

Titans of Discourse

Web and Social Network Analysis of the *Attack on Titan* Subreddits



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Spoiler Warning! This study cites major plot points and character developments from *Attack on Titan* up to the manga/anime's latest arcs. Reader discretion is advised.

Abstract

Attack on Titan (Shingeki no Kyojin) has cultivated a massive and global fandom, much of which congregates on online platforms such as **Reddit**. This project explores the **social dynamics, sentiment polarity, and network structures** within the many subreddit dedicated to the show. By applying data analysis, topological network exploration, community detection, sentiment analysis, topic modeling and named entity recognition (NER) focused on character mentions, the study uncovers **how fans interact, how discussions evolve, and how emotional tone shifts over time**. Additionally, by merging results from NER and sentiment analysis, we **differentiated communities** based on their preferences. Ultimately, this project aims to deepen our understanding of modern fan communities and their dynamic online ecosystems.

Introduction

In the digital age, **fandoms have shifted from physical spaces to online platforms**, where engagement, discussion, and collaboration thrive. The *Attack on Titan* fandom is a prime example, sparking global debate across the internet.

Among these platforms, **Reddit** stands out for its **community-driven** structure and **large-scale** interaction. Subreddits like *r/attackontitan*, *r/ShingekiNoKyojin*, *r/titanfolk*, and *r/AttackOnRetards* serve as **dynamic hubs** where fans share theories, reactions, memes, and critiques—especially around major story milestones.

This project focuses on a period of heightened activity: the series' conclusion in both manga and anime. During this time, we investigate:

- The **topological structure** of user interactions and subreddits activity
- The formation of **distinct communities** within the subreddits
- The **sentiment polarity** of user interactions, and its evolution over time
- The **topics** that are more discussed by the users in different communities and different time windows
- The frequency and sentiment surrounding key characters, using **Named Entity Recognition (NER)**

By integrating these approaches, the project aims to uncover patterns of interaction, emotional trends, and community behavior that define this digital fandom space.

Data Gathering and First Analysis

To understand the themes and engagement within the Attack on Titan (AoT) Reddit community, we collected and analyzed Reddit submissions from several key subreddits. Our focus was on **both general discussion and posts specifically about the ending of the series**, as this topic is highly debated and polarizing among fans.

Data Collection

We identified the most relevant AoT subreddits based on community recommendations and moderator insights:

- **r/attackontitan:** The original subreddit, but not the main hub for high-quality content.
- **r/titanfolk:** Known for criticism of the manga's ending and a strong presence of "Jaegerists."
- **r/AttackOnRetards:** Focused on memes and satirical takes, often mocking critics of the ending.

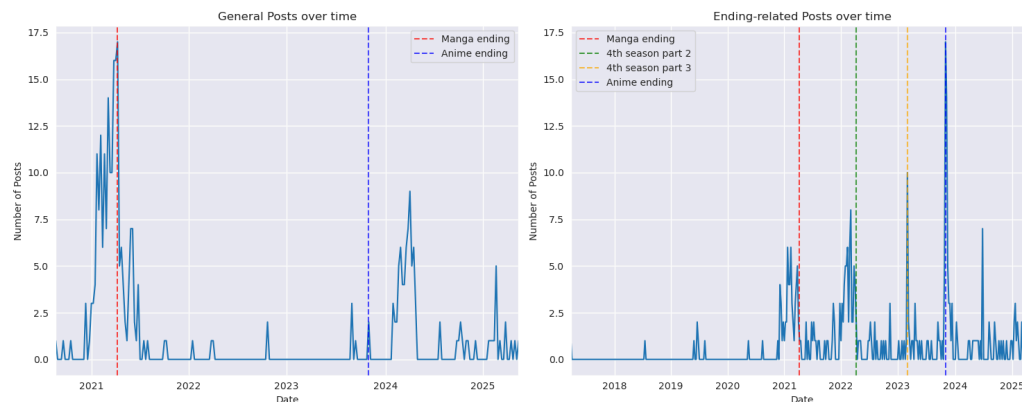
For our analysis, we gathered data from these three subreddits using the **Reddit API** via the **PRAW** library. We collected two main datasets:

- **General Posts:** The top 100 posts from each subreddit, regardless of topic.
- **Ending-related Posts:** The top 100 posts from each subreddit containing keywords such as "ending," "finale," "final chapter," or "final episode."

The collected data includes metadata (e.g., post date, score, number of comments, flair, spoiler status) and the full selftext of each submission.

First Analysis

- **Posting Activity Over Time:** Peaks during major events (manga ending Apr 2021, anime finale Nov 2023); engagement surges with plot developments.



- **Hourly Posting Patterns:** Activity spread across the day; reflects a global audience with varied posting habits.
- **Submission Length:** Ending-related posts are longer on average than general posts.
- **Word Clouds:** Custom word clouds highlight unique terms and memes (e.g. "lemur", "Madagascar"); character names & common terms filtered out.
- **Post Scores & Upvote Ratios:** Most posts get moderate engagement; ending-related posts show more polarized reactions with some very high-visibility outliers.
- **Number of Comments:** Ending-related posts attract more comments and spark more intense debates.
- **Flair & Spoiler Usage:** General posts → "Humor"/"Memes"; Ending-related posts → "Discussion". Spoiler tags used more often in ending-related posts.

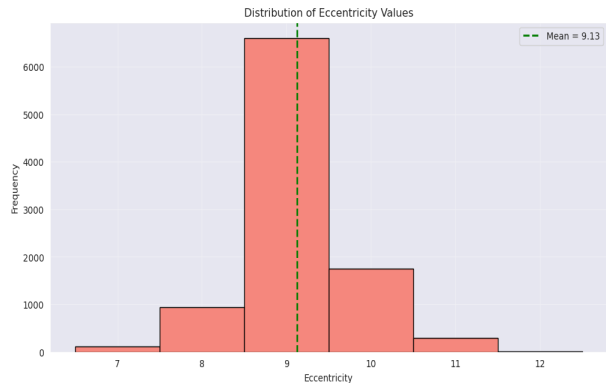
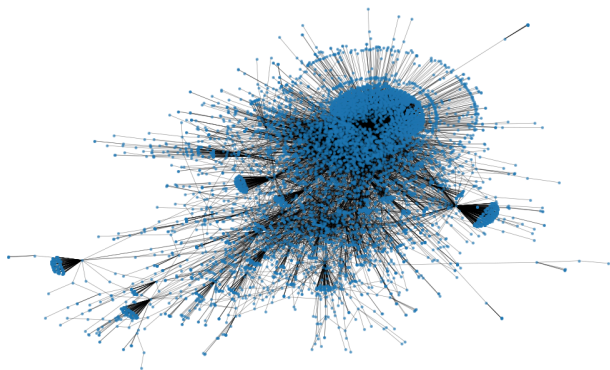
Topological Analysis

In this section, we construct and analyze the topology of the Attack on Titan Reddit discussion network, focusing on **the structure of user interactions in threads about the series ending**. Our goal is to understand the underlying patterns of communication, identify influential users, and compare the dynamics across different subreddits.

Building the Reply Graph

We extracted comments from the ending-related submissions, collecting replies up to the third level. Each node in the resulting graph represents a unique Reddit user, and each edge represents a reply between two users. Although replies are inherently directional, **we treat the graph as undirected to focus on the presence of interaction rather than its direction**.

After cleaning the data to remove invalid or missing users, we constructed the graph and retained only the largest connected component for further analysis. This ensures that our results reflect the main body of discussion rather than isolated or inactive users.

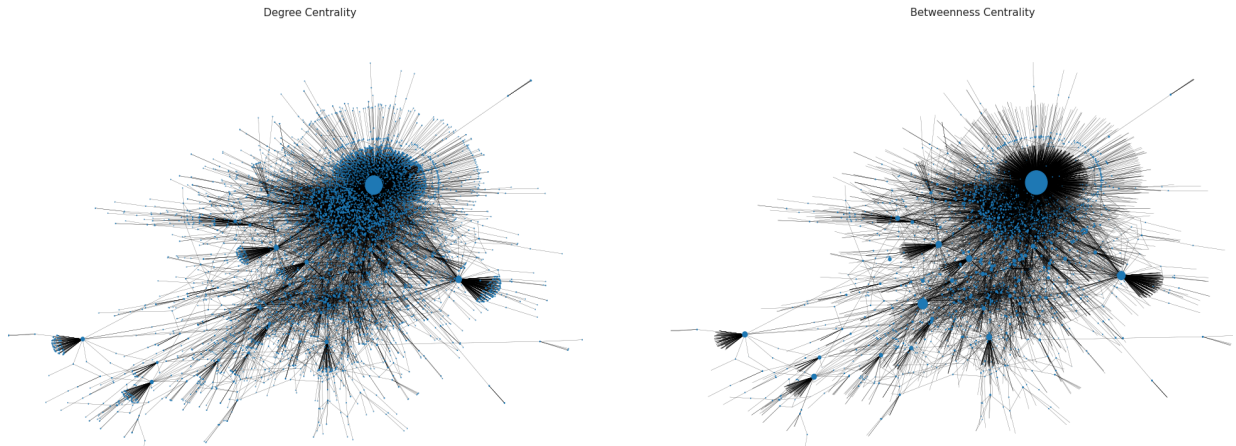


The reply network exhibits a diameter of 11 and a radius of 6, meaning even the most distant users are connected through relatively short paths. As expected for Reddit discussions, the graph density is low, with most users engaging in limited direct interactions. Eccentricity values further confirm this pattern of a sparsely but efficiently connected community.

Graph Statistics	
Radius	6
Diameter	11
Avg. Shortest Path	3.57847
Avg. Clustering Coeff.	0.10621
Density	0.00031

Centrality Measure

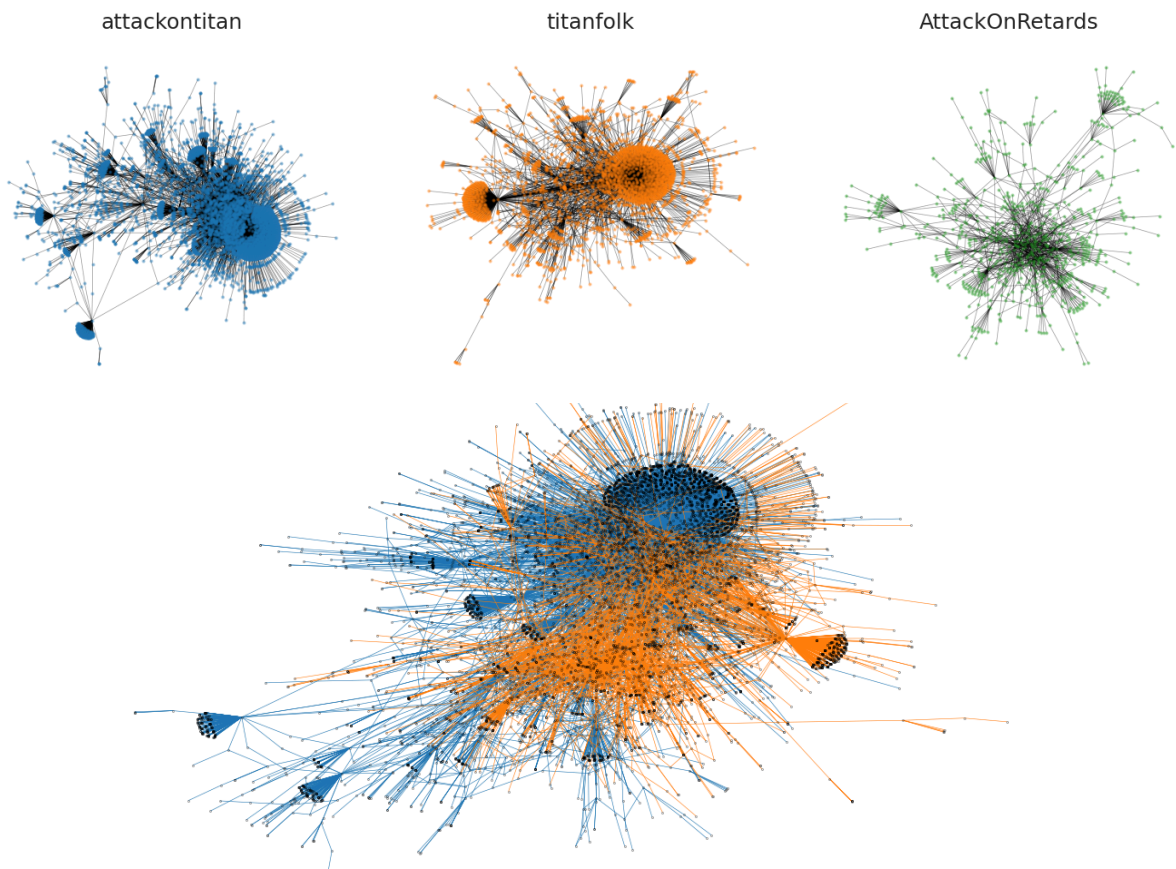
To identify the most influential users in the reply network, we computed and visualized some centrality measures. In particular, we analyzed **degree centrality** (left) and **betweenness centrality** (right), using them to scale the size of the nodes in the plotted graphs. These measures highlight users who are either highly connected or who act as bridges within the communication structure.



Through this analysis, we identified the user **Sane-Ni-Wa-To-Ri** as a central figure in the network. This user is the big blue ball that appears at the core of the largest connected component.

Graph by Subreddit

We further analyzed the network by subreddit, constructing separate graphs for *r/attackontitan*, *r/titanfolk*, and *r/AttackOnRetards*. Unlike the former two, *r/AttackOnRetards* showed lower connectivity and more isolated discussions, consistent with its focus on meme content.



Edge coloring by subreddit in the overall graph highlights the overlap and boundaries between communities, showing that **while there is some cross-subreddit interaction, most discussions remain within their respective communities.**

The topological analysis reveals that the Attack on Titan Reddit discussion network is **highly interconnected**, with **a few central users driving much of the conversation.** Differences between subreddits reflect varying levels of engagement and community structure, with *r/attackontitan* and *r/titanfolk* forming the main hubs of discussion.

Community Detection

Applying community detection algorithms to the Attack on Titan Reddit reply network uncovers **the structure of user interactions and distinct discussion groups.** We further examine **how these communities evolve over time** using a series of temporal snapshots.

Methods and Metrics

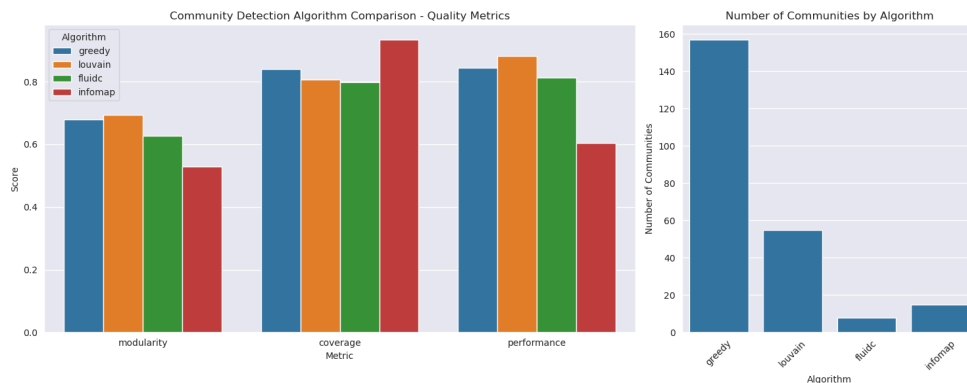
We evaluated four community detection algorithms:

1. **Greedy modularity:** Iteratively merges communities to maximize modularity, offering fast but sometimes over-partitioned results.
2. **Louvian:** Hierarchically optimizes modularity to detect multi-scale community structures with high efficiency.
3. **FluidC:** Simulates information flow to assign nodes to communities, with sensitivity to specified community count and size balance. Low performance on unbalanced communities.
4. **Infomap:** Employs random walks and information theory to identify communities by minimizing flow description length, yielding well-separated partitions.

To assess the quality of the detected communities, we used the following metrics:

- **Modularity:** Measures the strength of division of a network into modules (communities). Higher modularity indicates denser connections within communities and sparser connections between them.
 - Formula: $Q = \frac{1}{2m} \sum_{ij} \left(A_{ij} - \gamma \frac{k_i k_j}{2m} \right) \delta(c_i, c_j)$
- **Coverage:** The fraction of edges that fall within communities.
 - Formula: $\text{Coverage} = \frac{\text{intra-community edges}}{\text{total edges in the graph}}$
- **Performance:** Considers both intra-community edges and inter-community non-edges, rewarding well-separated communities.
 - Formula: $\text{Performance} = \frac{\text{intra-community edges} + \text{inter-community non-edges}}{\text{total possible edges}}$

Results



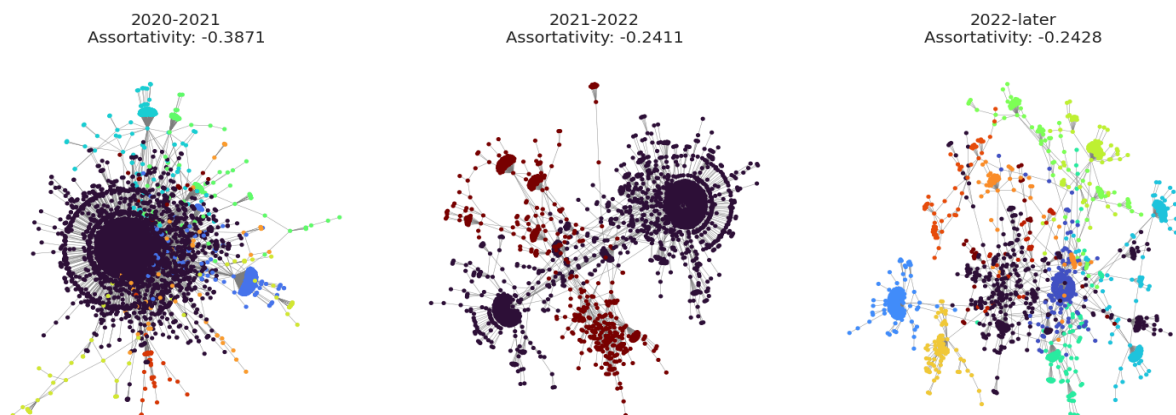
We excluded **FluidC** and **Greedy Modularity**, since they provided intermediate results but **were less effective in terms of coverage and interpretability**. The choice came down to Louvian and Infomap. While **Louvian** had a big advantage in **performance** and **modularity**, we opted for **Infomap** for its excellent coverage and reduced number of communities, and consequently **higher simplicity and interpretability**.

Temporal Community Detection

To explore how community structure evolved over time, we divided the dataset into three time windows:

- 2020-06-30 to 2021-06-30: Manga ending; Anime season 4, part 1
- 2021-06-30 to 2022-06-30: Anime season 4, part 2
- 2022-06-30 to present: Anime ending + specials

While we expect comments and replies graphs to be quite **disassortative** (lots of “big nodes” receiving many one-off replies), we want to explore how the user interaction changes over time.



We can notice how **we start with a considerable degree of disassortativity**: The scene was probably dominated by a few highly active users, and get replied by many occasional commenters. Indeed, we can see on the left graph a big, single hub. Things change in the next two graphs, where negative assortativity is less extreme. In the middle one, we can see many big hubs, with some **interconnections**, indicating cross-talk between them. Things evolve down the same trend, as we get even more but smaller clusters.

Negative assortativity persists: Reddit naturally favors this because of how reply dynamics work (popular comments rise to the top, increasing visibility).

Sentiment Analysis

In this section, **we analyze the sentiment of user comments** from various AoT (Attack on Titan) subreddits, applying multiple sentiment analysis techniques **to understand the emotional tone and its evolution over time and across communities.**

Methods

We employed four main sentiment analysis approaches:

1. **AFINN:** A lexicon-based method that assigns integer scores to words.
2. **NLTK Opinion Lexicon:** Another lexicon-based approach using positive and negative word lists.
3. **VADER:** A rule-based model specifically tuned for social media text.
4. **Transformer-based Model:** A machine learning model (*tabularisai/multilingual-sentiment-analysis*) that classifies sentiment on a five-point scale.

For each method, we computed sentiment scores and mapped them to three categories: negative, neutral, and positive. We then visualized the distribution of scores and labels, as well as their evolution over time, focusing on key periods of heightened user activity.

During our testing, it became clear that **VADER and the ML model were more decisive in their category assignment.** AFINN and Opinion Lexicon approaches are based solely on a list of words: AFINN assigns a score between -5 and +5, while Opinion Lexicon only labels the words either as positive or negative. This resulted in the two approaches to have a tendency to judge a text as neutral.

Finally, given how the **Transformer-based Model has context-awareness**, this will be the approach used to gauge the sentiment of user replies.

Overall Trends

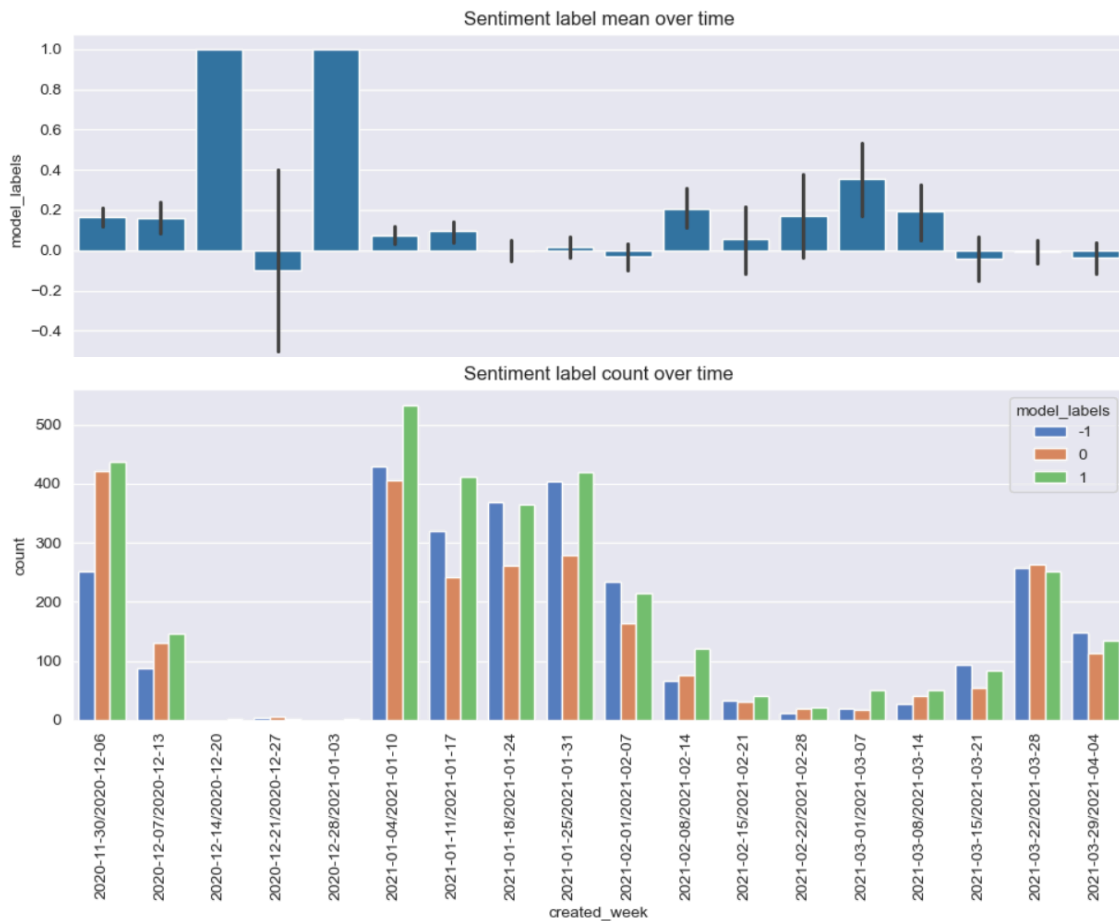
Across all methods, the majority of comments during major discussion spikes (e.g., manga ending, anime finales) were neutral, with positive and negative sentiments **being relatively balanced.** This suggests that the subreddit communities fostered active debates with multiple perspectives, rather than echo chambers dominated by a single viewpoint.

Additionally, **the time period caused tone shifts.** The **manga ending** period showed a marginally **positive tilt**, whereas the **anime ending** period **leaned slightly negative**, especially around the release dates.

In the graph below, we can see the **sentiment mean and sentiment polarity count** over the period of time when the manga ended. Notice how in weeks where there's a high count of replies, the mean is always centered

around a **zero mean**, and with a **small variance**. This indicates polarized debates: No dominant opinion that takes over the conversation.

Manga ending - Sentiment mean and polarity label count



Sentiment Over Time

We then analyzed the sentiment polarity during the three main spikes in user interaction in the AoT subreddits:

- First Spike (Manga Ending, 2020-12 to 2021-03): Despite a surge in activity, sentiment remained balanced. The high volume of replies did not correspond to a strong positive or negative swing, indicating **diverse opinions and robust debate**. Only ever so slightly positive.
- Second Spike (Anime Season 4, Part 2, 2022-01 to 2022-04): This period was marked by several smaller spikes, each corresponding to major plot events. **Sentiment remained neutral on average**, with both positive and negative voices present. The scale remains quite balanced.
- Third Spike (Anime Ending, 2023-11 to 2023-12): Here, **the sentiment shifted slightly negative**, particularly in the US around the release date. However, the variance remained high, and neutral voices were still significant, **suggesting ongoing debate rather than consensus**. Note also that the anime also adopted some slight modifications on the ending, compared to the manga (tighter pacing and a fragmented release schedule of the episodes).

Sentiment in Communities & Subreddits

What about the communities? Certainly, some communities should bias toward more positive or negative opinions on certain topics.

- Largest Community: The most active user, **Sane-Ni-Wa-To-Ri**, skewed the overall sentiment of their community. Excluding this user, the community showed a **strong positive sentiment** during the **manga ending** period (instead of balanced).
- Second and Third Largest Communities: The second community was more neutral, with **balanced positive and negative opinions**, and less activity during the anime ending. The third community, active mainly during the manga ending, **leaned positive**.

Subreddits also showed preference toward a certain sentiment polarization.

- *r/attackontitan*: Showed **balanced sentiment**, reflecting its role as a central hub.
- *r/titanfolk*: Displayed a positive bias, likely due to **community alignment** on certain opinions.
- *r/AttackOnRetards*: Maintained mostly a **neutral** tone, contrary to expectations of more polarized sentiment.

Topic Modeling

This section explores the main discussion topics within the AoT subreddit communities using topic modeling techniques. We analyze both community-specific and temporal trends to understand how conversation themes shift across groups and over time.

Methods & Findings

We applied two main approaches:

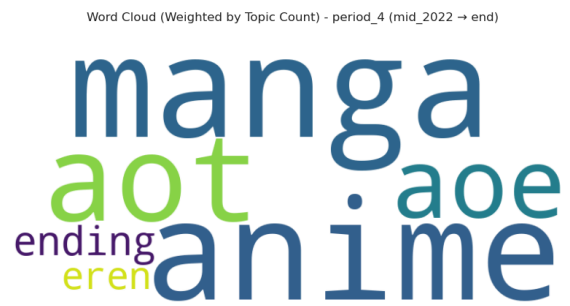
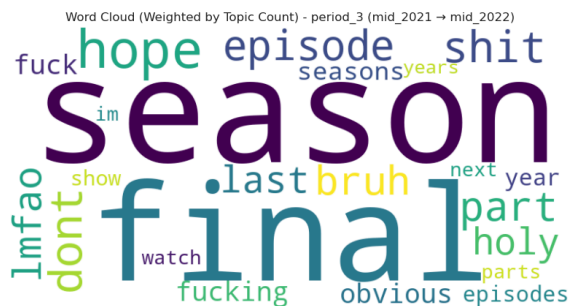
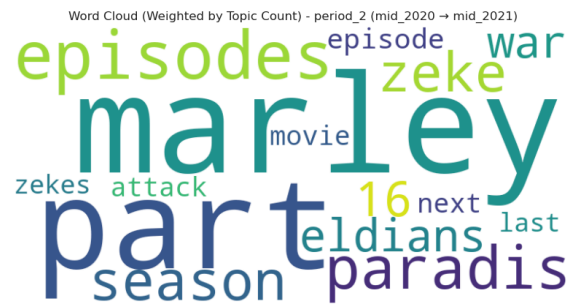
1. Word Clouds per Community: For each community, we combined all comments to create word clouds, visually **spotlighting the top terms** and key discussion themes. “Eren” and key terms related to the series are the most discussed ones.
2. BERTopic: We used BERTopic, a topic modeling framework, to extract **coherent discussion topics** from comments across communities and time periods. There are some overlaps on the main topics and episodes, especially the ending.

Temporal Topic Trends

We divided the dataset into four periods to capture the evolution of discussion topics:

- Start – mid 2020: **"Eren" and "titans"**
- mid 2020 – mid 2021: **War between Marley and Paradis**
- mid 2021 – mid 2022: **Emotionally charged and vulgar slangs** ("shit," "hope," "fuck," "bruh," "lmfao"), indicating strong reactions to the ending.

- mid 2022 – end: **Retrospective discussion terms** (“manga”, “aot”, “anime”)



Named Entity Recognition

Named Entity Recognition (NER) and **Named Entity Linking** (NEL) are used to extract, analyze, and connect references to characters and other entities within the *Attack on Titan* subreddit dataset. This approach reveals how fans discuss characters, explore relationships, and express sentiment across different communities.

Methods

We used two main NER pipelines from spaCy:

1. **en_core_web_sm**: A lightweight English model optimized for CPU, providing a baseline for entity extraction.
2. **en_core_web_trf**: A transformer-based model (**RoBERTa**), offering improved accuracy, especially **for complex or fictional entities**.

For entity linking, we used DBpedia Spotlight to associate detected entities with real-world knowledge graph entries, enabling richer contextualization.

NER Performance

The small model (**en_core_web_sm**) **struggled with fictional names and context**, often misclassifying key entities (e.g., "Eren" not recognized, "Marley" as PERSON instead of LOC). The transformer model instead

(`en_core_web_trf`) performed better, but is not perfect. Given the complex and lore-heavy world of Attack on Titan, errors are to be expected.

Character Co-occurrence

We constructed a character co-occurrence graph, where nodes represent characters and edges indicate **how often two characters are mentioned together** in the same comment. They are defined as such:

$$G = (N, E), N = \{\text{characters}\} = \{c_1, c_2, \dots, c_n\},$$

$$E = \{\text{co-occurrences}\} = \{(c_i, c_j, w_{ij})\} \forall i, j \text{ s. t. } c_j \text{ appears in the same comment of } c_i$$

Understandably, **Eren and Zeke** appear the most together, since by the final seasons, the entire narrative pivots around the Yeager brothers.

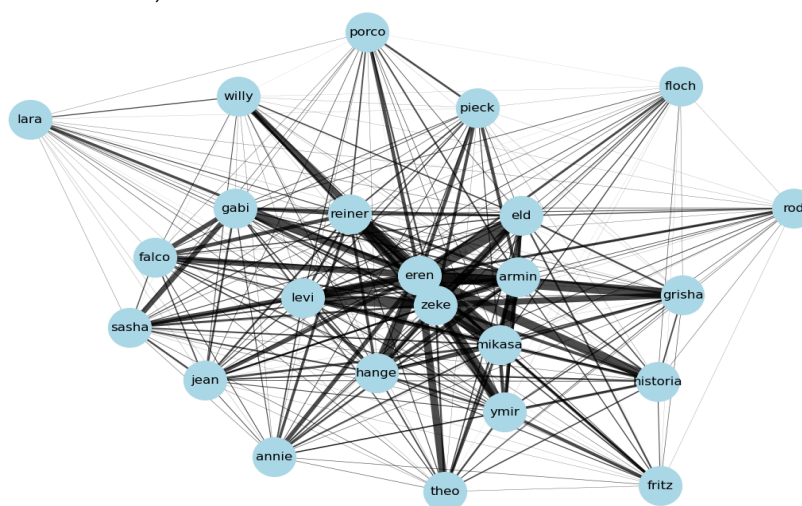
The original trio of **Eren, Mikasa and Armin** are also quite connected between them.

Marley, Eldians and Paradis also co-occur quite often, reflecting the core conflict.

Meta references such as Mappa and Isayama **have the lowest co-occurrence** with any other entity.

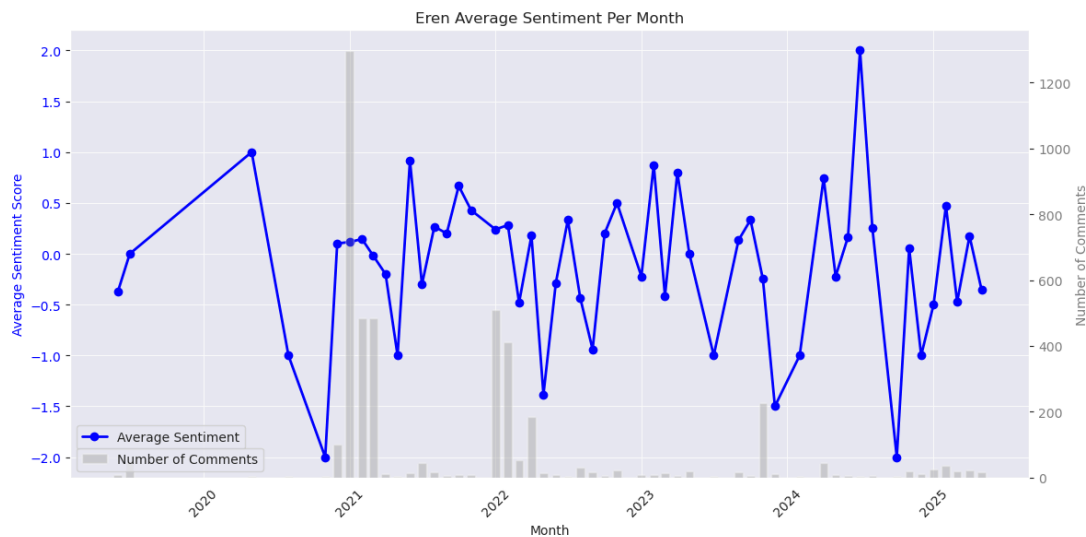
The graph on the previous page shows the co-occurrence of characters only. Below that is the co-occurrence heatmap showing all the entities, including Marley, Eldians, Paradis, Mappa... (that we named before).

zeke	444							
armin	264	99						
mikasa	354	68	180					
marley	192	95	40	40				
mappa	57	19	8	9	12			
eldians	126	82	30	32	90	8		
paradis	164	63	45	45	107	4	53	
isayama	88	16	20	33	7	19	8	19
eren								
zeke								
armin								
mikasa								
marley								
mappa								
eldians								
paradis								



Character Sentiment & Community Storytelling

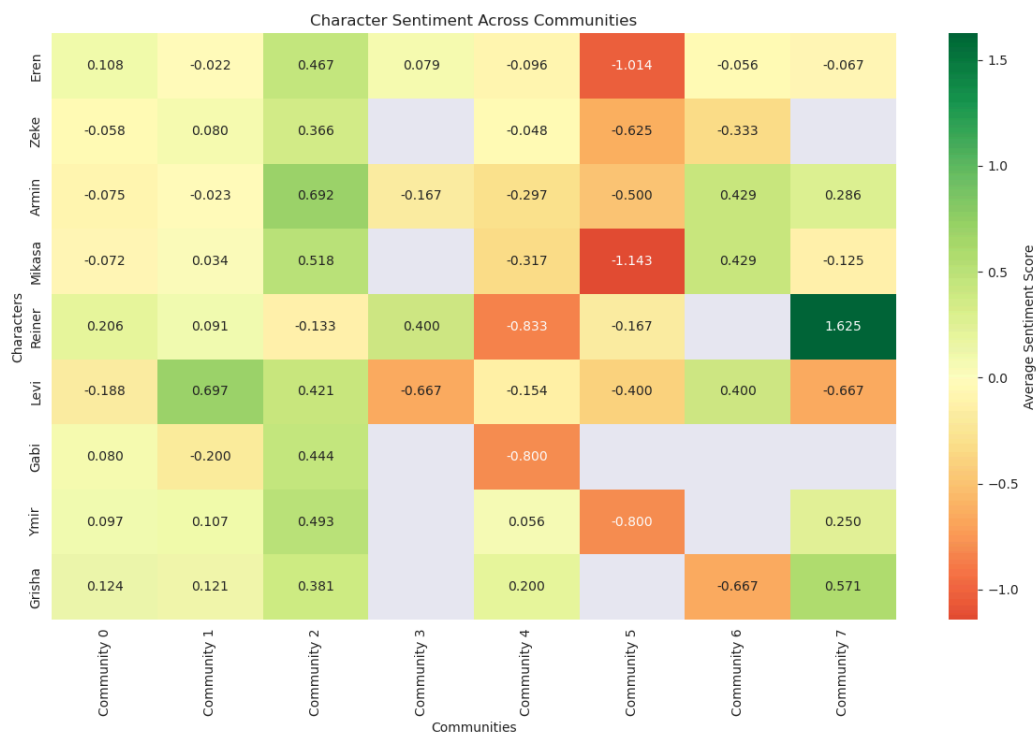
By merging NER and Sentiment Analysis data, we studied **how well the entities are perceived by the AoT fandom**. Eren, being the most discussed character in the whole fandom, is a key study subject, especially how much his character evolved throughout the show.



Total comments: 4301 — Avg. sentiment score: 0.089 — Months covered: 52

Sentiment towards Eren’s character is very variable, considering we’re studying the ending period of the show. One of the main points for debate is **his philosophy vs his actions**. In the first peak, the sentiment is neutral. In the second instead we see a dip, and this period is linked to the explanation of Eren’s motives. Users might **be against his perceived hypocrisy**, but there’s a smaller community of users that believe that this makes him **a more fleshed out, tragic anti-hero character**.

It can be interesting to see if detected communities have a certain preference or critique over certain characters.



This matrix gives us a rough way to characterize each community: Community 1 carries strong signs of being the **Levi fanclub**, while Community 7 seems to be **rooting for Reiner**, but hating on Levi. **These also reflect the differences between Levi and Reiner's characters:**

- Levi: Ruthless, cold, efficient. He does not hesitate in his mission in wiping out the titans, and ensuring humanity's survival.
- Reiner: Human, conflicted, remorseful. He hesitates in his mission as an infiltrated warrior of Marley, torn apart by his own guilt.

Community 5 is a weird one. Not only do they have on average a quite low sentiment towards all the key characters, but are especially harsh on Eren and Mikasa. **They might be the critical or salty corner of the fandom during the ending.**

Similarly, Community 4 **is not a fan of the ending**, not really resonating with the "both sides are victims" message AoT pushes later. They either are the **resentful Paradis Loyalists**, or really liked Sasha and Marco. Both would explain the score distribution, as Reiner and Gabi being Marley agents raises hostility for the former case, and were the direct cause for the death of the abovementioned (beloved) characters.

Community 2 is the opposite. They are an **appreciative group**, with a preference towards **Armin**. A possible explanation is that the users may resonate with Armin's thoughtfulness and tactical brilliance. They do not make a scene, and just enjoy the plot and the character developments.

Finally, Community 6 are the pure **Paradis Loyalists**. Not aligned with Eren's "end it all" vision, and blaming Zeke and Grisha for the Eldian/Marley conflict, they have a soft spot for Mikasa, Armin and Levi.

Conclusion

Our journey through the Attack on Titan Reddit ecosystem has shown **that digital fandoms are as complex and layered** as the stories they love, if not more so. From polarized debates about Eren's motivations to lighthearted memes about lemurs, the community's dynamics are shaped not just by the narrative, but by the interactions, emotions, and identities of its members.

Network topology revealed a tightly connected web of discourse, with **key users acting as central figures** in driving conversation. Community detection illustrated how **discussions evolve from centralized hubs to more distributed, nuanced dialogues** over time. Sentiment analysis underscored the emotionally charged yet balanced nature of debates, **reflecting a fanbase that remains engaged even when divided**. Finally, topic modeling and NER highlighted the shifting **focal points** of conversation and the **emotional weight** fans attach to their favorite (and least favorite) characters.

This analysis highlights how online communities serve as dynamic arenas for collective interpretation, emotional expression, and evolving discourse, a phenomenon increasingly central to understanding modern digital culture.