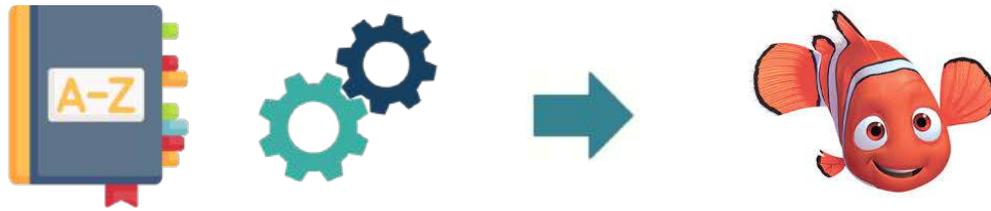# NLP for Affective Science:

Exploring Fundamental Questions on Emotions through Language and Computation

Saif M. Mohammad
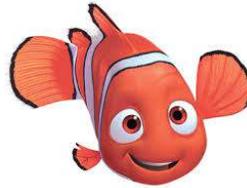
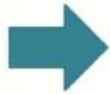Principal Research Scientist, National Research Council Canada

✉ Saif.Mohammad@nrc-cnrc.gc.ca   🐦 @SaifMMohammad

National Research Council Canada   Conseil national de recherches Canada

Canada
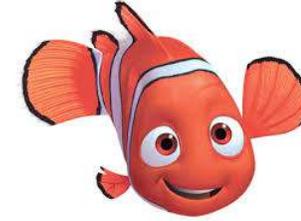
NLP for Affective Science:

A window into emotions through language and computation

NLP for Affective Science:

A window into emotions (mind, body, health, and behavior) through language and computation

What are Affect and Emotions?

to start with…

Affect: the basic sense of feeling

Emotions: joy, sadness, fear, anger, etc.

Psychological Theories of Emotions

National Research Council Canada
Conseil national de recherches Canada

Canada

ON

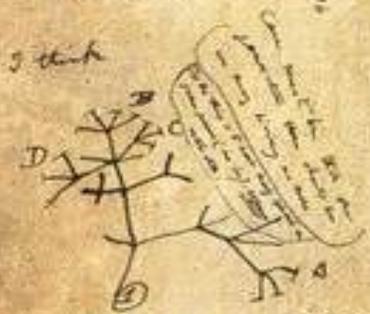# THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE

FOR LIFE

BY CHARLES DARWIN, M.A.

I think
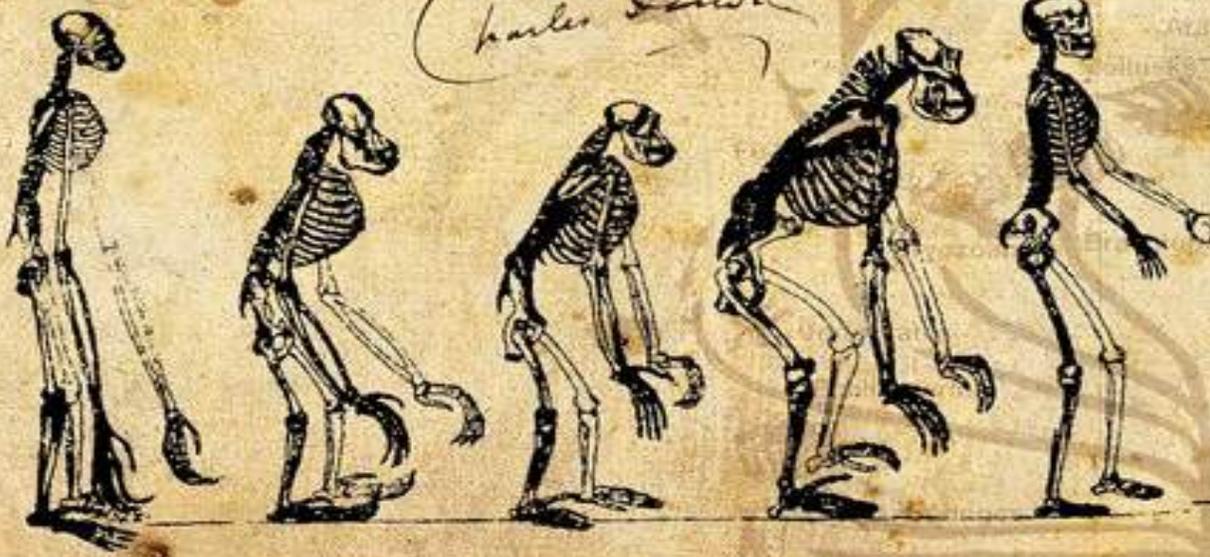
Gibbon   Orangutan   Chimpanzee   Gorilla   Man

200TH ANNIVERSARY EDITION
Charles Darwin 1809-1882

CHARLES
DARWIN

THE EXPRESSION
OF THE EMOTIONS IN
MAN AND ANIMALS

Introduction, Afterword and Commentaries by
PAUL EKMAN
New Preface for the Anniversary Edition

'As fresh and provocative today
as it was 125 years ago.'
—Steven Pinker

Theories of Emotion

Margaret Mead
Cultural anthropologist

Paul Ekman, Psychologist

- Mead, 1950s: culture determines emotion
- Paul Ekman, 1971: Six Universal Basic Emotions
  - Plutchik, 1980: Eight Basic Emotions
  - And many others

Plutchik's Emotion Wheel
Image credit: Julia Belyanevych

Core Dimensions of Connotative Meaning

Influential factor analysis studies (Osgood et al., 1957; Russell, 1980, 2003) have shown that the three most important, largely independent, dimensions of word meaning:

- valence (V): positive/pleasure – negative/displeasure
- arousal (A): active/stimulated – sluggish/bored
- dominance (D): powerful/strong – powerless/weak

Thus, when comparing the meanings of two words, we can compare their V, A, D scores. For example:
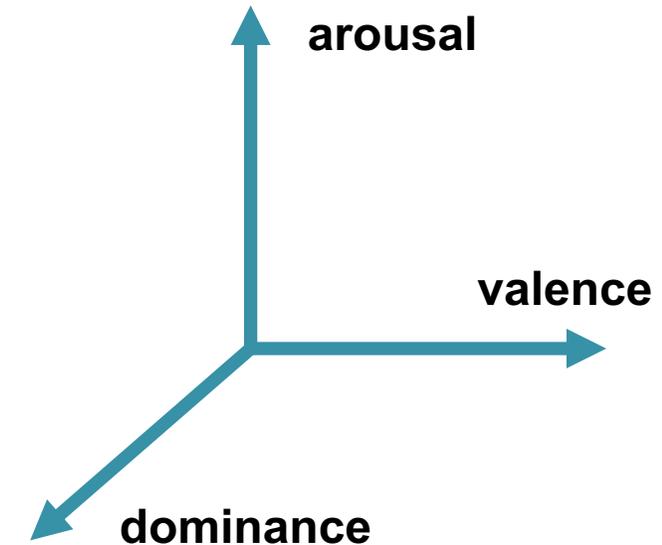
- *banquet* indicates more positiveness than *funeral*
- *nervous* indicates more arousal than *lazy*
- *queen* indicates more dominance than *delicate*

Osgood   Russell

arousal

valence

dominance

Theories of Emotion

Margaret Mead
Cultural anthropologist

Paul Ekman
Psychologist and discoverer
of micro expressions.

Lisa Barrett
University Distinguished
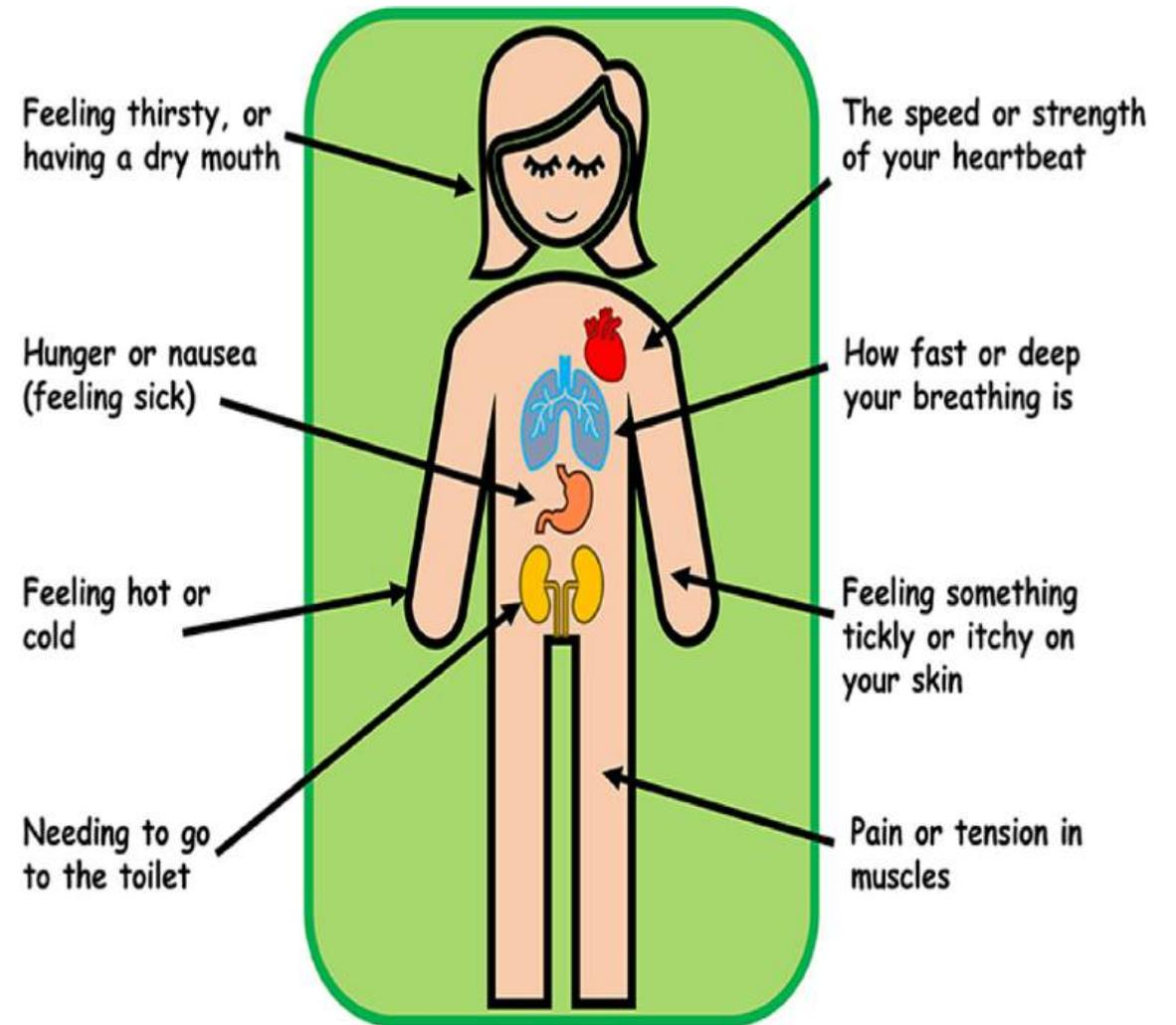Professor of Psychology,
Northeastern University

Theory of Constructed Emotion (Barrett, 2017)

- the brain constructs emotions
- important tenets of BET discredited ("basic" emotions)
- stress on variability

Interoception

the ability to sense signals
about your bodily state

Interoceptive signals
sensory representations of the
interior of the body (viscera)

Feeling thirsty, or having a dry mouth

The speed or strength of your heartbeat

Hunger or nausea (feeling sick)

How fast or deep your breathing is

Feeling hot or cold

Feeling something tickly or itchy on your skin

Needing to go to the toilet

Pain or tension in muscles

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Canada

Constructed Emotion

External Situation	Bodily Signal	Possible Emotions
Public speaking in front of an audience	Heart races Palms sweat Stomach churns	Anxiety Excitement
Walking alone at night and hearing footsteps behind you	Muscles tense Heart rate spikes Breathing shallow	Fear Apprehension Hypervigilance
Sitting alone at café	Slow breathing Relaxed muscles	Loneliness Contentment

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Affect

The basic sense of feeling:

- Transduced and summarized from interoceptive signals
  - sensory representations of the interior of the body (viscera)

- A feature of consciousness
  - occurs in every moment (whether you're aware of it or not)

- Key dimensions
  - Valence: displeasure to pleasure
  - Arousal: idle/sluggish to activated
  - Dominance: weak/loss of control to strong/having a sense of control

Emotions

Constructed by the brain using:

- affective and interoceptive signals
- "emotion concepts" from one's culture learned through socialization
- predictive coding

The brain categorizes the continuous affect into discrete categories (analogous to color perception)

- joy, sadness, fear, anger, etc.

Why Emotions and Affect Matter

- Determine human experience and behavior

- Condition our actions

- Central in organizing meaning
  - No cognition without emotion

- A window into
  - understanding our body, brain, and well-being
 - the evolutionary forces that shaped us

Affective Science

Interdisciplinary field focused on understanding emotions and affect

- How do affect and emotions work?
  - affective and emotional processes
  - affective neuroscience
  - emotion regulation

- How do they impact our mental health, physical health, and behaviour?
  - wellbeing, emotion-related disorders

- What agency do we have in managing our emotions?

The Language of Emotions
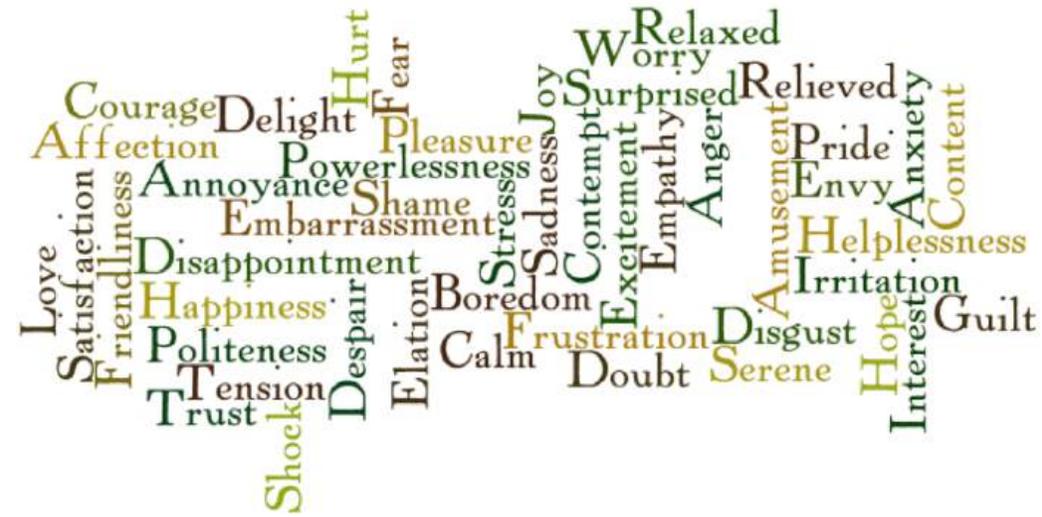
Language is a powerful way of expressing emotions

- can express numerous emotional shades
  ◦ terms with fuzzy boundaries, overlapping meanings, socio-cultural influences, etc.

- usually conveyed by connotation (and not denotation)
  ◦ can be subtle, direct, ambiguous, deceptive
  ◦ can be creative
  ◦ can be conscious expression or subconscious manifestations

NLP for Affective Science
Computational Analysis of Emotions Through Language

- Challenging
  - see previous slide on language

- Powerful
  - makes use of large amounts of text
  - simple to complex NLP techniques
  - language impacts thought and how we construct emotions
    linguistic relativity aka Sapir–Whorf hypothesis

- Complementary view to traditional affective science approaches in psychology
  - makes use of, complementary, ecologically valid data

Computational Analysis of Emotions Through Language

Affective Science Questions

- How do emotions work?
- What impacts our emotions?
- How do emotions relate to our bodies and health?
- How do we regulate emotions?

Linguistics

- How do we use language to convey emotions?
- How does language impact emotions?

Social Science

- How do emotions impact social cognition, morality, stereotypes, and behavior?

AI

- What tools can we build to help people, clinicians, social scientists?

This Talk

- Core Theories of Affect and Emotion
  - What is NLP for Affective Science?

- Word-Emotion Associations: basic units of emotion expression in language
  - Anxiety (EMNLP 2024)
  - Warmth and Competence (ACL 2025)

- Emotion Arcs: a window into Mind and Body

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  - Body Part Mentions (in submission)

- Ethical considerations in emotion recognition (ACL, CL Journal, 2022)

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word --

Word-Emotion Association Lexicons

Over the years, created lexicons for both categorical emotions as well as for valence, arousal, and dominance

- Lists of words associated with joy, sadness, fear, etc.
- Lists of words and their valence, arousal, and dominance scores

NRC Word–Emotion Association Lexicon aka NRC Emotion Lexicon or EmoLex (2010)

provides associations for ~14,000 words with eight emotions

(anger, fear, joy, sadness, anticipation, disgust, surprise, trust)

http://saifmohammad.com/WebPages/NRC-Emotion- Lexicon.htm

The NRC Emotion Intensity Lexicon aka Affect Intensity Lexicon (2018-19)

provides intensity scores for ~6000 words found to be associated with the 8 emotions

http://saifmohammad.com/WebPages/AffectIntensity.htm

NRC Valence, Arousal, and Dominance Lexicon (2018)

provides ratings of valence, arousal, and dominance for ~20,000 English words

http://saifmohammad.com/WebPages/nrc-vad.html

NRC Word–Colour Association Lexicon (2010)

provides associations for ~14,000 words with 11 common colours

http://saifmohammad.com/WebPages/lexicons.html

Anxiety

the anticipatory unease about a potential (future) negative outcome

- common and beneficial human emotion
- can sometimes manifest into mental disorders
  - mismatch: current environment and
    what anxiety response slowly evolved to address

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Why create language resources for anxiety?

- Understanding anxiety and the underlying mechanisms (Psych, Health)
  - how it relates to other emotions and affect
  - how it relates 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 (Ling.)
  - 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 in physical and virtual environments (SS)

- Studying anxiety in stories, character development, etc. (DH)

WorryWords

Repository of manually derived word–anxiety associations

- Scale: maximum calmness (-3) to maximum anxiety (3)
    - real-valued scores and also coarse categorical labels (e.g, low anxiety, high anxiety)
- Size
    - 44K English words
    - 10K English MWEs
- Quality
    - interspersed gold (control) questions
    - show that the anxiety associations are highly reliable
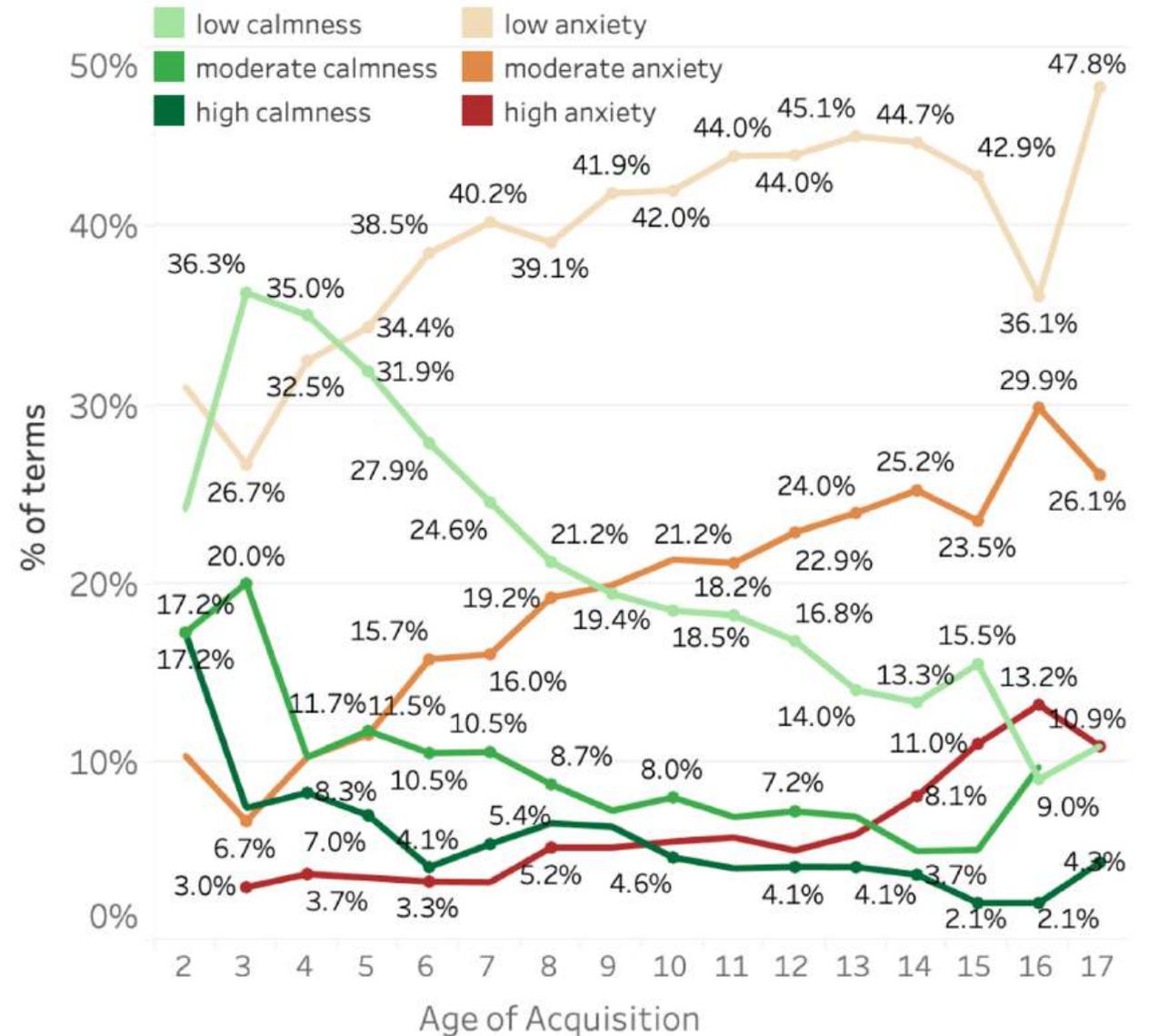   - split-half reliability of 0.82

Term	Score
suffocative	3.00
manic	2.41
riskily	1.72
ceramic	0.12
conformed	-1.71
lullaby	-2.79

EMNLP 2024:

WorryWords: Norms of Anxiety Association for over 44K English Words. Saif M. Mohammad.

WorryWords

study the rate at which children acquire anxiety words with age

Used WorryWords to

Track the change of anxiety in streams of text

Warmth And Competence

Warmth And Competence

Primary dimensions we assess people and groups on:

- Warmth (W)
  - Sociability (S): friendliness, gregariousness, and conviviality
  - Trust (T): morality, goodness, sincerity, and integrity

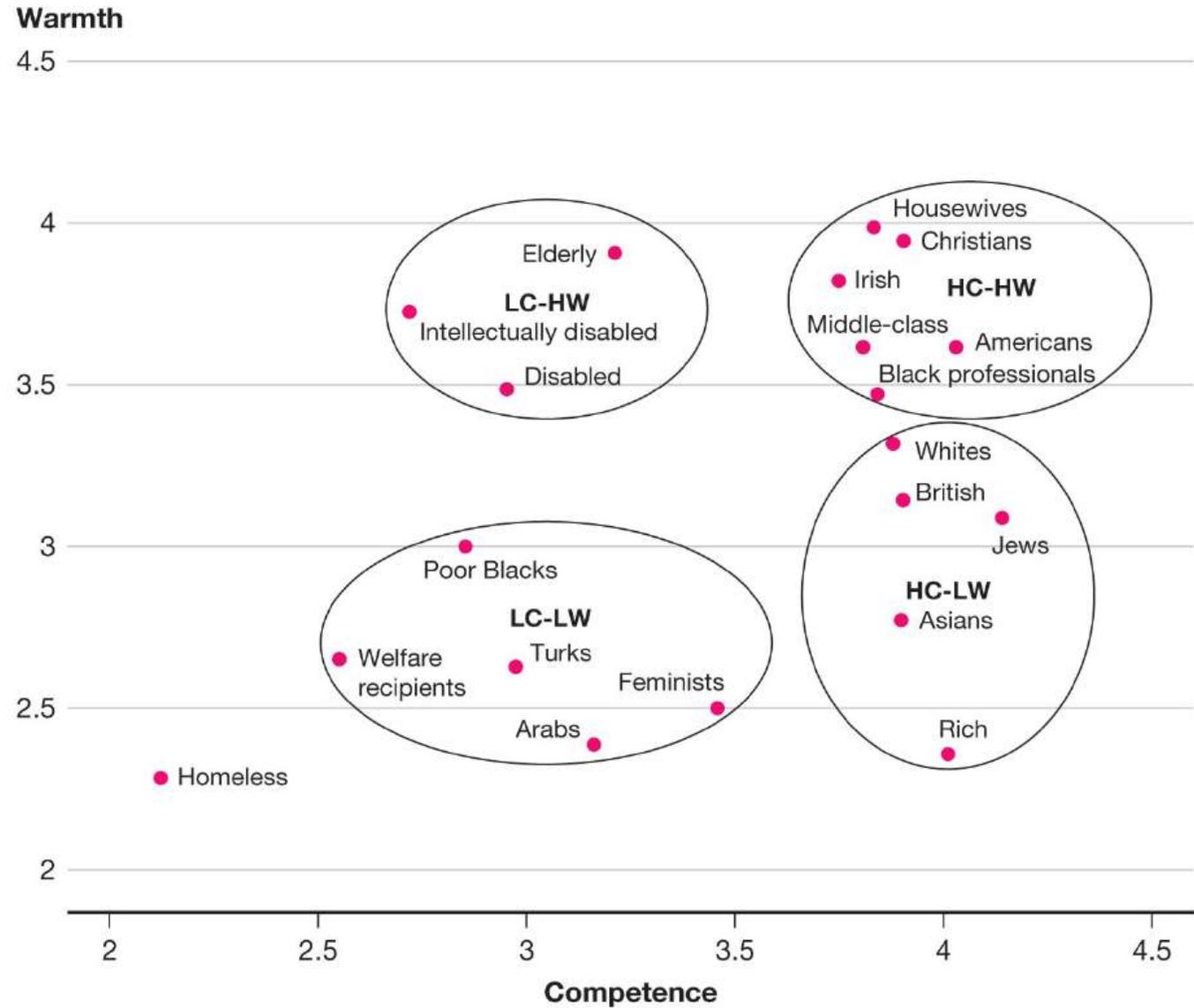- Competence (C)
  - ability, power, dominance, and assertiveness

[Decades of social cognition and stereotype research. Notably by Susan Fiske and colleagues. Evolutionary benefits.]

American Stereotypes

Cuddy, Fiske, and Glick 2008

Tied to who is considered to be in their:

- ingroup
- outgroup

American Stereotypes

Cuddy, Fiske, and Glick 2008

Tied to who is considered
to be in their:

- ingroup
- outgroup

Different quadrants associated
with different emotions
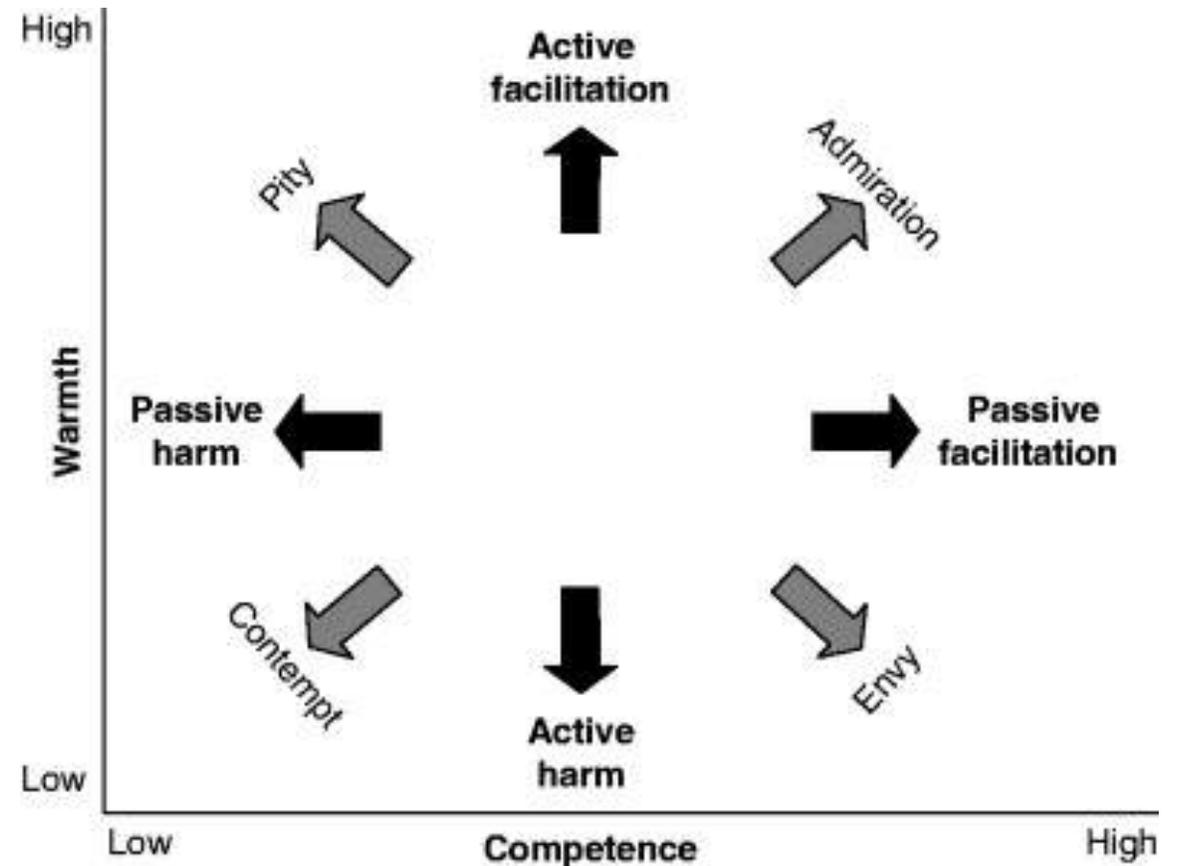
Why create language resources for WCTS?

In Psychology and Social Cognition

- What kind of WCTS assessments do children develop first?

In Computational Social Science, NLP

- Levels of WCTS in public discourse (climate change, vaccines, etc.)

In HCI and NLP

- Perceptions of WCST of people towards artificial agents.

In Digital Humanities and NLP

- Role do WCTS in developing compelling characters and story arcs

In Commerce

- Warmth, competence, trust, and sociability towards one's product on social media

Words Of Warmth

- Manually derived fine-grained scores of association for 26K English words

  ◦ maximum coldness / unsociability / untrustworthiness (-3) to maximum warmth /sociability / trustworthiness (3)

- The annotations are reliable (high split-half reliability scores)

- Warmth analyses are often done along with competence (aka dominance) analyses

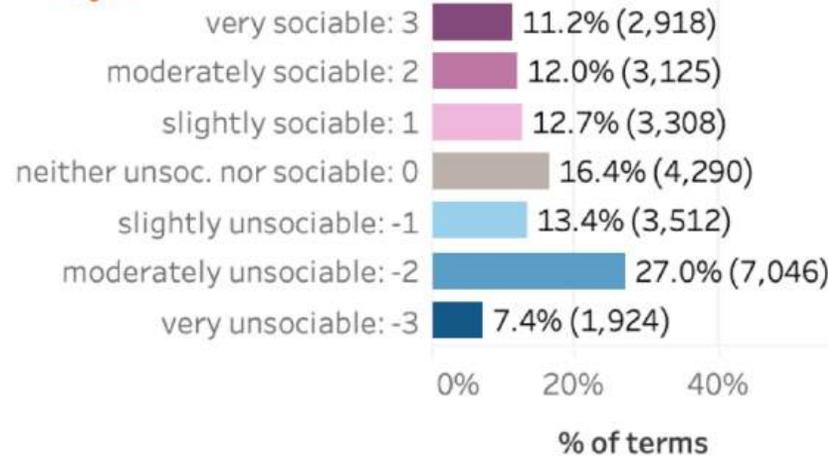 ◦ we include in the lexicon the competence scores taken from the NRC VAD Lexicon v2 (Mohammad, 2025)
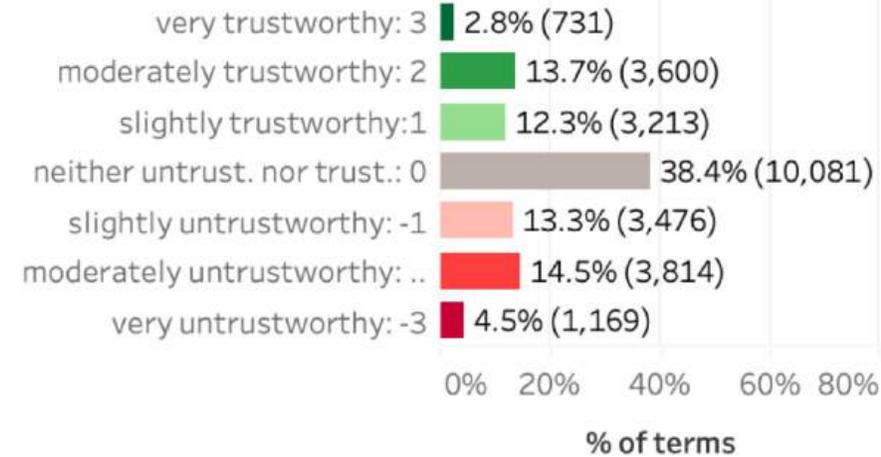
Class Distributions

warmth (group)

	% of terms
very warm: 3	12.28% (3,202)
moderately warm: 2	17.04% (4,445)
slightly warm: 1	12.71% (3,315)
neither cold nor warm: 0	10.50% (2,738)
slightly cold: -1	11.70% (3,052)
moderately cold: -2	26.94% (7,026)
very cold: -3	8.84% (2,306)

sociability (group)

	% of terms
very sociable: 3	11.2% (2,918)
moderately sociable: 2	12.0% (3,125)
slightly sociable: 1	12.7% (3,308)
neither unsoc. nor sociable: 0	16.4% (4,290)
slightly unsociable: -1	13.4% (3,512)
moderately unsociable: -2	27.0% (7,046)
very unsociable: -3	7.4% (1,924)

trust (group)

	% of terms
very trustworthy: 3	2.8% (731)
moderately trustworthy: 2	13.7% (3,600)
slightly trustworthy: 1	12.3% (3,213)
neither untrust. nor trust.: 0	38.4% (10,081)
slightly untrustworthy: -1	13.3% (3,476)
moderately untrustworthy: ..	14.5% (3,814)
very untrustworthy: -3	4.5% (1,169)

Experiments

1. At what rate do children acquire WCST words?

Rate at which children acquire WCST words

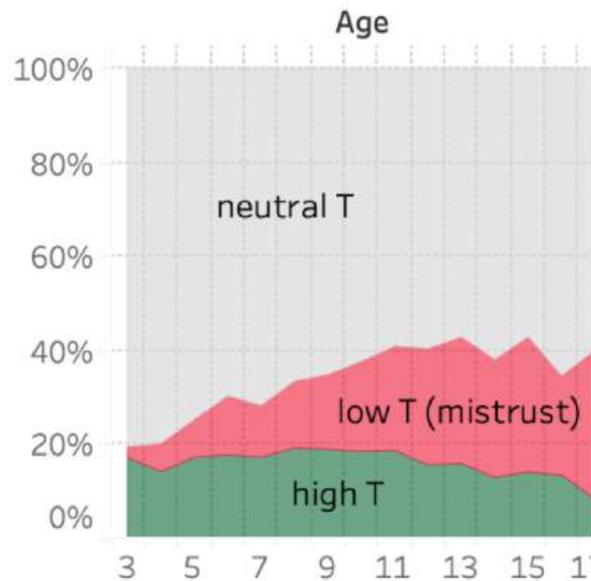Graphs created using: Words Of Warmth, NRC VAD, Age of Acquisition lexicons.
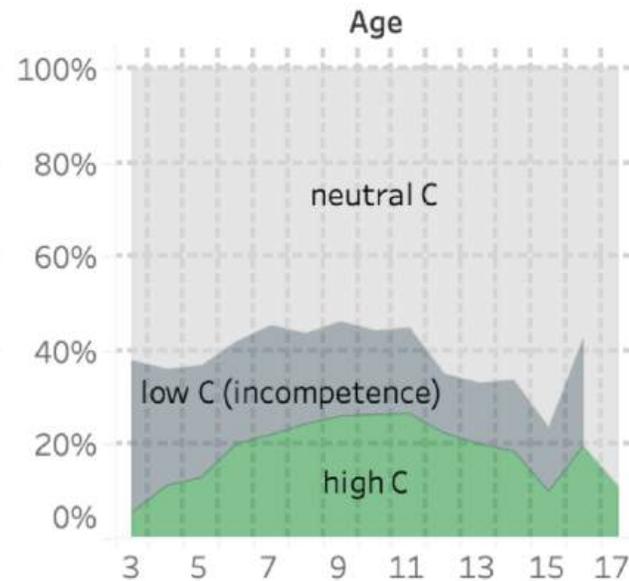

(a) warmth (W) — neutral W, low W (cold), high W

(b) sociability (S) — neutral S, low S (unsociable), high S

(c) trust (T) — neutral T, low T (mistrust), high T
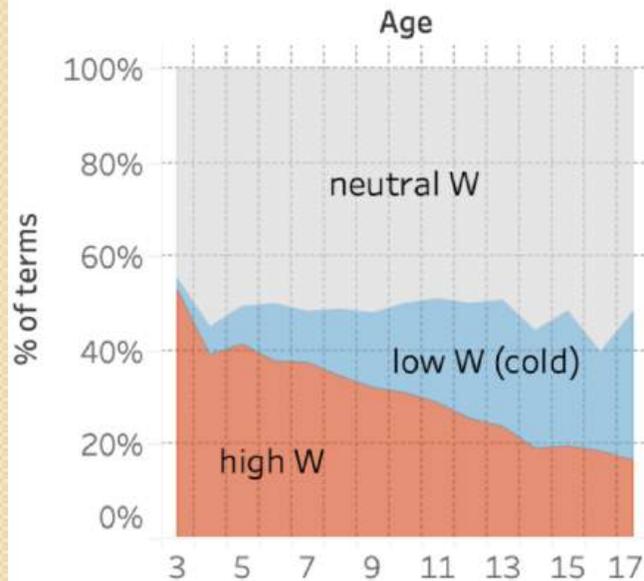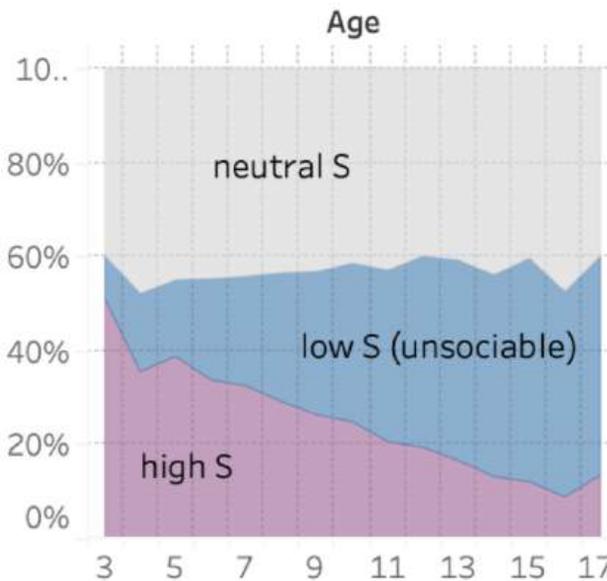
(d) competence (C) — neutral C, low C (incompetence), high C

W/S/T scores −1.5 to 1.5: neutral; <= −1.5: low; >= 1.5: high. C scores −0.33 to 0.33: neutral; −1 to −0.33: low C; 0.33 to 1: high C.

- Higher % for polar W words vs. polar C words: consistent with the primacy of valence hypothesis (not primacy of C).
- Higher % for polar S words as opposed to polar T words in early years: S is more important than T (and morality).
- Among the polar words, the early years are marked with a greater % of high-WST words, as well as low-C words.

Experiments

2. Case Studies of W and C Stereotypes

Measuring Stereotypes

Windows into stereotype towards various targets: Two methods

- Direct: Direct Target Lookup in the WCTS lexicon

- Co-terms: Examining WCTS of terms co-occurring with the target terms in the TUSC dataset

  American and Canadian geo-located posts on X from 2015 to 2021 (Vishnubhotla and Mohammad, 2022).

 Average W and C scores of all 3.1 million posts in the corpus: 0.5001, 0.1370 (in a range from -1 to 1).

Ethical Considerations

- Associations and stereotypes; not inherent properties

- 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)

a. gender (direct)
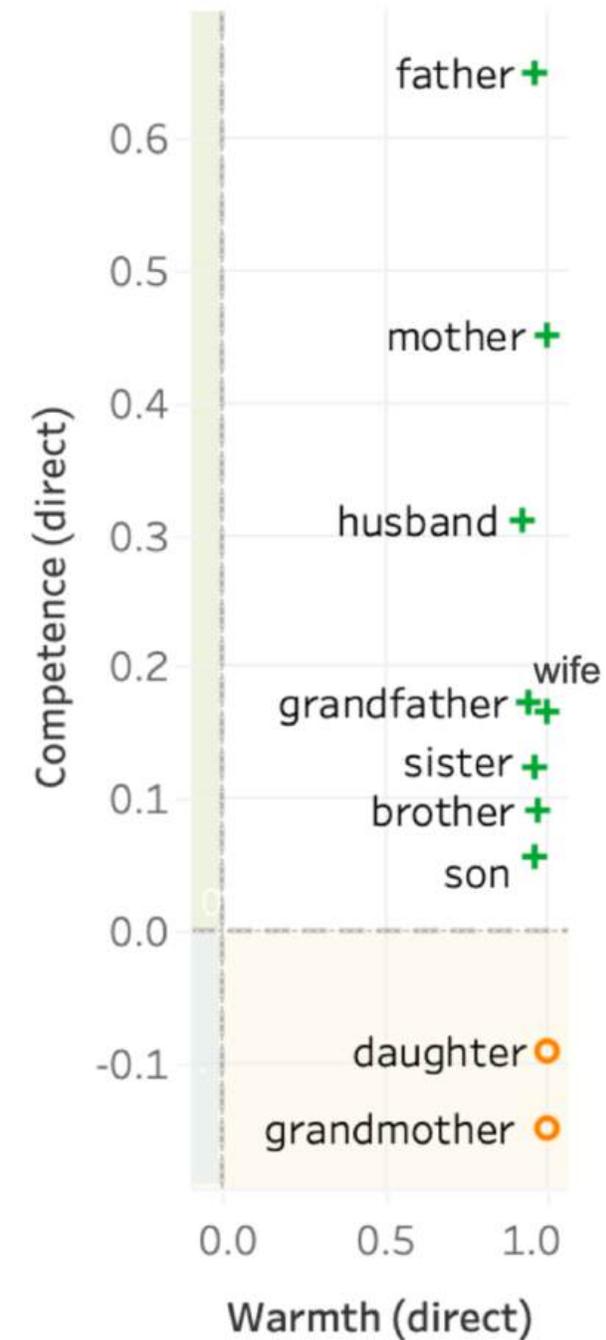
b. gender (coterms)
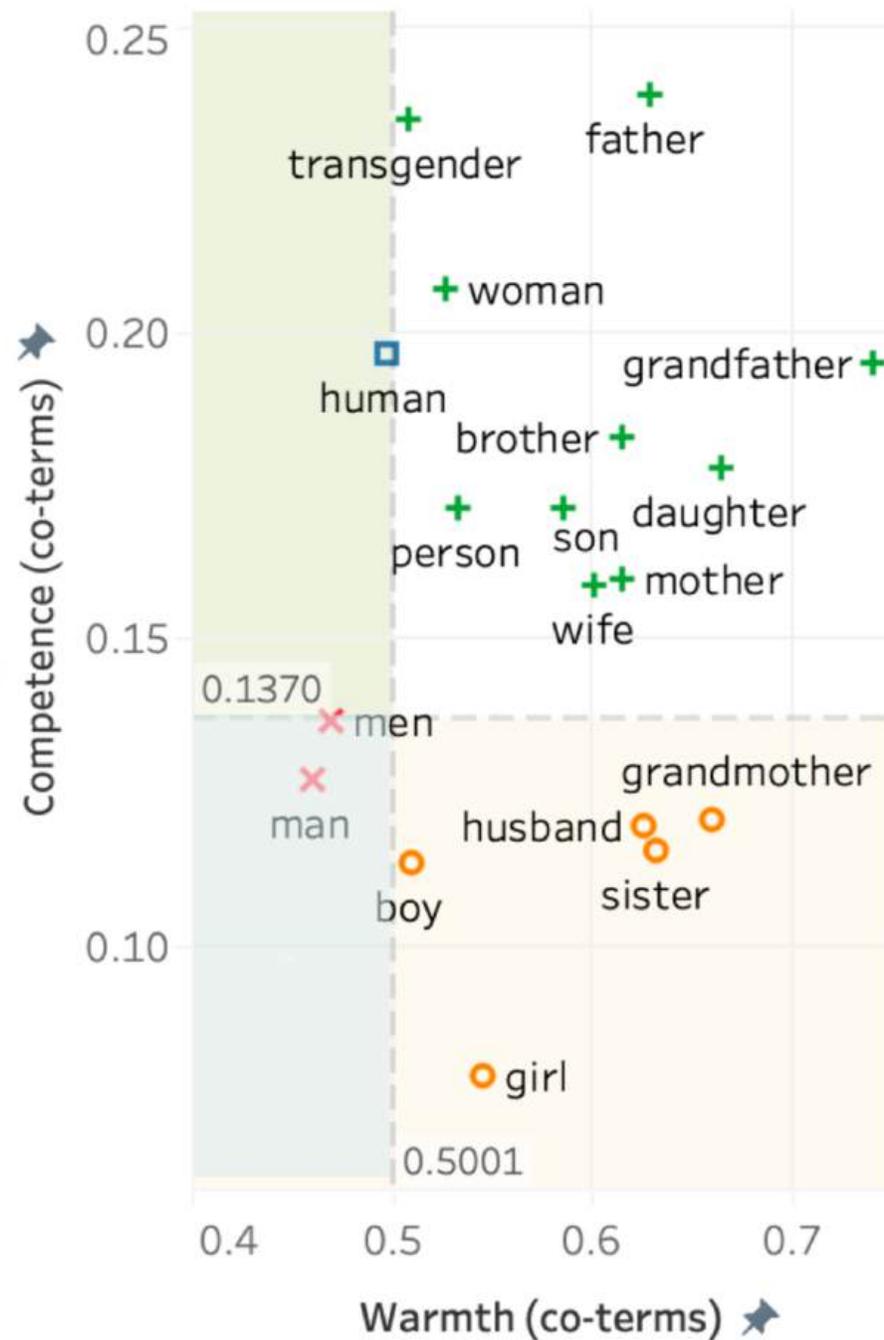
Relations

- Direct WC: people consider all these terms as high W; substantial variations in their C.

- In contrast, the co-term plots show that our language has marked differences for these terms for C and W.

- Clear gender stereotypes reflected in these scores

a. social groups (direct)
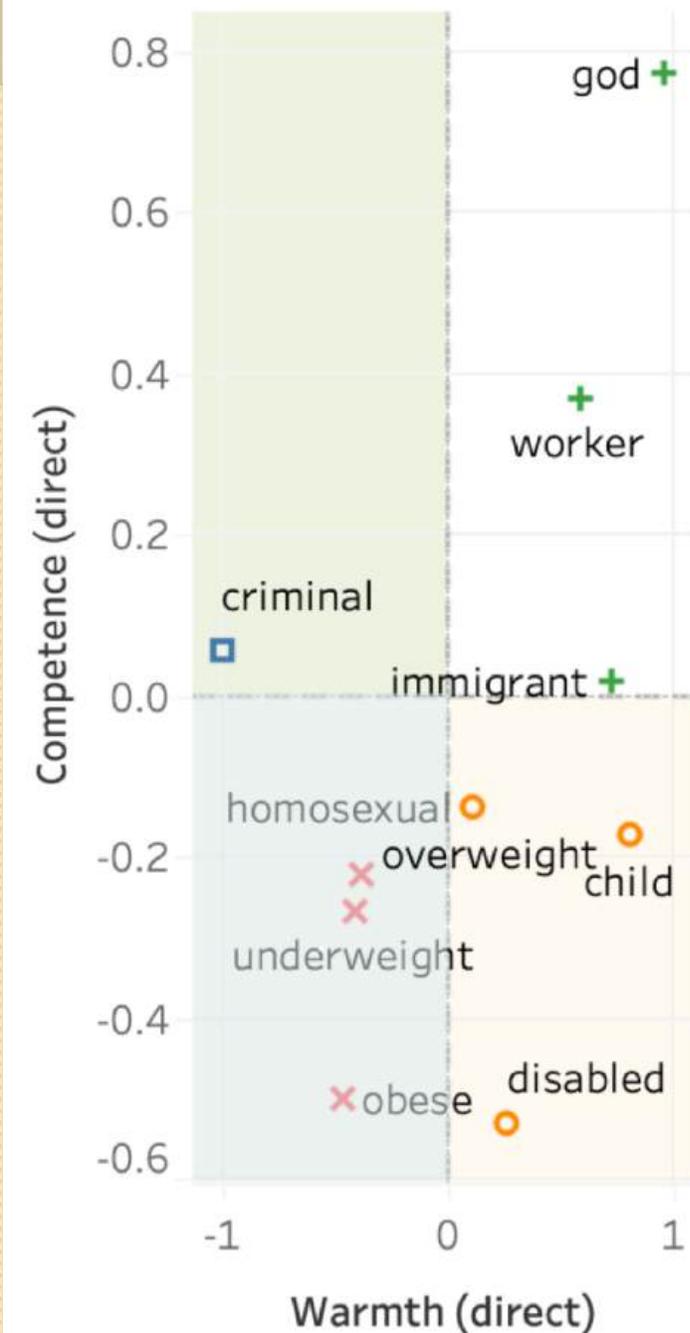
b. social groups (coterms)
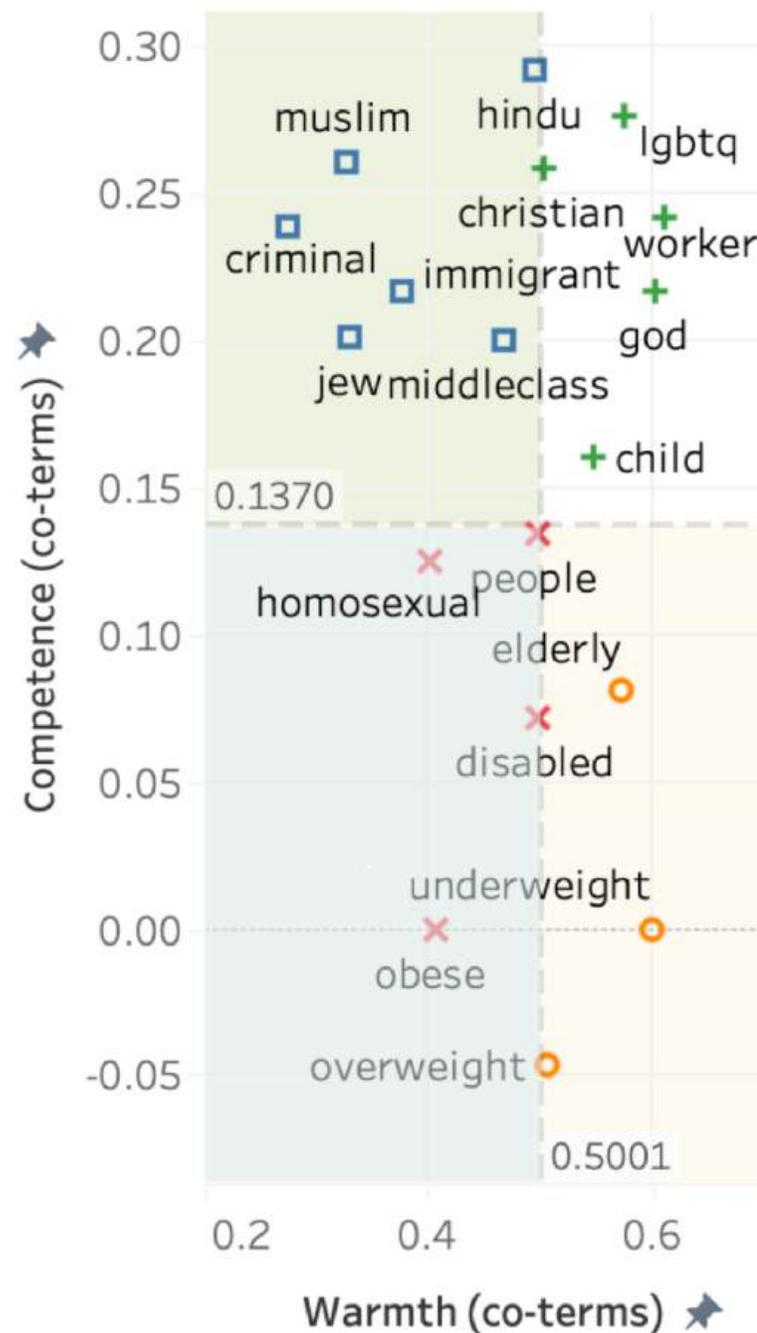
Social Groups

- *muslim, jew, immigrant:* low-W scores (consistent with known negative stereotypes in US, CA)

- *elderly, underweight:* low-C, high-W; *overweight:* even lower C score *obese:* low-W, low-C scores

- *god:* high direct W and C scores; but the discourse around *god* on X is such that the term gets lower co-terms-based C score than many other terms

The blue dashed lines indicate the average W and C scores of all posts by Americans and red dashed lines indicate the averages for Canadians.

In-group–Out-group Dynamics

- posts by Canadians in general have higher W and C scores than posts by Americans

- Canadians view themselves as more competent and much warmer than their neighbour (consistent with ingroup and out-group stereotypes)

- while Americans view themselves as more competent than Canadians, they too perceive Canadians as warmer (the *Canadians are nicer* stereotype overrides the outgroup stereotype)

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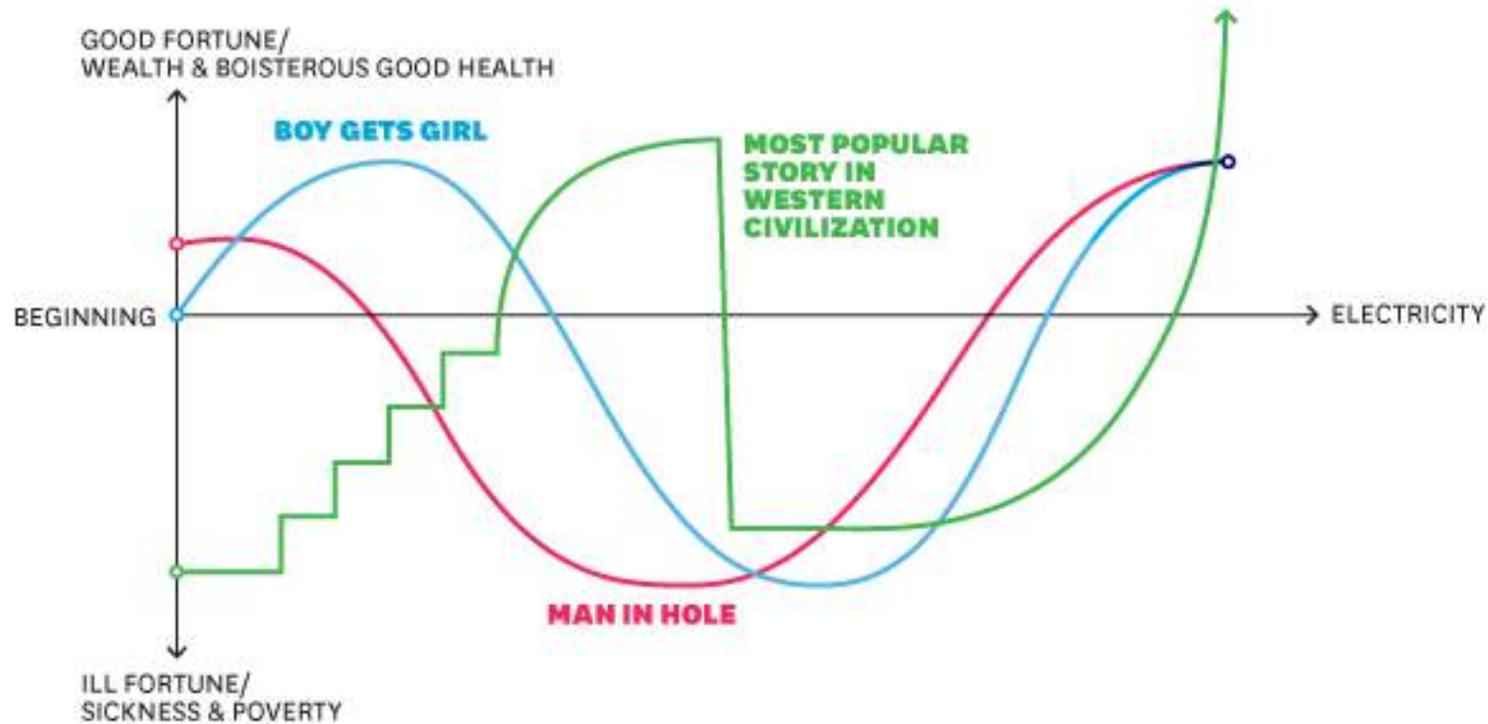- Ethical considerations in emotion recognition (ACL, CL Journal, 2022)
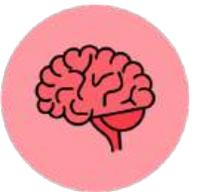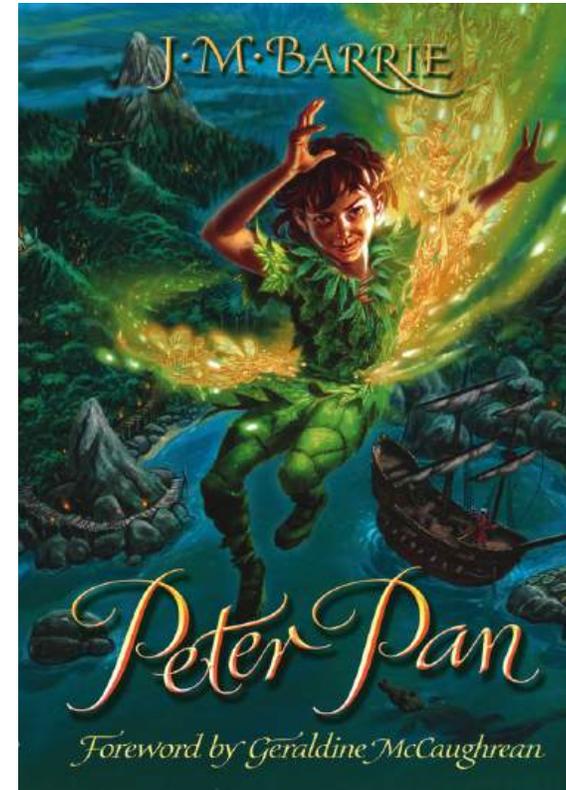
Emotions Arcs in Commerce, Psychology, and Stories

Tracking Emotions in Stories

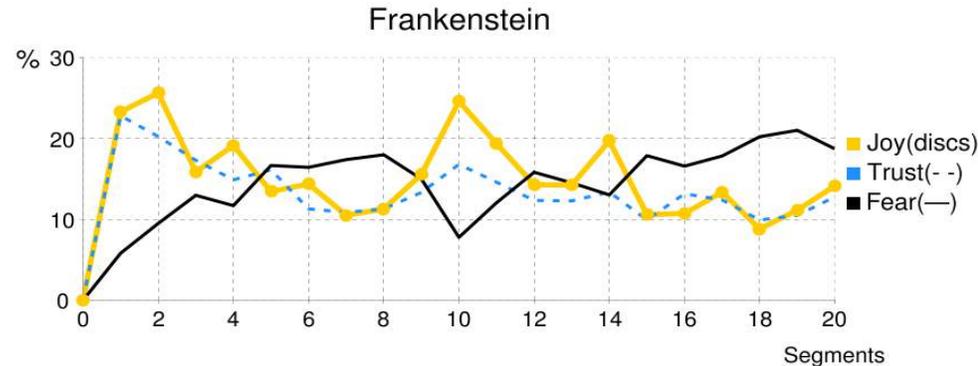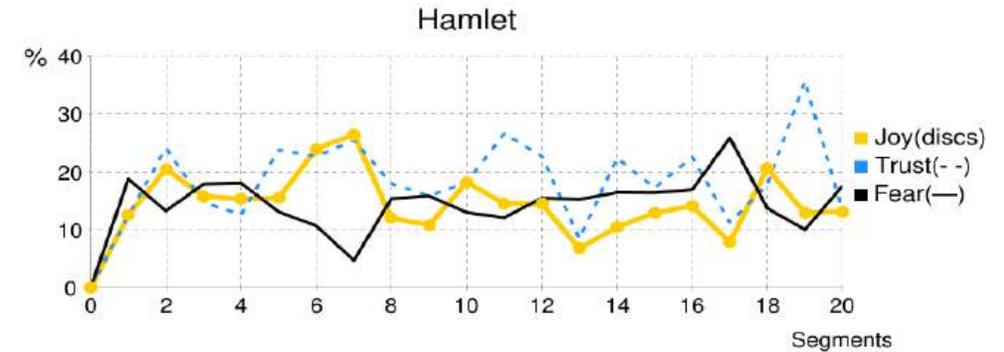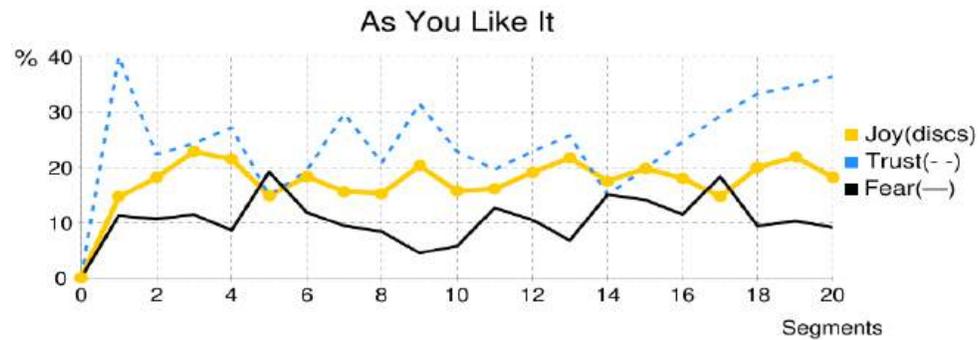SIMPLE SHAPES OF STORIES
As told by Kurt Vonnegut.

GOOD FORTUNE/
WEALTH & BOISTEROUS GOOD HEALTH

BOY GETS GIRL

MOST POPULAR STORY IN WESTERN CIVILIZATION

BEGINNING

ELECTRICITY

MAN IN HOLE

ILL FORTUNE/
SICKNESS & POVERTY

SOURCE DAVID YANG, VISUAL.LY

HBR.ORG

Tracking Emotions in Stories

Creating Emotion Arcs

- Lexicon-only approach
- ML approaches (sometimes making use of lexicons)

Lexicon-only approaches

- Pros
  - simple, accessible
  - interpretable
  - low-carbon
  - domain-free
- Cons
  - not highly accurate at instance level (context, long-distance dependencies)

Evaluating Emotion Arcs

Very little work!! No dataset of gold arcs.

Evaluating Emotion Arcs

Consider tracking anger in tweets associated with vaccines (week by week)

- Manually annotate 300,000 individual tweets from 2018 to 2024
- Take the percentage of tweets marked as joy in every week to create the emotion arc

Annotating data is a bottleneck

Daniela Teoderescu

2023 EMNLP: Evaluating Emotion Arcs Across Languages

- make use of existing emotion datasets (usually 2 to 5K instances)
- sample instances with replacement to generate random but non-trivial arcs
- create gold emotion arcs as usual
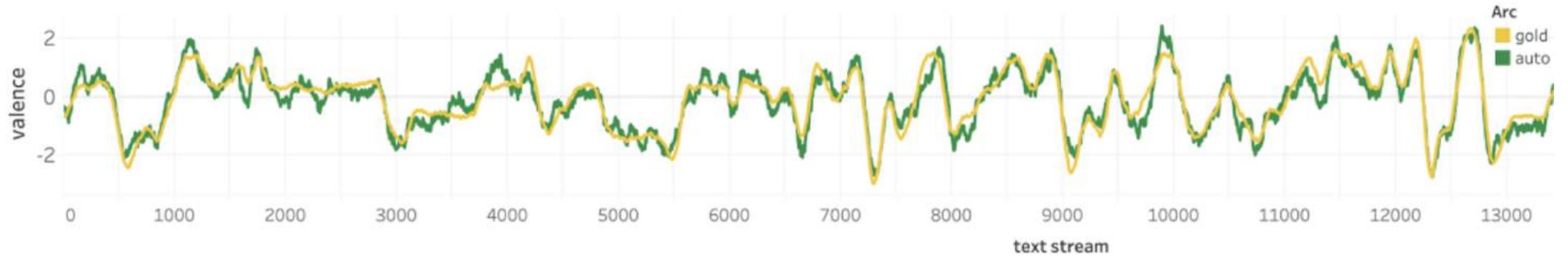
2023 EMNLP: Generating High-Quality Emotion Arcs Using Emotion Lexicons

- Used 36 datasets that had emotion-labeled sentences/tweets to create gold arcs
- For various affect categories, multiple languages, and other characteristics

Key Conclusions:

- lexicon-only based methods are extremely accurate

- aggregating information from hundreds of tweets/instances to create points of the emotion arcs very powerful

Emotion Dynamics (from Psychology)

Study of change in emotional state with time

- intensive longitudinal data (repeated self-reports of emotional state)
- quite difficult to obtain such data
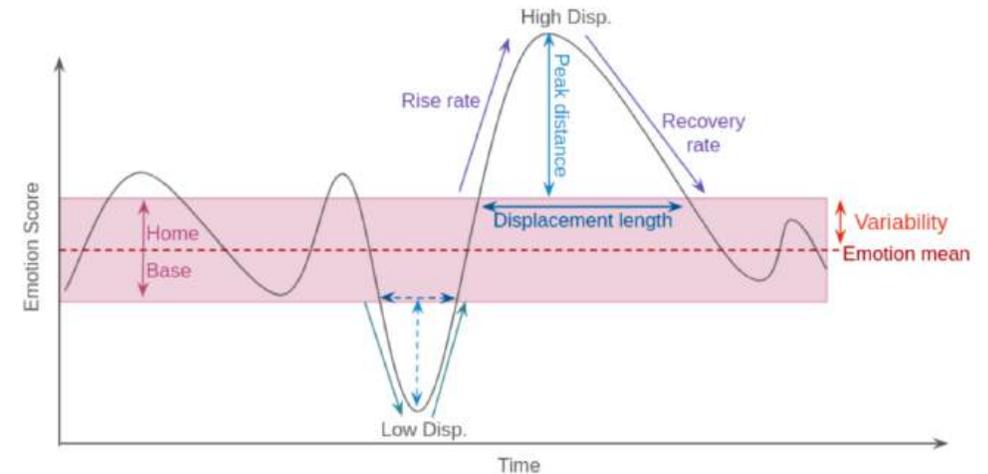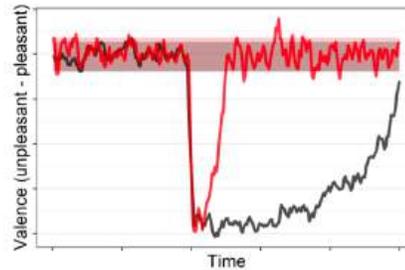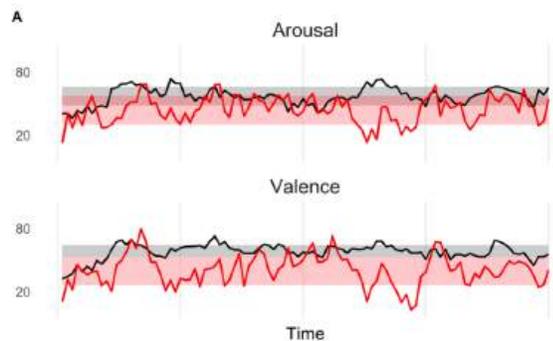
Another window into emotions is through our words:

- E.g., if happier, we are likely to utter more happiness-associated words

Utterance Emotion Dynamics: study of change in emotion words over time
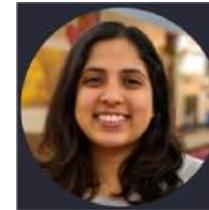(Hipson and Mohammad, 2021)

PLOS One

Will Hipson

2021: Emotion Dynamics of Fictional Characters

LREC

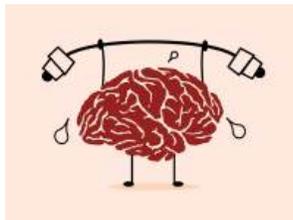Krishnapriya (KP) Vishnubhotla

2022: Tweet Emotion Dynamics
Emotion Word Usage in Tweets from US and Canada

EMNLP

Daniela Teodorescu   Tiffany Cheng   Alona Fyshe

2023: Language and Mental Health:
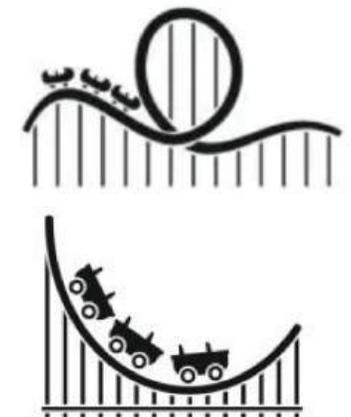Measures of Emotion Dynamics from Text as Linguistic Biosocial Markers.

We saw…
    Emotion Dynamics: Individual Emotion Arcs

next…
    Emotion Granularity: Pairs of Emotion Arcs

Emotion Granularity/Differentiation (from Psychology)

Some people:

- recognize, identify, describe their feelings using precise terms
  - like guilt, anger, frustration, or helplessness

- can reliably describe these concepts using language
  - distinguishing between angry and sad, elated and content, etc.

Others:

- tend to use more broad terms to convey emotions
  - a general sense of feeling bad or feeling low
- co-endorsing multiple emotions

Emotion granularity (Barrett et al., 2001)

- this ability to experience and categorize emotions in very specific terms
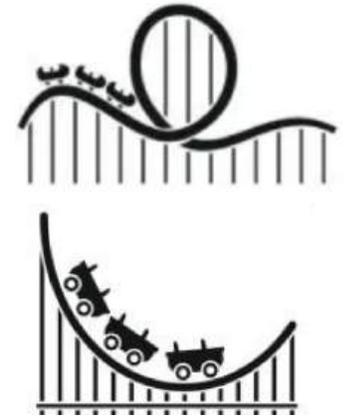- the degree of not co-endorsing multiple emotions

Lisa Barrett

Link between Emotion Granularity and Health

- Mental health (Erbas et al., 2014, 2018)
  - depression (Starr et al., 2017)
  - anxiety (Seah et al., 2020)
  - borderline personality disorder (Dixon-Gordon et al., 2014, Suvak et al., 2011)
  - show less neural reactivity to rejection (Kashdan et al., 2014)

- Physical health (Hoemann et al., 2021)
  - cardiovascular physiological activity and stress (Bonar et al., 2023)

- Behavior
  - maladaptive behaviours such as binge drinking, aggression, and self-injurious behavior (Dixon-Gordon et al., 2014, Kashdan et al., 2015)
  - school behaviour (Brackett, Rivers, Reyes, & Salovey, 2012)
  - eating disorders (Selby et al., 2013)
  - less likely to retaliate aggressively (i.e., verbally or physically assault) against someone who has hurt them (Pond et al., 2012)

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Emotion Granularity from Text (our work)

- To what extent are we co-endorsing multiple emotions **in text**?
  - through connotations and not necessarily denotations

- Compute emotion arcs for various emotions

- Compute emotion granularity (EG): correlation between pairs of emotion arcs

- Show that text by those who have self-disclosed to have certain mental health conditions (depression, PTSD, ADHD, etc.) have significantly lower EG than text by control group

EMNLP 2024:
Emotion Granularity from Text: An Aggregate-Level Indicator of Mental Health
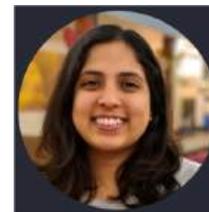
Krishnapriya (KP) Vishnubhotla   Daniela Teodorescu   Mallory Fedman   Kristen Lindquist

National Research Council Canada   Conseil national de recherches Canada

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Sophie Wu   Jan Philip Wahle

The Language of Interoception:

Examining Embodiment and Emotion Through a Corpus of Body Part Mentions

Impact of the body on our

- brain
- how we conceptualize and perceive things
- emotions

Work from

- Medicine
- Psychology
- Affective Science
- Cognitive Science
- Philosophy

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Key Theories

- Embodiment Theory
  - our physical body and its interactions with the world are fundamental to our cognitive processes, emotions, and experiences (not separate)

- The Theory of Conceptual Metaphor (Lakoff & Johnson, 1980)
  - abstract concepts (like time, emotion, power, and relationships) map to concrete source domains (like body, movement, or space)'
    e.g., *grasp* (a physical act) to mean *understand*
  - abstract domains are understood via source domains like the body, movement, or space.

Body Part Mentions (BPMs) offer a rich entry point into conceptual metaphor.
Studying them can help reveal how language encodes embodied thought.

Key Theories (continued)

- **Mindfulness Theory**
  - developing an awareness of the present-moment
    > positive outcomes (reduced stress, improved emotional regulation, well-being)

- **Theory of Constructed Emotion**
  - Emotions are actively constructed by the brain in each moment based on past experiences, context, and sensory information

- **Theories on Interoception**
  - Better interoception positively correlated with better physical and mental health
    - Emotional regulation (Zamariola et al., 2019)
    - Emotional decision-making (Dunn et al., 2010)
    - Emotional granularity (ability to distinguish emotions) (Zamariola et al., 2024)
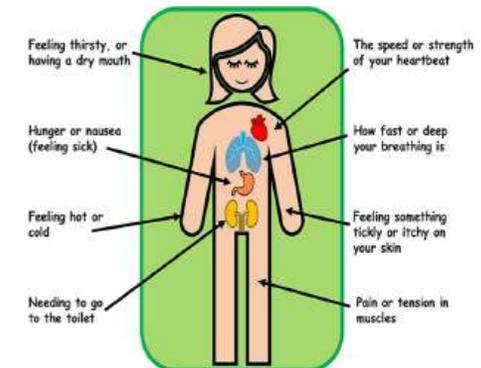
The Language of Interoception:

Examining Embodiment and Emotion Through a Corpus of Body Part Mentions

Can we use language to shed light on this connection of the body with the mind, emotions, health, and behavior?

Body Part Mentions

Instances of language where words referring to parts of the body are used.

Examples:

My <u>head</u> hurt after the smog from last week.

Her <u>chest</u> tightened after hearing the news.

His <u>back</u> ached after the long flight.

I could feel my <u>heart</u> racing.

She rolled her <u>eyes</u> at the comment.

The <u>hair</u> on my <u>arms</u> stood up.

Ambiguity with BPMs

BPMs that abstractly refer to a person's body.

```
Thank you for always being by my side.

That went over my head.
```

BPMs that use body parts as active metaphor, but do not refer to a person's body.

```
Hands down, the best film of the year.

The heart of the matter is (...)
```

BPMs with fossilized/weak metaphorical connections.

```
I will be right back.

Let's head out.
```

Everyday use of BPMs can tell us about:

- the relationship between the body and mind
- how natural language is connected to the physical world from which it originates

Body Research Questions

1. To what extent do we use body-related words?

2. To what extent do we talk about our own body parts versus others' body parts?

3. Which of our body parts do we refer to most often? Do we refer to our body differently in different online contexts?

4. Does the time of day/week/year impact whether we refer to our body?

5. Do individuals in different regions refer to their bodies at different frequencies?

B1 – To what extent do we use body-related words?

Corpus	S	T_{city}	T_{ctry}
Instances	(80,379)	(104,575,991)	(3,181,879)
<BPM> instances	10.4	6.4	7.3

Percentage of instances in each corpus with at least

one BPM. S = Spinn3r (blog posts). T = TUSC (X posts).

We use 295 body parts words taken from Collins dictionary and an educational website on human body vocabulary.

- Consistent presence across platforms suggests that references to the body are a routine part of online communication.
  - more common in personal narratives and long-form expression than tweets
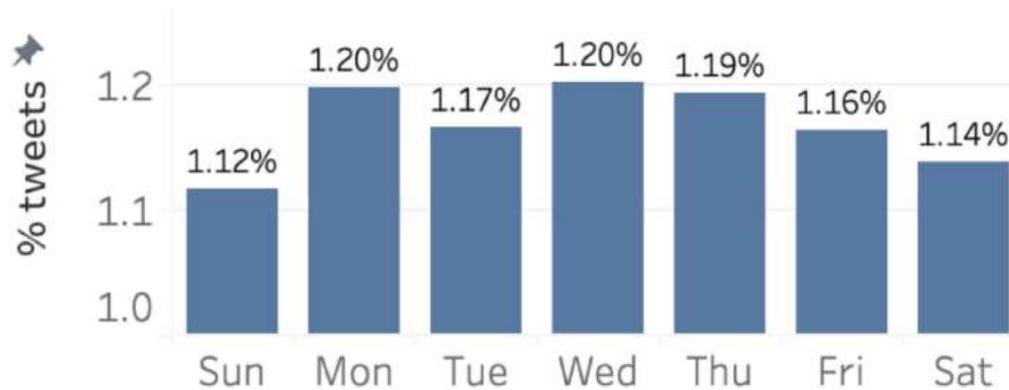
B4.a. Mentions of "my <BPM>" by Month
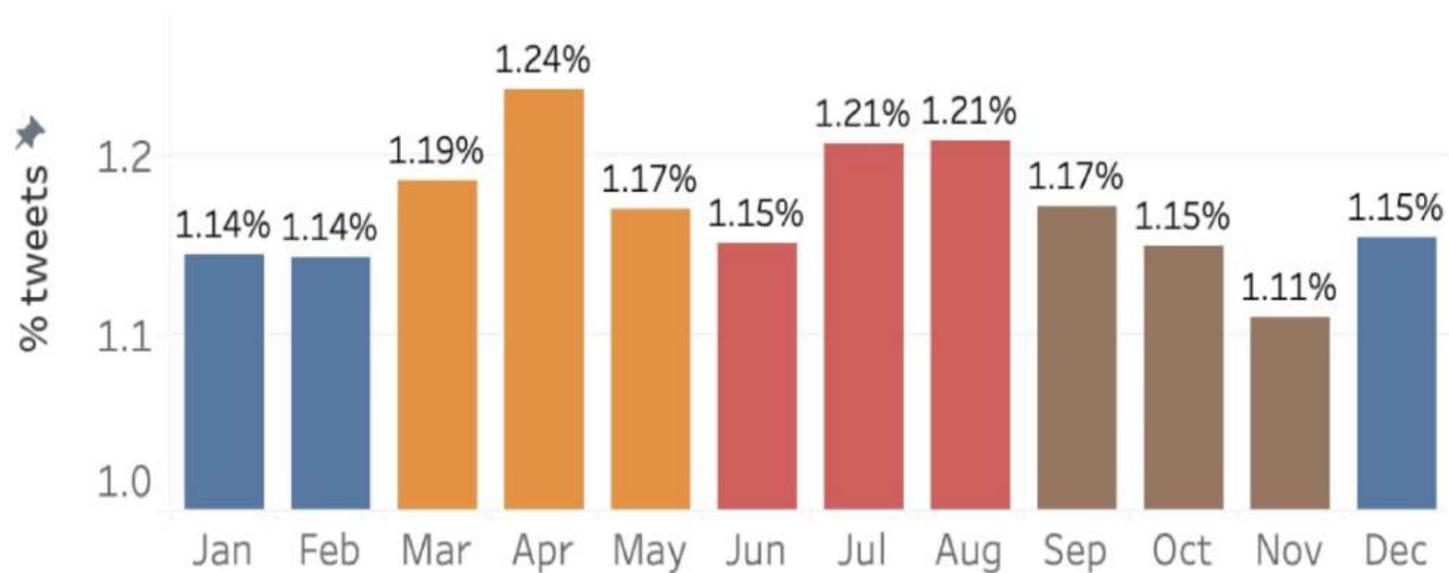
Mentions of "my <BPM>" peak in spring and summer, decline in fall, and stay lowest in winter.
- May reflect increased bodily awareness in warmer, more active months (sunlight, time outside).

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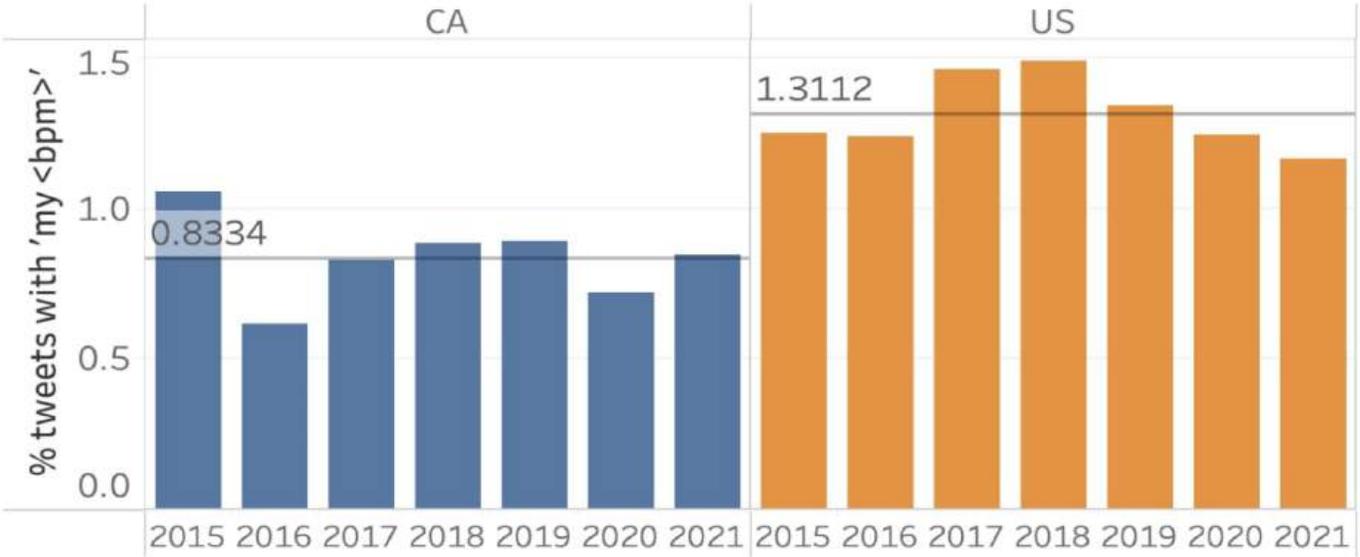
Canada

B4.b. Mentions of "my <BPM>" by Day of Week

- Usage rises from Weekends to mid-week, then declines
- Suggests a connection to the structure and fatigue of the work week

References to our bodies are not static—they reflect seasonal, environmental, and social rhythms in our lives.

B5.a. Do individuals in different regions refer to their bodies at different frequencies?
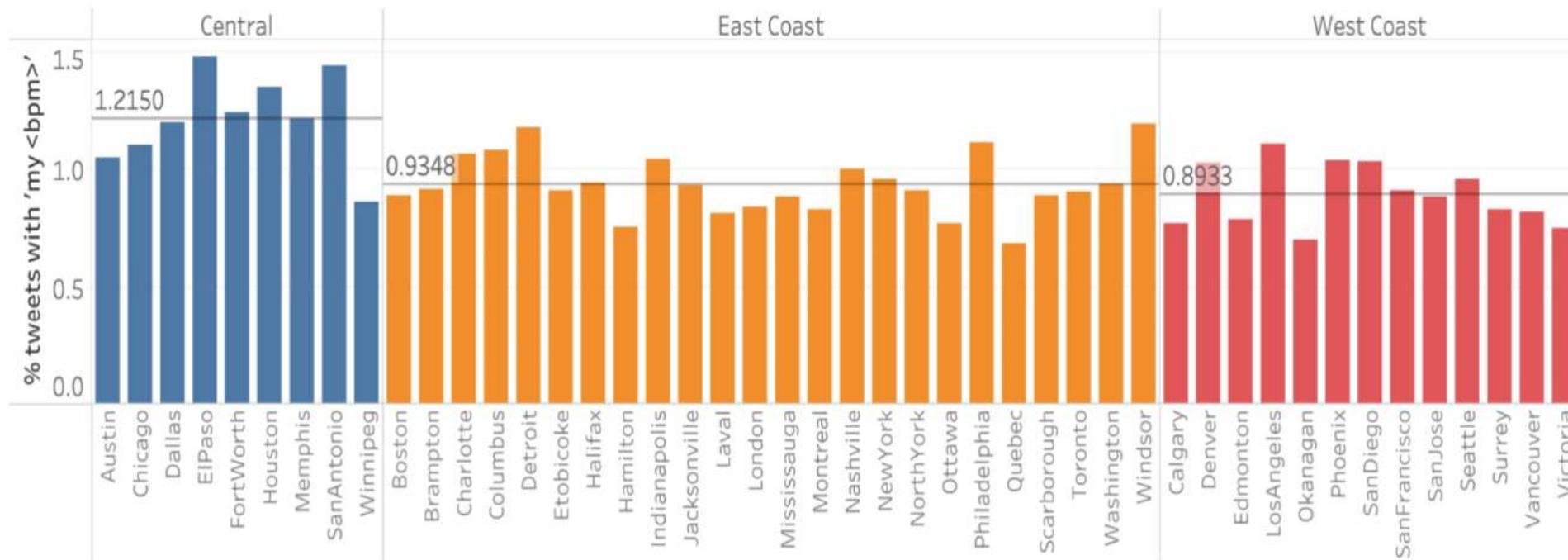
Canada vs. US across Years

Americans refer to their bodies more than Canadians in tweets.

B5.b. Do individuals in different regions refer to their bodies at different frequencies?

US cities: Central, East Coast, West Coast

Central cities show higher BPM usage than coastal cities.

Body and Affect Research Questions

1. Do posts with body part mentions have markedly different emotional associations?

2. What is the impact of explicitly embodied emotion on the emotions expressed through body part mentions?

3. Do individual body part mentions co-occur with markedly different emotion distributions?
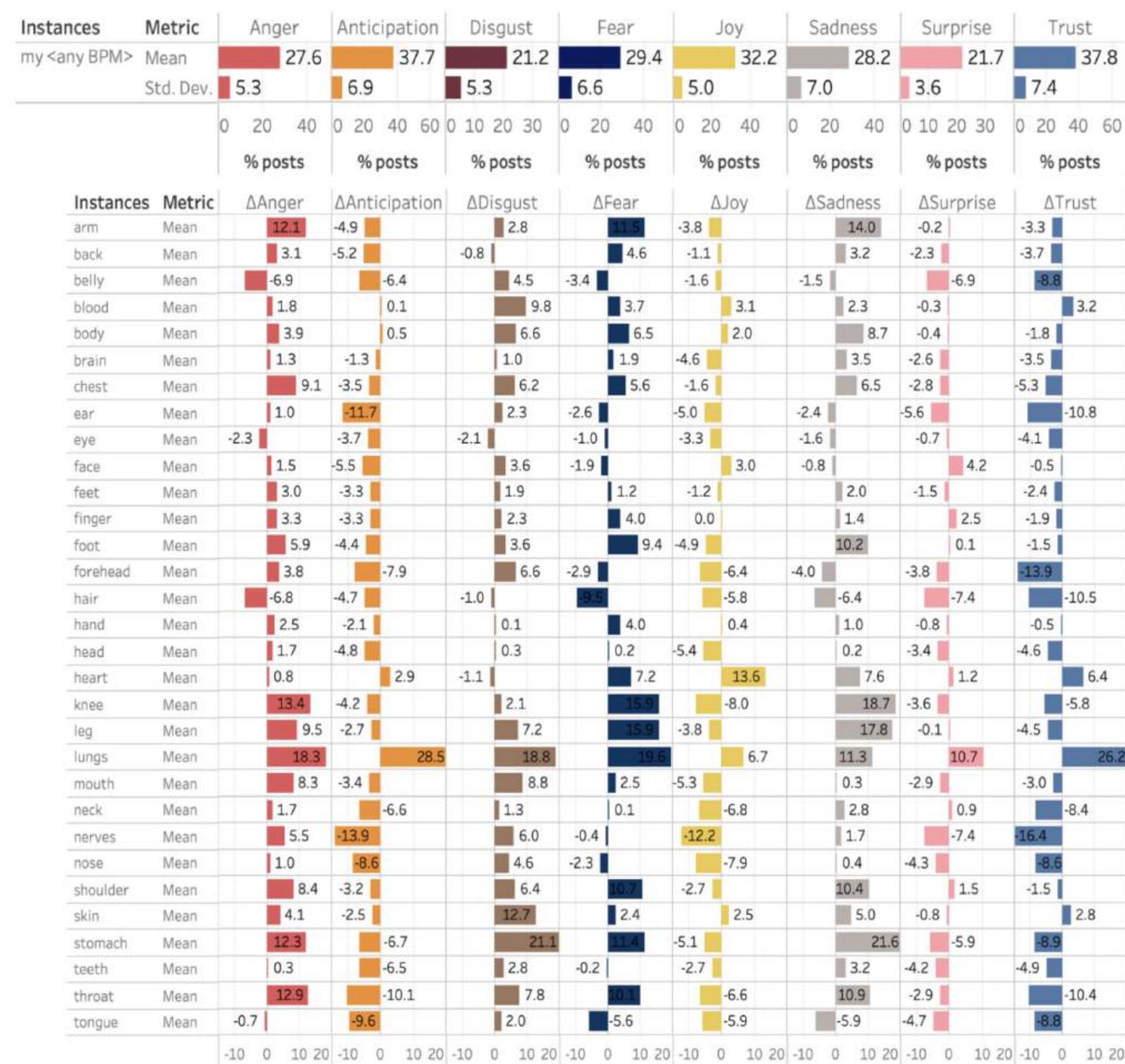
BPMs and Emotions

- Different body parts are associated different emotions

  my stomach → sadness

  my chest → anger

- Negative emotions (anger, fear, sadness) dominate many high-frequency BPMs.

Are BPMs correlated with health outcomes?

	Freq. Mental Distress		Freq. Phys. Distress		Life Expectancy		Physical Inactivity	
	Spearman's r	p-value	Spearman's r	p-value	Spearman's r	p-value	Spearman's r	p-value
a. Number of tweets	-0.170	0.418	-0.167	0.425	0.290	0.160	-0.243	0.242
b. Prop. of *<Fear word>* tweets	-0.230	0.231	-0.370	0.054	0.160	0.403	**-0.460**	**0.014**
c. Prop. of *"my <BPM>"* tweets	**0.497**	**0.012**	**0.721**	**0.000**	**-0.409**	**0.043**	**0.704**	**0.000**
d. Prop. of *"<BPM>"* tweets	**0.527**	**0.007**	**0.553**	**0.004**	**-0.613**	**0.001**	**0.539**	**0.006**

- Proportion of BPM tweets is a strong predictor of negative health outcomes
- Emotion word use weakly correlated (at best)

Summary of Body and Affect Research Questions

- 👋 Body part mentions (BPMs) are common, patterned, and meaningful
- 💬 BPMs are rich signals of affect
- 📉 BPMs correlate with regional health outcomes

- BPMs can be a novel linguistic marker of embodied experience in everyday language and public health.

- Future work could…

    Investigate causal links and finer-grained spatial data

    Explore BPMs across other languages and mediums for language

    Apply BPM insights in mental health monitoring, AI empathy models, and interoception research

This Talk

- Core Theories of Affect and Emotion
  - What is NLP for Affective Science?

- Word-Emotion Associations: basic units of emotion expression in language
  - Anxiety (EMNLP 2024)
  - Warmth and Competence (ACL 2025)

- Emotion Arcs: a window into Mind and Body
  - Tracking Emotion Arcs and Evaluation (EMNLP 2023)
  - Mind: Emotion Dynamics (multiple, 2021-24); Emotion Granularity (EMNLP, 2024)
  - Body Part Mentions (in submission)

- **Ethical considerations in emotion recognition (ACL, CL Journal, 2022)**
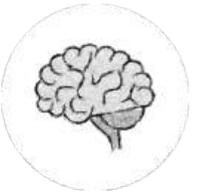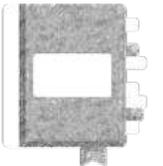
Emotion Recognition: Task

1. Inferring emotions felt by the speaker

Emotion Recognition: Task

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2. Inferring emotions of the speaker as perceived by the reader/listener
3. Inferring emotions that the speaker is attempting to convey
4. Inferring emotions evoked in the reader/listener
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6. Inferring whether what is described is good for pre-determined target of interest

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7. Inferring the intensity of the emotions discussed above
8. Inferring patterns of speaker's emotions over long periods of time, across many utterances; including the inference of moods, emotion dynamics, and emotional arcs
9. Inferring speaker's emotions/attitudes/sentiment towards a target product, movie, person, idea, policy, entity, etc.
10. Inferring emotionality of language used in text (regardless of whose emotions)
11. Inferring how language is used to convey emotions such as joy, sadness, loneliness, hate, etc.
12. …

Emotion Recognition: Task

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12. …

All of these come with…
Benefits, Potential Harms, Ethical Considerations

Theories of Emotion

Margaret Mead
Cultural anthropologist

Paul Ekman
Psychologist and discoverer
of micro expressions.

Lisa Barrett
University Distinguished
Professor of Psychology,
Northeastern University

Theory of Constructed Emotion (Barrett, 2017)

- the brain constructs emotions
- important tenets of BET discredited ("basic" emotions)
- stress on variability

Computational Analysis of Emotions and Automatic Emotion Recognition (AER)

A force that helps unlock:

- how emotions work
- how they relate to our health, language, behavior, social interactions,…
- numerous commercial applications that benefit society

A tool for substantial harm, e.g.:

- mass application on vulnerable populations
- unreliable approaches
- privacy concerns
- perpetuation of physiognomy

OpenGlobalRights

Strategies   Topics   Regions   Up Close   Tools   Multimedia

Partnerships

How emotion recognition software strengthens dictatorships and threatens democracies

Given that the idea of using emotion recognition technology as a tool of governance is an entirely flawed premise, a ban makes the most sense.

By: James Jennion   Español

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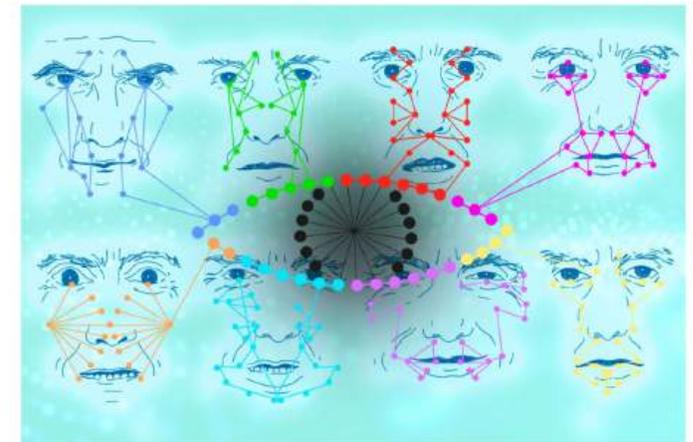
Ethics Sheet for
Automatic Emotion Recognition and Sentiment Analysis

Medium Blog Post in summer of 2021:
https://medium.com/@nlpscholar/ethics-sheet-aer-b8d671286682

CL Journal June 2022

Ethics Sheet for Automatic Emotion Recognition and Sentiment Analysis

Saif M. Mohammad*

*The importance and pervasiveness of emotions in our lives makes affective computing a tremendously important and vibrant line of work. Systems for automatic emotion recognition (AER) and sentiment analysis can be facilitators of enormous progress (e.g., in improving public health and commerce) but also enablers of great harm (e.g., for suppressing dissidents and manipulating voters). Thus, it is imperative that the affective computing community actively engage with the ethical ramifications of their creations. In this paper, I have synthesized and organized information from AI Ethics and Emotion Recognition literature to present fifty ethical considerations relevant to AER. Notably, the sheet fleshes out assumptions hidden in how AER is commonly framed, and in the choices often made regarding the data, method, and evaluation. Special attention is paid to the implications of AER on privacy and social groups. Along the way, key recommendations are made for responsible AER. The objective of the sheet is to facilitate and encourage more thoughtfulness on why to automate, how to automate, and how to judge success **well before** the building of AER systems. Additionally, the sheet acts as a useful introductory document on emotion recognition (complementing survey articles).*

Template

50 considerations grouped under:

- *Task Design*
- *Data*
- *Method*
- *Impact and Evaluation*
- *Implications for Privacy and Social Groups*
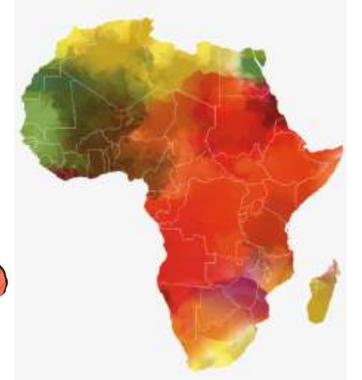
common phases in system development

First SemEval Shared Task on African Languages:

SemEval 2023: AfriSenti: Detecting Sentiment in African Languages

Labeled sentiment datasets for **14** languages from 3 language families
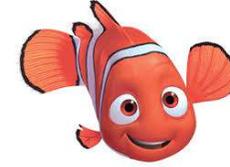
Led by African researchers

Shared Task on Emotions

SemEval-2025 Task 11: Bridging the Gap in Text-Based Emotion Detection

Labeled emotion datasets for **35** languages

-- most from Africa and Asia

Most popular task in CodaLab for the year 2024

NLP for Affective Science

A Window into emotions, mind, body, health, and behavior through language and computation

Slides, Papers, Datasets, Lexicons, Code
Available at: www.saifmohammad.com

✉ saif.mohammad@nrc-cnrc.gc.ca, uvgotsaif@gmail.com

🐦 @SaifMMohammad