Social Network Analysis Report

Comparing a 5G Conspiracy Graph vs. a Non-Conspiracy Graph (WICO Dataset)

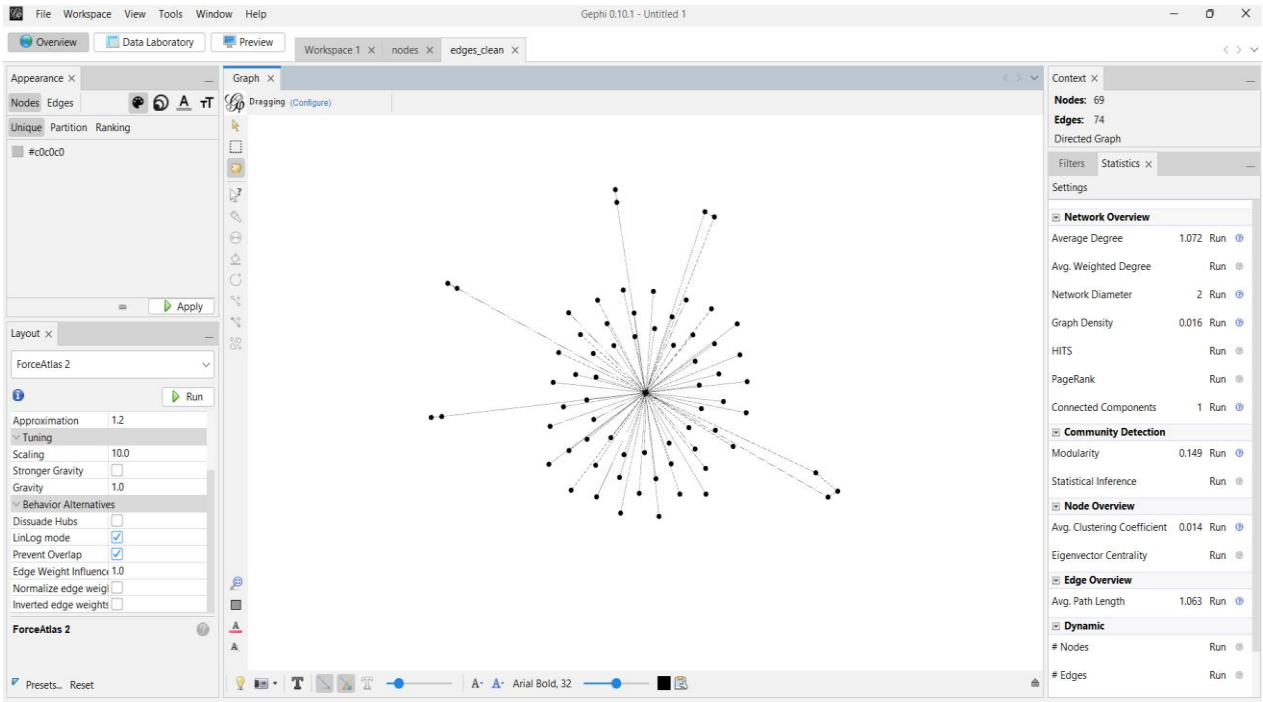
1. Dataset & Method

We used two Twitter subgraphs from the **WICO Graph Dataset**:

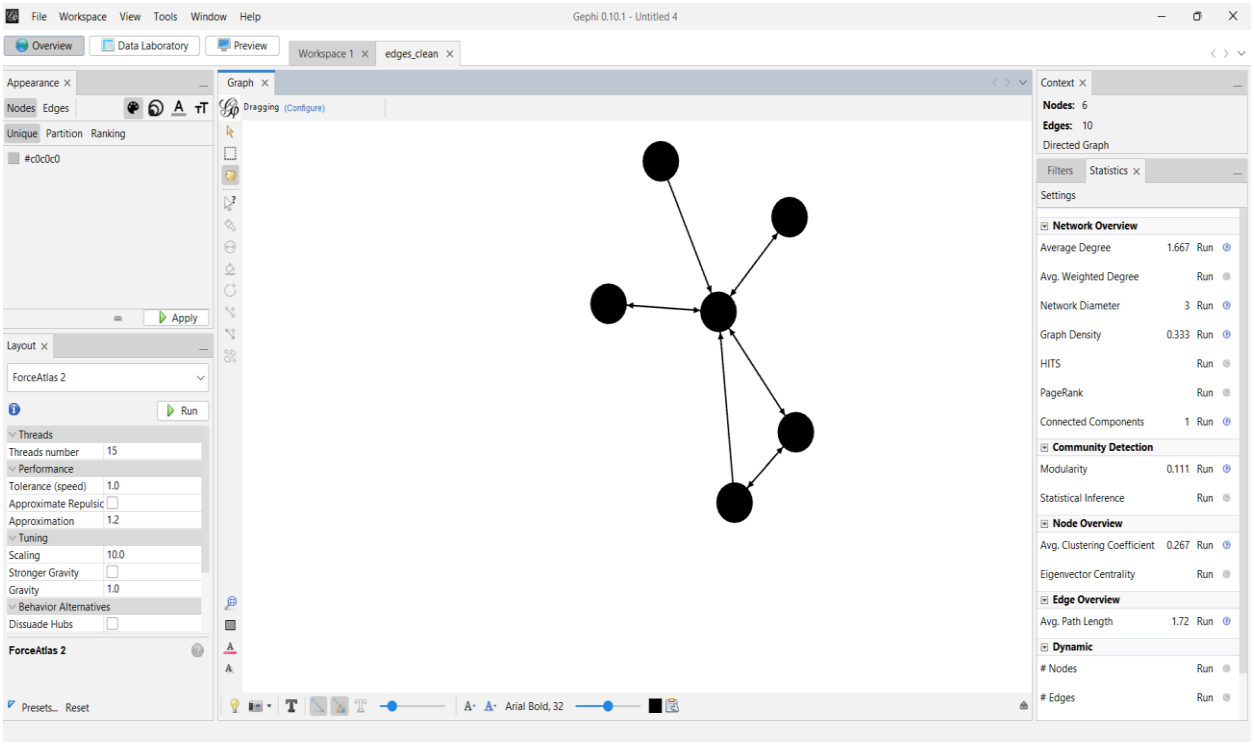
- **5G Conspiracy Graph (misinformation cluster)** – **Graph 15** from `5G_Conspiracy_Graphs`
- **Non-Conspiracy Graph (normal cluster)** – **Graph 8** from `Non_Conspiracy_Graphs`

Both graphs were imported into **Gephi** as directed graphs (Twitter interactions are directional).
For each graph we:

- Applied the **ForceAtlas2** layout to visualise the structure
- Ran **Statistics** in Gephi to compute:
    - Number of nodes and edges
    - Average degree
    - Graph density
    - Average clustering coefficient
    - Modularity (Q) and number of communities
    - Network diameter and average path length
    - Betweenness and closeness centrality
    - Connected components



5G Conspiracy Graph



Non_Conspiracy Graph

2. Recorded Outputs (All Metrics)

2.1 Summary Table

Metric	5G Conspiracy (Graph 15)	Non-Conspiracy (Graph 8)
Nodes	69	6
Edges	74	10
Average Degree	1.072	1.667
Diameter	2	3
Average Path Length	1.063	1.72
Graph Density	0.016	0.333
Avg. Clustering Coefficient	0.014	0.267
Modularity Q	0.149	0.111
Number of Communities	6	2
Highest Betweenness Centrality	1.0 (normalized)	14.0
Highest Closeness Centrality	1.0	0.8
Weakly Connected Components	1	1
Strongly Connected Components	65	2

3. Metric Explanations and Interpretation

3.1 Nodes and Edges

Meaning:

- **Nodes:** Twitter accounts
- **Edges:** interactions (retweets, replies, mentions)

5G Conspiracy
69 nodes and 74 edges indicate a large interaction cluster centered around one dominant account.

Non-Conspiracy
Only 6 nodes and 10 edges, forming a small conversation among a few users.

Interpretation:
The conspiracy graph is larger, but size alone does not determine behavior—network structure does.

3.2 Average Degree

Meaning:
Average number of interactions per node.

Values:

- **Conspiracy:** 1.072
- **Non-conspiracy:** 1.667

Interpretation:
The conspiracy network is larger but less interactive—most users only interact once,

usually retweeting a central hub.
In contrast, the non-conspiracy group has slightly more interaction relative to its size, indicating genuine conversation.

3.3 Diameter & Average Path Length

Meaning:

- **Diameter:** longest shortest path between any two nodes
- **Average path length:** average number of steps needed to reach another node

Values:

- **Conspiracy:** Diameter = 2, Avg Path Length = 1.063
- **Non-conspiracy:** Diameter = 3, Avg Path Length = 1.72

Interpretation:
The conspiracy graph has a star-shaped, hub-and-spoke structure where almost every node is only 1–2 steps from the central account.
In the non-conspiracy graph, messages travel through several nodes—typical of a natural discussion rather than a broadcast pattern.

3.4 Graph Density

Meaning:
How connected the network is relative to the maximum possible connections.

Values:

- **Conspiracy:** 0.016 (extremely sparse)
- **Non-conspiracy:** 0.333 (much higher)

Interpretation:
The conspiracy network is almost entirely “fans replying to one hub”, with almost no user-to-user connections.
The normal network is much more interconnected, consistent with real conversation.

3.5 Average Clustering Coefficient

Meaning:
Measures the formation of triangles—situations where “my friend interacts with my other friend.”

Values:

- **Conspiracy:** 0.014
- **Non-conspiracy:** 0.267

Interpretation:
The conspiracy graph has almost no triangular structure—users do not talk to each other, only to the hub.
The non-conspiracy graph contains small conversational loops, showing real interaction among multiple users.

3.6 Modularity (Q) & Number of Communities

Meaning:
How well the network separates into communities.

Values:

- **Conspiracy:** Q = 0.149, **6 communities**
- **Non-conspiracy:** Q = 0.111, **2 communities**

Interpretation:
Communities in the conspiracy graph are weak—most nodes still revolve around the same hub.
The non-conspiracy graph forms **2** small, natural discussion clusters.

3.7 Betweenness Centrality

Meaning:
How often a node lies on the shortest path between other nodes (acts as a bridge).

Values:

- **Conspiracy:** 1.0 (central node dominates flow)
- **Non-conspiracy:** 14.0

Interpretation:
The conspiracy graph depends heavily on one account—almost all paths go through a single node.
In the normal graph, betweenness is shared across several nodes, reflecting a balanced conversation.

3.8 Closeness Centrality

Meaning:
How close a node is to all others.

Values:

- **Conspiracy:** 1.0
- **Non-conspiracy:** 0.8

Interpretation:
The central misinformation source reaches everyone almost instantly.
In the normal graph, users are close but not extremely centralised.

3.9 Connected Components

Meaning:
Groups where each node can reach every other.

Values:

- **Conspiracy:** 1
- **Non-conspiracy:** 1

Interpretation:
Both graphs form one unified component, but the conspiracy network is dominated by a single central node, while the normal network remains more balanced.

4. Comparative Analysis

Network Shape

- **Conspiracy:** Star-shaped, hub-and-spoke
- **Non-conspiracy:** Small cluster with mutual links

Centralisation

- **Conspiracy:** Extremely centralised around a single influencer
- **Non-conspiracy:** More balanced participation

Density & Clustering

- **Conspiracy:** Very sparse (0.016), almost no triangles
- **Non-conspiracy:** Dense (0.333), more triangular conversation loops

Information Flow

- **Conspiracy:** Spreads in 1–2 steps → very efficient for misinformation
- **Non-conspiracy:** Slower, multi-step, natural conversation flow

5. Conclusion

This analysis shows clear structural differences between misinformation and normal online conversations.

The **5G conspiracy network** is highly centralised, very sparse, and dominated by a single account.
It operates like a broadcast system, where one source pushes content outward to many passive receivers.

The **non-conspiracy network** is smaller but much more interactive, dense, and conversational.
Users talk to each other rather than depending on a single influencer.

These patterns support existing research:
Misinformation spreads through hub-and-spoke networks, while legitimate discussions form more distributed and interconnected structures.