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Twitter and the Affordance: A Case Study of Participatory Roles in the #Marchforourlives Network

Miyoung Chong

Department of Journalism and Digital Communication, University of South Florida, St. Petersburg, FL 33701, USA; mc17@usf.edu

Abstract: The study empirically analyzed activism participants' roles drawn from the lens of social media affordance and identified the activism opinion leaders based on the framework of network connectivity, message diffusion, and semantic relevancy through the case of the #Marchforourlives Twitter network, which has been rebranded as X. The study defines the #Marchforourlives Twitter network as a co-created activism network in collaboration with different degrees of contributors, such as the core advocates, the advocates, the supporters, and the amplifiers. The results showed that a very small number of tweets created by the core advocates played significant roles due to their extensive adoption by other participants, while many other original tweets were never mentioned or retweeted in the network. This study disclosed the extensive proportion of amplifiers as 95.13% among the examined participants. The study findings suggest that creating core agenda tweets with high amplifiability might be critical for successful hashtag activism to attract like-minded masses as networked protesters.

Keywords: Twitter; affordance; hashtag activism; opinion leader; social network analysis; LDA

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1. Introduction

On 24 March 2018, the March for Our Lives rally in Washington D.C. and its subsequent events, which included 880 sibling protests, were held in the U.S. and globally, and recorded as the biggest anti-gun violence protest in U.S. and world history. The March for Our Lives movement was initiated in response to the Marjory Stoneman Douglas (MSD) High School mass shooting in Parkland, Florida on 14 February 2018. The event was recorded as the deadliest mass school shooting in the U.S. and yielded 34 casualties, including 17 deaths and 17 injured people. Shortly after the MSD mass shooting event, some of the surviving students founded "Never Again MSD" and organized the March for Our Lives movement to call out policymakers to take immediate and meaningful action on gun control policy [1]. On 18 February 2018, as the founders of the March for Our Lives movement, Never Again MSD members released the March for Our Lives rally in Washington D.C. on 24 March 2018 on Twitter via the @AMarch4OurLives March for Our Lives Twitter handle (Figure 1). After the MSD mass shooting and the announcement of the rally, heated public conversations generated hashtags on mass shootings, gun violence, and control on social media, such as #neveragain, #marchforourlives, and #enoughisenough. Particularly, the hashtag #marchforourlives was shared more than 3.6 million times starting from the announcement of the March for Our Lives (MFOL) movement on Twitter (see Figure 1).

Activism supported by information communication technologies (ICTs) reconstructed the way people participate in organizing sociopolitical life [2]. The development of ICTs changed the dynamics of political activism and influenced protesters' behaviors because it allowed more people to quickly organize protests and share information [3]. Claiming self-motivated sharing as the crux of connective action, Bennett and Segerberg characterized connective action as a new means of collective engagement facilitated by social media, wherein diverse actors with various objectives co-produce and co-distribute content

independently and spontaneously based on personalized statements [4]. Describing the mechanism of connective action, Bennett and Segerberg said, "The core of this logic is the recognition of digital media as organizing agents" [4]. Self-motivated individual actors voluntarily share their "internalized or personalized ideas, plans, images, and resources with networks of others", as opposed to group identities [4].

Figure 1. The March for Our Lives rally announcement posted on Twitter by @AMarch4OurLives.

This study chose Twitter as the organizing agent for the #marchforourlives hashtag movement because the movement was first announced on Twitter, which is one of the most dynamic online social media platforms for hashtag activism, such as #blacklivesmatter, #IfTheyGunnedMeDown, #womensmarch, and #metoo [5]. The #womensmarch event occurred on 21 January 2017, the day after Trump's inauguration day. Teresa Shook, a retired attorney, created the hashtag #womensmarch the day after Donald Trump was elected as the 45th U.S. President on 9 November 2016. This was to advocate for women's rights and equality while criticizing Trump's anti-women stance presented during his presidential election campaign. Despite initially starting as a Facebook event, due to the uniting power through the hashtag it quickly received extensive responses from women all over the world. It was recorded as the largest single day protest in the U.S. history [6]. In October 2017, the hashtag #metoo became viral to disclose the sexual misconduct and assaults by the media mogul, Harvey Weinstein. The initial motive of #metoo was to support victims of sexual assaults. However, the hashtag, used with personal experiences of sexual harassment or assault for both women and men, was shared in more than 12 million tweets within a day, which made it the biggest protest on social media in 2017.

Activism scholars often explore sociopolitical aspects of social media activism and the significance of connective leadership in contemporary activism [7–9]. Despite a great deal of research on social media and hashtag activism, little empirical research has been carried out into how key actors connect and inform people by disproportionately affecting communications using the techno-commercial architecture of social media platforms and there is a dearth of research on how to metrically identify protest leaders in social media activism [9–12]. Very few studies have investigated the individual actor or participant's role in the connective activism network and there is no comprehensively developed framework to determine the opinion leaders of social media activism. With these gaps in the literature in mind, this study aims to identify activism participants' roles drawn from Twitter affordance

and offer a framework to systematically determine the protest leaders based on the degree of network connectivity, message diffusion, and semantic relevancy through the case of the #Marchforourlives (#MFOL) Twitter network. This study used a mixed-method approach that mainly involved social network analysis and latent Dirichlet allocation topic modeling, and addressed the following research questions:

- RQ1: What are the participants' roles in the #MFOL Twitter network?
- RQ2: Who are the top opinion leaders in the #MFOL Twitter network?

I began by discussing the affordances of social media, followed by the descriptions of participatory roles on Twitter. Then, I provided a framework for role identification of activism participants in the Twitter network. Next, I outlined the data collection and analysis processes. Directly after, I presented my findings before discussing the implications of the study on the increasing research agenda of participatory leadership and social media affordances in sociopolitical activism.

2. Affordances of Social Media

Features of social media platforms offer the bedrock for affordances [13]. Faraj and Azad defined affordances as "action possibilities and opportunities that emerge from actors engaging with a focal technology" [14]. Leonardi classified affordances as "individual affordances, shard affordances, and collective affordances" [15]. Collective affordances best describe online activism because diverse participants together can accomplish collective affordances by using technology as a method to demand their needs and to create a cumulatively collective outcome [16]. Adopting ICTs for activism situates it at the "intersection between social context, political purpose, and technological possibility" [17]. The employed networked technologies expedite quick communications among participants and the diffusion of information to a large audience. Each user on social media can observe other users' previous actions based on information and determine whether they participate or not [18,19].

Many studies on the application of social media in the Arab uprisings mainly discussed social media as "the logistics of the protest" [20]. Cammaerts explored the communicative affordance of social media in activism, such as one-to-many, one-to-one, and many-to-many forms of communication, which leads to diverse actions for activism and activists [21]. Seminal scholarship has emerged to analyze how the relationships between various kinds of actors could be transformed [22], how different actor types or contributions may develop [23], or how extant or advanced collective processes may be facilitated [24] with the application of social media. Therefore, more studies about how social media use relates to courses of collective involvement and how social media functions as a "focal coordination mechanism" without primarily involving official institutions are welcome [13].

One direction of such scholarship could specifically examine how diverse actors of social media applications count on the features of social media platforms. Investigating the use of features in social media would help address gaps, especially in technology use on social media [25] and in information system scholarship on technology use [26,27]. Moreover, a focus on this application dependence would also contribute to excavating how individual social media users may play emerging roles within connective action networks [13]. However, few studies have analyzed the interdependency of social media users based on features of social media applications. Furthermore, little has been examined regarding each actor's participation in view of social media affordance within protest contexts.

3. Participatory Roles on Twitter: Core Advocates, Advocates, Supporters, and Amplifiers

Loader and Dutton depicted connective action as new ways of collective engagement based on "loose networks facilitated through technology platforms and applications" [28]. Connective action scholars claim that diverse users on social media may primarily carry out independent roles in connective action [4,29,30]. Building further upon their insight,

Vaast et al. recognized three types of roles on Twitter, labeled as "advocates", "supporters", and "amplifiers" [13]. Two studies have investigated these roles on Twitter so far. Vaast and her colleagues examined a total of 1882 tweets from three activism Twitter networks (#stopthedrill, #boycottBP, and #hairandfur), adopting the concept of connective action episodes [13]. Ansari and her colleagues analyzed 2324 tweet relationships from 123 activists in India from January 2011 to January 2018 [31]. Both studies investigated a small number of tweets to examine multiple Twitter activism networks and focused on episodic descriptions in role identification. Due to a scarcity of research on actors' interdependent roles based on the features of social media, the characterization of those roles needs to be further empirically tuned. This study investigated the composition and characteristics of the roles in the #MFOL Twitter network. In particular, by adding the role of core advocates to the framework of Vaast et al. [13], this study examined the #MFOL Twitter network by considering them the opinion leaders at the core of the leadership in the network. Core advocates produce tweets that include goal-oriented and essential messages to encourage and move forward activism, while advocates' tweets can be about anything as an activism participant. Tweets posted by core advocates are shared the most, while advocates' tweets could be distributed just a few times in the network or not at all. The tweets posted by core advocates can be called agenda tweets because they often include action items and directions to guide participants in the activism.

Table 1 illustrates an overview of the roles of participants based on Twitter affordance. Explaining reciprocal interdependence among the core advocates, advocates, supporters, and amplifiers, Vaast et al. [13] described that "Advocates initiate, guide, and rekindle the connective action; supporters qualify the connective action; amplifiers scale the connective action by further circulating others' content and sustaining the momentum" (p. 1192). Advocates are the ones who create original content in the Twitter network, such as posting or tweeting original textual content while frequently including images, videos, or hyperlinks in a tweet. The advocates can lead the discussions and provide distributable content in the Twitter network. Supporters are the ones who primarily support the advocates and generally follow the posts of the advocates. On Twitter, supporters extensively use the tagging feature, called "mention" on Twitter, which allows users to tag other users in the posted content. Posted content by supporters can attract the tagged users' attentions and may encourage those users to respond to the content. Supporters are less intensively engaged in the Twitter network than advocates and are restricted with less features on Twitter. Amplifiers are the ones who "scale up and maintain over time the momentum of the connective action" [13]. The most distinctive difference between amplifiers and the two other roles is that amplifiers never create their own content; thus, their contribution in terms of shared content in the Twitter network is null. However, amplifiers "help in accelerating the activism and providing it the momentum" [31].

In the context of the Egyptian revolution against Hosni Mubarak and his regime in January 2011, social media was the principal communication and information-sharing medium for the protest. Scholars discovered that the protest leaders extensively communicated via social media during the Arab Spring protests [9,32]. Kiss and Rosa-García asserted that the flow of information played a key role in efficient mobilization because more access to information leads to a greater probability of a successful protest [19]. However, no studies have examined protest leadership from the perspective of the participatory roles established by the affordances of social media. To fill this gap in the literature regarding protest leaders in online activism, this study describes core advocates as protest leaders who create the essential content for the activism and guide other users with high levels of interest. Both core advocates and advocates share the technological features of Twitter by creating original content tweets, but the core advocates play centripetal roles in the activism network and are supported by advocates, supporters, and amplifiers in a focused manner. Table 1 illustrates the four roles of activism participants on Twitter, which was updated based on a study of "enacted roles in investigated connective active episodes" [13]. By adding in the role of core advocates, I modified Vaast and her colleagues' role classification

in accordance with the research objectives of the study. As the most influential participants, the core advocates should be well connected with other network participants. Their tweets should be shared exhaustively, and their tweet messages should be aligned with the aim of the activism network participants. To define the core advocates of the #MFOL Twitter network, this study applied a framework of network connectivity, message diffusion, and semantic relevancy.

Table 1. Roles taken by activism participants on Twitter.

Roles	Core Advocates	Advocates	Supporters	Amplifiers
Definition	Act as key initiator, produce agenda tweets largely shared, and guide other online users to participate.	Act as initiators and guide other online users to participate. Heavy users of social media features.	Support advocates in sustainingthe activism.	Help accelerate the activism and provide it withmomentum.
Characteristic	Extremely high level of interest and access to resources.	High level of interest and access to resources.	High level of interest and moderate access to resources.	Moderate level of interest and low access to resources.
Types of tweets	Agenda tweets	Original tweets	Replies tomentions in mentions and mentions in retweets	Retweets

4. Data Collection

I retrieved Twitter data through the application programming interface (API) using the import function on NodeXL [33]. Although Twitter is one of the major data providers for social media researchers and journalists, it is ephemeral and the company did not provide a clear policy for removing data at the time of the data search. The NodeXL Pro version could retrieve around 18,000 tweets among the most recent Twitter feeds at the time of data collection. Applying the hashtag "#MarchforOurLives", I collected tweets, including original tweets, replies, mentions, and retweets from 18 February to 10 April 2018. I implemented 13 data collection activities and acquired a total of 200,939 tweets that included the hashtag #MarchforOurLives. The original datasets were scrubbed and organized in time order. Removing 24,327 duplicates from a total of 200,939 tweet relationships, I acquired a total of 176,612 edges. The cleaned tweets were compiled into a single dataset ready for analysis.

5. Data Analysis

To establish the different levels of contributions from the participants in the #MFOL Twitter network and analyze each participant's role in the #MFOL Twitter network, entire tweet relationships were parsed to group the advocates, the supporters, and the amplifiers. Tweets, mentions, and retweets were sorted out to identify the advocates, the supporters, and the amplifiers. The original tweets were categorized as advocates, and the mentioned relationships were classified as supporters. Tweet relationships such as replies to, mentions in mentions, and mentions in retweets were also categorized as supporters, who were making efforts by intentionally adding other Twitter users to call attention to the particular tweet content instead of merely retweeting them. Lastly, the pure retweet relationships were classified as amplifiers.

I employed social network analysis (SNA) to examine network connectivity and message diffusion and performed latent Dirichlet allocation (LDA) topic modeling to examine relevancy to determine the core advocates in the #MFOL Twitter network. Traditional

social theory and data analytics often exclude social context when depicting a social actor as an independent agent. On the contrary, SNA illustrates the connections between actors within the social context while focusing on individual characteristics to comprehensively understand a social event [34]. Computational SNA can discover influencers and visualize connections between actors based on centrality metrics and structural features of the network. In SNA, "density" describes the interconnectedness among vertices. "Centrality" means the level of centeredness of a specific vertex and illustrates how and to what extent a network is centralized. For instance, "degree centrality" describes how many connections a vertex has. A centralized network features a small number of major actors with a high degree of centrality carrying many edges in a network [33]. In a social network, a vertex with high centrality can influence the actions and perspectives of other participants by controlling information flow [35]. Particularly, "betweenness centrality", a measure of how often a given vertex lies on the shortest path between two other vertices, presents the linkage centrality of a vertex among clusters by bridging gaps within the network [33]. Granovetter claimed that via weak ties, people can access important information that triggers an action or a change expanding their information fields [36]. Furthermore, weak ties can be a crucial bridge between dense groups while prompting information-sharing between various groups in the network. Vertices with high betweenness centrality convey a great deal of social (information) traffic, and they are often regarded as the most critical actors who facilitate conversations and diminish information discrepancies in the network [37]. Thus, the high betweenness centrality vertices are classified as "top influencers" instead of vertices simply holding numerous followers [38].

The premise of LDA is that the creator of the document produces textual content based on a generative model, according to which, given the document, a topic is chosen from a matching dependent multinomial distribution of topics. Then, given the topic, words are chosen from the multinomial distribution of terms that are associated with that topic [39]. In LDA, "topics" are probability distributions and associations applied to all terms in the dictionary [40]. For instance, the topic "mass shooting" could be associated with terms such as "shooting", "gun", "school", etc., with high probability; terms such as "control", "background check", "violence", etc., with lower probability, and the probability of the rest of the terms in the dictionary—which could generally comprise hundreds of terms—would be almost 0. The specifications of the multinomial (Dirichlet) distributions of documents across topics and topics across terms are intransigent; thus, Markov chain Monte Carlo simulations are applied due to this estimation problem. LDA topic modeling utilizes clues from the context because LDA models associate words with relevant meanings and isolate the applications of words which have multiple meanings [41]. After LDA topic modeling was conducted, the extracted topics were labeled to provide an emphasis on the human interpretability of the topics. One of the main principles of the LDA algorithm in extracting keywords from the document is salience and discriminative power; thus, topic modeling is an appropriate method to identify agendas [42,43]. The LDA topic modeling performance was evaluated by document classification. The accurate classification yields the highest probability topic on the topic that the topic modeling was assigned to.

Primarily focusing on betweenness centrality, I applied centrality metrics to discover the actors with the highest network connectivity and message diffusion in the #MFOL Twitter network. In addition, the entire retweeted counts of the top advocates' tweets were analyzed to investigate message diffusion. Latent Dirichlet allocation (LDA) topic modeling was conducted for the advocates' tweets to examine the semantic relevancy of the core advocates' tweets. In a nutshell, this study implemented a three-step procedure to determine the core advocates in the #MFOL Twitter network:

1. The degree of network connectivity was measured by SNA based on the SNA centrality measures centering on betweenness centrality;
2. The level of message diffusion was examined by ranking the advocates' retweet counts;
3. The semantic relevancy of the top actors was measured with LDA topic modeling;

4. Based on the results of 1, 2, and 3, the core advocates of the #MFOL Twitter network were determined.

6. Results

Table 2 presents the proportion of the original tweets, the mention tweets, and the retweeted tweets in the #MFOL Twitter network. The total number of original tweets that created the content in the #MFOL Twitter network was 15,840, which accounted for 0.44% of the entire tweets in the network. The number of mentioned tweets, including replies to, mention in mentions, and mention in a retweet, was 160,770, which comprised 4.43% of the entire number of tweets. Through the mentioned tweets, the messages and content of the original tweets were distributed to other actors by tagging the Twitter handle with the @ symbol. The assessed retweets that amplified the original and mentioned tweets totalled 3,452,456, which accounted for 95.13% of the network. The #MFOL Twitter network consisted of the roles of 15,840 advocates, 160,770 supporters, and 3,452,456 amplifiers, which accounted for 0.44%, 4.43%, and 95.13% of the #MFOL Twitter network, respectively.

Table 2. The proportion of tweets in the #MFOL Twitter network.

Types of Tweets	Count	Proportion (%)	
Original tweet	15,840	0.44%	
Mention Replies to (4243), mention in retweet (140,994), mention in mentions (15,533)	160,770	0.12%	4.43%
		0.43%	
		3.88%	
Retweet	3,452,456	95.13%	
Total	3,629,066	100%	

Next, prioritizing betweenness centrality (BC), this study used degree centrality, eigenvector centrality, and page rank score to determine the top influencers in the #MFOL network. Table 3 presents the top 20 BC participants, and also includes degree centrality, eigenvector centrality, page rank score, and the number of followers of the top 20 BC vertices (Twitter handles). While degree centrality is simply the number of edges incident to a vertex, a vertex with a high eigenvector score is connected to vertices with a high degree of centrality vertices [44]. Created by Larry Page, who is one of the founders of the company Google, the PageRank algorithm is designed to classify popular webpages based on the premise that more important website pages gain more visits than other website pages [45].

The vertex @cameron_kasky displayed the highest BC of 970777881.363, with a large gap between the second highest BC @davidhogg111 with 542322197.458. This suggested that @cameron_kasky was the greatest connector and gap filler by linking groups in the network. It was Cameron Kasky's idea to co-found Never Again MSD with his surviving friends directly after the MSD school shooting (Witt, 19 February 2018). In addition, @cameron_kasky demonstrated the largest degree centrality at 11,657, and his Twitter website page indicated not only the largest eigenvector centrality but also the highest page rank score. Including David Hogg (@davidhogg111) and Emma González (@emma4change), multiple co-founders of the MFOL movement, Lauren Hoggs (@lauren_hoggs), Jaclyn Corin (@jaclyncorin), and Matt Deitsch (@mattxred) were discovered as high BC vertices. The Twitter handle of the March for Our Lives website (marchforourlives.com/ accessed on 18 May 2018 @AMarch4OurLives) was ranked third, and multiple non-profit gun control advocate organizations were also ranked with high BC, such as @everytown (Everytown for Gun Safety) and @momsdemand (Moms Demand Action).

Table 3. The top 20 participants prioritized by betweenness centrality.

Rank	Vertices (Twitter Handle)	Betweenness Centrality	Degree Centrality	Eigenvector Centrality	PageRank Score	Number of Followers on Twitter
1	@cameron_kasky	970777881.363	11,657	0.006	3442.978	406,500
2	@davidhogg111	542322197.458	6358	0.002	1670.171	1 million
3	@amarch4ourlives	521423927.104	4999	0.001	1241.191	461,800
4	@lin_manuel	376290342.162	6151	0.001	1524.935	3.1 million
5	@simonhedlin	320929063.287	4572	0.000	1609.149	29,600
6	@nra	255517273.319	2651	0.000	561.324	829,400
7	@spryguy	254955355.635	3591	0.000	1223.360	15,700
8	@emma4change	239138704.312	2390	0.001	515.423	1.5 million
9	@nadegegreen	223952709.336	2937	0.000	1073.472	10,400
10	@sayshummingbird	127642348.147	1850	0.000	520.712	256,600
11	@lauren_hoggs	127239803.145	2758	0.000	512.455	79,200
12	@realdonaldtrump	103892970.278	1109	0.000	227.571	82 million
13	@michaelskolnik	92157049.273	1164	0.000	380.376	289,400
14	@disavowtrump16	91816227.960	1289	0.000	458.436	30,400
15	@bensplatt	89984784.562	3176	0.001	638.053	585,300
16	@jaclyncorin	87893154.155	1743	0.001	395.660	182,000
17	@mattxred	78762159.438	1234	0.000	302.846	68,500
18	@kimkardashian	76077713.148	1215	0.000	358.721	65.5 million
19	@ingrahamangle	73743824.737	2740	0.000	503.523	3.4 million
20	@jackj	59780704.813	732	0.000	322.051	5.8 million

Several celebrities, public figures, and social activists, such as @lin_manuel (the producer of the "Hamilton" musical), @simonhedlin (a researcher and journalist), @spryguy (a progressive activist), @nadegegreen (a writer and storyteller), @sayshummingbird (a leading member of #TheResistance against Trump), @realdonaldtrump (the 45th President of the U.S.), @michaelskolnik (a social justice movement leader), @disavowtrump16 (a progressive activist), @bensplatt (an actor and singer), @kimkardashian (an actress and model), @jackj (pop duo), and @khloekardashian (a model) were revealed as influential actors. With the exception of @realdonaldtrump, the top influencers identified disclosed absolute solidarity with the March for Our Lives movement.

The SNA analysis shows the largest and most significant BC gap between @nadegegreen (223952709.336) and @sayshummingbird (127642348.147) of 96310361.189. To define the actors with high diffusion, I analyzed the top nine BC vertices by examining retweets and their proportion in the network (Table 4). The tweets posted by @cameron_kasky, @davidhogg111, @emma4change, and @AMarch4OurLives were far more extensively retweeted (shared) compared to the tweets posted by the other top nine influencers. The retweet count of Cameron Kasky was 228,309, which accounted for 42.84% of the retweet count among the top nine influencers. The retweet count of these top nine influencers accounted for 15.43% of the entire retweets in the #MFOL Twitter network.

Table 4. The retweeted count and the proportion of retweets of the top nine BC participants.

Rank	The Top Nine Influencers	The Original Tweet Count	Retweeted Count	Proportion of Retweets Among the Top Nine Influencers (%)	Proportion of Retweets Among the Entire Network (%)
1	@cameron_kasky	66	228,309	42.84%	6.61%
2	@davidhogg111	8	37,384	7.01%	1.08%
3	@amarch4ourlives	36	106,318	19.95%	3.08%
4	@lin_manuel	5	9790	1.84%	0.28%
5	@simonhedlin	2	14,958	2.8%	0.43%
6	@nra	1	318	0.06%	0.01%
7	@spryguy	3	5124	0.96%	0.15%
8	@emma4change	9	123,531	23.18%	3.58%
9	@nadegegreen	2	7229	1.36%	0.21%
Total		135	532,961	100%	15.43%

The 54 original tweets posted by Cameron Kasky, Emma Gonzalez, David Hogg, and the March for Our Lives were included in the top three hundred retweeted tweets. In particular, Cameron Kasky's tweets were the most frequently retweeted by including his 32 tweets in the same list. Cameron Kasky, Emma Gonzalez, David Hogg, and the March for Our Lives had 54 tweets within the top three hundred most retweeted tweets in the network. Particularly, as previously analyzed, Cameron Kasky's tweets were the most extensively retweeted, including 32 of his tweets which were within the top 300 most retweeted tweets in the network.

Lastly, to identify the actors with high relevancy in the #MFOL Twitter network, this study qualitatively examined the original tweets posted by the top nine BC vertices. Taking up 92.98% of the entire number of tweets posted by the top nine influencers, @cameron_kasky, @davidhogg111, @emma4change, and @AMarch4OurLives created the largest number of original tweets. The textual messages posted by these four vertices share themes with the co-founders of the MFOL movement. For example, the most frequently shared words in tweets posted by the co-founders of the MFOL included #marchforourlives (119), #neveragain (55), march (15), gun (13), violence (9), people (9), vote (7), and change (7). The LDA topic modeling results of majorly shared themes from the original tweets created by @cameron_kasky, @davidhogg111, @emma4change, and @AMarch4OurLives are presented in Table 5.

Based on the level of network connectivity, message diffusion, and semantic relevancy among the advocates, @cameron_kasky, @davidhogg111, @emma4change, and @AMarch4OurLives were indicated as the core advocates of the #MFOL Twitter network. These core advocates created the most shared and vital content, which can be described as agenda tweets, and their original tweets were shared more extensively via mentions and retweet activities than any other top influencers' tweets in the network. Table 6 presents the composition of the participants' roles of the #MFOL Twitter network. The amplifiers comprised the majority of the tweets (95.13%). The core advocates, the advocates, and the supporters consisted of 0.03%, 0.44%, and 4.43%, respectively.

Table 5. LDA topic modeling results of the top four vertices.

Topic	Terms	Label	Example Tweets
1	0.158*"world" + 0.135*"know" + 0.083*"march" + 0.083*"time" + 0.083*"begin" + 0.083*"right" + 0.008*"need" + 0.008*"neveragain" + 0.008*"country" + 0.008*"violence"	The marches around the world	Shoutout to the over 800 sibling marches across the country and around the world!
2	0.157*"neveragain" + 0.081*"march" + 0.081*"live" + 0.081*"movement" + 0.081*"begin" + 0.081*"fight" + 0.081*"change" + 0.007*"country" + 0.007*"https" + 0.007*"stand"	Fight for our lives	The march is not the climax of this movement, it is the beginning.
3	0.146*"march" + 0.077*"excite" + 0.077*"Saturday" + 0.064*"violence" + 0.064*"thank" + 0.064*"history" + 0.055*"bring" + 0.033*"country" + 0.033*"ameron" + 0.033*"communities"	Make history	We're so excited to see Lyft's support of #MarchForOurLives! Thanks for marching with us.
4	0.137*"bullets" + 0.118*"https" + 0.072*"time" + 0.072*"shoot" + 0.072*"come" + 0.072*"work" + 0.072*"minutes" + 0.072*"stand" + 0.007*"march" + 0.007*"neveragain"	Unity/stand together	Bullets do not discriminate so why should we?
5	0.121*"thank" + 0.104*"country" + 0.064*"excite" + 0.064*"change" + 0.064*"stand" + 0.064*"word" + 0.064*"future" + 0.064*"world" + 0.064*"ameron" + 0.064*"violence"	Change/we are the change.	I'm so excited for the future of this country. Thank you all. The world is about to change for the better.
6	0.098*"march" + 0.098*"register" + 0.098*"vote" + 0.066*"join" + 0.066*"students" + 0.066*"proud" + 0.035*"sure" + 0.035*"know" + 0.035*"announce" + 0.035*"school"	Vote	Register Educate Vote. That's what it will take to create real change. Add your name to be a part of what's next.
7	0.094*"need" + 0.071*"live" + 0.071*"violence" + 0.071*"people" + 0.037*"streets" + 0.037*"mass" + 0.037*"ameron" + 0.037*"demand" + 0.037*"communities" + 0.037*"come"	End gun violence	Watch LIVE as we #MarchforOur Lives in the streets of Washington DC to demand that we end gun violence and mass shooting.
8	0.078*"world" + 0.078*"sign" + 0.078*"march" + 0.053*"proud" + 0.053*"stand" + 0.028*"change" + 0.028*"transportation" + 0.028*"money" + 0.028*"Saturday" + 0.028*"life"	Prepare the march	Seeing people all over the world prepare their signs for the marches, setting up their transportation.
9	0.078*"march" + 0.068*"tomorrow" + 0.068*"people" + 0.068*"vote" + 0.068*"ameron" + 0.036*"country" + 0.036*"forget" + 0.036*"demand" + 0.036*"shoot" + 0.036*"streets"	Demand gun control	Tomorrow we will take to the streets of Washington DC and all across the country to end mass shootings and demand gun control. March with us.
10	0.018*"march" + 0.018*"neveragain" + 0.018*"violence" + 0.018*"change" + 0.018*"country" + 0.018*"people" + 0.018*"stand" + 0.018*"bullets" + 0.018*"need" + 0.018*"bring"	American problem	Gun violence is more than a Chicago problem, or a Parkland problem. It is an AMERICAN problem.

Table 6. The composition of the core advocates, the advocates, the supporters, and the amplifiers in the #MFOL Twitter network.

Roles	**Core Advocates**	**Advocates**	**Supporters**	**Amplifiers**	**Total**
Types of tweets	Agenda tweets	Original tweets	Mention tweets	Retweets	
Number of tweets	119	15,840	160,770	3,452,456	3,629,066
Proportion (%)	0.03%	0.44%	4.43%	95.13%	100%
Example tweets	I have absolutely no words. . . Thank you not only for your service but for standing with us as we #MarchForOurLives tomorrow all over the world #VeteransForGunReform #GunControlNow #NeverAgain. (@emma4change) Everybody please tweet #MarchForOurLives. We're trending. Need people to want to look us up. (@Cameron_Kasky) Watch LIVE as we #MarchForOurLives in the streets of Washington, DC to demand that we end gun violence and mass shootings in our schools and communities today. (@amarch4ourlives) Sign up and spread the word! Every name matters. #MarchForOurLives. (@amarch4ourlives)	#MarchForOurLives Time to take action on gun control! Our children have to worry about their safety in the classroom. This is unacceptable. Change is needed now, enough is enough!! We need to do what it takes to keep this movement going strong. #IWillMarch for common sense gun laws so nobody has to be afraid of being shot in their safe space. #MarchForOurLives #NeverAgain RETWEET to show SUPPORT for these courageous students sitting-in on Mitch McConnell's office DEMANDING #GunReformNow. HAPPENING LIVE RIGHT NOW. ✊✊✊ #StudentsSitIn #BoycottNRA We are here to call out every single politician. . .they know that if there is no assault weapons ban passed then we will vote them out. End gun violence. No more silence. Survivors. Students. Activists.	Replying to @callmeX and @emma4change Oh Emma, the strength in all of your voices have inspired so many. This moved me to tears. Thank you, and I will be marching with you in spirit in Australia. Replying to @callmeX and @emma4change As a veteran, I stand with you and support the ban on the AR15. Thank you Emma and all the students who are leading this fight. @Emma4Change @cameron_kasky @Akfeather907 @al3xw1nd @delaneytarr @davidhogg111 Please share by RT so that people know that we want to share their experiences and keep the movement going by telling their stories.	RT @cameron_kasky: I've said it before and I'll say it again. The NRA isn't trying to protect your constitutional rights. RT AMarch4OurLives: Watch LIVE as we #MarchForOurLives in the streets of Washington, DC to demand that we end gun violence and mass shooting RT @cameron_kasky: I've said it before and I'll say it again. The NRA isn't trying to protect your constitutional rights.	

7. Discussions and Conclusions

The #MFOL Twitter network is a co-created activism network with different levels of contributions. The network was initiated by the core advocates, guided by the advocates (146 times greater than the core advocates), encouraged by the supporters (1477 times greater than the core advocates), and multiplied by the amplifiers (31,710 times greater than the core advocates). Stratified by the level of contributions depending on Twitter affordance, individually, the core advocates as the opinion leaders contributed the most by creating agenda tweets. Although the tweets made by the core advocates accounted for only 0.03%, they are the ones who initiated the #MFOL Twitter network, and without their tweets, no other advocates, supporters, or amplifiers could exist. On the contrary, the largest mass participated as amplifiers (95.13%), which illustrates the pivotal function of retweeting on Twitter in the context of hashtag activism.

The Never Again MSD student leaders frequently appeared on nationwide news and other media outlets to share their ideas and the agenda of the MFOL movement with the public and demand actions from politicians. Among them, Cameron Kasky, Emma Gonzalez, and David Hogg were identified as the core advocates of the network. Quickly gaining numerous followers on Twitter, including @davidhogg111 (1 million) and @emma4change (1.5 million), the Never Again MSD student leaders became "the networked microcelebrity activist(s)" [46]. @AMarch4OurLives was identified as one of the core advocates, which implies that the ideas and information posted on the official Twitter account of the MFOL website were widely shared and distributed to organize the MFOL movement and guide the network participants. The four core advocates played the significant roles in connecting the #MFOL Twitter network participants, and their messages, shown in Table 5, were highly welcomed and inspiring as shown through retweets and mentions.

Previous studies have labeled the top social media actors as "connective leaders" who connect activists and information [7]. However, those key actors were examined in the context of social media activism under authoritarian regimes [7,9,46,47]. The leading actors had no desire to be recognized while communicating with other network participants and no official social media activism account was created due to the extreme level of surveillance and oppression of the network participants. The #MFOL Twitter activism is a connective action network with a collective identity. The "collective narrative" could be built via protest agendas posted on the Twitter account of the official activism organization (www.marchforourlives.com, accessed on 8 May 2018). In addition, affective and emotional connectivity within the #MFOL protest communication could build a collective identity as "communication-based social capital" [2]. Thus, by differentiating from the connective leaders who led social media activism under a dictatorship without having an official protest organization, I argue that the prominent actors of the #MFOL network are connective collective leaders.

Although the main agenda of the network supported the MFOL movement and encouraged others to participate in the MFOL protests while demanding gun control legislation, counter agendas were also presented. Multiple tweets claimed the Second Amendment justifies gun rights and condemned the MFOL movement. For example, a tweet said, "Sorry kids, I call BS on #MarchForOurLives. You are being used as political puppets. Trump is fighting for your country, your constitution. You are going for a walk. With a banner. Be better than this" and the counter agenda tweets included hashtags such as "#2A, #NRA, #IAmTheNRA, #StandAndFight, #2ADefenders, #DontTreadOnMe, #MolonLabe, #MarchForOurLives, #IStandWithTheNRA, and #MarchForOurRights". Multiple tweets were particularly humiliating and demonizing to the core advocates. For example, a tweet said, "Boss Hogg and His Ingraham Angle—American Thinker—Parkland bully puts Laura Ingraham in his crosshairs #DavidHogg #IStandWithLauraIngraham #MarchForOurLives #Parkland #ParklandShooting", and another tweet said, "Fake Tears Emma. A very poor actress. #FBIasset 24 yr old FAUX high school student, college grad. Crisis Actor". As shown in Figure 2, there were counter-protests along with the MFOL protests on 24 March

2018 [48]. The examination of the counter agendas could provide a more comprehensive understanding of the #MFOL Twitter network.

Figure 2. A tweet in support of gun rights.

Another significant finding was the large contributions of amplifiers. In particular, the messages posted by the core advocates were enormously distributed by amplifiers. For instance, as shown in Table 4, the retweet proportion of core advocates (@cameron_kasky, @davidhogg111, @amarch4ourlives, and @emma4change) accounted for 14.35% of the entire retweet counts in the #MFOL Twitter network. The number of amplifiers' roles (retweets) was 31,710 times greater than the number of the core advocates' roles (tweets). These findings could implicate that a large number of amplifiers, sharing and distributing the core advocates' messages and content, are necessary for successful social media activism.

The tweets shared the core ideas of the agenda tweets and were dispersed by numerous people in the world. The core advocates, Cameron Kasky (6.61%), Emma Gonzalez (3.58%), the March for Our Lives (3.08%), and David Hogg (1.08%), were the most frequently retweeted participants in the #MFOL Twitter network. As shown in Tables 3 and 4, the contributions of top influencers to structuring and sustaining the network were substantial. That small number of core agenda tweets played a considerable role in building up the #MFOL Twitter network, while many other originally posted tweets were never mentioned or retweeted in the network. From the perspective of successful social media activism, creating core agenda tweets that have the potential for maximum amplification might be critical to attracting participants to the movement. Journalists may need to pay careful attention to those extensively retweeted posts or their authors on Twitter to gather ideas about the direction of their reporting.

This study investigated participants' roles in the #MFOL Twitter network and disclosed the extensive proportion of the amplifiers as 95.13% in the examined network.

Each Twitter network has its own characteristics depending on the participants, shared topics and resources, cultural elements, and many other factors. Table 7 displays the findings of Vaast and her colleagues' study regarding Twitter applications during the BP oil spill incident [13]. The current study displayed consistent findings with the cases of Vaast and her colleagues' study with high similarity in proportional ratios among the three actors. For example, "advocates" comprised of the smallest number of participants, while "supporters" occupied a larger part than "advocates". The "amplifiers" took up the dominant portion of the participants, significantly outnumbering "advocates" and "supporters" in all cases. However, despite the prevailing number of amplifiers for both the #BoycottBP and #Stopthedrill networks, the percentage of retweets was comparatively lower compared to the current study (95.13%). Identifying participants' roles on social media is an emerging area of research. Furthermore, cases related to those research topics should be investigated to increase their generalizability power.

Table 7. The roles of tweeters during the Gulf of Mexico oil spill [13].

	Roles	Tweets	Tweeters	% of Tweeters
#BoycottBP	Advocates	196	38	6%
	Supporters	99	79	13%
	Amplifiers	604	485	81%
#Stopthedrill	Advocates	184	22	4%
	Supporters	105	94	19%
	Amplifiers	402	384	77%

The findings of the #MFOL Twitter network analysis suggest that the strategic use of Twitter and the large social media presence of the protest leadership might be crucial factors for the success of protests on the streets and online. The easy and maximized application of the Twitter platform by the Never Again MSD student leaders enabled them to set the agendas of the MFOL movement effectively and strategically, while helping them swiftly reach the critical mass needed for the success of the MFOL protest. Furthermore, the like-minded public across nations and the globe could take united action through many-to-many and one-to-many interactive communications via social media. The #MFOL Twitter network demonstrated the next level of social media and hashtag activism, addressing the connective collective leaders as well as the public's agenda-setting capability using social media affordance.

The results must be translated in the light of the study's limitations. Each Twitter network has its own characteristics depending on the participants, shared topics and resources, cultural elements, and many other factors. In particular, the psychosocial aspects of participation should be further investigated to provide a comprehensive understanding of social media activism [49]. There are multiple ways to assess the performance of topic modeling, including coherence and perplexity scores. To yield more competent topic modeling to determine public agendas and enhance human interpretability, more precise evaluation methods must be explored.

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