Sentiment & Structure in a Mental Health Subreddit

As the world becomes increasingly digital, more individuals are seeking social support through online platforms. Reddit, an anonymous forum, provides a unique environment where users can disclose personal experiences and seek emotional support (De Choudhury & De, 2014). The platform's anonymity encourages greater self-expression, and prior research has shown that posts involving personal disclosure and vulnerability tend to attract more supportive responses. Unlike platforms such as Twitter and Facebook, Reddit interactions are characterized by more supportive and informative comments.

Conversations of different types often form distinct network structures. Himelboim et al. (2017) identified six types of network structures for Twitter discussions. For instance, political debates often form divided networks, while help-seeking threads tend to resemble a hub-and-spoke pattern, with a central post and numerous responses. Understanding these dynamics in supportive online communities is crucial for promoting safer and more emotionally beneficial digital environments.

Sentiment analysis, the process of detecting and categorizing emotional tone in text as positive, negative, or neutral, can offer insights into users' emotional states following online interactions (Silveira et al., 2021). Studies have observed that individuals who initially compose negative posts may express more positive sentiments after participating in online discussions, suggesting that social interaction can contribute to emotional improvement. Thus, this study aimed to investigate how sentiment influences and structures the network within a mental health subreddit and whether online interactions are associated with improvements in emotional tone.

Four primary analyses were conducted to explore the dynamics of sentiment and interaction: (1) Positive vs. Negative Clusters—examining the structure of interactions based on emotional tone; (2) Engagement vs. Positivity—assessing the relationship between user activity and sentiment; (3) Sentiment Changes in Triads—analyzing how sentiment evolves across interactions; and (4) Balance Theory and Structural Tension—exploring the association between triadic balance and sentiment shifts.

Method

The data was collected using Communalytic, a web-based tool designed for ethical social media data collection. The dataset includes 757 entries, comprising 200 submissions and 557 comments or replies. The resulting network is directed and unweighted, consisting of 676 nodes and 557 edges. Nodes represent submissions or comments, and edges denote reply relationships. Throughout the analyses, "submission" and "post" are used interchangeably.

Sentiment scores were calculated using the sentimentr package in R. Sentiment values were translated into categorical signs: -1 for negative, 0 for neutral, and 1 for positive sentiment. A threshold of 0 was chosen for neutrality to better capture subtle emotional nuances. Sentiment score and sign were incorporated as node attributes within the network graph.

Preliminary Analysis

The overall network exhibits a sparse structure, with a density of 0.001, indicating very few connections overall. The mean degree is 1.65, suggesting that posts receive relatively few replies on average. The mean geodesic distance is 1.68, meaning that any two nodes are, on average, approximately two steps apart. As shown in Figure 1, the network is composed of multiple small star-like subgraphs. Most users tend to comment directly on the original

submission rather than reply to other comments. Node size is scaled by in-degree centrality, and larger nodes—those with higher in-degree—are generally associated with more positive sentiment. Figure 2 further supports the observation that the network exhibits a hub-and-spoke structure with minimal back-and-forth interaction among commenters.

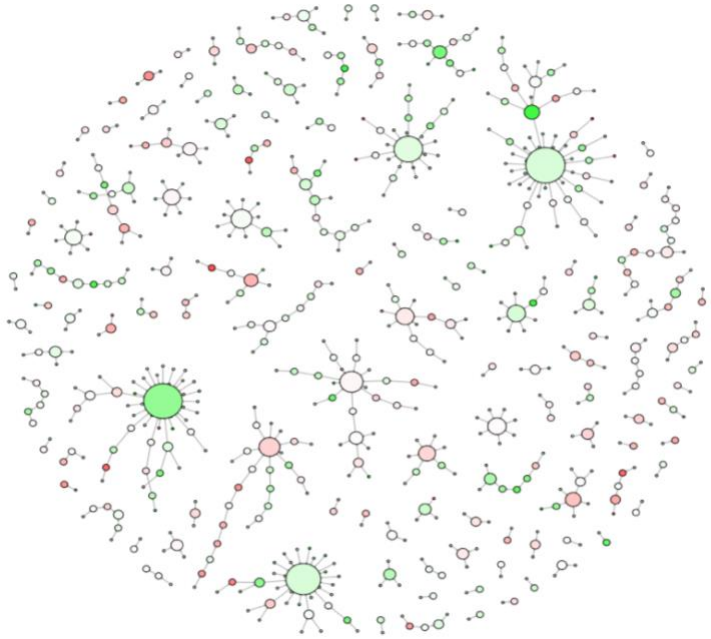

Figure 1. The overall network colored by sentiment and sized by in-degree centrality.

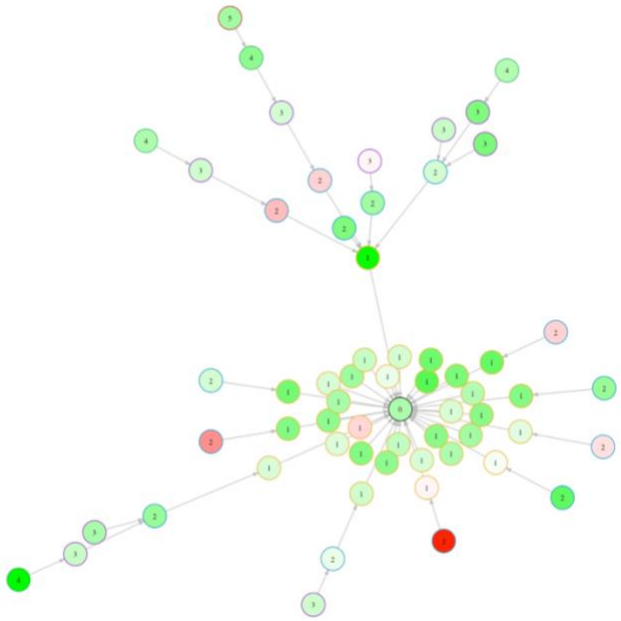

Figure 2. Geodesic distances from the node with the highest in-degree, colored by sentiment.

Results

(1) Positive vs. Negative Clusters

The sentiment-based subnetworks (see Figures 3 and 4) reveal that positive sentiment clusters form centralized, star-like structures centered around the original post. In contrast, negative sentiment clusters display decentralized, chain-like formations where users respond to comments rather than directly to the post.

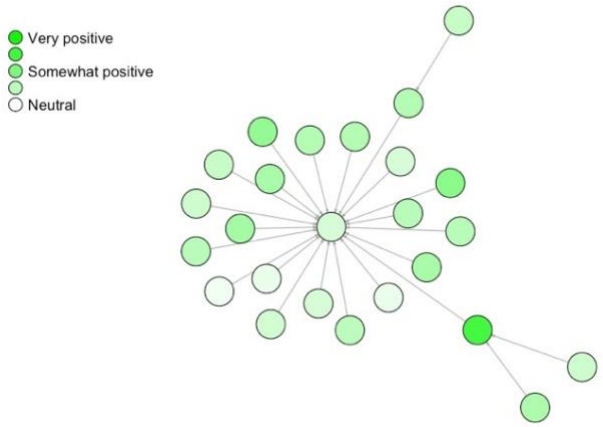

Figure 3. Largest positive sentiment subnetwork.

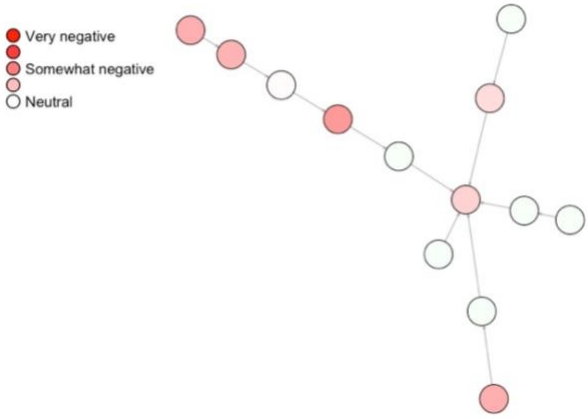

Figure 4. Largest negative sentiment subnetwork.

(2) Engagement vs. Positivity

To assess the relationship between user activity and emotional tone, user engagement was measured by the number of submissions, comments, and replies written. The correlation analysis revealed no significant relationship between user engagement and positivity ($r = 0.01$, $p = 0.84$), indicating that more active users do not necessarily produce more positive content. Figure 5 supports this finding, as the scatterplot displays a funnel pattern with a large variation in sentiment across user engagement, suggesting no linear relationship between the two variables.

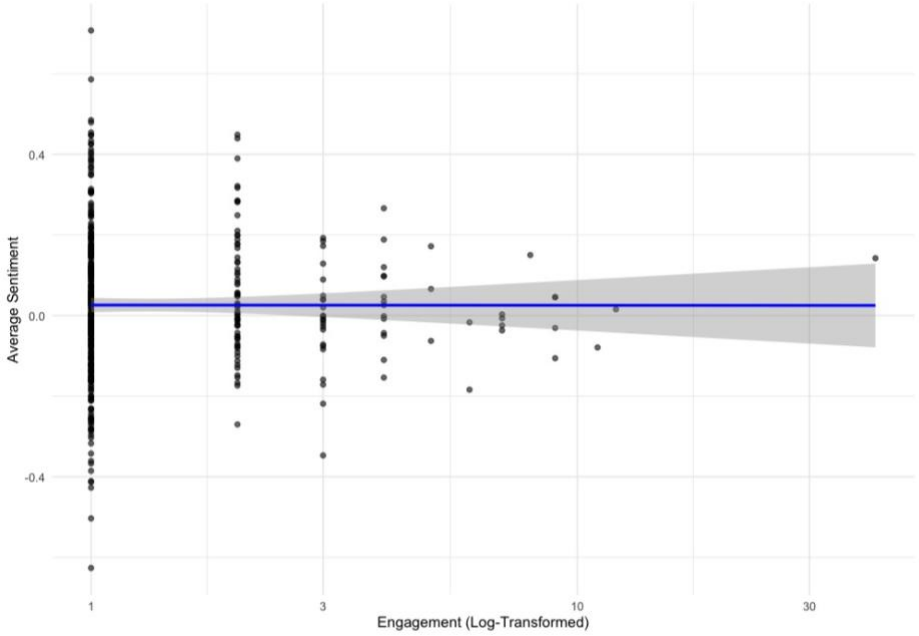

Figure 5. Relationship between user engagement and sentiment scores (log-scaled).

To further investigate whether receiving more replies was associated with positivity, the relationship between in-degree centrality and sentiment was also examined. In-degree centrality showed no significant correlation with positive sentiment ($r = -0.03$, $p = 0.50$). Thus, posts or comments that received more responses were not necessarily more positive in tone. The corresponding scatterplot similarly exhibits a funnel pattern, consistent with the absence of a linear relationship (see Figure 6).

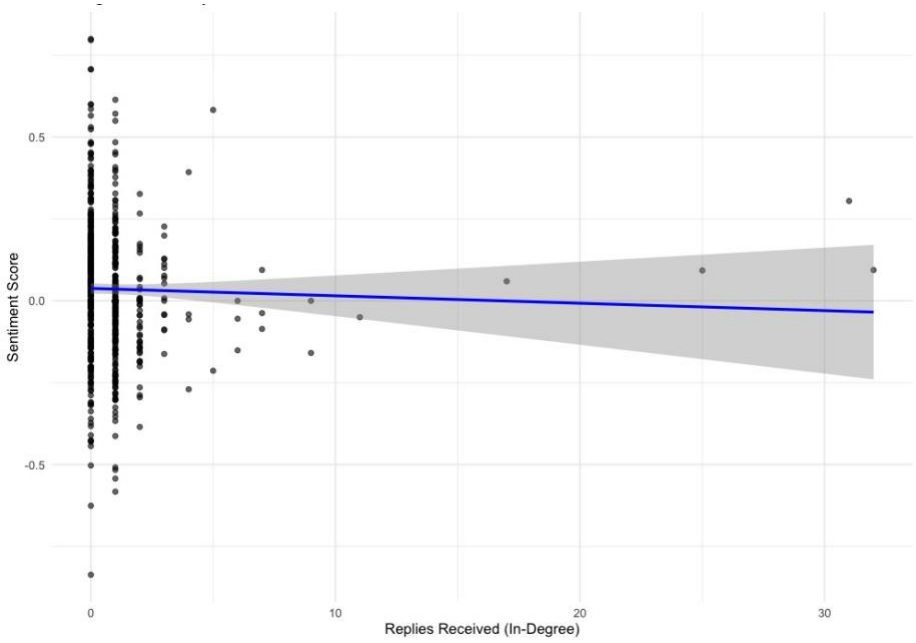

Figure 6. Relationship between in-degree centrality and sentiment scores.

(3) Sentiment Changes in Triads

Triads—three-node structures connected by at least two edges—were analyzed for sentiment progression. Sentiment change within triads was evaluated by analyzing how emotional tone evolved over time across the three interactions. To explain the evaluation method, consider Users A, B, and C as an example. Sentiment flow was assessed by calculating the difference between A and B's sentiment scores and between B and C's scores. If both differences were positive—indicating that User B had a higher (more positive) sentiment score than User A, and User C had a higher score than User B—the triad was categorized as exhibiting increasing sentiment. Conversely, if both differences were negative, suggesting a progressive decrease in emotional tone, the triad was classified as exhibiting decreasing sentiment. In all other cases, where one difference was positive and the other negative, the triad was classified as exhibiting mixed sentiment. No triads displayed completely constant sentiment across all three interactions.

As shown in Table 1, more than half of these triads demonstrated an increase in sentiment, suggesting that emotional tone tends to improve over the course of interactions within this subreddit.

Table 1. Distribution of sentiment flow in triads.

Increasing Sentiment	Decreasing Sentiment	Mixed Sentiment	Total Triads
13	2	9	24

In Figures 5-7, nodes were ordered chronologically from left to right: the submission appears first, followed by two subsequent comments or replies. In triads characterized by increasing sentiment, nodes shifted progressively toward greener hues, indicating a more positive emotional tone over time (see Figure 7). Typically, these interactions began with a negative or neutral post, followed by increasingly positive responses, suggesting that responders sought to uplift the original poster's emotional state.

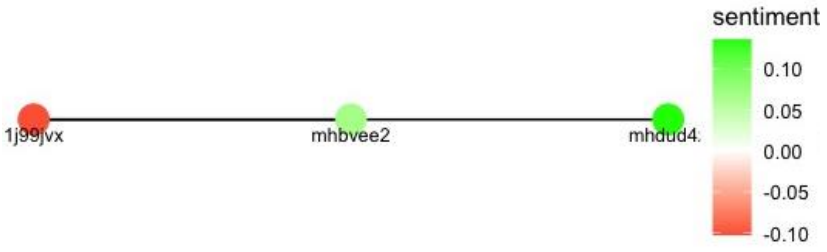

Figure 7. Example triad displaying increasing sentiment across interactions.

Only two triads exhibited a decrease in sentiment. In these cases, node colors shifted toward red, indicating that interactions became more negative over time (see Figure 8). However, the small number of decreasing triads reinforces the observation that the subreddit environment is predominantly positive and supportive.

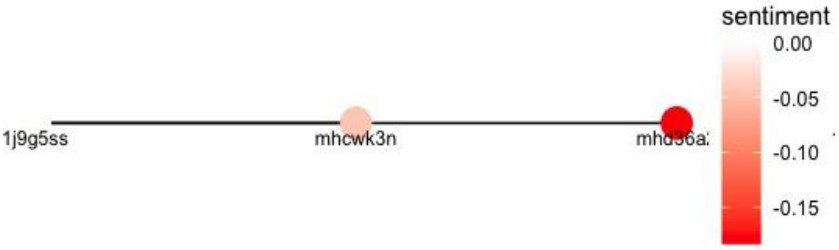

Figure 8. Example triad displaying decreasing sentiment across interactions.

Triads categorized as displaying mixed sentiment showed fluctuating emotional tones without a clear trajectory. In Figure 9, a negative post was followed by a somewhat positive comment, which was then followed by another negative comment—suggesting that initial supportive efforts may have been interrupted or challenged by subsequent interactions.

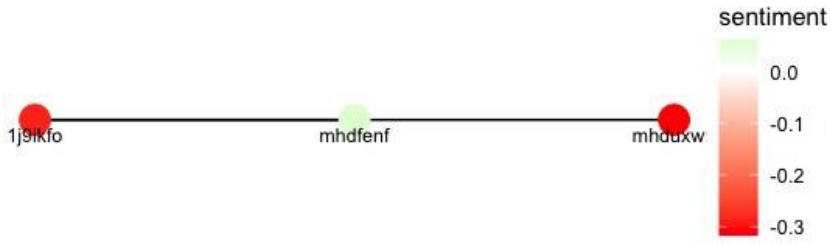

Figure 9. Example triad displaying mixed sentiment across interactions.

(4) Balance Theory and Structural Tension

To examine the relationship between structural balance and sentiment changes in triads, Fisher's Exact Test was conducted due to the small sample size. The test yielded a statistically significant result ($p = 0.038$), suggesting that triad balance type is associated with patterns of sentiment change. As shown in Table 2, all triads exhibiting an increase in sentiment—meaning the overall tone of interactions became more positive over time—were structurally unbalanced. In the context of this study, an unbalanced triad refers to a configuration containing two positive

sentiment nodes and one negative sentiment node, specifically following a negative–positive–positive pattern (see Figure 7). In contrast, no consistent structural pattern was observed among the two triads that exhibited decreasing sentiment as one fell within a balanced structure, while the other was unbalanced. Triads with mixed sentiment changes were distributed across all structure types but were predominantly unbalanced.

Table 2. Distribution of sentiment change by triad balance type.

Structure Type	Increasing	Decreasing	Mixed
Balanced	0	1	1
Unbalanced	13	1	6
Neutral/Incomplete	0	0	2

Discussion

The exploratory analysis conducted in this study highlights the generally supportive nature of the mental health subreddit examined. The network as a whole demonstrated a tendency toward positive sentiment, with the subnetworks displaying mostly star-like and hub-and-spoke patterns. These patterns align with the findings of Himelboim et al. (2017), where supportive conversations tend to form hub-and-spoke structures, centered on the original post. The results suggest that different sentiments display different network structures. Positive sentiment clusters displayed centralized structures, suggesting that users often respond directly to the original poster in an effort to offer support. In contrast, negative sentiment clusters formed more decentralized, chain-like patterns, which may reflect more fragmented or tense interactions among commenters. This distinction in structural form based on sentiment implies that emotional tone may influence how users choose to engage with one another.

In addition to network structure, the analysis of user engagement revealed that the emotional tone of a user's contributions was not significantly associated with either their activity

level or the popularity of their posts or comments. The lack of correlation between user engagement and positivity, and between in-degree centrality and sentiment score suggests that positivity within the network is not driven by how often users participate or how widely their posts are engaged with, but may instead depend on the context, content, or intent of their individual contributions.

The triad analysis further highlighted the underlying support dynamics within the community. Over half of the identified triads exhibited increasing sentiment over time, meaning the emotional tone became more positive as interactions unfolded. This aligns with prior findings by Silveira et al. (2021), which suggest that emotional tone can improve through online engagement. Furthermore, all triads that showed increasing sentiment were structurally unbalanced. Unbalanced triads are thought to reflect emotional or structural tension. The consistent association between unbalanced triads and increasing sentiment indicates that users may be motivated to restore emotional balance by responding positively in emotionally tense situations. This result is consistent with the findings of De Choudhury and De (2014), who observed that users on Reddit tend to be more supportive. Mixed sentiment triads were also frequently unbalanced, indicating that such structures may contribute to emotional variability. This reinforces the idea that real-world conversations often involve emotional complexity and nonlinearity, with supportive efforts sometimes interrupted or countered by less constructive responses.

While these findings contribute to an understanding of online emotional support dynamics, several limitations should be acknowledged. First, sentiment analysis tools may fail to capture the full nuance of emotional expression, particularly in the presence of sarcasm, ambiguous phrasing, or short responses. Second, the dataset was limited to a single day and a

single subreddit, with only 200 submissions and their associated comments analyzed. As such, the results may not generalize across time or to other online communities.

Future research would benefit from expanding the scope of analysis to include multiple subreddits and longer timeframes. Comparing sentiment and interaction patterns across subreddits focused on specific mental health concerns (e.g., depression vs. anxiety) may reveal further insight into how support manifests differently across communities. Additionally, temporal analyses could track emotional tone over extended conversations or over days and weeks, allowing for a richer understanding of emotional trajectories and the sustainability of support.

References

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