

# Extremist discourse on alt-right sub-reddit: An Inferential Network Analysis Approach

Rodger van der Heijden

*independent*

Tilburg, Netherlands

rodgervanderheijden@gmail.com.

Ellen Mans

*Independent*

Tilburg, Netherlands

ellen.mans@outlook.com

Tim Jongenelen

*independent*

Tilburg, Netherlands

Claudia Zucca

*Tilburg University*

Tilburg, Netherlands

c.zucca@tilburguniversity.edu

Giuseppe Cascavilla

*Tilburg University*

Tilburg, Netherlands

g.cascavilla@tilburguniversity.edu

**Abstract**—The use of extreme language in social networks is a problem of increasing relevance since it might be a driver of radicalization. Reddit is one of the platforms that provide a place for extremist groups to express themselves. Groups that share (extreme) opinions often contain both passive members and activists. The goal of the activists is to shape the perceptions of the wider public and attract support for their ideology. The current study's aims are twofold. First, it explores the engagement patterns of activists in the alt-right groups on a conservative subreddit. Second, this study explores the role played by anger and extremist wording in shaping the discussions that take place in the sub-reddit. The study employs inferential network analysis, namely conditional uniform graphs tests and exponential random graph model, in combination with sentiment analysis. Our findings suggest that a small group of users is engaged in the alt-right sub-reddit a lot more than the average user, defining a profile for activism. Moreover, we observe a relationship between engaging in alt-right discussions in the sub-reddit and the sentiment of the users deduced from their posts. These results are a first step toward finding strategies to prevent online radicalization.

**Index Terms**—Online Data, Social Networks, Social Network Analysis, Sentiment Analysis

## I. INTRODUCTION

Authors in [1] define political extremism as “a form of active political behavior which implies a strong commitment to pursuing political goals. This commitment coexists with the rejection of the system as it is. It is not disengagement for reasons of apathy or ambivalence. Instead, it is an attempt by the actor to improve the political system in which she finds herself. This improvement may be a radical reshaping of the current political system or the creation of an entirely new political system more in line with what the actor considers ideal”. Radicalization can be defined as acting on extremist positions, which can be expressed by spreading extremist ideas or by violent outbursts of several types. This research explores the dynamics of people expressing extremist political ideas opposing a society's values in online anonymous platforms. Those can vary from racial, religious, supremacy, or ideo-

logical values that deny basic human rights or democratic principles [2].

The rise of new extremist movements never occurs in a social vacuum [3]. These movements are fueled by socio-political views shared between individuals of the social movement. There are members of the group who only show their support for ideas proposed by others, and some more extreme activists play a central role in the formation of group identity by introducing ideas and engaging in more visible actions of extremism. They aim to impact the wider public perceptions and attract support for their ideology [3].

A way of engaging in more visible actions and reaching a wider audience is through online propaganda or simply interactions with people who convey on the same websites. Extremists express their ideas on social media to influence others and convince them to adopt their ideology [4], [5]. The goal of extremists is not only to radicalize non-extremists but also to recruit them to carry out acts of violence. Moreover, it is an easy way to establish contact with other radicalized individuals. In [6], the authors state that social media platforms have evolved into a crucial medium for extremists to connect, interact, and share their content to find additional extreme information and other extremists.

Research on radicalization within online social media platforms delves into modeling the textual content of alt-right discourse [7], [8]. Another key research area examines the social network structures underlying online alt-right communities [9]. A recent study by [10] integrates textual content analysis with social network structures to identify the most influential actors within the alt-right Twitter community. Analyzing these social networks can provide valuable insights for Law Enforcement Agencies, enabling them to more effectively identify groups and the most active individuals who disseminate extreme ideologies.

Previous studies employed Exponential Random Graph models (ERGMs) [11] to explore the complex system interactions taking place online [12], [13]. Also, several scholars explore the dynamics of opinion formation, polarization, and

radicalization in the context of social media [14]–[16]. This research contributes to this body of literature by suggesting new approaches to exploring people’s interactions in a politically extremist Reddit channel, considering those interactions a complex system where opinions are formed and changed and exploring them with ERGMs and another inferential network analysis technique, Conditional Uniform Graph tests [17].

## II. THEORETICAL BACKGROUND

Several online platforms can be explored to analyze the relationship between alt-right activists. Twitter (now X) is the social media platform that is most commonly used for the analysis of radicalization [7], [10], [18]–[20], even though platforms like Facebook and Instagram have a much larger user base [21]. This is due to the fact that Twitter used to have an API that allowed for relatively easy data collection, and alt-right discourse tends to find the most fertile ground on the “fringe” instead of mainstream platforms [19]. Gab, an alternative to Twitter that welcomes users banned or unwelcome on other platforms, has also attracted some research interest [19], [22]. Studies also look at Reddit, 4chan [8], and non-Western social media platforms [9].

This study will focus on the ‘conservative’ subreddit */r/conservative*. Reddit was targeted because of its status as the second-largest social media platform and its accessibility for data scraping [21], providing a relevant context for this research. The focus on */r/conservative* arises from being the subreddit with the highest volume of alt-right content, following the removal of more extreme subreddits such as *r/The\_Donald* and *r/WatchPeopleDie* [23].

Previous research indicates that extremists use social media to disseminate their ideas, radicalize individuals, and recruit new followers to their ideology [4]. Establishing such groups and shaping public opinion requires a substantial amount of visible online activity, with a small number of users being significantly more active within the network than others [3]. Accordingly, the following research question can be formulated in the context of the alt-right Reddit:

*RQ1: Is there a small group of users showing a quantity of activity much higher than the average within the network?*

Consequently, we hypothesize that: *H1: The alt-right Reddit network modeling the ‘conservative’ subreddit contains a small subset of users showing a quantity of activity much higher than the average.*

Furthermore, [6] highlights that extremists leverage these social network platforms to interact and connect with like-minded individuals to disseminate their content. To examine whether the alt-right Reddit network similarly exhibits patterns where more extreme alt-right individuals establish connections with one another, and assuming that these activist express anger and negative feelings, this study formulates the following research question:

*RQ2: Do negative feelings drive social interaction between activists in the conservative sub-reddit?*

Regarding this research question, we hypothesize that: *H2: Reddit users who express themselves with an angry-negative*

*alt-right discourse are more likely to interact with each other if compared to users who employ a different language.* To test these hypotheses, we used social network analysis. We scraped our network from the conservative subreddit */r/conservative*. The network consists of vertexes representing users who posted a post and edges representing comments. Network links are directed and unweighted since they were created when a user comments on another user’s post. We calculated the alt-right discourse for each user using a proxy, which calculated the anger and negative emotions in their language.

For the first hypothesis, conditional uniform graph (CUG) distributions are created to investigate whether the degree distribution of our alt-right Reddit network significantly differs from generated distributions with identical size and number of edges. An exponential random graph model (ERGM) is used for the second hypothesis to find the cause of the relations observed in the network.

The remainder of this report is structured as follows: Section III explains our methodology in more detail. Sections IV and V report the experiments conducted to test hypotheses H1 and H2 and discuss the results. Section VI provides some concluding remarks.

## III. METHODOLOGY

### A. Dataset and Network Creation

For this study, we collected network data by scraping the top 1000 posts from the */r/conservative* subreddit, a community situated on the extreme right of the political spectrum, using the social network platform Reddit. In addition to these posts, we also gathered all associated comments. This data was collected using an R package specifically designed for scraping Reddit <sup>1</sup>.

The dataset comprises 236 users who posted on the subreddit and 16,821 who commented on these posts. Given the project’s scope, we narrowed the focus by excluding users who only commented and never posted, resulting in a network of 236 users who both posted and commented.

In our network, edges are directed: an edge from user *A* to user *B* exists if user *A* commented on a post created by user *B*. The network is unweighted to simplify the analysis and only to capture the fundamental dynamics of the discussion; thus, edges are binary, indicating only the presence or absence of a comment, regardless of the number of comments exchanged. The network contains 3,978 edges.

Each vertex representing a Reddit user is associated with several extra pieces of information that we refer to as attributes, most of which were also scraped from Reddit. These attributes include the date the user joined Reddit, whether they possess Reddit gold (a premium account), whether they serve as a moderator on Reddit (both binary variables), and the karma (likes) received on their posts and comments. During the data collection process, we discovered that Reddit had banned six users in the week between scraping the network data and scraping the vertex attributes. Due to these bans, we

<sup>1</sup><https://github.com/ivan-rivera/RedditExtractor>

were unable to retrieve the required vertex attributes for these users. Given the small number of affected users, we excluded them from our analyses.

To explore extremism, we developed a method to quantify it using a proxy based on the emotional content of the language in users' posts and comments. This analysis draws on a previous study that measured emotions in tweets<sup>2</sup>. We calculated scores for each user's posts and comments by assessing the presence of the eight emotions from Plutchik's wheel of emotions [24] (fear, anger, disgust, sadness, joy, surprise, anticipation, and trust) based on the words used. To approximate extremism, we averaged the anger and disgust scores for each user, creating the additional vertex attributes *post emotion* and *comment emotion*. The rationale behind these attributes is that a user expressing more extreme anger or disgust in an extreme-right subreddit likely exhibits more extremist tendencies.

Upon closer inspection of the network, we identified a significant number of self-loops within the edge set (1,141 out of 3,978 edges). Since self-loops—where a user comments on their own post—do not contribute to understanding relationships between different users, we removed them. This adjustment resulted in a network comprising 2,837 edges between 230 vertices.

### B. Network Descriptive Statistics

The table I presents some descriptive measures from the final network.

Measure	Value
Mean distance	3.21
Diameter	9.00
Reciprocity	0.02
Transitivity	0.20
Edge density	0.05

TABLE I  
NETWORK ATTRIBUTES.

As shown in table I, although the network's diameter is 9, the average path length between any two vertices is just over 3 steps. The transitivity measure indicates the presence of undirected closed triads, but the likelihood that two vertices connected to the same vertex are also connected to each other remains low. Additionally, the network exhibits minimal reciprocity, suggesting that receiving a comment from another user does not typically lead to reciprocation. The low edge density further implies that the network is relatively sparse despite the number of vertices it contains.

### C. Data Analysis

To test our first hypothesis concerning the network structure, we sought to determine whether some actors are sensibly more engaged than others in the network than playing a key role in it. First, we identified degree as the most appropriate influence metric for this analysis. The degree of a node reflects

the number of edges within the network connected to that specific node. By calculating the degree of each node, we can obtain the degree distribution of the network. However, our primary interest lies not in the entire network but in identifying whether a small set of users exerts disproportionate influence, as shown by [3]. To estimate this, we selected the value at the 90th percentile of the degree distribution to avoid excessive influence from outliers.

Variations in user interaction within this type of social network are expected. To determine whether this variation falls within expected limits, we generated random networks (with specific constraints) and tested whether our observed 90th percentile degree distribution results were random or the expression of a specific social process of interest—in our case, larger engagement of some users due to the key role they play in this network. These random networks were simulated using the Conditional Uniform Graph (CUG) test [17], which constrains the number of nodes and edges. The CUG test was estimated in R with the 'sna' package [25].

To test the second hypothesis, we employ Exponential random graph models (ERGM) [11] to explore a series of dynamics. First, we explore whether sentiment, as a proxy for extremism, predicts the extent to which users engage in an online discussion in the sub-reddit. In other words, we test whether the sentiment predicts the existence of an edge between two nodes.

Second, prior research suggests that extremism rarely occurs in isolation; rather, it is often incited and reinforced by the contributions of others. We aim to determine whether ties are predominantly unidirectional (senders mainly send, and receivers mainly receive) or whether mutuality exists (senders in one instance become receivers in another, with roles being less distinct). Hence, the second thing we test for is the mutuality of edges.

Additionally, we are interested in whether extremism is driven by direct one-on-one interactions or by broader, interconnected communities where users share numerous contacts.

Given the nature of our network and our data collection methods, we do not anticipate a normal distribution of in-degrees. By sampling only the top 1000 posts from */r/conservative*, we introduced bias into the network's degree distribution. Accurately representing this bias in our models is crucial for capturing the network's structure. Further terms describing the network will be empirically examined for relevance. The ERGM will accordingly control for this bias.

## IV. RESULTS MODEL 1 (CONDITIONALLY UNIFORM GRAPH; CUG)

Our first research question focuses on whether the observed node degree distribution over the actual network is within expected bounds. It was tested with a CUG test [17]. To do so, we look at the total degree (in-degree plus out-degree) and see the spread of users' involvement. From this, we can test the hypothesis that expects a small number of users to be more engaged than the average with the sub-reddit discussions. We examine the total degree to assess the distribution of

<sup>2</sup><https://github.com/ccatalao/covid19vaccine-emotions>

user involvement with the discussions in the sub-reddit. This analysis allows us to determine whether involvement is evenly distributed across all users or if certain users are more engaged than the average.

Given the expectation that more radicalized users on the sub-reddit would exhibit higher total degrees [10], we expected to find a significant difference in the degree distribution in the sub-reddit network compared to the null hypothesis of a uniform distribution.

The CUG test evaluates whether the total degree distribution in the network under analysis is similar or different from a number of simulated networks with the same number of nodes and edges. The test provides a p-value to assess statistical significance. As our primary interest lies in identifying whether a subset of users wields disproportionate engagement, we focus on the 90th percentile of the degree distribution. To conduct this analysis, we developed a custom function in R, which calculates the degree distribution (using `sna::degree()`) and extracts the value at the 90th percentile (using `quantile()`).

```
compute_90_percentile <- function(g) {
  f <- sna::degree(dat=g)
  the_90_percentile <- quantile(f, c(0.9))
}
```

If the sub-reddit network shows no difference at the 90th percentile compared to the generated networks, the null hypothesis ( $H_0$ ) cannot be rejected. In this context, the CUG test employed 10,000 simulations. The results are shown in Fig. 1.

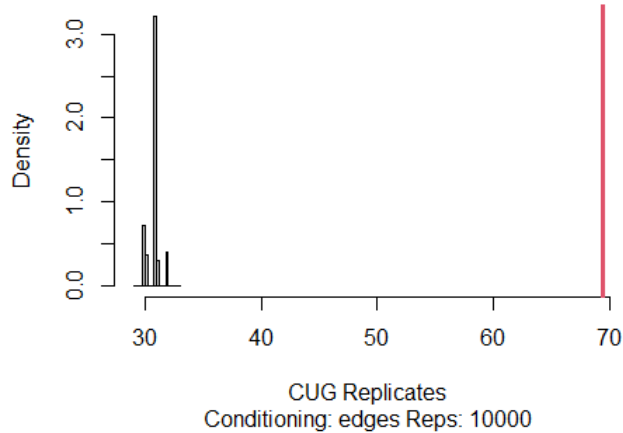


Fig. 1. Univariate Conditional Uniform Graph Test result

The CUG test results depicted in Fig. 1 show on the left-hand side the distribution of the total degree centrality in the simulated networks. The red line shows the measurement for the observed sub-reddit one. With a visual appraisal it is immediately clear that the observed network shows values that are very different from the simulated ones. Looking at the CUG test output, we appraise a significant alpha for  $X \geq obs$ , suggesting a noticeable difference between the 90th percentile of the target model and the generated models. The alpha value of 0 for  $X \geq obs$  at the 90th percentile indicates that in all 10,000 generated models, the 90th percentile was

lower than that of the target model. This finding highlights the disproportionately high degree of the sub-reddit network under examination and allows us to reject the null hypothesis of no effects. The dataset shows a higher engagement of a small number of users.

Therefore, we reject the null hypothesis that there is no difference between the degree of the node at the 90th percentile in our network and that of the 10,000 simulated networks. In practical terms, this suggests that the node at the top 10 percent of the degree distribution in our network has significantly more connections than would be expected, given the size and density of the network. A small group of posters on the */r/conservative* subreddit attracts a disproportionate number of responses to their posts. This phenomenon may be linked to the radicalization evident in their posts, although further research is required to confirm this.

The CUG test conditions the analysis on nodes and edges, focusing on the 90th percentile of in-degree (edges directed towards a given node). The observed value for our network was 69.4. This result is further contextualized by comparing it to the results of the 10,000 simulated networks. The comparison yields a score of 0 for  $Pr(X \geq Obs)$  and 1 for  $Pr(X \leq Obs)$ , indicating that our network has a higher 90th percentile in-degree than all simulated random networks under the specified parameters.

## V. RESULTS MODEL 2 (EXPONENTIAL RANDOM GRAPH MODELS; ERGMs)

To assess whether Reddit users who express themselves with an angry-negative alt-right discourse are more likely to interact with each other if compared to users who employ a different language (H2), we employed Exponential Random Graph Models (ERGMs). The final model has been selected through a systematic process involving multiple steps. We began with a baseline model and iteratively incorporated terms that tested the hypothesis and improved the model fit. We evaluated each term individually by checking changes in the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). A smaller value of AIC and BIC is an indication of a better fit,

Our process started with the inclusion of exogenous terms testing the influence of sentiment on the probability that users engage in discussions. As previously mentioned, we used post-and comment-emotion scores as proxies for extremism. We introduced the *nodeicov* and *diff* terms for these proxies. The first measures how the increasingly positive sentiment predicts the extent to which users talk to each other; The second measures the extent to which having a different sentiment is associated with talking to each other.

We also included the *DaysOnReddit* term, which indicates the duration since a user created their Reddit account. We control for seniority in Reddit; assuming that users who have been on Reddit longer would engage more and primarily interact with other long-term users, so we also added the *nodeicov* and *diff* terms for this attribute.

Subsequently, we incorporated endogenous terms, which reflect the structural aspects of the network. Drawing on the literature highlighting the roles of popularity and sociality in extremism [3], we aimed to capture these dimensions through endogenous terms in the ERGM. We experimented with various terms before finalizing our selection. We included the *mutual* term to capture whether users comment on each other's posts, several variants of *odegree* to measure sociality (i.e., the number of people a user comments on), and *ctruple* to account for triangles in the network. Although we initially tested other terms such as *istar* to capture the number of comments a user receives and additional triangle-related terms like *gwesp* and *gwdsp*, these terms were excluded from the final model due to issues with model convergence or poorer results.

In the table II below, we compare the baseline model, the model with all final exogenous terms, the model with all endogenous terms, and the final model. The comparison with all other models that lead to the final formulation can be found in table IV available in the online appendix in [26]. According to table II, the final model has the best (lowest) AIC and BIC scores, 12595 and 12825, respectively, and the best Goodness of fit.

Before interpreting the results from the ERGM, we first ensured the model's adequacy by conducting Markov Chain Monte Carlo (MCMC) diagnostics, available in Fig. 8 (online appendix [26]), and assessing the Goodness of Fit (GOF) in Fig. 2. These steps were also performed for many of the other tested models, but with the conclusion that they did not have an acceptable fit.

The MCMC diagnostics and GOF for our final model can be found in Listing 2 available in the online appendix in [26]. The trace plots from the MCMC diagnostics indicated effective chain mixing. The density plots, with means centered around zero and bell-shaped curves, confirmed the robustness of sample statistics. We utilized these diagnostics to determine which *odegree* terms to include in the model (Fig. 5). Having verified that the diagnostics for the final model were satisfactory, we assessed the Goodness of Fit, which produced adequate plots (Fig. 4). However, issues arose with the *idegree* term. Attempts to address this by including terms such as *istar* led to convergence problems. Despite these challenges, the overall Goodness of Fit plots supported the validity of the final ERGM (Fig 2 and Fig 3). The *p*-values in the model statistics GOF table in Tab. III ranged from 1 to very high values, indicating that the modeled values closely matched the real network values, thus confirming a good fit.

We proceeded to interpret the final model results. Statistically significant terms reveal whether they positively or negatively influence the formation of edges based on the sign of their coefficients. If the sign is negative, it is unlikely that an edge is formed; if it is positive, it is the opposite. We transformed the ERGM coefficients into odds and probabilities for interpretation since the estimates are expressed in a log scale. These transformed values are presented in Table III.

Table III, shows that, with the exception of the post emotion

	Base	Exo	Endo	Total
edges	-3.49 *** (0.03)	-4.32 *** (0.06)	-2.01 *** (0.06)	-3.72 *** (0.03)
nodeicov.comment_emotion		2.98 *** (0.19)		0.86 *** (0.01)
diff.t-h.comment_emotion		2.62 *** (0.12)		0.57 *** (0.00)
nodeicov.days_on_reddit		0.00 *** (0.00)		0.00 *** (0.00)
diff.t-h.days_on_reddit		0.00 *** (0.00)		0.00 * (0.00)
mutual			0.04 (0.27)	0.22 *** (0.00)
odegree1			-0.31 (0.36)	-2.58 *** (0.00)
gwdsp			-0.16 *** (0.01)	
gwdsp.decay			0.00 (0.20)	
nodeicov.post_emotion				-0.08 *** (0.01)
diff.t-h.post_emotion				-0.02 (0.03)
odegree2				-4.37 *** (0.00)
odegree3				-5.54 *** (0.00)
odegree4				-6.62 *** (0.00)
odegree5				-6.58 *** (0.00)
odegree6				-7.63 *** (0.00)
odegree7				-7.06 *** (0.00)
odegree8				-6.78 *** (0.00)
odegree9				-7.91 *** (0.01)
odegree10				-8.24 *** (0.01)
odegree11				-6.17 *** (0.00)
odegree12				-5.63 *** (0.00)
odegree13				-6.64 *** (0.01)
odegree14				-4.84 *** (0.00)
odegree15				-3.80 *** (0.00)
odegree16				-4.39 *** (0.01)
odegree20				0.08 *** (0.00)
ctruple				0.04 *** (0.01)
AIC	14055.74	13613.85	13464.84	12594.75
BIC	14064.61	13658.21	13509.20	12825.41
Log Likelihood	-7026.87	-6801.93	-6727.42	-6271.37

TABLE II  
AIC SCORE FROM FREQUENTIST PROBABILITY AND BIC SCORE FROM BAYESIAN PROBABILITY.

*diff*, all variables are statistically significant at the  $p = 0.05$  threshold. Based on the probabilities, we can conclude that there is only a very small (2.4%) probability of forming edges, hence that the network is sparse. Substantively, this means that people do not talk to each other at random but carefully post only according to some criteria. The probability that post emotion influences whether a user will receive a comment is 48%. Comment emotion has a more pronounced effect, with a 70.4% probability that the extremism in user A's comments affects the volume of comments user A receives, and a 63.8% probability that users with similar comment emotions are more

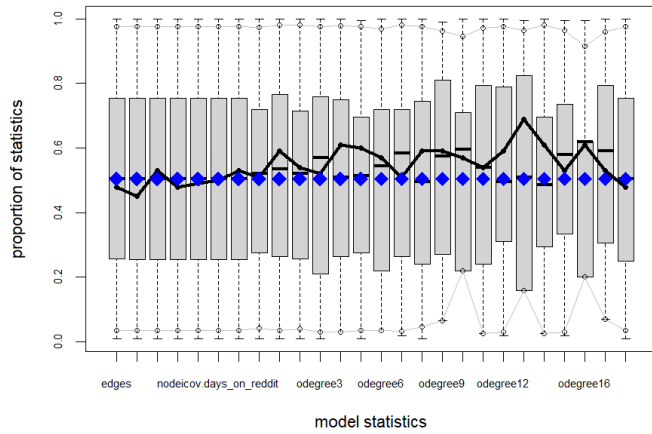


Fig. 2. Goodness Of Fit.

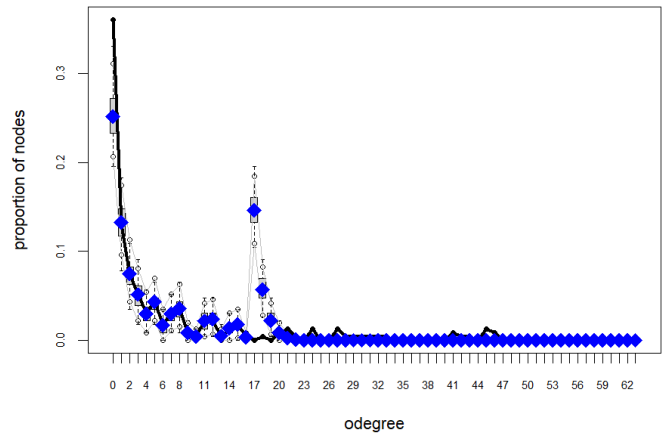


Fig. 5. Goodness Of Fit Odegree.

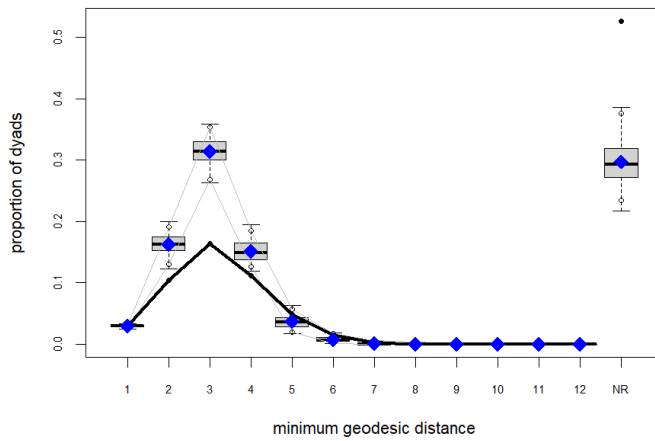


Fig. 3. Goodness Of Fit Diagnostics.

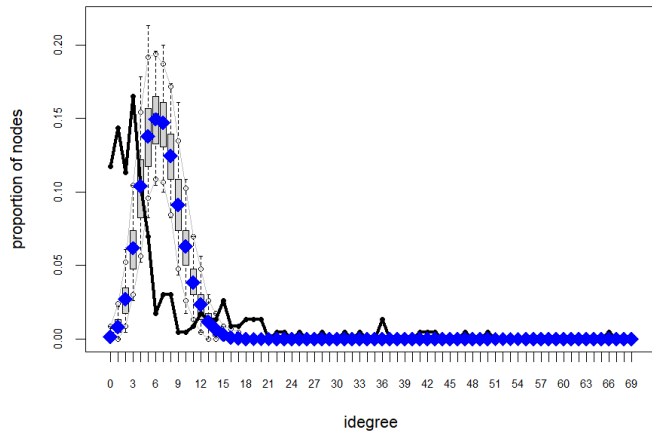


Fig. 4. Goodness Of Fit Indegree.

likely to connect. Additionally, the number of days a user has been active on Reddit does not significantly influence edge formation.

The model shows a 55.5% probability of mutual connections

	Estimate	Odds	Prob	Std.Error	Pval
edges	-3.721	0.024	0.024	0.030	0.000
nodecov.post_emotion	-0.080	0.923	0.480	0.010	0.000
diff.t-h.post_emotion	-0.024	0.976	0.494	0.035	0.495
nodecov.comment_emotion	0.865	2.375	0.704	0.006	0.000
diff.t-h.comment_emotion	0.567	1.763	0.638	0.003	0.000
nodecov.days_on_reddit	0.000	1.000	0.500	0.000	0.000
diff.t-h.days_on_reddit	0.000	1.000	0.500	0.000	0.014
mutual	0.219	1.245	0.555	0.002	0.000
odegree1	-2.576	0.076	0.071	0.002	0.000
odegree2	-4.372	0.013	0.012	0.002	0.000
odegree3	-5.544	0.004	0.004	0.003	0.000
odegree4	-6.621	0.001	0.001	0.003	0.000
odegree5	-6.582	0.001	0.001	0.003	0.000
odegree6	-7.633	0.000	0.000	0.004	0.000
odegree7	-7.060	0.001	0.001	0.004	0.000
odegree8	-6.784	0.001	0.001	0.004	0.000
odegree9	-7.906	0.000	0.000	0.005	0.000
odegree10	-8.239	0.000	0.000	0.006	0.000
odegree11	-6.173	0.002	0.002	0.005	0.000
odegree12	-5.634	0.004	0.004	0.005	0.000
odegree13	-6.638	0.001	0.001	0.006	0.000
odegree14	-4.843	0.008	0.008	0.004	0.000
odegree15	-3.804	0.022	0.022	0.004	0.000
odegree16	-4.386	0.012	0.012	0.005	0.000
odegree20	0.076	1.079	0.519	0.004	0.000
ctriple	0.044	1.045	0.511	0.007	0.000

TABLE III

RESULTS OF THE ERG MODEL WITH ODDS AND PROBABILITIES.

between vertices regarding endogenous terms. The *odegree* shows a small probability of finding users that post a number of times comprising between 1 and 20 messages. With a visual appraisal of Fig. 6 we can corroborate the findings of the model.

Fig. 6 illustrates that most nodes have an outdegree of 0. An exception to this rule is *odegree(20)*, which has a formation probability of 51.9%. Since *odegree* measures the number of people a node comments on, this suggests a tendency for users to comment on a relatively large number of others. Finally, as depicted in Fig. 7, the model indicates a 51.1% probability of triangle formation.

The summary of the total ERGM is available in Listing 1 in the online appendix in [26].

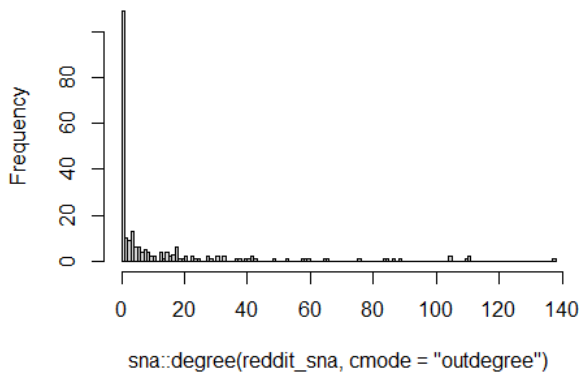


Fig. 6. Outdegrees of the Nodes in the Network.

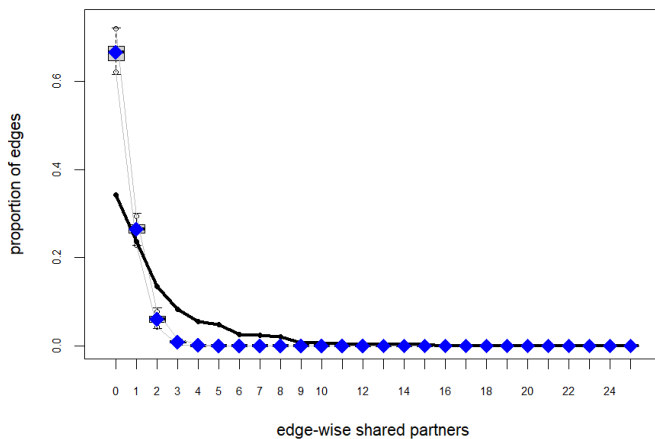


Fig. 7. Edge-Wise shared partnerships forming triangles.

## VI. CONCLUSION

This study explored the characteristics of an alt-right Reddit network to explore the triggers that make users participate on these extreme conversations. A dataset of user interactions from the subreddit *r/conservative* was analyzed to address two research questions relevant to the literature about the behavior of extremist people online. The first research question *RQ1*: “*Is there a small group of users with a disproportionately high amount of activity in the network?*” examined whether the network contained a small number of users with disproportionately high connectivity. The Conditional Uniform Graph (CUG) test provides evidence for our hypothesis, showing that the Reddit few highly connected individuals in the network are not random but the expression of a specific social behavior.

The second research question *RQ2* “*Do negative feelings drive social interaction between activists in the conservative sub-reddit?*” investigated whether the extremism of sentiment predicted user engagement in conversations. The ERG model shows that sentiment matters when engaging in online conversations. The patterns of this causality will need to be addressed by further studies.

This study presents a series of limitations. First, The analysis focused solely on the *r/conservative* subreddit, which

may not fully represent more radicalized online communities. Future research could explore different networks. Additionally, Reddit may not serve as the most representative example of a social network compared to platforms like X, where user interactions might more directly reflect individual relationships. Second, the research design only includes users responsible for the top 1000 posts in an extreme-right sub-reddit. Since these users created the most popular posts, they may represent a subset that is not fully reflective of the broader user base within this subreddit.

A third limitation concerns the operationalization of extremism, which we measured through the valence of posts and comments using a natural language processing algorithm. This approach introduces potential biases and reduces the measure of extremism to a proxy of a proxy, which may affect the validity of our findings. A fourth limitation concerns the goodness of fit of the ERGM. The model is good enough, but the GOF shows that we are missing out on some explanatory variables that should be researched with future studies.

In conclusion, the *r/conservative* sub-reddit aligns with previous research concerning extremist social network structures that are characterized by a few highly active users more engaged than the average. This pattern likely extends to other online social networks. Furthermore, extreme language is associated with patterns of interactions online within the sub-reddit.

These findings hold implications for law enforcement and policymakers, who may benefit from monitoring such channels to identify and address emerging extremist groups. Early intervention could help prevent incidents similar to the 2021 United States Capitol attack. Additionally, Reddit’s developers might consider enhancing user exposure to diverse viewpoints beyond their preferred sub-reddits, which could mitigate radicalization.

## REFERENCES

- [1] S. Jackson, “Non-normative political extremism: Reclaiming a concept’s analytical utility,” *Terrorism and Political Violence*, vol. 31, no. 2, pp. 244–259, 2019. [Online]. Available: <https://www.tandfonline.com/action/journalInformation?journalCode=ftpv20>
- [2] P. R. Neumann, “The trouble with radicalization,” *International Affairs*, vol. 89, no. 4, pp. 873–893, jul 2013.
- [3] P. Bleakley, “Days of alt-rage: using the Weatherman movement to deconstruct the radicalisation of the alt-right,” *Contemporary Politics*, vol. 26, no. 1, pp. 106–123, jan 2020. [Online]. Available: <https://www.tandfonline.com/doi/abs/10.1080/13569775.2019.1663395>
- [4] P. Wadhwa and M. Bhatia, “New metrics for dynamic analysis of online radicalization,” *Journal of Applied Security Research*, vol. 11, no. 2, pp. 166–184, 2016.
- [5] G. Cascavilla, D. A. Tamburri, and W.-J. Van Den Heuvel, “Cybercrime threat intelligence: A systematic multi-vocal literature review,” *Computers Security*, vol. 105, p. 102258, 2021. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S0167404821000821>
- [6] M. Barhamgi, A. Masmoudi, R. Lara-Cabrera, and D. Camacho, “Social networks data analysis with semantics: application to the radicalization problem,” *Journal of Ambient Intelligence and Humanized Computing*, pp. 1–15, 2018.
- [7] P. Bleakley, “Panic, pizza and mainstreaming the alt-right: A social media analysis of pizzagate and the rise of the qanon conspiracy,” *Current Sociology*, July 2021.



- [8] D. Rieger, A. S. Kümpel, M. Wich, and G. G. Kiening, Toni, "Assessing the extent and types of hate speech in fringe communities: A case study of alt-right communities on 8chan, 4chan, and reddit," *Social Media Society*, October 2021.
- [9] T. Yang and K. Fang, "How dark corners collude: a study on an online chinese alt-right community," *Information, Communication & Society*, July 2021.
- [10] J. Torregrosa, Panizo-Lledot, G. Bello-Orgaz, and D. Camacho, "Analyzing the relationship between relevance and extremist discourse in an alt-right network on twitter," *Social Network Analysis and Mining*, vol. 10, no. 68, 2020.
- [11] M. Morris, M. S. Handcock, and D. R. Hunter, "Specification of exponential-family random graph models: terms and computational aspects," *Journal of statistical software*, vol. 24, no. 4, p. 1548, 2008.
- [12] C. Zucca, "Exponential random graph models: explaining strategic patterns of collaboration between artists in the music industry with data from spotify," in *Handbook of Social Computing*. Edward Elgar Publishing, 2024, pp. 12–26.
- [13] Y. Leung, W. Liebrechts, M. Janssen, and C. Zucca, "Collaboration between self-employed artists in the music industry: A network analysis with exponential random graph models," in *Babson College Entrepreneurship Research Conference*, 2024.
- [14] D. Balsamo, V. Gelardi, C. Han, D. Rama, A. Samantray, C. Zucca, and M. Starnini, "Inside the echo chamber: Disentangling network dynamics from polarization," *arXiv preprint arXiv:1906.09076*, 2019.
- [15] M. C. Benigni, K. Joseph, and K. M. Carley, "Online extremism and the communities that sustain it: Detecting the isis supporting community on twitter," *PloS one*, vol. 12, no. 12, p. e0181405, 2017.
- [16] F. Xiong and Y. Liu, "Opinion formation on social media: an empirical approach," *Chaos: An Interdisciplinary Journal of Nonlinear Science*, vol. 24, no. 1, 2014.
- [17] C. T. Butts, "Social network analysis: A methodological introduction," *Asian Journal of Social Psychology*, vol. 11, no. 1, pp. 13–41, 2008.
- [18] J. Berger, "The alt-right twitter census: Defining and describing the audience for alt-right content on twitter," VOX-Pol, Dublin, Ireland, Tech. Rep., 2018.
- [19] S. Zannettou, B. Bradlyn, E. De Cristofaro, H. Kwak, M. Sirivianos, G. Stringini, and J. Blackburn, "What is gab: A bastion of free speech or an alt-right echo chamber," in *WWW '18: Companion Proceedings of The Web Conference 2018*. Lyon, France: International World Wide Web Conferences Steering Committee, April 2018, pp. 1007–1014.
- [20] G. Cascavilla, "The rise of cybercrime and cyber-threat intelligence: Perspectives and challenges from law enforcement," *IEEE Security and Privacy*, no. 01, pp. 2–11, jun 5555.
- [21] Statista, "Most used social media 2021," Sep 2021. [Online]. Available: <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/>
- [22] D. M. Zhou, Y. and, D. A. Broniatowski, and W. D. Adler, "Elites and foreign actors among the alt-right: The gab social media platform," *First Monday*, vol. 24, no. 9, 2019.
- [23] Wikipedia, "Controversial reddit communities," 2021. [Online]. Available: [https://en.wikipedia.org/wiki/Controversial\\_Reddit\\_communities](https://en.wikipedia.org/wiki/Controversial_Reddit_communities)
- [24] R. Plutchik, "Chapter 1 - a general psychoevolutionary theory of emotion," in *Theories of Emotion*, R. Plutchik and H. Kellerman, Eds. Academic Press, 1980, pp. 3–33. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/B9780125587013500077>
- [25] C. T. Butts, "Social network analysis with sna," *Journal of statistical software*, vol. 24, pp. 1–51, 2008.
- [26] G. Cascavilla, "Diffusion of ideas through extreme language on alt-right social media," Oct 2024. [Online]. Available: [https://figshare.com/articles/figure/Diffusion\\_of\\_ideas\\_through\\_extreme\\_language\\_on\\_alt-right\\_social\\_media/27181110/1](https://figshare.com/articles/figure/Diffusion_of_ideas_through_extreme_language_on_alt-right_social_media/27181110/1)