Abstract:

Create a classification system that models the level of entropy (entropic disposition) in the brain. For simplicity, we will use the simple categories of low, medium and high entropy. We will utilize Robin Carhart-Harris' model of the entropic brain to find indicators of high and low entropy and attempt to find markers along this scale through both survey question data as well as social media / online markers. (the latter will dip into NLP and project 4).

The overarching idea of this project is essentially the antithesis of the Youtube algorithm. Youtube funnels the user down a path of more and more 'extreme' content based on your watch history. A user who watches a video that might have some right-wing tendency (or comments) for example might then be given a video with slightly more right-leaning views and so on. The end result is that the user is entrenched in content from a hyper specific viewpoint.

For this project, we would like to establish a baseline categorical classification for any given user and expose them to divergent patterns of thinking through a customized narrative delivery. Said another way, we'd like to open up the user to previously unexplored patterns of thinking, to broaden their viewpoint and ultimately help them to break out of established patterns of thought.

We will be populating the categories of low to high entropy with mental markers (depression to low entropy, AHDH to high entropy etc.) and utilizing existing datasets that test for these markers as the training data. There existings a number of studies that map psychological profile tests, social media data etc. to mental illness markers like those above and will be utilizing those tests as our training data.

While there exists many psychological and behavioral tests to determine things like depression, addiction or narcissism, we will be using machine learning in the form of online profile metadata to stand in for such tests. In other words, rather than give individuals a test that ranks them on the entropic scale, we'll be using machine learning to classify users based on their online metadata. (social media sites etc.)

(possibly out of scope for this project) In addition to classifying the users based on public profile information, we can classify novels, movie/play scripts (or characters within them in a similar way. We can capture the overarching classification in a protagonist or work (low to high entropic disposition) and use this as a baseline for our generative narrative framework in project 5. We would then map low entropy persons to low entropy characterizations and move the character in the narrative (and by extension the individual) from low to high throughout the experience.

Notes from Robin Carhart Paper:

- Entropy is applied here in the context of states of consciousness and their associated neurodynamics
- entry into primary states depends on a collapse of the normally highly organized activity within the default-mode network (DMN) and a decoupling between the DMN and the medial temporal lobes (which are normally significantly coupled).

Low entropy:

- DMN resting-state functional connectivity correlates positively with **ratings of internal awareness** (Vanhaudenhuyse et al., 2011), **depressive rumination** (Berman et al., 2011) and **trait neuroticism** (Adelstein et al., 2011). DMN connectivity increases during **mental time-travel** (Andrews-Hanna et al., 2010; Martin et al., 2011) and activity in the medial prefrontal node of the DMN is **reliably elevated in depression** (Farb et al., 2011; Lemogne et al., 2012). These findings strongly implicate the DMN in introspective thought and suggest that hyper activity and connectivity in the DMN is **related to a certain style of concerted introspection.**
- a reciprocal **decrease in flexible or divergent thinking (and positive mood).**
- The phenomenon of depression can help us here. Cognition during an episode of depression is characteristically inflexible; the **patient's focus is almost entirely inward and self-critical, and he/she is unable to remove him/herself from this state**
- **Unyielding pessimism**
- the patient **loses the ability to think and behave in a flexible manner.**
- In consideration of these things, **narrow-mindedness** is to pessimism what openness (MacLean et al., 2011) is to optimism and strategies that promote the latter may be effective treatments for depression (see MacLean et al., 2011).
- **depression, OCD or addiction/craving**
- **pays deference to reality** and **diligently seeks to represent the world as precisely as possible**

High entropy:

- **attention deficit/hyperactivity disorder (ADHD)**
- a **suspension of repression**, enabling cascade-like processes to propagate through the brain
- **Openness and flexibility**
- 1) **diminished spatial and temporal awareness**, 2) **diminished subjectivity** (equivalent to increased objectivity), 3) **feelings of profound joy and peace**, 4) a **sense of divinity**, 5) **paradoxicality (where two opposing things appear to be true)**, 6) **ineffability (the difficulty of expressing the experience in words)** and 7) **a sense of oneness with the world, otherwise known as "the unitive experience."**
- **experienced meditators**
- "my **imagination was extremely vivid**" or "the **experience had a dreamlike quality**"

- dreaming, onset-phase psychosis, the **near death experience**, the sensory-deprived state and the psychedelic drug state)
- **less firmly anchored to reality and is easily misled by simple explanations motivated by wishes and fears**

Social Media (Depression) -

social media contains useful signals for characterizing the onset of depression in individuals, as measured through decrease in social activity, raised negative affect, highly clustered egonetworks, heightened relational and medicinal concerns, and greater expression of religious involvement.

Traits:

- Major Depressive Disorder or MDD1 . MDD is characterized by episodes of **all-encompassing low mood accompanied by low self-esteem, and loss of interest or pleasure in normally enjoyable activities**. It is also well-established that people suffering from MDD tend to **focus their attention on unhappy and unflattering information, to interpret ambiguous information negatively, and to harbor pervasively pessimistic beliefs**
- individuals with depression show **lowered social activity, greater negative emotion, high self-attentional focus, increased relational and medicinal concerns, and heightened expression of religious thoughts.** Further, despite having **smaller egonetworks**, people in the **depressed class appear to belong to tightly clustered close-knit networks, and are typically highly embedded with the contacts in their egonetwork.**
- **negative processing biases**, particularly (cognitive) biases in resolving ambiguous verbal information can predict subsequent depression.
- **negative cognitive styles and stress-reactive rumination** were predictive of the onset, number and duration of depressive episodes.
- **lack of social support and lowered self-esteem** are important factors linked to higher incidences of depression. Among a variety of somatic factors, **reduced energy, disturbed sleep, eating disorders, and stress and tension have also been found to be correlates of depressive disorders**

Social Media and Depression

- 243 males and 233 females, with a **median age of 25**, with the two most frequent education levels being “**Some college, no degree**” and “Bachelor’s degree,” and the most reported income range of “**$25,000-$50,000”.**
- Literature on depression indicates that users showing depression signs **tend to be active during the evening and night.**

- class trend shows **peaks late in the night (post 8pm), with lower activity through the day (between 9am and 5pm)**. It is known from literature that for 8 out of 10 people suffering from depression, symptoms tend to worsen during the night (Lustberg & Reynolds, 2000). In fact, night time online activity is a known characteristic of these individuals, which may explain the increased levels of nighttime posting on Twitter.
- considerable decrease in user engagement measures, such as volume (38% lower; $p<.001$ based on a t-test) and replies (32% lower; $p<.001$). This indicates that these users are **posting less, suggesting a possible loss of social connectedness.**
- **lower activation relative to the nondepression class (11% lower; $p<.01$) may indicate loneliness, restlessness, exhaustion, lack of energy, and sleep deprivation,** all of which are known to be consistent depression symptoms
- Finally, we find that the **presence of the first-person pronoun is considerably high** (68% higher; $p<.0001$), while that of 3rd person pronouns is low in posts of the users in this class (71% lower; $p<.0001$), reflecting their **high attention to self and psychological distancing from others** (Rude et al., 2004).
- **Symptoms dominate, indicating details about sleep, eating habits, and other forms of physical ailment**—all of which are known to be associated with occurrence of a depressive episode
- It appears that sufferers may **turn to social media platforms in order to share feelings with others, receive social support, or to express their emotional state—especially feelings of helplessness and insecurity**
- noticeable **volume of unigrams relating to religion or religious thoughts** (jesus, bible, church, lord).
- **lower numbers of followers and followees for the depression class**—possibly showing that these users exhibit reduced desire to socialize or tendency to consume external information and remain connected with others.
- **reduced reciprocity to others' communications, indicating decreased desire for social interaction.**

Conclusion:

- **we notice a general decrease over time in some measures, e.g., volume, replies, activation, 3rd person pronoun (note the negative slope in the trend lines), while a general increase over time for others like NA, 1st person pronoun usage, swear word use, and frequency of depression terms (positive slope in trend lines).**

Social Media and Drug/Alcohol Abuse

- young adult participants had pictures or messages referencing alcohol, tobacco, or other drug use in their publicly accessible social media profiles.

Social Media and Narcissism

- (a) time spent on social media, (b) frequency of status updates/tweets on social media, (c) number of friends/followers on social media, and (d) frequency of posting pictures of

self or selfies on social media. Findings suggest that grandiose narcissism is positively related to all four indices
- must engage in interpersonal strategies to obtain self-affirming feedback from their environment
- Individuals high in grandiose narcissism are known to prefer emotionally shallow social relationships and like to publicly associate themselves with high status others
- high extraversion and openness and low agreeableness
- more friends and generate more content on social media may, in part, be linked their extraversion
- low agreeableness and neuroticism, which suggests more anxiety or discomfort associated with social media use.
- Self-promoting content with little regard to privacy

Personality Assessments/Questions

Further study: - meditation
(Farb et al., 2007; Brewer et al., 2011; Hasenkamp et al., 2012) as well as decreased DMN-TPN inverse coupling in meditation (Brewer et al., 2011; Josipovic et al., 2011; Froeliger et al., 2012).

KEY RESEARCH:

Social media and depression -
https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/icwsm_13.pdf

Entropy and consciousness -
https://www.frontiersin.org/articles/10.3389/fnhum.2014.00020/full#h6

Online personality datasets -
https://openpsychometrics.org/_rawdata/

Classifications and Proxies -

LOW ENTROPY:

- Depression
    - Personality type D
        - Negative Affectivity
        - Social inhibition

- OCD
- Anxiety
    - Feeling/Thinking Type (Myers Briggs)
- PTSD
- Addiction
- Narrow-mindedness
- Self-Criticality
- Trait Neuroticism
- Seeks order through material reality

HIGH ENTROPY

- ADHD
- Openness / Flexibility
    - Sensing/Intuition Type (myers briggs)
- Experienced Meditators
- Diminished Subjectivity / Increased Objectivity
- Vivid Imaginations
- Less anchored to reality
- Motivated by wishes and fears