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

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We introduce:
- TUSC: ~45 million geo-located Tweets from US, Canada
- Tweet Emotion Dynamics (TED): a set of metrics to quantify emotion word usage in tweets across time

Why Track Emotion Word Usage
- **Over Time**: How are we tweeting more positive words, negative words, high arousal words, etc. over time? How has the COVID-19 pandemic impacted tweets? When did we use the most number of words conveying a lack of control and uncertainty? How were individual cities impacted? etc.
- **Geographically**: How are Canada and US different in terms of emotion word usage?

The TUSC Dataset (after appropriate preprocessing of tweets)
- **TUSC-Country**: tweets from US and Canada (CA)
  - ~103K tweets per year, 2015–2018
  - ~380K tweets per year, 2019–2021
- **TUSC-City**: tweets from 46 US–CA cities, Apr 2020–Dec 2021
  - ~26M tweets per year

Fun fact: CA tweets, on average, use two more tokens per tweet than US tweets (less informal, slang, etc. (Snefjella et al. 2018))

**EXPERIMENTS**

1. **Average Emotion Scores of Words in Tweets** (How emotional are our tweets?)
   - **Year**: 2015–2021
   - **Value**: Valence (V), Arousal (A), Dominance (D)
   - **Country**: TUSC-Country, a set of metrics to quantify emotion word usage in temporal streams of words
   - **City**: TUSC-City, a set of metrics to quantify emotion word usage in temporal streams of words

2. **Proportion of Tweets with Emotional Terms** (How often are we tweeting emotional terms?)
   - **Year**: 2015–2021
   - **Value**: Low Valence, Low Arousal, Low Dom, High Valence, High Arousal, High Dom
   - **Country**: TUSC-Country, a set of metrics to quantify emotion word usage in temporal streams of words
   - **City**: TUSC-City, a set of metrics to quantify emotion word usage in temporal streams of words

**Ethical Considerations**
- Before you start:
  1. Ethics Sheet for Automatic Emotion Recognition (Mohammad, 2022)
  2. Practical and Ethical Considerations in the Use of Emotion Lexicons (Mohammad, 2022)

**Utterance (e.g., Tweet) Emotion Dynamics**
- **Emotion Dynamics**: A framework from Psychology for measuring changes in one’s emotions over time.
- **Utterance Emotion Dynamics (UED)** Hipson and Mohammad (2020): A computational framework that captures changes in emotions associated with "utterances" over time.
- **Tweet Emotion Dynamics (TED)**: Our use of UED on tweets.

**Set Up**
- Create temporally ordered stream of words by speaker
- Apply a rolling window averaging word-emotion association scores
- This sequence of window emotion scores is the emotion arc of their utterances

**Notable UED Metrics**
- **Home Base**: Range of emotion scores one standard deviation away from the mean on each side. Most probable emotion space occupied by speaker.
- **Variability**: Standard deviation of emotion means.
- **Rise Rate**: Rate at which speaker reaches peak emotional intensity (emotional reactivity).
- **Recovery Rate**: Rate at which speaker returns to home base (emotion regulation).

**EXPS 1, 2**: aggregate emotion word usage (city, country)

**CA (vs US)**: higher V, lower A, lower D
- **Yearly**:
  - V: Lowest in 2020 (June 2020)
  - A: US scores increased with time
  - D: Steady increase with time
- **Pandemic impact**: lower V, lower D

**TUSC-City**: Country: similar trends

**3. UED Metrics**
- **Exp 1.2**: aggregate emotion word usage (city, country)
- Here we benchmark individual tweeter behavior.

**NRC VAD Lexicon**
- Scores between 0 and 1 for the V, A, D
- Removed ‘neutralish’ words (0.33—0.66)
- Removed frequent ambiguous words (Trump, may, will)

**High-V (vs Low-V)**: ~100% more
- Low-A (vs High-A): ~40% more
- Low-D (vs High-D): ~33% more

**CA (vs US)**: more high-V, fewer low-V
- Trend is reversed for A

**City-level** (figure not shown here):
- **Highest V**: London, Ottawa, Halifax, Victoria (CA)
- **Lowest V**: Detroit, Houston, LA, Philadelphia (US)

**Overall**: Metrics show Gaussian distribution
- **Mean**: Similar VAD trends across CA–US as in 1, 2
- **Rise and Recovery Rates**: Larger third quartile for CA

**Applications in domains such as digital humanities, social sciences, psychology.**
- **Collaboration with UNC Carolina Affective Science Lab**
- Can TED inform us about the mental and physical health of populations?