

# WorryWords: Norms of Anxiety Association for over 44K English Words

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## Anxiety

The anticipatory unease about a potential (future) negative outcome

- common and beneficial human emotion
- can sometimes manifest into mental disorders
  - mismatch: current environment vs. what anxiety has evolved for

## WorryWords

- Manually derived fine-grained scores for association of 44K English words with anxiety
  - maximum calmness (-3) to maximum anxiety (3)
  - coarse categorical labels also available (e.g. moderate calmness, low anxiety, high anxiety)
- The annotations are reliable (high split-half reliability scores)
- Has applications in NLP, psychology, public health, digital humanities, social science, etc.

I have some affection for my anxiety. When it does not have me in a swirl, I think of it as a little pet, a black cat who has gotten stuck in my house and who I keep feeding milk, even though I am not sure that I wanted a pet. The cat's language is gentle, pawing, and brings me back to the things that matter: Hospitality, compassion, service, kindness. The cat is my teacher.

- Laura Turner

Sketch: Charles Darwin, The Expression of Emotion in Man and Animals (London: John Murray, 1872), p. 125.



## Existing Emotion Lexicons

### The NRC Valence, Arousal, and Dominance Lexicon

- v1: ratings of V, A, and D for ~20,000 words
- v2: ratings of V, A, and D for ~44,000 words
- <http://saifmohammad.com/WebPages/nrc-vad.html>

### The NRC Emotion Lexicon

- associations for ~14,000 words with eight emotions

### The NRC Emotion Intensity Lexicon

- intensity scores for ~6000 emotional words
- <http://saifmohammad.com/WebPages/AffectIntensity.htm>

Are anxiety terms essentially just low-valence, high-arousal, low-dominance terms? Or fear terms? [Ans: No, see Exp 1]

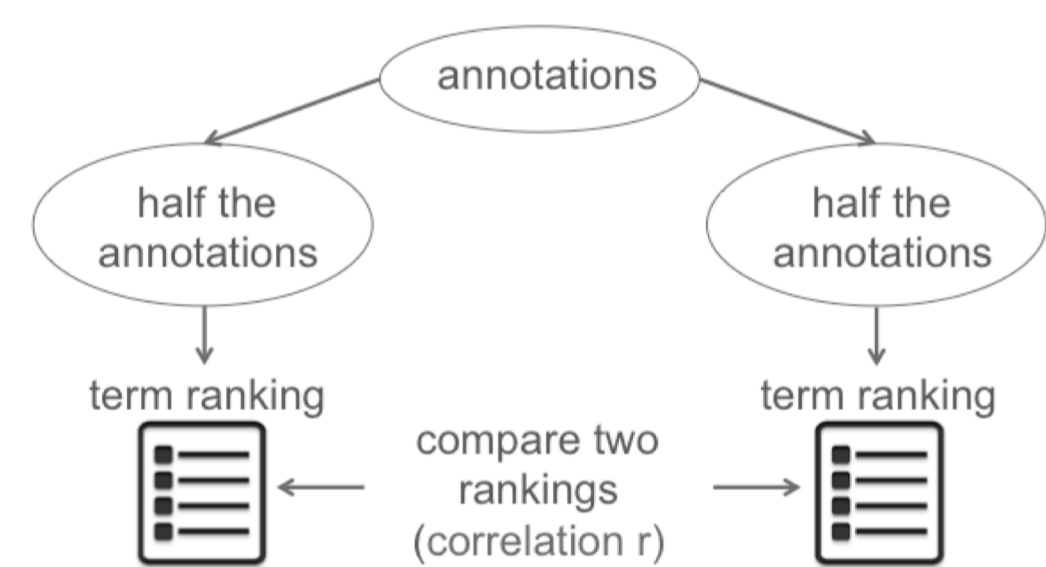
## Why create language resources for anxiety?

- Understanding anxiety and the underlying mechanisms (Psychology, Health)
  - how it relates to other emotions and affect; to our body
  - how anxiety changes with age, socio-economic status, weather, green spaces, etc.
  - identifying coping mechanisms, clinical interventions to manage anxiety
- Study how anxiety manifests in language (Linguistics)
  - how language shapes anxiety; how culture shapes the language of anxiety
- Tracking the degree of anxiety towards targets of interest such as climate change, government policies, biological vectors, etc. (Health, Policy)
- Developing automatic systems for detecting anxiety (NLP)
- Studying how anxiety impacts behaviour (Social Science)
- Studying anxiety in stories, character development, etc. (Digital Humanities)

## Crowdsourced Annotations



- Terms: NRC VAD Lexicon v1 (Mohammad, 2018)
- Age of Acquisition Dataset (Brysbaert et al., 2019)
- Questionnaire:
- Quality Control: interspersed gold (control) questions
- Annotation Aggregation: average of annotator scores
- Measured average split-half reliability (SHR):
- Platform: MTurk



This study was approved by the NRC Research Ethics Board (NRC-REB).

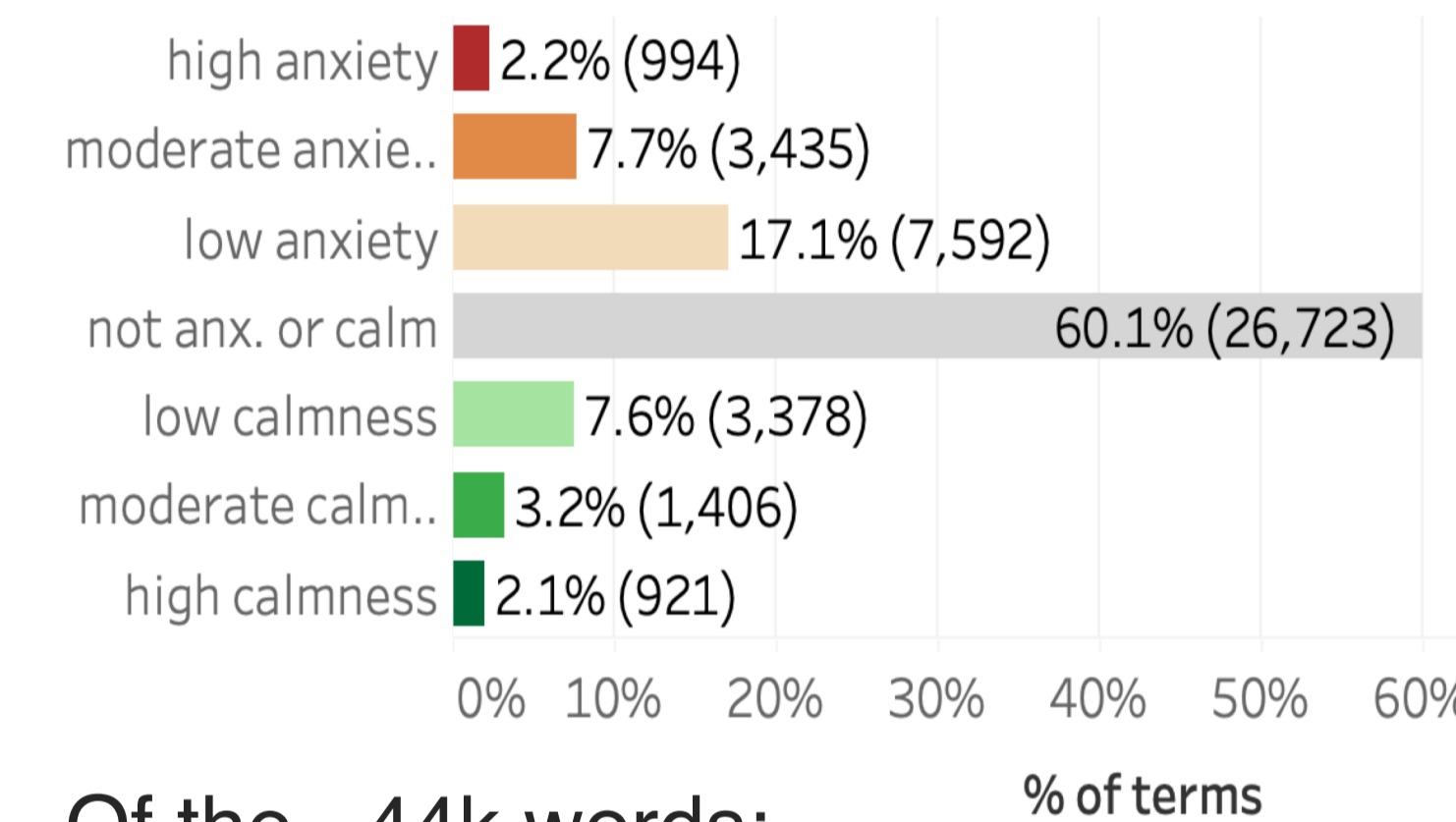
Dataset	#words	Annotators	#Annotators	#Annotations	MAI	SHR ( $\rho$ )	SHR ( $r$ )
unigrams	44,450	US, India, UK, Canada	1,020	375,796	8.5	0.82	0.89

Consider anxiety to be a broad category that includes: jittery, antsy, insecure, nervous, unease, tense, worried, unnerving, nerve-racking, apprehensive, fretful, troubled, self-doubting, discontented, concerned, and keyed up

Consider calmness to be a broad category that includes: calm, relaxed, comforted, serene, at ease, self-assured, carefree, composed, collected, untroubled, peaceful, contented, unconcerned, indifferent, and uninvolved

Select the options that most English speakers will agree with.

- Q1. <term> is often associated with feeling:
- 3: very anxious
  - 2: moderately anxious
  - 1: slightly anxious
  - 0: not associated with feeling anxious or calm
  - 1: slightly calm
  - 2: moderately calm
  - 3: very calm



Term	Score
suffocative	3.00
manic	2.41
risky	1.72
brusquely	1.25
ceramic	0.12
aloof	-1.67
conformed	-1.71
lullaby	-2.79

Of the ~44k words:

- ~60% associated with neither anxiety nor calmness
- ~27% associated with anxiety; ~13% with calmness

## Experiments

### 1. How does anxiety relate to other emotions?



Correlation of Anxiety associations with other Emotion associations: WorryWords – NRC Emotion Intensity Lexicon

	anxiety	anger	anticipn.	disgust	fear	joy	sadness	surprise	trust
anxiety	1.000	0.336	-0.011	0.279	0.357	-0.132	0.272	0.082	-0.137

Correlation of Anxiety with Affect: WorryWords – NRC VAD Lexicon

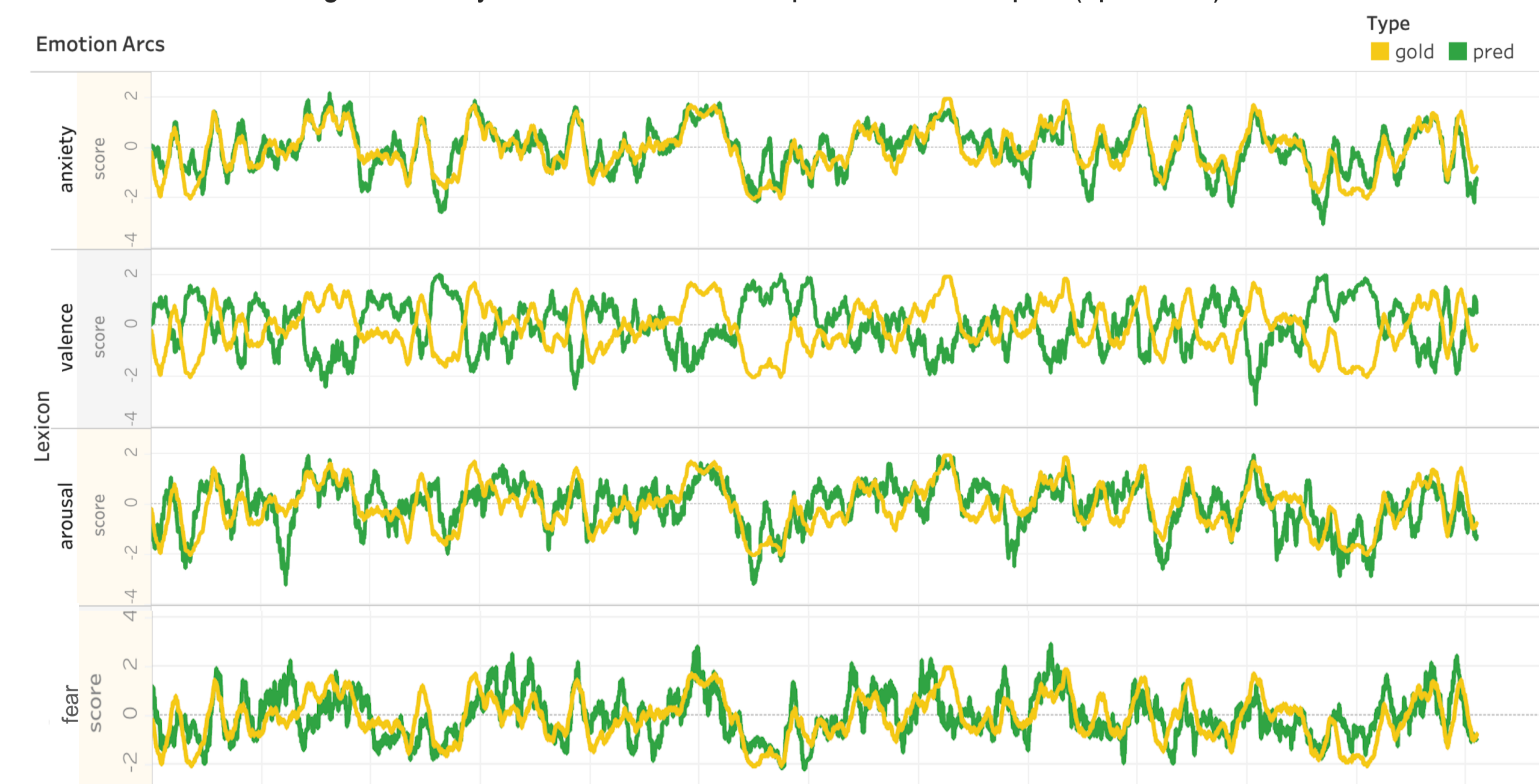
	anxiety	valence	arousal	domin.
anxiety	1.000	-0.471	0.237	-0.218
valence	-0.471	1.000	-0.014	0.568
arousal	0.237	-0.014	1.000	0.286
domin.	-0.218	0.568	0.286	1.000

Anxiety not captured by other constructs:

- mostly no or mild correlations
  - slight corr. with fear (then anger, sadness)
  - moderate inverse corr. with valence.
- Examples: high calm., low V: pity, aloof  
high anx., high V: *adrenalin*, *revolutionary*

### 3. Can we Track Anxiety in Text Streams using WorryWords alone?

Created text streams and gold arcs by sampling posts from the Rastogi et al. (2022) dataset (5,488 Reddit posts annotated for anxiety) with replacement such that the gold anxiety arcs had random amplitudes and slopes (spikiness). Predicted arcs created using lexicons (word counting).

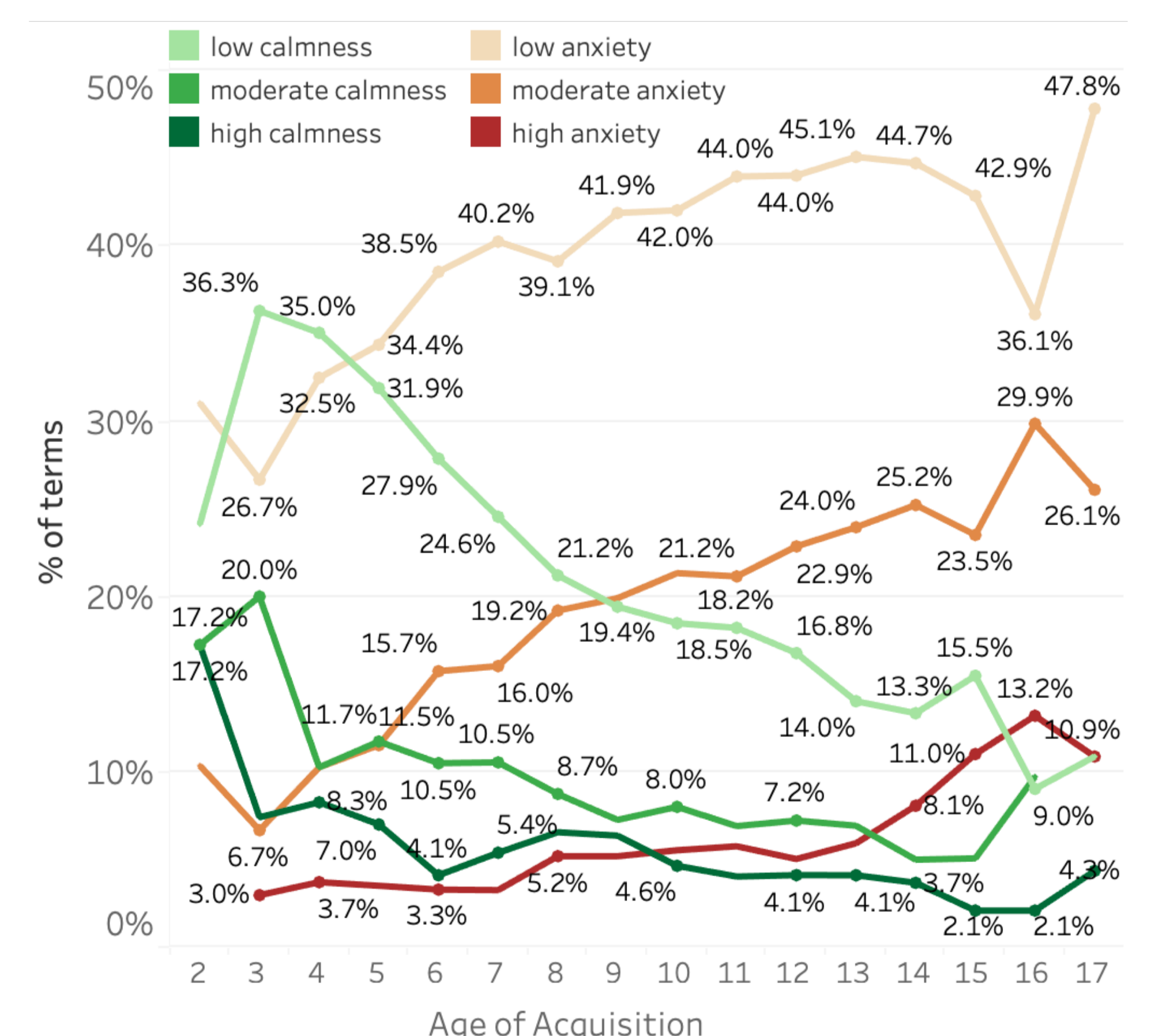


Lexicons used: WorryWords, NRC VAD Lexicon, NRC Emotion Intensity Lexicon

- WorryWords highly accurate at tracking anxiety in text streams
- Valence and arousal lexicons better indicators than fear (fear lexicon much smaller)
- Inverse of anticipation better correlated than fear: 0.659

### 2. At what rate do children acquire anxiety words as they age?

Graph created using WorryWords and the Age of Acquisition lexicons



Up to age 5: more calming words than anxiety words  
After age 5: increasing proportion of anxiety words

## Ethical Considerations

- Not to be used as a stand-alone tool for diagnosing disorders
- Consider coverage, domain, ambiguity, socio-cultural effects, etc.
- Ethics Sheet for Emotion Recognition (Mohammad, 2022) [CL Journal]
- Best Practices in the Use of Emotion Lexicons (Mohammad, 2020)