



# Computing with Affective Lexicons

Affective, Sentimental,  
and Connotative  
Meaning in the Lexicon

# Affective meaning

- Drawing on literatures in
  - affective computing (Picard 95)
  - linguistic subjectivity (Wiebe and colleagues)
  - social psychology (Pennebaker and colleagues)
- Can we model the lexical semantics relevant to:
  - sentiment
  - emotion
  - personality
  - mood
  - attitudes

# Why compute affective meaning?

- Detecting:
  - sentiment towards politicians, products, countries, ideas
  - frustration of callers to a help line
  - stress in drivers or pilots
  - depression and other medical conditions
  - confusion in students talking to e-tutors
  - emotions in novels (e.g., for studying groups that are feared over time)
- Could we generate:
  - emotions or moods for literacy tutors in the children's storybook domain
  - emotions or moods for computer games
  - personalities for dialogue systems to match the user

# Connotation in the lexicon

- Words have connotation as well as sense
- Can we build lexical resources that represent these connotations?
- And use them in these computational tasks?

# Scherer's typology of affective states

**Emotion:** relatively brief episode of synchronized response of all or most organismic subsystems in response to the evaluation of an event as being of major significance

angry, sad, joyful, fearful, ashamed, proud, desperate

**Mood:** diffuse affect state ...change in subjective feeling, of low intensity but relatively long duration, often without apparent cause

cheerful, gloomy, irritable, listless, depressed, buoyant

**Interpersonal stance:** affective stance taken toward another person in a specific interaction, coloring the interpersonal exchange

distant, cold, warm, supportive, contemptuous

**Attitudes:** relatively enduring, affectively colored beliefs, preferences predispositions towards objects or persons

liking, loving, hating, valuing, desiring

**Personality traits:** emotionally laden, stable personality dispositions and behavior tendencies, typical for a person

nervous, anxious, reckless, morose, hostile, envious, jealous



# Computing with Affective Lexicons

## Sentiment Lexicons

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# The General Inquirer

Philip J. Stone, Dexter C Dunphy, Marshall S. Smith, Daniel M. Ogilvie. 1966. The General Inquirer: A Computer Approach to Content Analysis. MIT Press

- Home page: <http://www.wjh.harvard.edu/~inquirer>
- List of Categories: <http://www.wjh.harvard.edu/~inquirer/homecat.htm>
- Spreadsheet: <http://www.wjh.harvard.edu/~inquirer/inquirerbasic.xls>
- Categories:
  - Positiv (1915 words) and Negativ (2291 words)
  - Strong vs Weak, Active vs Passive, Overstated versus Understated
  - Pleasure, Pain, Virtue, Vice, Motivation, Cognitive Orientation, etc
- Free for Research Use



# LIWC (Linguistic Inquiry and Word Count)

Pennebaker, J.W., Booth, R.J., & Francis, M.E. (2007). Linguistic Inquiry and Word Count: LIWC 2007. Austin, TX

- Home page: <http://www.liwc.net/>
- 2300 words, >70 classes
- **Affective Processes**
  - negative emotion (*bad, weird, hate, problem, tough*)
  - positive emotion (*love, nice, sweet*)
- **Cognitive Processes**
  - Tentative (*maybe, perhaps, guess*), Inhibition (*block, constraint*)
- **Pronouns, Negation** (*no, never*), **Quantifiers** (*few, many*)
- \$30 or \$90 fee

# MPQA Subjectivity Cues Lexicon

Theresa Wilson, Janyce Wiebe, and Paul Hoffmann (2005). Recognizing Contextual Polarity in Phrase-Level Sentiment Analysis. Proc. of HLT-EMNLP-2005.

Riloff and Wiebe (2003). Learning extraction patterns for subjective expressions. EMNLP-2003.

- Home page: [http://www.cs.pitt.edu/mpqa/subj\\_lexicon.html](http://www.cs.pitt.edu/mpqa/subj_lexicon.html)
- 6885 words from 8221 lemmas
  - 2718 positive
  - 4912 negative
- Each word annotated for intensity (strong, weak)
- GNU GPL

# Bing Liu Opinion Lexicon

Minqing Hu and Bing Liu. Mining and Summarizing Customer Reviews. ACM SIGKDD-2004.

- [Bing Liu's Page on Opinion Mining](#)
- <http://www.cs.uic.edu/~liub/FBS/opinion-lexicon-English.rar>
- 6786 words
  - 2006 positive
  - 4783 negative

# SentiWordNet

Stefano Baccianella, Andrea Esuli, and Fabrizio Sebastiani. 2010 SENTIWORDNET 3.0: An Enhanced Lexical Resource for Sentiment Analysis and Opinion Mining. LREC-2010

- Home page: <http://sentiwordnet.isti.cnr.it/>
- All WordNet synsets automatically annotated for degrees of positivity, negativity, and neutrality/objectiveness
- [estimable(J,3)] “may be computed or estimated”  
Pos 0    Neg 0    Obj 1
- [estimable(J,1)] “deserving of respect or high regard”  
Pos .75    Neg 0    Obj .25



# Computing with Affective Lexicons

## Other Affective Lexicons

# Scherer's typology of affective states

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# Two families of theories of emotion

- Atomic basic emotions
  - A finite list of 6 or 8, from which others are generated
- Dimensions of emotion
  - Valence (positive negative)
  - Arousal (strong, weak)
  - Control

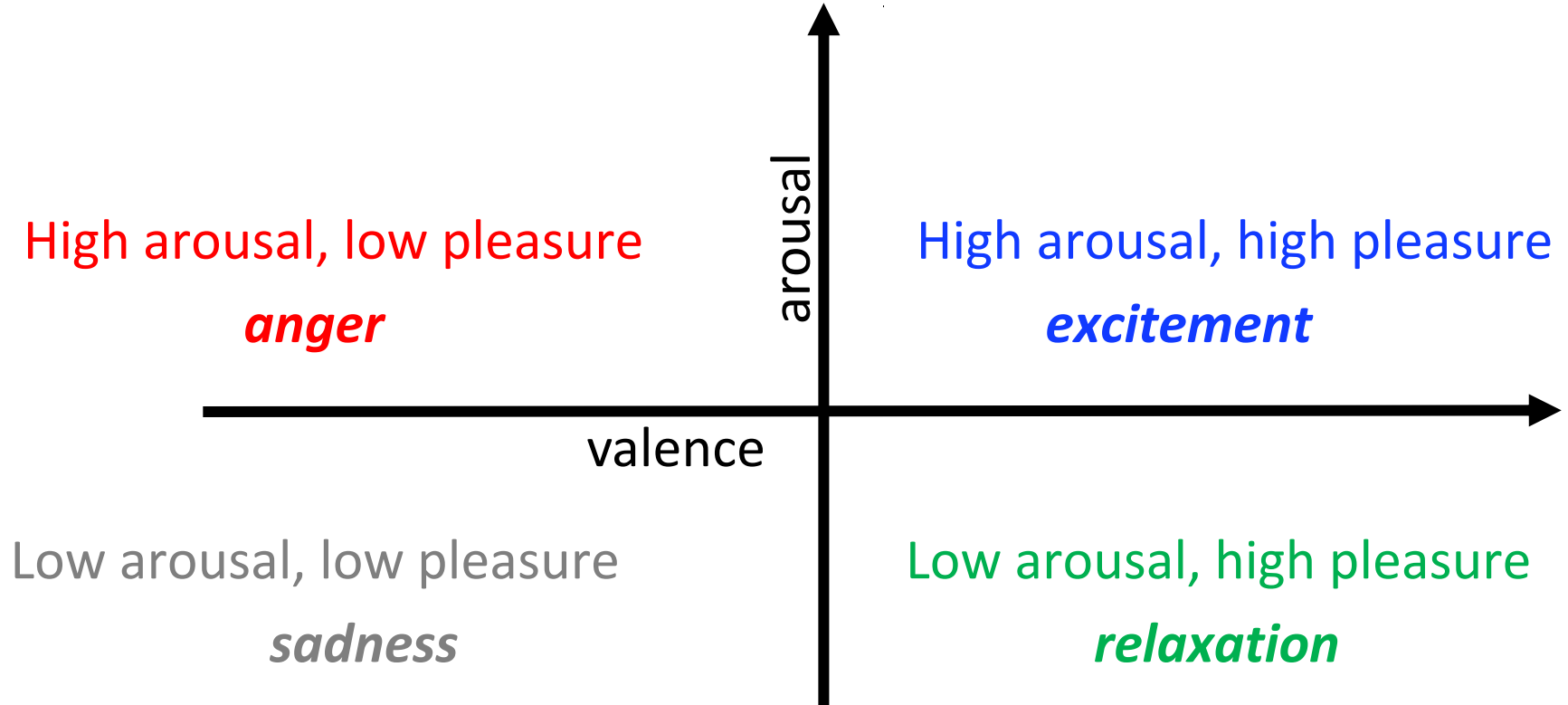
# Ekman's 6 basic emotions:

Surprise, happiness, anger, fear, disgust, sadness





# Valence/Arousal Dimensions



# Atomic units vs. Dimensions

## Distinctive

- Emotions are units.
- Limited number of basic emotions.
- Basic emotions are innate and universal

## Dimensional

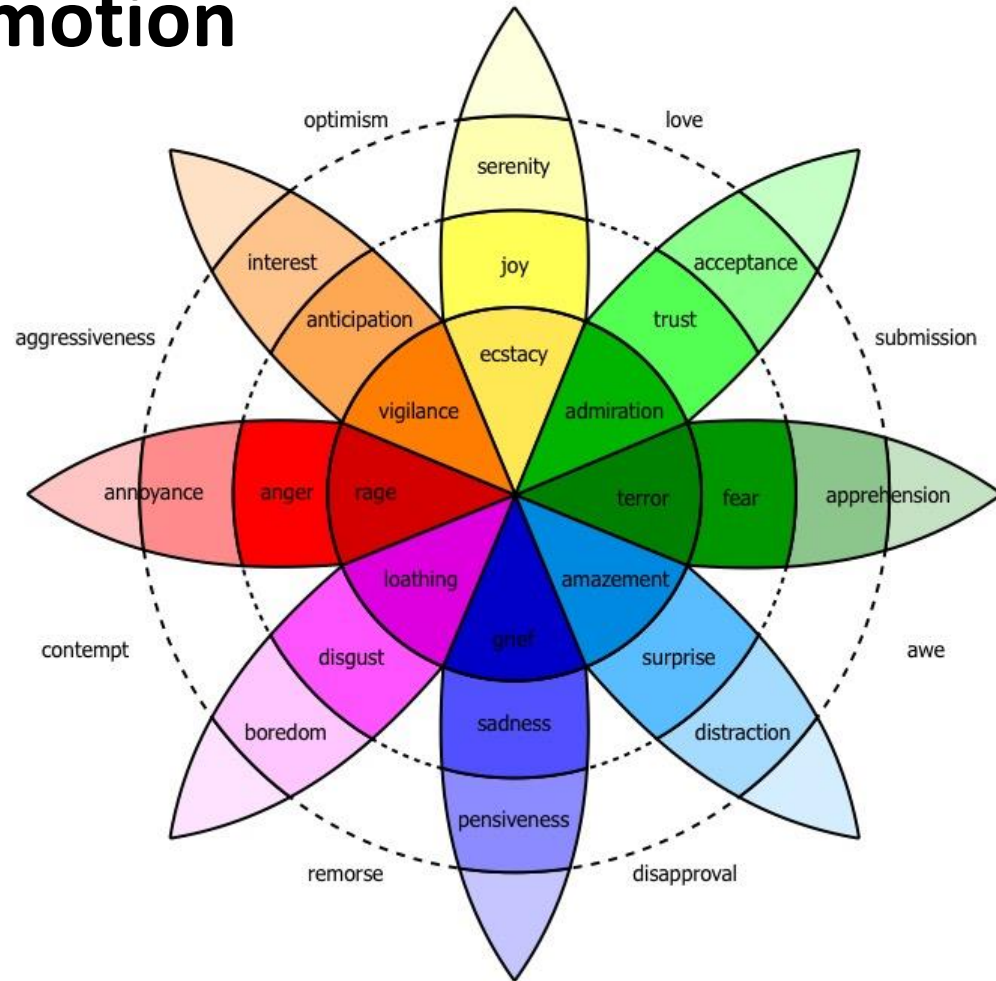
- Emotions are dimensions.
- Limited # of labels but unlimited number of emotions.
- Emotions are culturally learned.

# One emotion lexicon from each paradigm!

1. 8 basic emotions:
    - NRC Word-Emotion Association Lexicon (Mohammad and Turney 2011)
  2. Dimensions of valence/arousal/dominance
    - Warriner, A. B., **Kuperman**, V., and Brysbaert, M. (2013)
- Both built using Amazon Mechanical Turk

# Plutchick's wheel of emotion

- 8 basic emotions
- in four opposing pairs:
  - joy–sadness
  - anger–fear
  - trust–disgust
  - anticipation–surprise



# NRC Word-Emotion Association Lexicon

Mohammad and Turney 2011

- 10,000 words chosen mainly from earlier lexicons
- Labeled by Amazon Mechanical Turk
- 5 Turkers per hit
- Give Turkers an idea of the relevant sense of the word
- Result:

amazingly	anger	0
amazingly	anticipation	0
amazingly	disgust	0
amazingly	fear	0
amazingly	joy	1
amazingly	sadness	0
amazingly	surprise	1
amazingly	trust	0
amazingly	negative	0
amazingly	positive	1

EmoLex	# of terms
<b>EmoLex-Uni:</b>	
Unigrams from Macquarie Thesaurus	
adjectives	200
adverbs	200
nouns	200
verbs	200
<b>EmoLex-Bi:</b>	
Bigrams from Macquarie Thesaurus	
adjectives	200
adverbs	187
nouns	200
verbs	200
<b>EmoLex-GI:</b>	
Terms from General Inquirer	
negative terms	2119
neutral terms	4226
positive terms	1787
<b>EmoLex-WAL:</b>	
Terms from WordNet Affect Lexicon	
anger terms	165
disgust terms	37
fear terms	100
joy terms	165
sadness terms	120
surprise terms	53
<b>Union</b>	<b>10170</b>

# The AMT Hit

**Prompt word:** *startle*

Q1. Which word is closest in meaning (most related) to *startle*?

- *automobile*
- *shake*
- *honesty*
- *entertain*

Q2. How positive (good, praising) is the word *startle*?

- *startle* is not positive
- *startle* is weakly positive
- *startle* is moderately positive
- *startle* is strongly positive

Q3. How negative (bad, criticizing) is the word *startle*?

- *startle* is not negative
- *startle* is weakly negative
- *startle* is moderately negative
- *startle* is strongly negative

Q4. How much is *startle* associated with the emotion joy? (For example, *happy* and *fun* are strongly associated with joy.)

- *startle* is not associated with joy
- *startle* is weakly associated with joy
- *startle* is moderately associated with joy
- *startle* is strongly associated with joy

Q5. How much is *startle* associated with the emotion sadness? (For example, *failure* and *heart-break* are strongly associated with sadness.)

- *startle* is not associated with sadness
- *startle* is weakly associated with sadness
- *startle* is moderately associated with sadness
- *startle* is strongly associated with sadness

Q6. How much is *startle* associated with the emotion fear? (For example, *horror* and *scary* are strongly associated with fear.)

- Similar choices as in 4 and 5 above

Q7. How much is *startle* associated with the emotion anger? (For example, *rage* and *shouting* are strongly associated with anger.)

- Similar choices as in 4 and 5 above

Q8. How much is *startle* associated with the emotion trust? (For example, *faith* and *integrity* are strongly associated with trust.)

- Similar choices as in 4 and 5 above

Q9. How much is *startle* associated with the emotion disgust? (For example, *gross* and *cruelty* are strongly associated with disgust.)

- Similar choices as in 4 and 5 above

...

# Lexicon of valence, arousal, and dominance

- Warriner, A. B., Kuperman, V., and Brysbaert, M. (2013). [Norms of valence, arousal, and dominance for 13,915 English lemmas. \*Behavior Research Methods\* 45, 1191-1207.](#)
- [Supplementary data: This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License.](#)
- **Ratings for 14,000 words for emotional dimensions:**
  - **valence** (the pleasantness of the stimulus)
  - **arousal** (the intensity of emotion provoked by the stimulus)
  - **dominance** (the degree of control exerted by the stimulus)

# Lexicon of valence, arousal, and dominance

- **valence** (the pleasantness of the stimulus)
  - 9: happy, pleased, satisfied, contented, hopeful
  - 1: unhappy, annoyed, unsatisfied, melancholic, despaired, or bored
- **arousal** (the intensity of emotion provoked by the stimulus)
  - 9: stimulated, excited, frenzied, jittery, wide-awake, or aroused
  - 1: relaxed, calm, sluggish, dull, sleepy, or unaroused;
- **dominance** (the degree of control exerted by the stimulus)
  - 9: in control, influential, important, dominant, autonomous, or controlling
  - 1: controlled, influenced, cared-for, awed, submissive, or guided
- Again produced by AMT



# Lexicon of valence, arousal, and dominance: Examples

Valence		Arousal		Dominance	
vacation	8.53	rampage	7.56	self	7.74
happy	8.47	tornado	7.45	incredible	7.74
whistle	5.7	zucchini	4.18	skillet	5.33
conscious	5.53	dressy	4.15	concur	5.29
torture	1.4	dull	1.67	earthquake	2.14

# Concreteness versus abstractness

- The degree to which the concept denoted by a word refers to a perceptible entity.
  - Do concrete and abstract words differ in connotation?
  - Storage and retrieval?
  - Bilingual processing?
  - Relevant for embodied view of cognition (Barsalou 1999 inter alia)
    - Do concrete words activate brain regions involved in relevant perception
- Brysbaert, M., Warriner, A. B., and Kuperman, V. (2014) [Concreteness ratings for 40 thousand generally known English word lemmas \*Behavior Research Methods\* 46, 904-911.](#)
- [Supplementary data: This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License.](#)
- 37,058 English words and 2,896 two-word expressions ( “zebra crossing” and “zoom in”),
  - Rating from 1 (abstract) to 5 (concrete)
  - Calibrator words:
    - shirt, infinity, gas, grasshopper, marriage, kick, polite, whistle, theory, and sugar

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- Some example ratings from the final dataset of 40,000 words and phrases

banana 5

bathrobe 5

bagel 5

brisk 2.5

badass 2.5

basically 1.32

belief 1.19

although 1.07

# Perceptual Strength Norms

## Connell and Lynott norms

Word	Perceptual strength						Concreteness	Imageability
	Auditory	Gustatory	Haptic	Olfactory	Visual			
soap	0.35	1.29	4.12	4.00	4.06	589	600	
noisy	4.95	0.05	0.29	0.05	1.67	293	138	
atom	1.00	0.63	0.94	0.50	1.38	481	499	
republic	0.53	0.67	0.27	0.07	1.79	376	356	



Microsoft Excel  
Worksheet



# Computing with Affective Lexicons

Using the lexicons to detect affect

# Lexicons for detecting document affect: Simplest unsupervised method

- Sentiment:
  - Sum the weights of each positive word in the document
  - Sum the weights of each negative word in the document
  - Choose whichever value (positive or negative) has higher sum
- Emotion:
  - Do the same for each emotion lexicon

# Lexicons for detecting document affect: Simplest supervised method

- Build a classifier
  - Predict sentiment (or emotion, or personality) given features
  - Use “counts of lexicon categories” as a features
  - Sample features:
    - LIWC category “cognition” had count of 7
    - NRC Emotion category “anticipation” had count of 2
- Baseline
  - Instead use counts of **all** the words and bigrams in the training set
  - This is hard to beat
  - But only works if the training and test sets are very similar





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# The Big Five Dimensions of Personality

## **Extraversion vs. Introversion**

sociable, assertive, playful vs. aloof, reserved, shy

## **Emotional stability vs. Neuroticism**

calm, unemotional vs. insecure, anxious

## **Agreeableness vs. Disagreeable**

friendly, cooperative vs. antagonistic, faultfinding

## **Conscientiousness vs. Unconscientious**

self-disciplined, organised vs. inefficient, careless

## **Openness to experience**

intellectual, insightful vs. shallow, unimaginative

# Various text corpora labeled for personality of author

**Pennebaker**, James W., and Laura A. King. 1999. "Linguistic styles: language use as an individual difference." *Journal of personality and social psychology* 77, no. 6.

- 2,479 essays from psychology students (1.9 million words), “write whatever comes into your mind” for 20 minutes

**Mehl**, Matthias R, SD Gosling, JW Pennebaker. 2006. Personality in its natural habitat: manifestations and implicit folk theories of personality in daily life. *Journal of personality and social psychology* 90 (5), 862

- Speech from Electronically Activated Recorder (EAR)
- Random snippets of conversation recorded, transcribed
- 96 participants, total of 97,468 words and 15,269 utterances

**Schwartz**, H. Andrew, Johannes C. Eichstaedt, Margaret L. Kern, Lukasz Dziurzynski, Stephanie M. Ramones, Megha Agrawal, Achal Shah et al. 2013. "Personality, gender, and age in the language of social media: The open-vocabulary approach." *PloS one* 8, no. 9

- Facebook
- 75,000 volunteers
- 309 million words
- All took a personality test

# Ears (speech) corpus (Mehl et al.)

Introvert	Extravert
<ul style="list-style-type: none"> <li>- Yeah you would do kilograms. Yeah I see what you're saying.</li> <li>- On Tuesday I have class. I don't know.</li> <li>- I don't know. A16. Yeah, that is kind of cool.</li> <li>- I don't know. I just can't wait to be with you and not have to do this every night, you know?</li> <li>- Yeah. You don't know. Is there a bed in there? Well ok just...</li> </ul>	<ul style="list-style-type: none"> <li>- That's my first yogurt experience here. Really watery. Why?</li> <li>- Damn. New game.</li> <li>- Oh.</li> <li>- That's so rude. That.</li> <li>- Yeah, but he, they like each other. He likes her.</li> <li>- They are going to end up breaking up and he's going to be like.</li> </ul>
Unconscientious	Conscientious
<ul style="list-style-type: none"> <li>- With the Chinese. Get it together.</li> <li>- I tried to yell at you through the window. Oh. xxxx's fucking a dumb ass. Look at him. Look at him, dude. Look at him. I wish we had a camera. He's fucking brushing his t-shirt with a tooth brush. Get a kick of it. Don't steal nothing.</li> </ul>	<ul style="list-style-type: none"> <li>- I don't, I don't know for a fact but I would imagine that historically women who have entered prostitution have done so, not everyone, but for the majority out of extreme desperation and I think. I don't know, i think people understand that desperation and they don't don't see [...]</li> </ul>

# Essays corpus (Pennebaker and King)

Introvert	Extravert
<p>I've been waking up on time so far. What has it been, 5 days? Dear me, I'll never keep it up, being such not a morning person and all. But maybe I'll adjust, or not. I want internet access in my room, I don't have it yet, but I will on Wed??? I think. But that ain't soon enough, cause I got calculus homework [...]</p>	<p>I have some really random thoughts. I want the best things out of life. But I fear that I want too much! What if I fall flat on my face and don't amount to anything. But I feel like I was born to do BIG things on this earth. But who knows... There is this Persian party today.</p>
Neurotic	Emotionally stable
<p>One of my friends just barged in, and I jumped in my seat. This is crazy. I should tell him not to do that again. I'm not that fastidious actually. But certain things annoy me. The things that would annoy me would actually annoy any normal human being, so I know I'm not a freak.</p>	<p>I should excel in this sport because I know how to push my body harder than anyone I know, no matter what the test I always push my body harder than everyone else. I want to be the best no matter what the sport or event. I should also be good at this because I love to ride my bike.</p>

# Classifiers

- **Mairesse**, François, Marilyn A. Walker, Matthias R. Mehl, and Roger K. Moore. "Using linguistic cues for the automatic recognition of personality in conversation and text." *Journal of artificial intelligence research* (2007): 457-500.
  - Various classifiers, lexicon-based and prosodic features
- **Schwartz**, H. Andrew, Johannes C. Eichstaedt, Margaret L. Kern, Lukasz Dziurzynski, Stephanie M. Ramones, Megha Agrawal, Achal Shah et al. 2013. "Personality, gender, and age in the language of social media: The open-vocabulary approach." *PloS one* 8, no.
  - regression and SVM, lexicon-based and all-words

# Sample LIWC Features

## LIWC (Linguistic Inquiry and Word Count)

Pennebaker, J.W., Booth, R.J., & Francis, M.E. (2007). *Linguistic Inquiry and Word Count: LIWC 2007*. Austin, TX

Feature	Type	Example
Anger words	LIWC	hate, kill, pissed
Metaphysical issues	LIWC	God, heaven, coffin
Physical state/function	LIWC	ache, breast, sleep
Inclusive words	LIWC	with, and, include
Social processes	LIWC	talk, us, friend
Family members	LIWC	mom, brother, cousin
Past tense verbs	LIWC	walked, were, had
References to friends	LIWC	pal, buddy, coworker
Imagery of words	MRC	Low: future, peace - High: table, car
Syllables per word	MRC	Low: a - High: uncompromisingly
Concreteness	MRC	Low: patience, candor - High: ship
Frequency of use	MRC	Low: duly, nudity - High: he, the

# Normalizing LIWC category features (Schwartz et al 2013, Facebook study)

- Mairesse:  
Raw LIWC counts
- Schwartz et al:  
Normalized per writer:

$$p(\text{category} \mid \text{subject}) = \frac{\sum_{\text{word} \in \text{category}} \text{freq}(\text{word}, \text{subject})}{\sum_{\text{word} \in \text{vocab}(\text{subject})} \text{freq}(\text{word}, \text{subject})}$$



# Sample results

- Agreeable:
  - +Family, +Home, -Anger, -Swear
- Extravert
  - +Friend, +Religion, +Self
- Conscientiousness:
  - -Swear, -Anger, -NegEmotion,
- Emotional Stability:
  - -NegEmotion, +Sports,
- Openness
  - -Cause, -Space

# Decision tree for predicting extraversion in essay corpus (Mairesse et al)

