Mainstream and Alternative Narratives in the Wake of Gun Shootings

Lisa Grobelscheg[1,2], Ema Kušen[3], Mark Strembeck[1,4,5]

[1]*Institute of Information Systems and New Media, Vienna University of Economics and Business, Vienna, Austria*
[2]*FH CAMPUS 02, University of Applied Sciences, Graz, Austria*
[3]*Faculty of Informatics, University of Vienna, Vienna, Austria*
[4]*Secure Business Austria (SBA), Vienna, Austria*
[5]*Complexity Science Hub (CSH), Vienna, Austria*
lisa.grobelscheg@s.wu.ac.at, ema.kusen@univie.ac.at, mark.strembeck@wu.ac.at

Abstract: In this paper, we explore narratives that emerge in the Twitter discourse during high stakes, low probability events. In particular, we analyze 7.4 million tweets related to four shooting events in the United States of America to identify differences that arise in the semantic structure and message diffusion of mainstream narratives on the one hand and alternative narratives on the other. Our findings indicate that alternative narratives introduce keyterms that have little to no connection to the respective shooting itself and that their diffusion patterns similar to those of mainstream narratives. Moreover, we found empirical evidence of alternative narratives, such as false flag accusations, that appear across different events and persist in the Twitter-sphere over an extensive period of time.

1 INTRODUCTION

If current news about a situation are in high demand, e.g. during a crisis event (Stieglitz et al., 2018), information shared via social media can have a strong impact on the users being exposed to it. It stands to reason that certain narratives emerging in the wake of a crisis event might even cause trauma or emotional pain in users engaging in public discourse (see, e.g., (Goodwin et al., 2018; Kušen and Strembeck, 2021)). In this paper, we define a narrative as a "*a set of topic-wise interconnected messages that have been sent/posted via a social media platform*" (see also (Cunliffe et al., 2004; Weick, 1995; Grobelscheg et al., 2022)).

Van Proojen and van Dijk (van Prooijen and van Dijk, 2014) indicated that two factors correlate with the probability of narratives being connected to conspiracy theories in the public discourse. Firstly, the scale of consequences caused by an event and secondly, the degree of perspective-taking with the victim group of an event. Based on these findings, we hypothesize a high potential of narratives describing conspiracy theories in social media discourse in the wake of crisis events. In this paper, we focus our work on the analysis of prevalent narratives related to gun shootings in the United States. Gun shootings affect all classes of the population in the U.S. as most attacks hit "soft targets", such as concert venues or schools (see, e.g., (Kušen and Strembeck, 2021)).

Following the intuition of (Starbird, 2017a) and (Nied et al., 2017) we built on the concept of "alternative narratives". As opposed to the notion of conspiracy theories and fake news, which inherently include false information, an alternative narrative might also convey truthful information. A distinctive feature of an alternative narrative is the contradiction of the mainstream view of an event or person (Wang et al., 2022). Building on this concept, we analyze alternative and mainstream narratives arising in social media in the wake of gun shootings in the U.S. To this end, we investigated semantic structures and hashtag associations of narratives as well as user activity. In particular, we aimed to discover differences in the narrative structure of alternative and mainstream narratives in order to find similarities in alternative narratives across multiple events.

The remainder of this paper is organized as follows. Section 2 covers related work on the construction of narratives in social media and the emergence of alternative narratives. Section 3 briefly describes the events considered in this paper and Section 4 outlines our research method and research questions. We present our results in Section 5 and discuss them in 6.

The final section 7 concludes our paper and provides an outlook for future research directions.

2 RELATED WORK

2.1 NARRATIVES IN SOCIAL MEDIA

Narratives in social media have been investigated from various perspectives. Li et al. used the narrative dimensions proposed by Fisher (Fisher, 1984) to analyse user health information adoption (Li et al., 2019). They found that information scoring high in narrative fidelity (how trustworthy a story sounds compared to the reader's own experiences) as well as narrative probability (how coherent a story appears) is more likely to be adopted by users in social media. As the credibility of information is crucial during and after crisis events, it has been the subject of numerous studies. For example, Hardy and Miller analyzed Twitter messages after a shooting at a Nightclub in Orlando, Florida in 2016 (Hardy and Miller, 2022). They found two main narrative themes among post-crisis narratives, namely unification and division. Both themes serve a different purpose. While division provokes future action, unification is a means of coping.

2.2 EMERGENCE OF ALTERNATIVE NARRATIVES IN SOCIAL MEDIA

Sometimes, the narratives in social media on the one hand and classical mass media outlets (such as newspapers, radio or TV channels) on the other diverge or even contradict each other. For example, while classical mass media outlets suggested an Islamic background to the 2011 Norway attacks, the discourse on Twitter condemned its inaccurate reporting, framing a competing narrative (Eriksson, 2016).

Alternative narratives might especially appear in the wake of a crisis event. By analyzing social media narratives in the wake of the Boston Marathon Bombing of 2013, claims of the event being a "false flag" appeared online within minutes of the blasts and kept spreading for months after the event (Nied et al., 2017). In (Starbird, 2017b), Starbird investigates the propagation of alternative narratives through a media ecosystem. Starbird defines alternative narratives as narratives offering an explanation of a man-made crisis event opposing the narrative found in classical mass media.

Another approach used Twitter data in the aftermath of the 2015 measles outbreak to create a narrative structure (Radzikowski et al., 2016). Radzikowski et al. use spatial data, important terms, as well as special types of communication (such as retweets) to identify a narrative of anti-vaxers. Additionally, they applied clustering on the hashtags used on the tweets to identify subgroups of narratives. In addition, they differentiate between "influencers" posting a message and "amplifiers" retweeting it. In (Klein et al., 2019), Klein et al. investigated social and linguistic features of users engaged in a Reddit conspiracy forum and found distinctive features in user behavior even before users post in conspiracy forums. Fong et al. (Fong et al., 2021) also analyzed user data (e.g., followers and tweets) of users in a Reddit conspiracy forum. They conducted a lexical analysis using LIWC (Tausczik and Pennebaker, 2010) and found that users proclaiming conspiracy theories include more negative emotions (e.g., anger) in their tweets. Also words related to power, death, and religion are common. Furthermore they express stronger orientation to the past and out- and in-group language ("us vs. them").

3 EVENTS OF STUDY

2017 Las Vegas shooting. On October 1, 2017, a mass shooting at the Route 91 Harvest music festival in Las Vegas, Nevada killed 60 people and wounded at least 416 others. The subsequent panic resulted in additional 451 injuries[1].

2018 San Bruno shooting. On April 3, 2018, Nasim Najafi Aghdam fired shots at the YouTube headquarters, injuring three individuals before committing suicide[2].

2018 Santa Fe school shooting. On May 18, 2018, eight students and two teachers were shot dead and 13 others wounded in a school shooting at Santa Fe high school in Santa Fe, Texas[3].

2019 El Paso shooting. On August 3, 2019, Patrick Wood Crusius fired shots at a Walmart in El Paso, Texas, killing 23 people and injuring 23 others[4].

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[1]see, e.g., https://www.reviewjournal.com/crime/shootings/las-vegas-woman-becomes-60th-victim-of-october-2017-mass-shooting-2123456/

[2]see, e.g., https://edition.cnn.com/2018/04/04/us/youtube-hq-shooting/index.html

[3]see, e.g., https://www.click2houston.com/news/local/2022/05/18/santa-fe-high-school-shooting-4-years-later-events-planned-to-mark-anniversary/

[4]see, e.g., https://www.buzzfeednews.com/article/maryanngeorgantopoulos/el-paso-shooting-white-supremacist
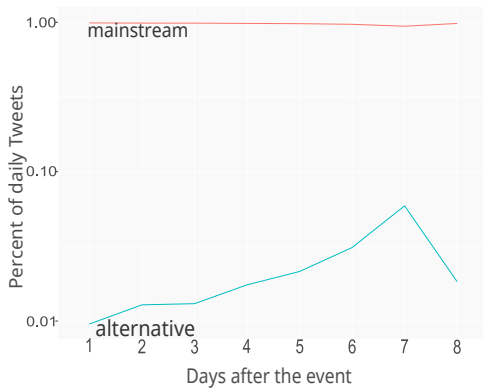
Figure 1: Proportions of daily Tweets for alternative and mainstream narratives
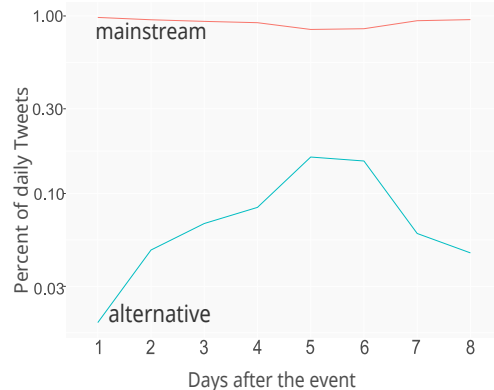for days 1 to n for each event.
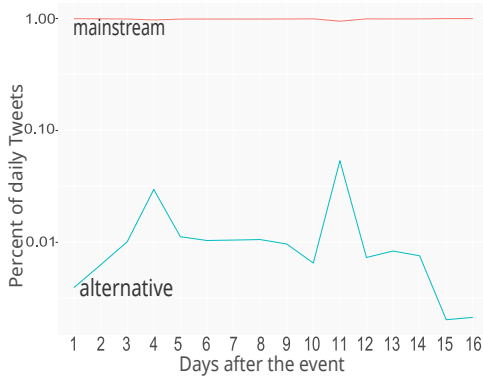
(a) Percentage of daily tweets for El Paso.
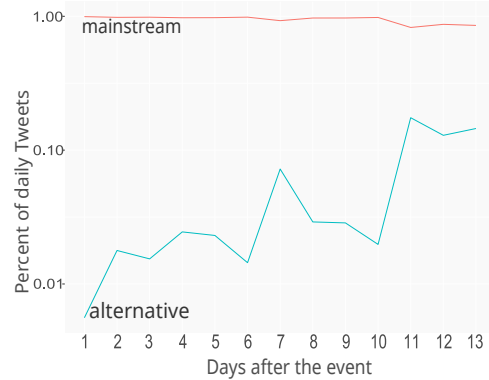
(b) Percentage of daily tweets for Las Vegas.

(c) Percentage of daily tweets for Santa Fe.

(d) Percentage of daily tweets for San Bruno.

4 RESEARCH APPROACH

Our paper is guided by the following research questions.

RQ1: What is the semantic structure of alternative narratives? After a manual labeling procedure of tweets into tweets conveying mainstream and alternative narratives (see Section 4.1), we investigated the language used in both types of narratives. We applied text mining techniques, such as part-of-speech tagging (POS) and word co-occurrence analysis to identify semantic patterns. Furthermore, we created a hashtag co-occurrence network to analyse content communities.

RQ2: How do users engage in alternative narratives across multiple events? To compare characteristics in terms of diffusion and user engagement, we analyzed retweet activity and user behavior across multiple data-sets.

-terror-attack-victims

4.1 PROCEDURE

Data collection. We used Twitter's search API to obtain tweets related to four mass shooting events in the U.S. The hashtags and keyterms used for the data respective extraction procedure, as well as the observation periods are presented in Table 1. After the removal of duplicate entries, our data collection counted over 7.4 million tweets.

Defining mainstream and alternative narratives. To identify and distinguish between mainstream and alternative narratives, we used five classical media outlets which, according to a Pew Reserach Center report (Shearer and Mitchell, 2021), are considered mainstream media by a large proportion of U.S. American citizens. This list includes: i) ABC News, ii) CNN, iii) MSNBC, iv) FoxNews and v) the Wall Street Journal.

The filtering procedure for news articles in these mainstream media outlets included the location of the shooting and a descriptive word (e.g., Santa Fe school shooting, El Paso shooting) as search terms for the

Location	Observation period	Victims		Users	Tweets	Search terms
		Dead	**Wounded**			
Las Vegas (NV)	2-14 October 2017	60	867	1,394,070	3,436,187	#lasvegasattack, #LasVegasMassShooting, #LasVegasShooter, #LasVegasStrong, #PrayforLasVegas, #PrayingForLasVegas, shooting Las Vegas, #StephenPaddock, #StephenPaddockIsATerrorist, #VegasStrong
San Bruno (CA)	4-10 April 2018	0	3	312,206	648,501	#YouTubeHQShooting, #NasimNajafiAghdam, #SanBurnoShooting, #shootingYouTube, #YouTubeHQTragedy, #youtubeShooter, #YouTubeStrong, #YouTubeShooting,
Santa Fe (TX)	18-25 May 2018	10	13	458,644	967,674	#DimitriosPagourtzis, #SantaFe, #SantaFeGunControl, #SantaFeGunControlNow, #SantaFeViolence, #SantaFeHighschool, #SantaFeStrong, #SantaFeShooting,
El Paso (TX)	3-18 August 2019	23	23	939,940	2,307,577	#ElPaso, #elpassoshooter, #ElPasoshooting, #ElPasostrong, #ElPasoterroristattack, #massshooting, #PrayersforElPaso, #PrayforElPaso, #walmartshooting, #domesticterrorism

Table 1: Basic information about data-sets.

above-mentioned online news portals. In our study, we considered articles published up to three months after a shooting event. In total, we manually inspected 130 related news articles.

This procedure resulted in eight narratives, which were subsequently categorized into three types of mainstream narratives: pro-gun narratives, anti-gun narratives, and general narratives, as summarized in Table 2. For each news article, we derived the most prevalent narrative conveyed in that very article. This implies that an article might also include messages of (for example) unity even though it is labeled as *blaming mental health issues*.

The narrative of *blaming mental health issues* especially includes mentions of wrong or insufficient treatment of mental health disorders and illnesses, as well as possible side effects of medication against it (e.g., Ritalin). In messages related to the Santa Fe gun shooting we found accusations towards ("young") people's attitude towards the value of life ("life is worth nothing"). In this light, abortion rights, video games, and porn consumption were mentioned as the main culprits for the act of shooting. Since many gun shootings are directed at "soft targets" such as schools or entertainment venues, pro-gun narratives occasion-

ally blame the security measures of these structures. Common demands include more weapons for teachers, less entry points and more security personnel. For all events, pro- and anti-gun advocates formulated accusations for the opposite side. Anti-gun narratives include demands for stricter gun laws or less power for the National Rifle Association (NRA). General narratives include appeals for hope and unity.

Narrative discovery in our collection. We build on the conclusions of (Zappavigna, 2015) who suggest that hashtags are widely used as topic-markers and possess the ability to add structural and interpersonal meaning. In our analysis, we used hashtags to distinguish between alternative narratives and mainstream media narratives. For this task, we deployed two annotators who manually examined the list of hashtags and labelled them as either "mainstream" or "alternative". The annotators were guided by the list of mainstream narratives that resulted from the news article inspection described above. For some hashtags, the annotators inspected a random sample of tweets containing the corresponding hashtags to decide on classification of that label. This procedure resulted in a substantial inter-rater agreement (Cohen Kappa 79.35%).

MAINSTREAM NARRATIVE	EVENT
Pro-gun narratives	
blaming mental health issues, medication against it (e.g. Ritalin)	Santa Fe, Las Vegas
blaming attitude towards life, abortion, porn, video games	Santa Fe
blaming vulnerability of soft targets	El Paso, Santa Fe
blaming opposing politicians, e.g. republicans blaming democrats	all events
Anti-gun narratives	
blaming current gun laws	all events
blaming influence of National Rifle Association (NRA)	Santa Fe
blaming opposing politicians, e.g. democrats blaming republicans	all events
General narratives	
stop the hate, unite as one nation	Las Vegas

Table 2: Narratives in mainstream media.

After the labels were revised and any discrepancies between the two annotators resolved, the proportion of alternative narratives in the data-set was 2.2% for the Las Vegas shooting, 4.6% for YouTube HQ shooting, 0.9% for El Paso Walmart shooting, and 0.1% for the Santa Fe school shooting.

Semantic and user analysis For our semantic analysis, we used the UDPipe R package (Straka and Straková, 2017) to carry out Part-of-Speech-Tagging (POS), word frequency, and a co-occurrence analysis. Furthermore, we created a hashtag co-occurrence network and applied the Louvain-clustering algorithm to obtain themes in the hashtags of the four events.

5 RESULTS

Semantic analysis. First, we investigated the correlation between proportional word frequencies among alternative and mainstream narrative tweets. Pearson's product-moment correlation sample estimate is between 0.2347 for Santa Fe and 0.3051 for El Paso which indicates a low correlation of word proportion between the two narrative subsets. The proportion of original messages (excluding retweets) among all messages accounts to 17.0415% for alternative and 18.4892% for mainstream messages. We then carried out a temporal analysis of alternative vs. mainstream narratives in order to identify differences in their prevalence. Figure 1 depicts the temporal (proportional) prevalence of alternative and mainstream narratives. The analysis indicated a time-lag in prevalence of alternative narratives which is intuitive as alternative narratives do not include news updates during the event. Across data-sets, we found peaks of

alternative tweets on certain days after an event. No obvious connection to real-world incidents could be identified for the peaks in alternative narratives.

As described above, we applied part-of-speech tagging to investigate structural differences. Figure 2 depicts the proportional difference in prevalence of universal part of speech categories between alternative and mainstream narrative. For example, in alternative narratives, the proportion of verbs is 1.59% higher than in mainstream narratives. Moreover, mainstream narratives include more pronouns, prepositions (such as in, to, during) and adjectives compared to alternative narratives. Interestingly, the proportion of undefined tokens "X" was higher for alternative narratives. The most frequent words in the "X" category were: qanon, falseflag, george, goodman, jason, webb, maga and wwg1wga (for our analysis, we excluded stop words such as lasvegasshooting).

To investigate the use of entities in alternative and mainstream narratives, we analyzed the top 15 nouns of each corpus and aggregated them in Figure 3. As expected, the top alternative nouns were populated by words associated with conspiracy theories, such as "wwg1wgaworldwide", which stands for "where we go 1, we go all worldwide" and is used by Qanon followers. "Fakenews", "fakenewsmedia" and "msm" (mainstream media) on the other hand accused mainstream media of spreading misinformation to support a hidden agenda. We also identified attempts to declare the event as a "falseflag" attack carried out by the government itself to cover-up for other actions towards alleged secret goals.

Mainstream word analysis included references to other shootings, labels such as "domestic terrorism" and entities directly associated with the events (e.g., "walmart", "victims" or "shootings").

Furthermore, we carried out a co-occurrence analysis for each narrative and data-set. Co-occurrences cover combinations of nouns and adjectives. Figure 4 depicts the 30 most prevalent combinations per tweet. The number of items in each Figure varies, as some terms might be included in multiple prevalent combinations (e.g., for mainstream narratives for San Bruno: gun - woman, gun - state).

When comparing word networks of alternative narratives with mainstream narratives, positive words that can be found in mainstream narratives (e.g., "prayer", "thought", "love") cannot be found in the word networks resulting from alternative narratives. Also, across all events, we found alternative narratives to be connected with conspiracy theories, such as Qanon. Prevalent word combinations were, for example, "deep state", "qanon", "george soros". Inter-
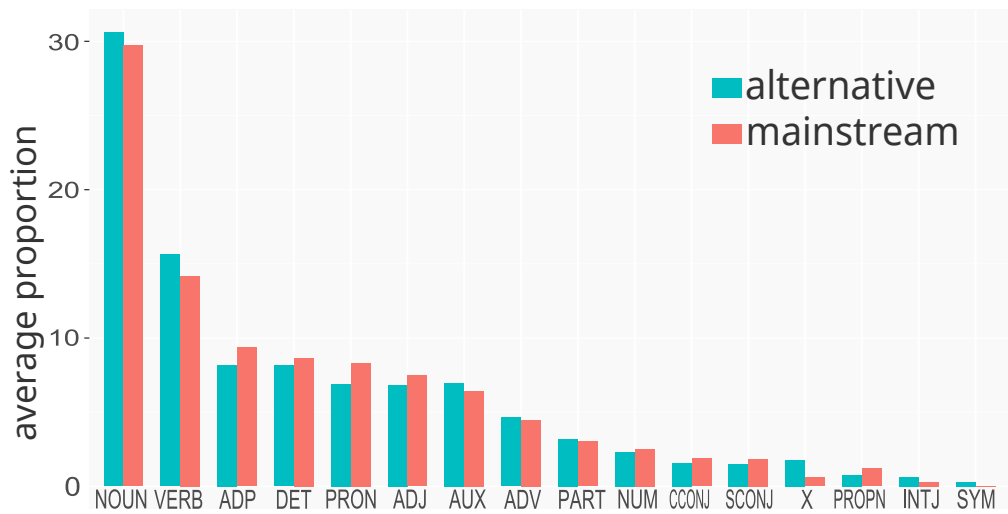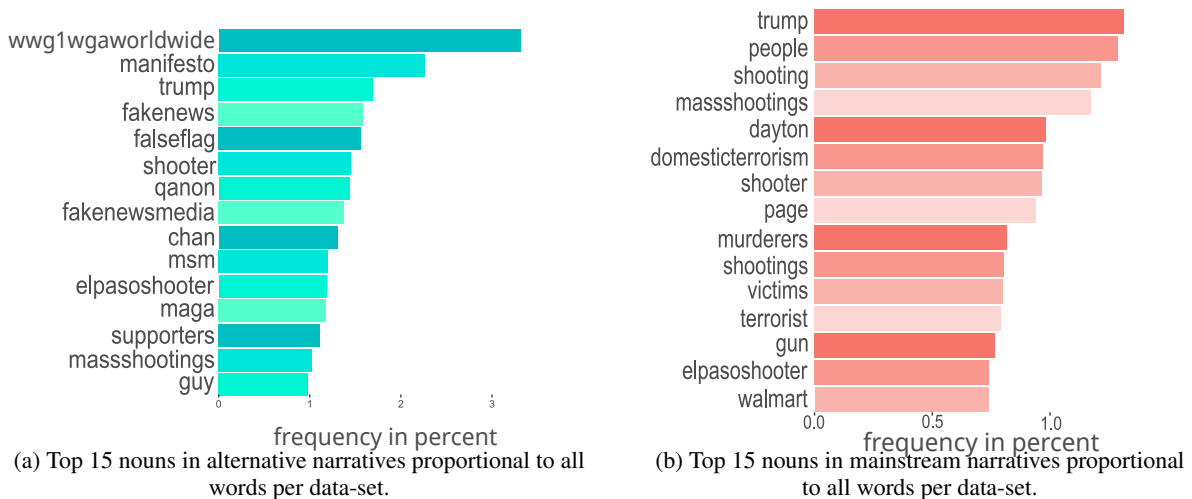
Figure 2: Difference in UPos categories between mainstream and alternative narrative.

Figure 3: Top 15 nouns for across all events.

(a) Top 15 nouns in alternative narratives proportional to all words per data-set.

(b) Top 15 nouns in mainstream narratives proportional to all words per data-set.

estingly, alternative narratives often included names of well-known individuals who were not directly connected to an event itself (e.g., George Soros, Jason Webb). This could not be observed for mainstream narratives. We often found negative references to "the" media (used for referring to mainstream media outlets) in alternative narratives. For example, "fakenewsmedia" as a central connection phrase in the El Paso data-set.

Users engaging in alternative narratives. Our user analysis was led by two main questions, namely: "Do certain users exclusively participate in the spreading of alternative messages?" and "How many of the users who are spreading alternative narratives participate in multiple events?". To compare our num-

bers, we also analyzed users spreading mainstream narratives with respect to the above stated questions.

Most users exclusively contribute to mainstream narratives (on average 97.51% of all users across all data-sets), whereas 1.57% (numbers rounded) engage in alternative narratives only, and 1.91% of all users contribute to both types of narratives. The number of messages sent per user is slightly higher for mainstream narratives (1.786 messages/user) as opposed to alternative narratives (1.317 messages/user). 2.49% of all users contributed to an alternative narrative at least once, 7.32% of these users contributed to narratives related to multiple events. For users who engaged in mainstream narratives at least once 10% contributed to narratives related to multiple events. In
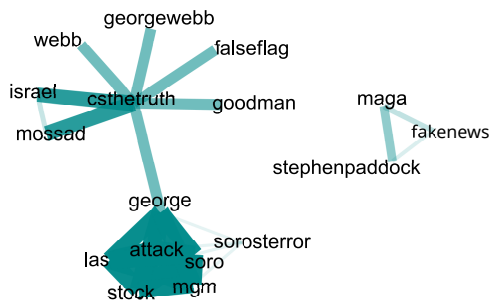
Figure 4: Word co-occurence networks for each event and narrative.
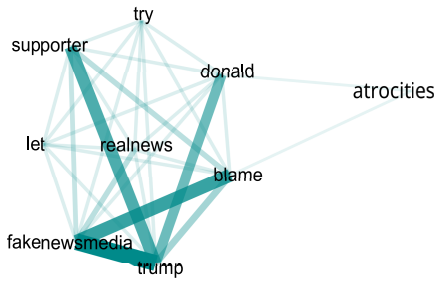
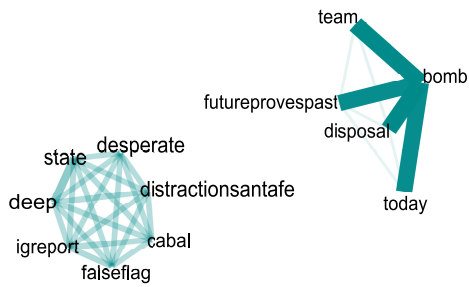(a) Word network for El Paso - alternative narratives.

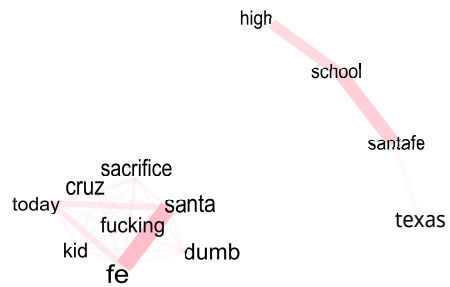(b) Word network for El Paso - mainstream narratives.

(c) Word network for Las Vegas - alternative narratives.

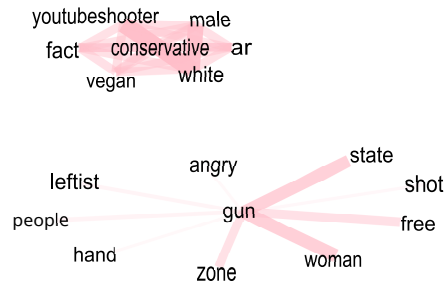(d) Word network for Las Vegas - mainstream narratives.

(e) Word network for Santa Fe - alternative narratives.

(f) Word network for Santa Fe - mainstream narratives.

(g) Word network for San Bruno - alternative narratives.

(h) Word network for San Bruno - mainstream narratives.

contrast, only 1.57% of the users who exclusively participated in the spread of alternative narratives contributed to multiple events. Therefore, we conclude no higher repeated engagement for alternative narratives as compared to mainstream narratives.

Hashtag co-occurrence networks. We created networks from hashtag co-occurrence and applied the Louvain-clustering algorithm to obtain communities, or hashtag themes. These networks include the most popular hashtags for each network[5]. For this analysis, we did not distinguish between alternative and mainstream hashtags, as our aim was to investigate if any alternative themes would arise.

Figure 5 depicts hashtag co-occurrence networks for all events. For the attack in Las Vegas, we found one hashtag theme focusing on hope and prayer (e.g., #prayingforvegas, #prayforvegas). The other two themes are connected to gun control and mixed discussions (see green theme). For El Paso, we find mainly mixed clusters, dealing with references to other attacks (Chicago, Dayton), gun control and the classification of the event as "domestic terrorism". Our analysis indicates a strong connection (see edge width in Figure 5a) between #domesticterrorism and #antifa which we traced back to various tweets either blaming or defending the Antifa movement. One hashtag theme in the El Paso only covered the debate about white supremacy and terror attacks carried out by white citizens (#whitesupremacistterrorism, #whitenationalistterrorism).

For Santa Fe, we identified one irrelevant hashtag cluster, consisting of hashtags about the royal wedding, Syria and racism. Furthermore, we found gun control themes mixed with general information (e.g., #santafestrong,#santafehighschool"). Another more defined cluster arose with #nrabloodmoney and #neveragain, mainly blaming the NRA. Interestingly, many pro-democrat tweets use hashtags usually associated with the Republican party, e.g. #maga for "make America great again" or #gop for "grand old party" but an investigation of sample tweets using those hashtags found an appeal for voting against Republicans. This practice is also known as "hashtag hijacking"(Hadgu et al., 2013).

For the shooting at the Youtube Headquarters in San Bruno we identified one hashtag theme about the female shooter (light blue cluster in Figure 5d) as well as clusters about gun control, Donald Trump, and event-specific entities. This network was the only one with an alternative hashtag among the most popular (#qanon) which was found in the same theme as #kag ("keep America great", which was used to support Donald Trump).

6 DISCUSSION

Alternative narratives use nouns with little connection to the event itself. We found alternative narratives to be defined by nouns and combinations thereof that exhibit no direct connection to the event itself (e.g., George Soros, Israel, George Webb). This also included news outlets known to spread misinformation (e.g., Crowdsource the Truth, #csthetruth, Jason Goodman). In addition, we found vocabulary from conspiracy theories, such as Qanon or False Flag[6] accusations across all data-sets. Based on these findings, alternative narrative structures can prevail over multiple events.

Alternative narrative patterns persist across events. We found alternative narratives, such as false flag accusations, across all data-sets. Additionally, we saw a strong partisan divide, which was indicated by hashtags like #maga (make america great again), or #bluewave (Democrats expecting an election win). The structural patterns of alternative narratives did not differ from mainstream narratives, though. Nevertheless, patterns reappeared across events, even in the time-span of two years between the events studied in this paper.

Alternative narratives diffuse no differently than mainstream narratives. In our user analysis, we found no obvious difference in message diffusion behavior of alternative vs. mainstream messages. On average, mainstream messages received more retweets. Such retweets often originate from a few breaking news messages. We could not identify more favourite tags for alternative tweets either.

Limitations. Our study comes with several limitations. Firstly, users might try to disturb ("troll") alternative narratives to upset other users engaging in them. Klein et al. (Klein et al., 2018) suggest between 4% - 12% of all users in a Reddit conspiracy forum just want to annoy or provoke users engaging in the respective discourse. This should be kept in mind when working with alternative narratives. Furthermore, our data-sets only cover four gun shootings in the U.S. which might be too little to draw a conclusion over time and across different events.

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[5]We took the number of appearances of a hashtag and used the 0.9995 percentile for El Paso and Las Vegas, 0.998 for Santa Fe and 0.995 for San Bruno

[6]False Flag accusations assume that an attack was planned by an official institution, usually the Government, to pursue some hidden agenda.

Figure 5: Hashtag Co-occurrence networks for each event.
Nodes in the same color belong to the same thematic cluster.

(a) Hashtag Co-occurrence network for El Paso.

(b) Hashtag Co-occurrence network for Las Vegas.

(c) Hashtag Co-occurrence network for Santa Fe.

(d) Hashtag Co-occurrence network for San Bruno.
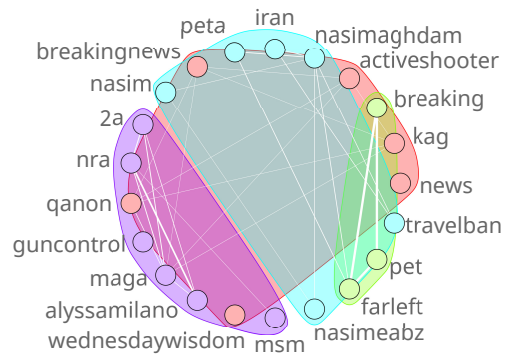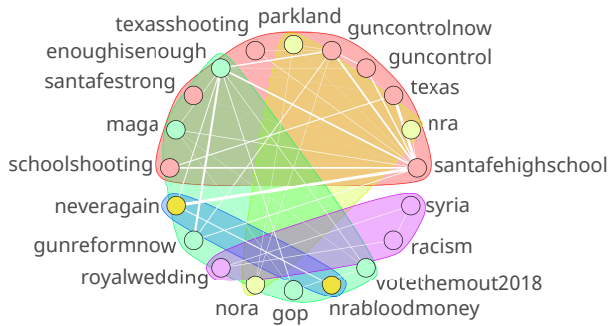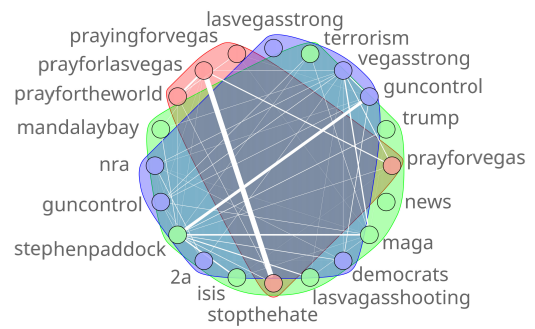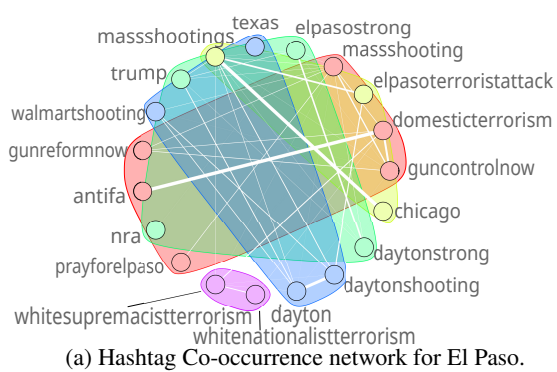
7 CONCLUSION

In our study, we analyzed tweets during and in the immediate aftermath of four gun shootings in the U.S. between 2017 and 2019. By analyzing mainstream news articles, we identified mainstream narratives which were prevalent in the wake of each event. We labeled tweets based on their hashtags either as an alternative narrative or a mainstream narrative and carried out a semantic analysis on the text of the tweet. Thereby, we found alternative narratives include much more unrelated topics without an obvious connection to the event itself, as compared to mainstream narratives. We also identified reoccurring themes connected to conspiracy theories, such as Qanon.

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