. . . ."

- ▶ 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.”

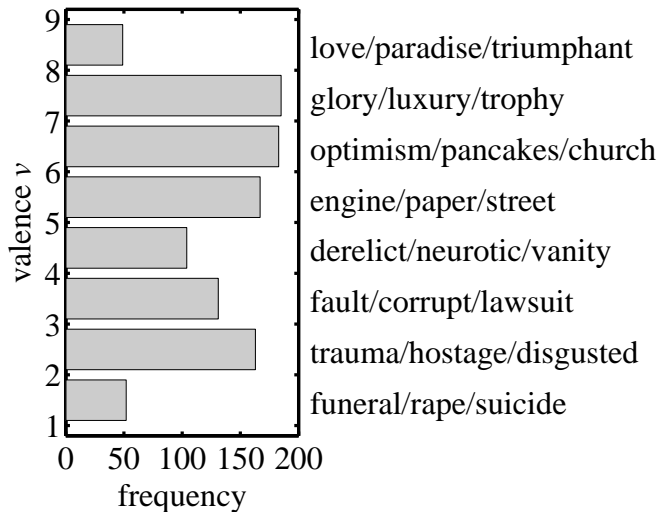
# Top and Bottom 5 words by valence

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)

# Top and Bottom 5 words by valence

1	triumphant (8.82)	rape (1.25)
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4	loved (8.64)	cancer (1.50)
5	miracle (8.60)	rejected (1.50)

# ANEW study 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  $\theta$  is average valence, arousal, or dominance for word  $i$ .

- ▶ Focus on valence,  $\theta = v$ .
- ▶ Average valence typically falls between 5 and 7.

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# Analysing 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

	$v_k$	$f_k$
$k=1$ . 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

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

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

---


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

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

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# Unhappiness:

## Some obvious problems/issues:

- ▶ Partial coverage of all words.
- ▶ Context is ignored.

# Unhappiness:

## Some obvious problems/issues:

- ▶ Partial coverage of all words.
- ▶ Context is ignored.
- ▶ You just don't like it.

# Unhappiness:

## Some obvious problems/issues:

- ▶ Partial coverage of all words.
- ▶ Context is ignored.
- ▶ You just don't like it. Really.

# Unhappiness:

## Some obvious problems/issues:

- ▶ Partial coverage of all words.
- ▶ Context is ignored.
- ▶ You just don't like it. Really.

## Clearly:

- ▶ Only suitable for large-scale texts.

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# 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](http://hotlyrics.com) (田)
- ▶ [freedb.com](http://freedb.com) (田)
- ▶ American Presidency Project:  
[www.presidency.ucsb.edu](http://www.presidency.ucsb.edu) (田).

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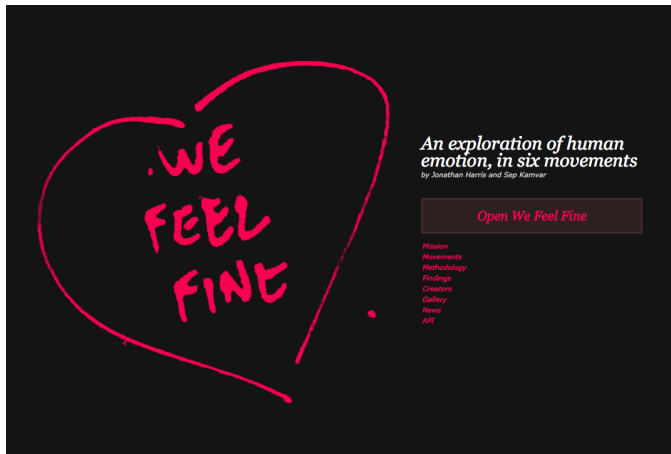
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# Data sets:

- 4 Blog phrases beginning with “I feel...” or “I am feeling” taken from [wefeelfine.org](http://wefeelfine.org) (田) (API, 2005–2009)




Created by Jonathan Harris and Sep Kamvar

Feeling [lonely](#) Gender [Both](#) Age [All](#) Weather [All](#) Location [All](#) Date [All](#)

- **i feel very lonely and unnoticed and that i am poised in a point of my life when i am able to do great things but just cant quite get them started**  
March 30, 2006 / from a 31 year old in fairfax virginia united states when it was cloudy
- **i feel lonely recently**  
March 30, 2006 / from someone in georgia united states
- **i feel lonely things are all good but i miss the way things used to be**  
March 31, 2006 / from an 18 year old female in arizona united states
- **i feel really lonely every night because i dont have any good friends irl that i can just talk about anything with**  
March 31, 2006 / from a 17 year old male in lawrenceville georgia united states
- **i feel really lonely and like any sensible loser i have to write about it in a blog**  
March 31, 2006 / from an 18 year old male in missouri united states
- **i feel so lonely inside**  
March 31, 2006 / from a 24 year old male in san diego california united states when it was cloudy
- **i feel soooooo lonely sometimes**  
March 31, 2006 / from a 19 year old female in ellensburg washington united states
- **i feel lonely**  
March 31, 2006 / from someone
- **i feel lonely i feel scared**  
March 31, 2006 / from a 29 year old in mount vernon ohio united states
- **i feel lonely when im with her**  
March 31, 2006 / from someone in florida united states

i feel so much less lonely knowing that there are people out there again



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Feeling	lovesick	Gender	Female	Age	20 - 29	Weather	Cloudy	Location	All	Date	Feb 14, 2006	
All Feelings		Both Genders		All Ages		All Weather		All Locations		All Dates		
A	looser			0s				afghanistan		2005	Jan	1
B	lopsided									2006	Feb	2
C	loquacious										Mar	3
D	lost										Apr	4
E	loud											5
F	lounging											6
G	lousy											7
H	lovable											8
I	loveable											9
J	loved											10
K	loveless			10s				argentina				
L	lovely											11
M	lovely											12
N	lovesick											13
O	loving											14
P	low											15
Q	lower											16
R	lowered											17
S	lowering											18
T	lowest											19
U	lowly			20s				australia				
V	loyal											20
W	lucid											21
X	luckier											22
Y	luckiest											23
Z	lucky											24
												25
												26
												27
												28



Find Feelings

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# 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	~ 20,000	~ 632,000

Counts	Weblogs	SOTU
All words	155,667,394	1,796,763
ANEW words	8,581,226 (5.5%)	61,926 (3.5%)
Individuals	~ 2,335,000	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%)

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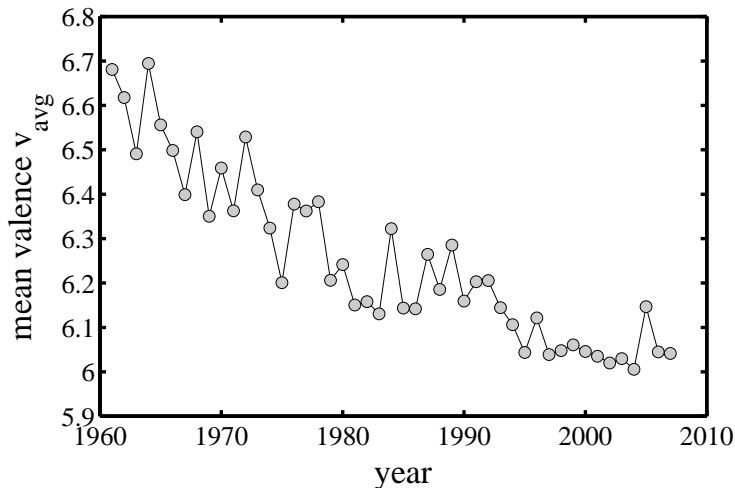
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# Lyrics—average valence



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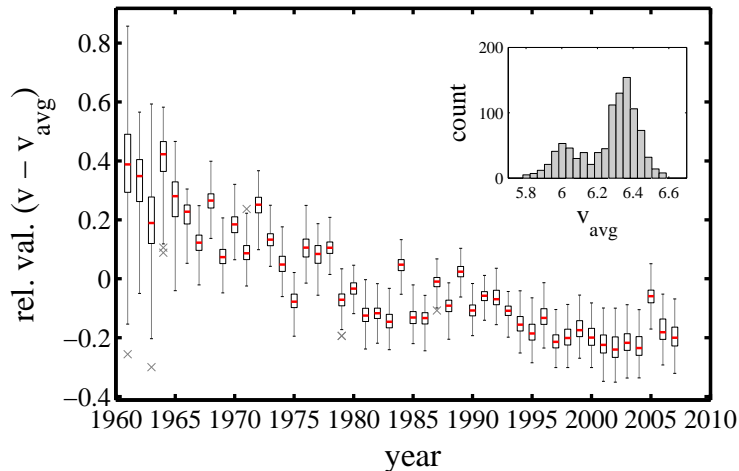
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# Lyrics—measurement robustness



100 random subsets of 750 ANEW words

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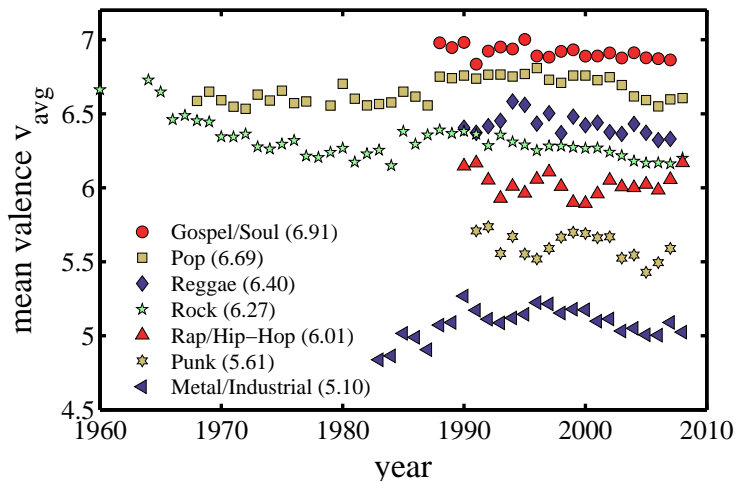
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# Lyrics—average valence of genres:



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# Valence shift details:

Given two texts  $a$  and  $b$ :

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

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# Valence shift details:

Given two texts  $a$  and  $b$ :

- ▶ Measure difference in average valence:  $v_{avg}^{(b)} - v_{avg}^{(a)}$
- ▶ Break difference down by contributions from individual words:

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

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

- ▶ Rank words by  $|\Delta_i|$

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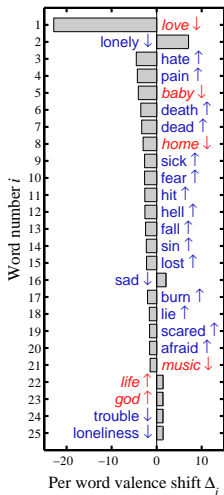
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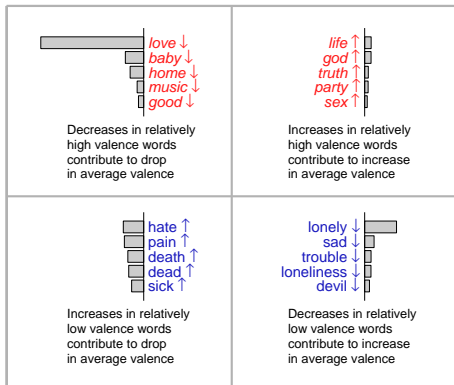
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Per word drop in valence of lyrics from 1980–2007 relative to valence of lyrics from 1960–1979:



Key:



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Top 50 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

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

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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

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

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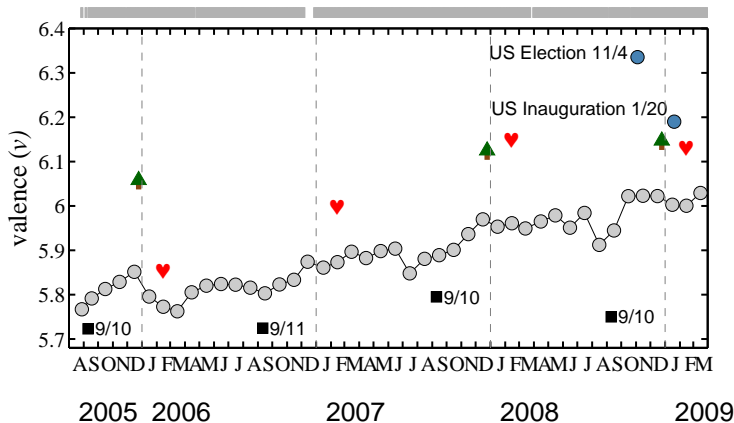
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# Blogs—Overall trend



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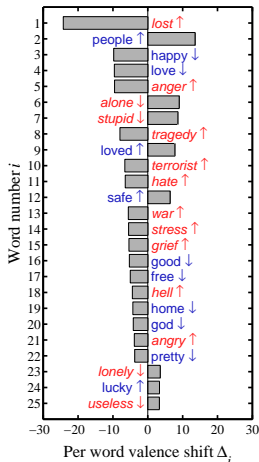
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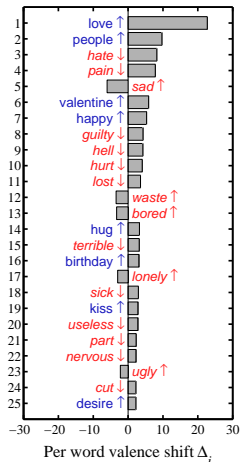
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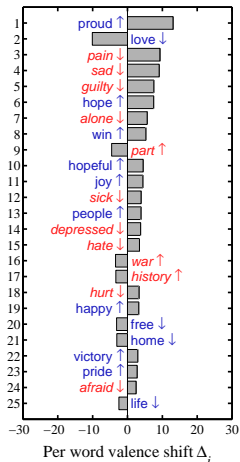
Sep 11, 2006 vs. Sep, 2006



Feb 14, 2008 vs. Feb, 2008



Nov 04, 2008 vs. Nov, 2008



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- ▶ Self-report studies find **little variation** in happiness with age <sup>[5, 6]</sup>

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- ▶ Self-report studies find **little variation** in happiness with age <sup>[5, 6]</sup>
- ▶ Surprising: Expect a rise and fall.

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- ▶ Self-report studies find **little variation** in happiness with age <sup>[5, 6]</sup>
- ▶ Surprising: Expect a rise and fall.
- ▶ A 'challenge' for theory...

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- ▶ Self-report studies find **little variation** in happiness with age <sup>[5, 6]</sup>
- ▶ Surprising: Expect a rise and fall.
- ▶ A 'challenge' for theory...
- ▶ Related to the **Easterlin Paradox**:  
**Money doesn't buy happiness**

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- ▶ Self-report studies find **little variation** in happiness with age <sup>[5, 6]</sup>
- ▶ 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).

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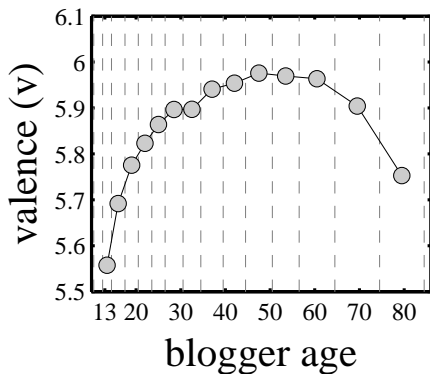
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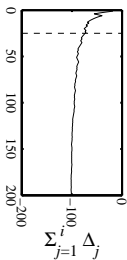
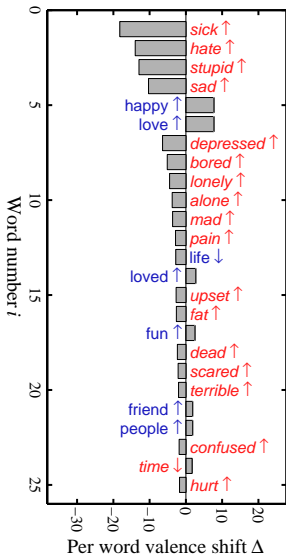


- ▶ Average valence as a function of the age bloggers report they will turn in the year of their posting.

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## 14 year olds compared to born 1960–1969



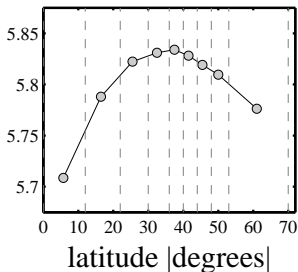
Mean valence:  
5.55 vs. 5.96

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# 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.'

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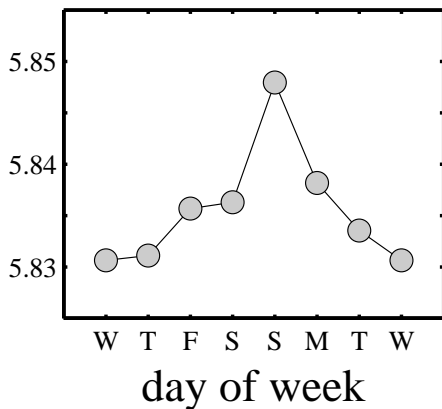
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# Blogs—day of the week

Very gentle weekly cycle:



Monday is not so bad for bloggers...

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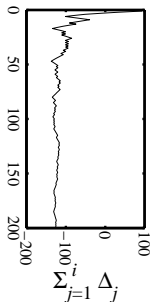
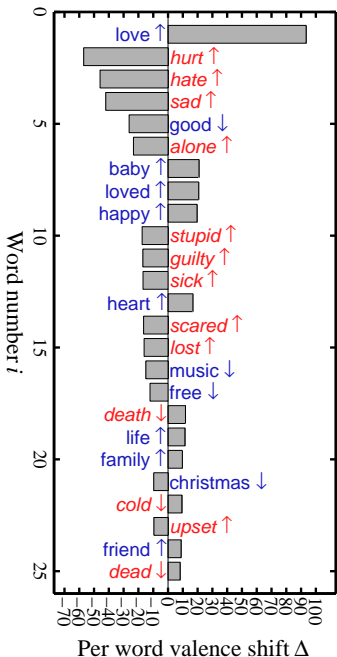
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# Female compared to Male



Mean valence:  
5.89 vs. 5.91

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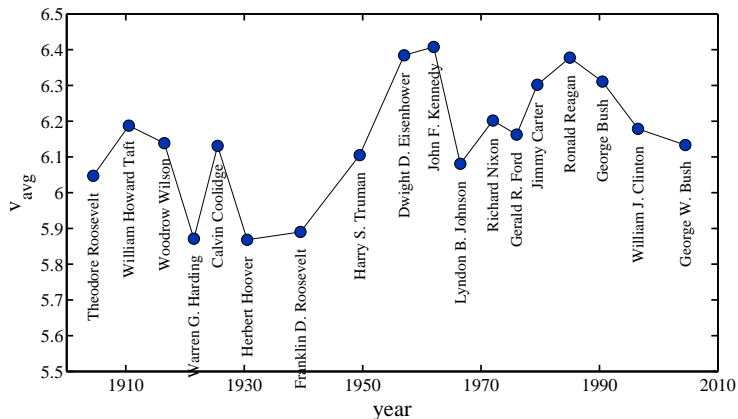
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# Presidential happiness:



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# Comparing Texts

Source	$V_{avg}$	Words with same value
Soul/Gospel Music	6.8	chocolate, leisurely, penthouse
Music Lyrics (1970)	6.5	candy, nice, power
Dante's Paradise	6.5	muffin, rabbit, smooth
Enron Emails	6.2	alert, clouds, computer
SOTU Addresses	6.1	bottle, grass, idol
Music Lyrics (2004)	6.0	curious, fragrance, pancakes
Weblogs	5.8	humble, owl, whistle
Dante's Inferno	5.5	glacier, mischief, repentant
Metal/Indust Music	5.4	elevator, lamp, truck
Indeterm. Sentence	4.8	anxious, curtains, tease

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# Measuring Emotional Content

## Goal: Improve on ANEW study

- ▶ Obtain estimates via online games.
  - ▶ The Play Project

# Measuring Emotional Content

Happiness

## Goal: Improve on ANEW study

- ▶ Obtain estimates via online games.
  - ▶ The Play Project
  - ▶ Local: university level
  - ▶ Intermediate: representative groups
  - ▶ Global: open on the Web

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# Measuring Emotional Content

## Goal: Improve on ANEW study

- ▶ Obtain estimates via online games.
  - ▶ The Play Project
  - ▶ Local: university level
  - ▶ Intermediate: representative groups
  - ▶ Global: open on the Web

## Measure emotional content of

- ▶ Many more words
- ▶ Phonemes and letters
- ▶ Sentences

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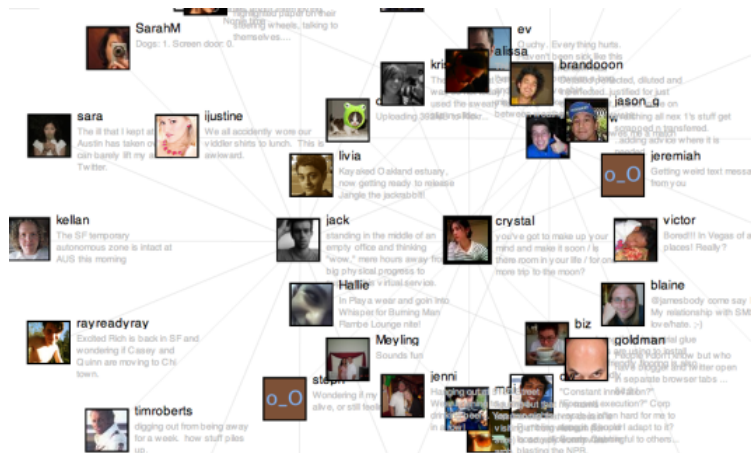
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# twitter.com Status Updates (microblogs)

Happiness



<http://flowingdata.com>

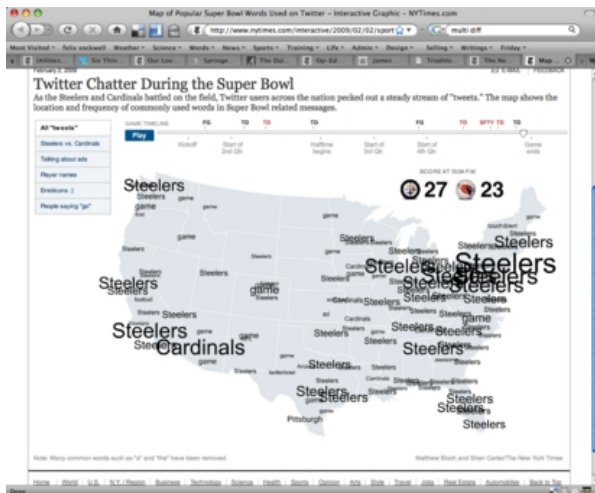
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# The possibilities of Twitter...

Happiness



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Twittering the Superbowl (田) [NY Times]

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## Alan Greenspan (September 18, 2007):



<http://wikipedia.org>

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## Alan Greenspan (September 18, 2007):

“I’ve been dealing with these big mathematical models of forecasting the economy ...



<http://wikipedia.org>

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Alan Greenspan (September 18, 2007):

“I’ve been dealing with these big mathematical models of forecasting the economy ...

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



<http://wikipedia.org>

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Frame 50/55

Alan Greenspan (September 18, 2007):

“I’ve been dealing with these big mathematical models of forecasting the economy ...

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.



<http://wikipedia.org>

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Frame 50/55

Alan Greenspan (September 18, 2007):

“I’ve been dealing with these big mathematical models of forecasting the economy ...

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>

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# Economics, Schmeconomics

Greenspan continues:

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# Economics, Schmeconomics

Greenspan continues:

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

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# Economics, Schmeconomics

Greenspan continues:

“The trouble is that we can't figure that out. I've been in the forecasting business for 50 years. I'm no better than I ever was,

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# Economics, Schmeconomics

Greenspan continues:

“The trouble is that we can't figure that out. I've been in the forecasting business for 50 years. I'm no better than I ever was, and nobody else is.

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# Economics, Schmeconomics

Greenspan continues:

“The trouble is that we can't figure that out. I've been in the forecasting business for 50 years. **I'm no better than I ever was, and nobody else is.** Forecasting 50 years ago was as good or as bad as it is today.

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# Economics, Schmeconomics

Greenspan continues:

“The trouble is that we can't figure that out. I've been in the forecasting business for 50 years. I'm no better than I ever was, and nobody else is. Forecasting 50 years ago was as good or as bad as it is today. And the reason is that human nature hasn't changed.

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# Economics, Schmeconomics

Greenspan continues:

“The trouble is that we can’t figure that out. I’ve been in the forecasting business for 50 years. **I’m no better than I ever was, and nobody else is.** Forecasting 50 years ago was as good or as bad as it is today. **And the reason is that human nature hasn’t changed.** We can’t improve ourselves.”

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