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The Networked Amplification of Activist Voices: An Empirical Framework for Evaluating the Growth and Challenges of Information Diffusion Efforts During Hashtag Campaigns

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The hashtag campaign around #TWforWHO and #TaiwanCanHelp aimed to bring international attention to Taiwan's exclusion from the global COVID-19 pandemic response. We use this campaign as a case study to develop and apply a social network analysis framework for evaluating the diffusion of hashtag campaigns. We collected and analyzed 121,711 tweets containing the two hashtags, which were published between February 9 and May 2, 2020, resulting in a retweet network of 23,715 users. We find that the movement improved over time on three of four growth indicators—increased size, geographic spread, and inclusion of elite users—while the network simultaneously became less stable. We find no evidence of major changes in the campaign's reach following a paid advertisement in the *New York Times*. Our approach provides guidelines for understanding and assessing message propagation by elites and non-elites.

Keywords: hashtag activism, diffusion, social network analysis, campaign evaluation

Social media have become a fertile ground for promoting social justice causes, allowing campaign organizers to reach wide and diverse audiences and influence public opinion and policy (Suk et al., 2021). Online affordances support such activities, particularly by enabling users to unite and communicate through hashtags (Freelon, McIlwain, & Clark, 2018). Studies have produced evidence of

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the impact of such campaigns at the domestic level—for example, the gender-focused #MeToo (Jackson, Bailey, & Welles, 2020) and the race-focused #BlackLivesMatter (Freelon et al., 2018). Nevertheless, little is known about the ability of campaigns to mobilize supporters around the globe, a key goal of campaigns that aim to highlight international oppression and discrimination (Liu, Ophir, Tsai, Walter, & Himelboim, 2024).

This study expands on prior research in hashtag activism and online social movements in three major ways. First, it focuses on activists' attempts to build a global coalition advocating for Taiwan's inclusion in the World Health Organization (WHO) during COVID-19. Second, it harnesses this unique case study to develop and apply an empirical framework for using social network analysis measures to examine and evaluate information diffusion over time. Third, it examines the potential role of paid media—in this case, a page-long advertisement in the *New York Times* (NYT)—in the social movement's growth. As opposed to other large-scale hashtag campaigns, like #MeToo, the limited scope of the Taiwanese case study allows us to better isolate the impact of specific users and how the network's influence changed over time. The resulting framework could be useful for understanding future case studies, including ones involving more participants, countries, or paid media. All 121,711 tweets published between February 9 and May 2, 2020, that included the hashtags #TaiwanCanHelp and #TWforWHO, were collected and analyzed. Theoretical, methodological, and practical implications are discussed.

Social Movements and Hashtag Activism

Social movements involve actions and communications initiated by individuals or groups seeking political or cultural change (Buechler, 1995). Traditionally, social action was tied to social classes and class conflict (Buechler, 1995), with collective identity (Christiansen, 2011) built around shared grievances and interests (Bergstrand, 2014). Such movements focused on specific cultural groups (Johnston, Larana, & Gusfield, 1994) or organizations (Bennett & Segerberg, 2013) in the social structure. More recently, academic inquiry has expanded into the "new social movement" (NSM) theory, shifting focus from class-centered movements to include movements advocating for social justice for women, racial minorities, LGBTQ+ individuals, and the environment (Johnston et al., 1994; Millward & Takhar, 2019).

This transition has affected the composition of action networks. Traditional social movements were typically organized by unions, while NSMs often involved individual actors and relied on crowd power (Bennett & Segerberg, 2013). Social movement organizations, however, remain vital as agitators throughout the lifetime of social movements (Bennett & Segerberg, 2013), as these movements mature over various stages of development (Christiansen, 2011). A comprehensive analysis of the development of movements and the diffusion of messages thus requires scholars to pay attention to both elites and non-elites (Bennett & Segerberg, 2013).

Since the early 2000s, the emergence of social media has vastly improved the ability of such actors to participate in public debates on social and political issues (Brady, Wills, Jost, Tucker, & Van Bavel, 2017). Specific affordances, such as the ability to unite around linguistic artifacts like hashtags, allowed new effective and efficient forms of activism across social media, particularly on Twitter (Williams, 2015; Yang,

Quan-Haase, & Rannenberg, 2017), where they played a key role in facilitating and organizing discourse (we refer to the company currently known as X as Twitter, as the communication processes discussed in this article happened before Elon Musk's acquisition of the company in April of 2022). Prominent examples of campaigns driven by the public using hashtags included the #MeToo movement (Jackson et al., 2020) and #blacklivesmatter campaigns (Freelon et al., 2018). In these and other cases, hashtags played a key role in allowing individuals to express personal and collective grievances (Bennett & Segerberg, 2013), join existing conversations (Xiong, Cho, & Boatwright, 2019), increase visibility (Segerberg & Bennett, 2011), and shape collective identity and virtual communities while also seeking alliances from other groups (Clark-Parsons, 2018). Furthermore, hashtags allow otherwise disconnected individuals and groups to connect beyond their immediate follower/followee relationships (Kuo, 2018). Through intentional searches or incidental exposure via trending content, hashtags make the messages of social movement participants more accessible without requiring the establishment of reciprocal relationships (Valenzuela, Correa, & Gil de Zuniga, 2018).

The Taiwanese Campaign

Campaigns can vastly benefit from support outside the protesting group itself. Just as the #MeToo movement benefited from the amplification of its message by men—not just women, who were at the heart of the injustice—campaigns like #TWforWHO and #TaiwanCanHelp also needed the support of non-Taiwanese individuals to reach diverse audiences better positioned to influence global public opinion and organizations. The #TWforWHO campaign was launched in a YouTube video calling for international attention to Taiwan's exclusion from the WHO and the global fight against COVID-19, encouraging people to use #TWforWHO to amplify its message. On April 14, a second hashtag, #TaiwanCanHelp, which emphasized not just Taiwan's victimhood, but also its capacity to contribute to global efforts against COVID-19 (Liu et al., 2024), was introduced via a full-page advertisement in the newspaper (Huang, 2020).

Key Factors in Social Movement Growth

The growth of a social movement can be evaluated in various ways, but a key goal of most movements is to increase awareness of their social causes. The literature identifies several unique factors, including the movement's size, the type of social actors involved, and media participation. We will describe and analyze each of these factors below.

Movement Size

Unsurprisingly, research on social movements highlights the importance of size and scope in gaining visibility and attracting legislative and political attention. Freelon and colleagues (2018) found that the number of Twitter users who participated in #BLM messaging on Twitter was an important predictor of political elites' responses. Changes were immediately discernable in terms of time and space. In the pre-online era, the slow spread of campaign messages across communities could allow movements to exert influence over wider geographic (and hence cultural) ranges, for example, by collaborating with representatives of more Congressional districts (Skocpol, 1992). Social media have made it

exponentially easier and faster to share messages instantaneously across space, as was evident, for example, during the Arab Spring in countries like Egypt (Eltantawy & Wiest, 2011). While numbers are critical, Freelon et al. (2018) suggested that research should also pay attention to the types and characteristics of participants.

To understand how campaign messages spread, we first look at changes in movement size, as reflected in the volume of activity online:

RQ1a: How has movement size and volume changed over time?

The Use of Paid Advertising in Social Movements

The #TaiwanCanHelp movement paid for an advertisement to be printed in the *NYT*, aimed at increasing attention among Western audiences. Mass media could play a key role in amplifying and mobilizing support for activism campaigns (Christiansen, 2011; Flynn, 2011; Ross, 1998). To date, most empirical work evaluating the effect of media on campaigns' growth has focused on journalists and mainstream media coverage (Freelon et al., 2018). Only a few studies have recognized the critical role of paid media in promoting movements. For example, during the 1960s, activists published a series of advertisements in the *NYT* for the civil rights movement. These positively framed images garnered attention from the public and the media, thereby facilitating further information dissemination (Ross, 1998). Importantly, Ross (1998) indicated that the ads predated media coverage, allowing activists to frame and control the narrative.

While the studies mentioned above examined campaigns that occurred before the rise of social media, more recently, Chan and Yuen (2023) examined crowd-sourced advertising on *Apple Daily*, a local Hong Kong newspaper known for its critical role by the government. These full-page advertisements advocated for press freedom in Hong Kong and opposed extradition laws. Other full-page advertisements advocating for Hong Kong in the G20 were published in 10 international newspapers, including the *NYT*, the *Guardian*, the *Globe*, and the *Japan Times* (Cheng, 2019). These examples demonstrate that paid media contributed to the formation of collective identities (Chan & Yuen, 2023). Despite these preliminary studies on the role of paid ads, little is known about their actual impact on campaign dynamics, including growth. Therefore, we explore:

RQ1b: Did the volume of activity increase after the NTY's ad?

Geographic Spread

Because the WHO is a global organization, the goal of the #TWforWHO and #TaiwanCanHelp campaigns was to garner support across the globe, especially from countries with leverage and influence on global organizations. While research on social movements has largely overlooked the importance of geography (Miller, 2000), some studies have found that social media provide the opportunity for activists to reach out to global audiences (Isa & Himelboim, 2018; Hopke, 2015). For example, Rane and Salem (2012) discussed how social media allowed Tunisian activists to connect with their Egyptian counterparts

during the Arab Spring. Similarly, for the Taiwanese campaign to pressure the WHO to include Taiwan during COVID-19, it needed support from non-Taiwanese people, a goal that they hoped the NYT ad would achieve. We asked:

RQ2a: Have the makeup of countries from which individuals posted in the network changed over time?

RQ2b: Have the makeup of countries from which individuals posted in the network changed after the NTY's ad?

Types of Social Actors in Social Movements

In the context of NSMs, success depends on the active participation of both elites and non-elites (LeFebvre & Armstrong, 2018). Elites are individuals and organizations who hold strategic positions in society that grant them substantial influence over important decisions within organizations or society (Higley & Burton, 2006). In the realm of social movements, elites are often defined as individuals or groups with outstanding power to shape political discourse (Irons, 2009) and influence decision-making processes (Earl & Schussman, 2008). They often provide resources and support to social movements (Khan, 2012) and engage in activities that present opportunities for policy changes (Irons, 2009). These elites, encompassing political, cultural, and social figures, have historically played a significant role in advancing the causes of movements (Diani, 1997). They possess the power to communicate with a large number of followers both offline and online, often attracting attention from gatekeepers like journalists and the mainstream media (Meraz & Papacharissi, 2013). The #MeToo campaign, for example, received substantial support from elite Twitter users such as celebrities, politicians, and media personalities (Clark, 2019). Similarly, Tenzek and colleagues (2023) illustrated how celebrities like actors Samuel L. Jackson and Brian Cranston contributed to raising awareness of Alzheimer's disease through the #ShareTheOrange hashtag. The rise of social media has also given non-elites a more significant role in social movements, both as participants and leaders.

Unlike elites, whose influence stems from their power outside of the movement (and usually outside of the online world), non-elites are ordinary citizens who use their voice to express support for the movement online (Hunt & Gruszczynski, 2024). Non-elites contribute by spreading information, mobilizing others, expanding the movement, and sustaining its momentum (Meraz & Papacharissi, 2013; Vicari, 2017). Barberá and colleagues (2015) highlighted the importance of peripheral participants who, despite being less influential and active on average than most elite users, still played a vital role in promoting and sustaining social protests.

We also pay attention to activists who have substantial online followings, are uniquely dedicated to the social cause, and play a key role in diffusing social and political messages online (e.g., Valenzuela et al., 2018). Isa and Himelboim (2018) identified the leadership role of what they called core actors who disproportionally initiate and sustain the movement's activity. For example, in Sweden, 62 civic organizations and local communities led efforts to promote environmental conservation. The activists played a crucial role in initiating and sustaining the movement, engaging in ongoing conversation, and engaging

with political forces in their attempt to protect Stockholm's National Urban Park and stop development plans (Ernstson, Sörlin, & Elmqvist, 2008).

Key Factors in Social Movement Growth: A Social Network

The growth of social movements can depend on the structure of the network itself. A network perspective allows us to examine the connections (links) between social actors (nodes) active in a social movement. Social media users create social networks when they interact with one another by following, sharing, mentioning, or replying to other users (Hansen, Shneiderman, & Smith, 2011; Kuo, 2018). Such links are asymmetrical, as a user can retweet another without reciprocity. Based on existing literature on social movements, we focus on the role of brokerage and assortativity in diffusing campaign messages.

Brokerage

A social network approach to social movements has proven useful in detecting social actors positioned strategically within the network, allowing them to disseminate information across otherwise disconnected areas. Burt's (2018) theory of structural holes in social networks emphasized the importance of communicating beyond closely knitted communities, facilitated by actors serving as bridges between otherwise disconnected areas of the network (Bakshy, Hofman, Mason, & Watts, 2011; Shen, Monge, & Williams, 2014). Such actors enjoy strategic advantages such as control, access to novel information, and resource brokerage, making them attractive relationship partners in networks (Burt, 2018). Research on information flow networks, such as YouTube (Liu-Thompkins & Rogerson, 2012) and Twitter (Bakshy et al., 2011), has shown that information brokers play a crucial role in information diffusion. Because maintaining the engagement of actors outside the network core could prove challenging, brokerage bridges are particularly valuable in large, diverse communities (Clark, 2019; Smith, 2005).

Recent studies on social media networks have highlighted the role brokerages play in connecting subgroups of users in a network. As has been studied at length, given the opportunity to interact freely, social actors create clusters in which connections internal to a subgroup are more numerous than connections with others outside that subgroup (Watts & Strogatz, 1998). Clusters capture higher levels of interconnectedness—network density—than the broader network, which is associated with information transmission (Burt, 2004; Carley, 1991) and communication intensity (Zubcsek, Chowdhury, & Katona, 2014). Brokerages play a vital role in distributing novel information across these groups.

Drawing on the #FreeAJStaff movement, which aimed to secure the release of three Al Jazeera journalists imprisoned in Egypt, Isa and Himelboim (2018) found that social mediators bridging distant groups played an essential role in scaling up online activity (Himelboim, Golan, Moon, & Suto, 2014). Lee (2022) found that bridging users in feminist social movements accounted for the connections created and coalitions built across organizations. Identifying the actors who are positioned to serve as bridges, thus, helps us understand information flow and coalition building in hashtag activism on a global scale (González-Bailón & Wang, 2016).

As social movements grow, keeping members connected, informed, and active becomes challenging. As is common in network analysis literature, we identified users capable of facilitating the circulation of information to new communities, particularly to non-Taiwanese users, by operationalizing brokerage as users high on betweenness-centrality scores (Everett & Borgatti, 2005), asking:

RQ3a: What type of social actors became brokerages in the #TaiwanCanHelp social movement?

RQ3b: Have the makeup of brokerages changed over time, and in particular after NYT's ad?

RQ3c: Have geographic makeup of brokerages changed over time, and in particular after NYT's ad?

Assortative Mixing and Network Stability

Assortative mixing by degree, or degree-assortativity, examines the extent to which users connect with others who have similar levels of connectivity. In highly assortative networks, high-degree nodes tend to connect with other high-degree nodes, while less-connected nodes link to similarly less-connected users. In contrast, a network with low assortative mixing allows nodes with both high and low numbers of connections to connect with each other (Newman, 2003). Levels of assortative mixing have implications for the stability of a network. Networks with high assortative mixing by degree were found to be more resilient to both targeted removal of high-degree nodes and the random removal of nodes (Catanzaro, Caldarelli, & Pietronero, 2004; Newman, 2003). In a network dominated by a core group of interconnected high-degree nodes, even if all or most users are removed, the impact of the rest of the network clusters is limited. In contrast, disassortatively mixed networks are susceptible to the removal of high-degree nodes because these nodes are spread across the network, and their removal can fragment it.

Retweet networks, which represent the flow of information, measure degree by the number of retweeting users. In this context, high degree-assortativity indicates a tendency for highly retweeted users to retweet each other. In contrast, low degree-assortativity suggests that retweeting behavior occurs across nodes with varying degrees. The impact of degree-assortativity on network stability is understood as the network's ability to disseminate information effectively among its users. In the context of social movements, highly retweeted users serve as major sources of information, whether they are elite figures or grassroots participants. It is in a social movement's best interest to maintain a stable flow of information that is independent of key information sources. To achieve this, decreasing degree-assortativity becomes a priority for social movements. Finally, we examine network stability in terms of assortativity, asking:

RQ4: Has the degree-assortativity structure of the network changed over time?

Method

Data

The data were collected via Brandwatch (www.Brandwatch. com). Since the campaign was directed toward the global community, we omitted 2,527 tweets not in English, resulting in a corpus of 121,711

tweets consisting of #TWforWHO or #TaiwanCanHelp published between February 9 and May 2, 2020. Brandwatch provides full access to all publicly available tweets, including country-level geographic data provided by Twitter. Twitter identifies the location from which a tweet is posted based on the device's IP address, accurately determining the country of origin.

Retweet Network

To understand users' engagement with the campaign, we created a retweet network by identifying users who served as post authors (tweet) and those who retweeted them (retweet). The network was created using NodeXL and analyzed in R using the *igraph* package. The data spans 12 weeks and is divided into four segments of three weeks each to identify changes over time. T1 began after RayDu released the original YouTube video, covering February 9 to 29, 2020. T2 covered March 1 to 21, 2020, and T3 covered March 22 to April 11, 2020. Finally, T4 encompassed the time after the NYT publication, between April 12 and May 2, 2020.

Dividing the data into four equal temporal sets, each spanning three weeks, allowed us to examine changes over time. Broadly speaking, the four time periods loosely represent the movement's emergence, coalescence, bureaucratization, and decline (Christiansen, 2011), though for empirical purposes, we prioritized equal time spans, acknowledging that pinpointing the exact moment a movement transitions from one stage to the next is difficult. The final period, T4, covered April 12 to May 2, 2020, and was selected because the campaign released the content of the paid ad on its social media page on April 12, including the reframed hashtag (Liu et al., 2024).

Measurements

This study employed a network analysis approach to social movements (Diani & McAdam, 2003; Krinsky & Crossely, 2014), measuring the following:

Brokers are positioned to fill structural holes and facilitate information flow (Burt, 2018). Given that the goal of the Taiwanese campaign was to extend the call for awareness and action, we considered brokers to be those with the highest betweenness centrality, representing actors' ability to connect otherwise disconnected areas of the network (Krinsky & Crossley, 2014). This study identified the top 20 key actors in terms of influence for each time period. To further explore the characteristics of brokers, we adopted Isa and Himelboim's (2018) typology and classified the top 20 influential Twitter accounts in each period into core actors, elites, and non-elites. Core actors are activists and advocates who initiated the movements and remained active until the end (Isa & Himelboim, 2018). Elites are Twitter users or accounts with the power to influence the discourse (Irons, 2009). Non-elites are laypersons of modest activity, following, and influence (Isa & Himelboim, 2018). The grassroot high-profile activists and the Taiwanese official governmental departments are classified as core actors. Taiwanese politicians and Western elites are labeled elite. Ordinary individuals who actively engaged in the campaign on Twitter are classified as non-elite.

Assortative mixing was operationalized using the assortativity coefficient by degree, ranging from -1 to 1 (McNulty, 2022). In a network with high-degree assortativity, high-degree nodes will

preferentially connect with other high-degree nodes, and vice versa. A network with low assortative mixing suggests that nodes with both high and low numbers of connections are more likely to connect with one another. As clusters emerge in self-organized networks, such as the retweet network in question, high degree-assortativity means clusters form from social actors with similar or identical degree attributes, and vice versa.

Clusters were identified as communities of interaction, where users tend to interact with others within the same community but not with those in others. We applied the Louvain clustering algorithm to detect the retweet sub-communities in the network (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008). Louvain partitions nodes into cohesive components based on the principles of hierarchical clustering algorithm (Bhowmick, Meneni, Danisch, Guillaume, & Mitra, 2020).

Results

The findings reveal that the *movement size and volume of activity* (RQ1a) changed over time, indicated by the number of nodes and links (see Table 1). The number of nodes (23,715) and links (38,122) increased over time, though T3 saw a few more links than T4. It should be noted that before the release of the NYT ad (T3), the size and volume of the movement had already shown a significant upsurge, and in light of this trend, the data do not suggest a significant effect of the publication. The numbers are detailed in Table 1.

A few events that occurred during the last weeks of the campaign and inspired the paid advertisement are worth noting. The NYT ad was driven by accusations from WHO Director Tedros Adhanom Ghebreyesus, who indicated receiving racial attacks from Taiwanese people during the WHO's press conference on April 8. In response, Taiwanese President In-Weng Tsai released the messages "Taiwan Can Help" and "Taiwan is Helping" on her Facebook on April 9 (Tsai, 2020). These two events triggered the crowdfunding campaign on April 10, which quickly reached its funding goal and completed the draft of the advertisement within 8 hours (Wang, 2020). The paid advertisement invited public engagement with the hashtags in the hope of reframing the campaign's message and increasing attention and engagement from outside Taiwan.

Table 1. The Total Number of Node and Link in the Four Time Periods.

	The YouTube video was released T1 (February 9 to 29)	T2 (March 1st to March 21st)	T3 (March 22nd to Apr. 11th)	The NYT ad was published T4 (April 12 to May 2)
Nodes	9634	6620	21701	23715
Links	13248	9507	39552	38112

To address the campaign's global nature (RQ1b), we examined which countries were involved in the movement and how many over time, based on Twitter users' geographical location data (while acknowledging the limitations of such approach). First, we grouped Twitter users by continent (see Figure 1). As with volume, the number of Twitter users involved in the online campaign increased before the publication of the NYT ad, though across all time periods, most activity originated in Asia.

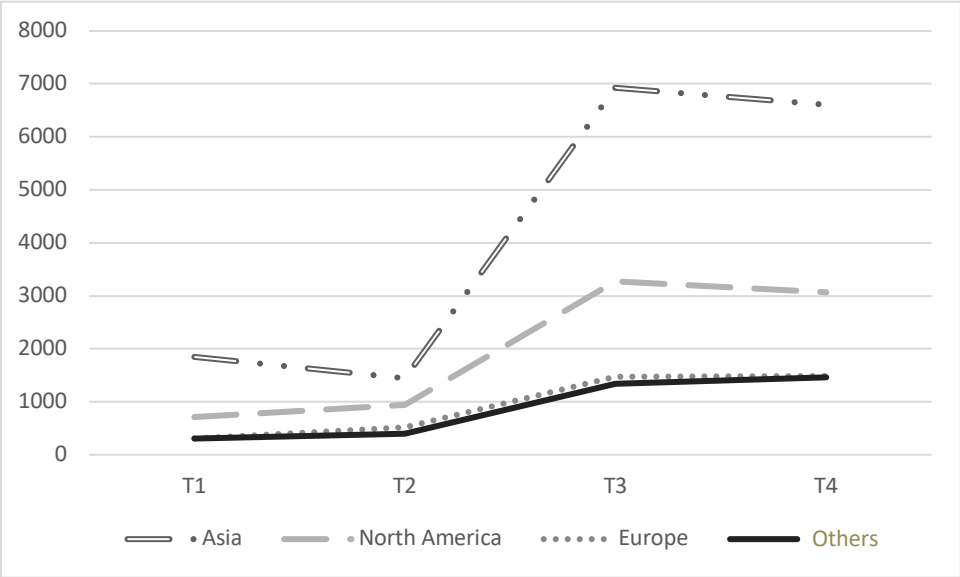

Figure 1. The number of Twitter users who retweeted, segmented by continent during each period.

Next, we examined the countries from which users tweeted (RQ2a and RQ2b). The results indicate an increase in the number of countries from which users participated in the campaign over time. Specifically, the average number of unique countries posting per day peaked in T4, with users from an average of 6.3 unique countries participating. During this period, the campaign was echoed across 132 counties within three weeks. During T3, the campaign consisted of tweets from users in 118 countries, with an average daily country participation rate of 5.6. In comparison, the campaign was tweeted by users from 78 countries at T1 and 88 countries at T2, with average daily country participation rates of 3.7 and 4.7, respectively. Overall, more countries participated in the discussion, both in total and on an average day, as the campaign progressed.

Among the influential accounts that bridged different groups, we identified three types: core actors, elites, and non-elites (RQ3a, RQ3b, and R3c). The betweenness-centrality scores for the top 20 influential accounts are provided in Online Appendix A.[1]

[1] The table of top influential Twitter accounts by betweenness centrality is provided at the OSF link: https://osf.io/9g5xb/?view_only=fbde26bf0c8f44a6a3181e88fda4689e

Core actors included the YouTuber who created the original call to use the hashtags, with a betweenness-centrality of 4605.57, ranking among the top 8 influential accounts in T4. Additionally, governmental organizations, such as Taiwan's Ministry of Health and Welfare and Ministry of Foreign Affairs, played crucial roles. Over time, the Ministry of Health and Welfare of Taiwan became more influential, specifically in T2 and T4. It held rankings of 16th and 2nd for most influential accounts with betweenness-centrality scores of 164.09 and 9336.38. Taiwan's Ministry of Foreign Affairs was dominant in T1, T2, and T3, with betweenness-centrality scores of 171.71, 164.0, and 96397.33, respectively (ranked 15th, 16th, and 1st during each of these periods, respectively).

Furthermore, Taiwanese representatives in the United States and in other countries participated as influential core actors. Most exerted their influence in T4. For example, Taiwan in the US (n.d.) ranked as the top influential account with a betweenness-centrality score of 13777.44. The betweenness-centrality scores for Taiwan in Denver (n.d.) and Taiwan in the UK (n.d.) are 1651.79 and 1562.60, respectively, along with a ranking of the 15th and 17th positions in T4. While Embassy of the Republic of China (Taiwan) in Belize did not rank among the top 20 influential accounts in T4, its betweenness-centrality score was 34918.64, and it ranked among the top 3 influential accounts in T3.

The core also included political elites, including Taiwanese politicians and Western elites. Specifically, Audrey Tang, a Minister of Digital Affairs, had a betweenness-centrality score of 13750 and ranked 11th in T3. Among the Western elites, Anders Fogh Rasmussen, former Prime Minister of Denmark, held the top position in T2, with the highest betweenness-centrality score (2650.10754). Samantha Power, a former U.S. ambassador to the UN, ranked 7th with a score of 4897.489 in T4.

Non-elite users played a key role in amplifying the campaign, especially in the initial stage. Among the top 20 most influential accounts in T1, 18 were non-elites. Overall, on average, eight core actors, one elite, and eleven non-elites dominated the list of influential accounts over the timespan of the campaign. These actors facilitated the campaign's diffusion during separate time periods by exerting their influence on bridge users worldwide.

Figure 2 illustrates changes in brokerage composition over time. In T1, non-elites dominated the campaign, with only two accounts associated with Taiwan's Ministry of Foreign Affairs in the top 20. Specifically, the Taiwanese news agency was ranked 10th, and the official account of the Taiwanese Ministry of Foreign Affairs ranked 15th. However, starting from T2, the number of non-elites who served as bridges continuously declined. By T4, the discourse was dominated by Taiwanese elites, such as the official account of the Taipei Economic and Cultural Representative Office in the USA. While this account was not among the most influential in T1, it ranked 10th before the publication of the NYT ad and rose to become the most central user in the network by T4. Notably, its regional offices in Miami, New York, San Francisco, and Denver also ranked highly—at 4th, 5th, 10th, and 15th, respectively. The Taiwanese office in the United Kingdom ranked 17th in T4, and their embassy in Eswatini ranked 20th. The first American to appear on the list of top influential users, the former U.S. Ambassador to the UN Samantha Power, ranked 7th in T4. Taken together, these findings indicate that while the campaign gained some attention from Western elites, its most influential users remained Taiwanese throughout the campaign, with non-elites dominating the early stages, and elites, particularly governmental offices, the latter. In other words, instead of turning the

campaign into a global or prominently Western movement, it primarily mobilized Taiwanese offices in the West to actively spread the message.

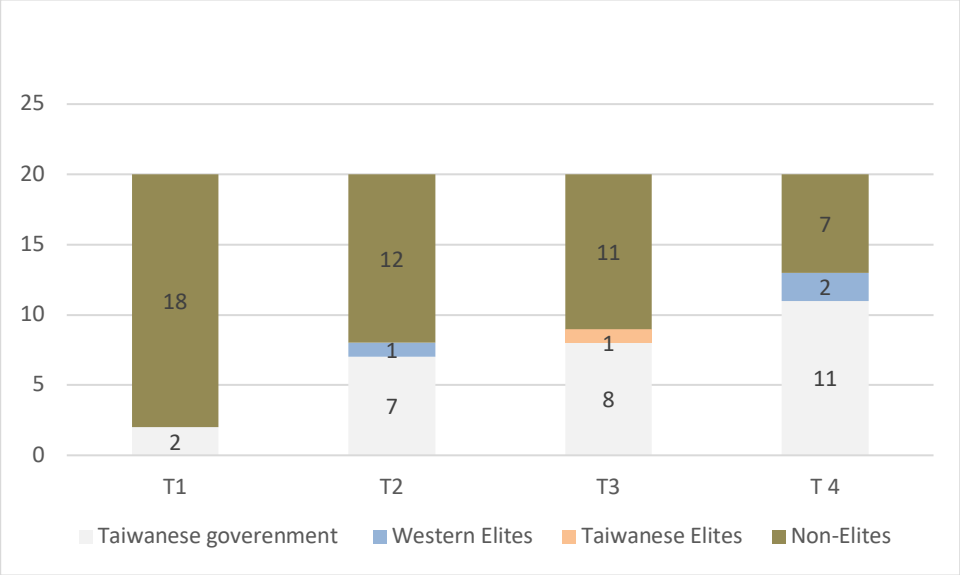

Figure 2. Brokerage types at each time period.

Finally, in terms of Assortative Mixing (RQ4), Table 2 indicates negative values in the assortativity coefficient at all time periods, suggesting a high tendency of Twitter users retweeting users across levels of connectivity. The value continued to drop, from -0.0074 in T1 to -0.1943 in T4, indicating increasing interaction between major sources of information (high retweeted users) and less retweeted users.

Table 2. Degree Assortativity Across Time.

	T1	**T2**	**T3**	**T4**
Assortative Mixing by degree	-0.0074	-0.1167	-0.0872	-0.1943
Mean	-0.44	-0.30	-0.38	-0.32
SD	1.86	1.67	6.97	2.53
Z-score	**234,160.46**	**11,013.30**	**4,147,167.09**	**80,644.87**

In summary, the network underwent several changes between T1 to T4. The network grew over time. Not only did the number of clusters increase, but the network also became more scattered over time, indicating reduced reliance on a few key actors as campaign resources. In other words, the network initially relied on a few powerful clusters driven by influential individuals who were connected to the YouTubers who launched the campaign. Over time, participation diversified. As the network grew, it relied more on several smaller, loosely connected clusters, as indicated by the decline in degree-assortativity.

Discussion

This study adopted a network approach to assess the diffusion of information related to social movements on social media. It accomplished this by examining changes in network structure[2] and the leaders responsible for the diffusion within the network over time, as the campaign evolved and attempted to attract broader audiences around the globe. Given that retweet connections play a crucial role in information propagation on Twitter, this study identified specific types of brokerages that influence the diffusion of campaign messages. Additionally, to evaluate the development of the campaign, we examined the network's stability, employing the degree-assortativity measure. In conclusion, we identified four primary empirical indicators of movement growth: (1) scale, measured by the number of users and retweets; (2) geographical reach, particularly in Europe and North America, which were targeted by this specific campaign; (3) increased involvement of elite users in broker roles; and (4) the stability of the overall information flow network.

Applying the suggested network approach to the Taiwanese campaign serves several significant purposes. First, it demonstrates the applicability of our proposed approach. Second, while a substantial portion of existing literature on social movements concentrates on local movements (e.g., #BLM), this study shifts the focus towards an international movement, highlighting its geographic reach as a crucial indicator of its growth. Third, it delves into the potential impact of paid media on social movements (in this case, the NYT ad), an area that has received limited attention in social movement studies. Finally, it introduces a network structural indicator, assortative mixing, to gauge the stability of information flow in online social movements.

Regarding the first three indicators, the Taiwanese campaign's performance improved in its first three quarters, prior to the publication of the NYT ad (T4). First, the number of participants (nodes) and retweets (links) reached its zenith before the NYT ad and did not change much afterwards. Second, we did not observe a change in the geographic reach of the social movement to Europe and North America before and after the publication of the advertisement. Third, in terms of key brokerage users who played a pivotal role in information diffusion in the network, the same trends exhibited before the ad—the increase of Taiwanese government breakages and the decrease of non-elite individuals in that role—continued after the ad. Importantly, our findings suggest that changes in the size and characteristics of the network began before the publication of the paid advertisement. Thus, the impact of the paid advertisement seems modest at best.

We found that Taiwanese government officials played a key role in the diffusion of information. Agencies such as the Ministry of Health and Welfare of Taiwan may have succeeded in disseminating the campaign's messages due to Taiwanese users' familiarity with and trust in them, factors that could contribute to information-sharing behavior (Osatuyi, 2013), though we did not observe these directly. Reliance on official sources may be particularly high during crises when people seek timely information from trustworthy sources that could help them reduce uncertainty by making sense of the ongoing developments

[2] The visualization of the network structure for each of the four stages can be found in Appendix Figures S1 to S4.

(Ophir, 2019; Weary & Jacobson, 1997). In turn, trustworthiness plays a role in establishing information sharing (Yang & Zhuang, 2020). In the Taiwanese case, those official agencies contributed to the diffusion and amplification of the hashtag campaign.

While the first three indicators suggested improvement over time, the fourth tells a different story. The final growth indicator, degree assortativity, was used to evaluate the network's stability over time. This method assesses the network's susceptibility to the removal of nodes, especially highly connected ones, providing insight into its overall vulnerability. Within the current information flow network, degree assortativity serves as a measure of susceptibility, reflecting the decreased activity of certain pivotal actors over time. High assortativity means that less connected users retweet one another, while low assortativity means that less connected actors tend to retweet highly connected users, identified here as brokerages. For this reason, low-degree assortativity networks are more vulnerable to the removal of high-degree actors.

Our analysis reveals that degree assortativity reached its lowest point at T4, indicating that the information flow network became less stable and more vulnerable, particularly for influential users identified early on as brokerages who became less active. This holds particular significance, as users naturally tend to become less active over time due to fatigue. In practical terms, it implies that the community discussing the #TWforWHO topic relied less on interconnections with one another and more on central hubs as primary sources of information. This discovery carries three noteworthy implications. First, this decline occurred when the movement peaked in all other growth indicators. Second, the network's stability decreased notably after the publication of the NYT ad, impacting the flow of information within the network, though we were careful not to make bold claims of causality in this complex, real-world situation. Third, there was a shift towards a more distributed network, where information diffused through a more varied and less connected set of social actors, rather than relying on a few key actors, as indicated by the decline of degree assortativity values. The findings also highlight the modest impact of the paid NYT ad, as evidenced by an increase in smaller, loosely connected clusters. While this may lead to reduced message consistency, it contributes to broader information diffusion and campaign amplification. In many ways, the drop in degree assortativity may indicate that the movement evolved, where information distribution is more grassroots-oriented than top-down.

In general, our findings suggested only a modest effect for the paid media on the network (though the ad did seem to influence the framing of messages, see Liu et al., 2024). Three of the four indicators peaked before the ad was published. For the fourth indicator, assortativity, we identified a decline in stability after the ad was published. We acknowledge these findings should be taken with a grain of salt, as the real-world setting did not allow for isolating the effects of this or other events. For example, assortativity may have been influenced by the dynamics of the movement, fatigue among its active members, or other unmeasured variables. Nevertheless, we believe that such findings are important, as there is value in examining phenomenon in the real world, even if the messy nature of such analysis prevents us from reaching causal conclusions. Overall, we surmise that the impact of the ad was limited and modest, at least in terms of the variables examined here. While understanding the unique Taiwanese campaign is important for historical, cultural, and geopolitical purposes, we hope that the four-indicator framework developed in this study will be used in future research to examine other hashtag activism campaigns across different contexts and social media platforms.

Limitations and Future Research

First, our study was primarily limited to tweets with geocode information. Further studies may rely on other methods for identifying geolocation in user profiles and tweet content (Leetaru, Wang, Cao, Padmanabhan, & Shook, 2013). Second, our study consisted of only English tweets. We believe that this choice was justified in this case, as the campaign explicitly aimed to communicate with Western audiences using English hashtags. Nevertheless, future studies may examine global participation in multiple languages to better reflect the international nature of the platform (Dixon, 2023). Multi-language studies could also examine the evolution of hashtags as they are adapted across countries and cultures, as suggested by Suk et al. (2024).

Despite these limitations, our proposed approach offers a novel way to evaluate the growth of online activism, including hashtag campaigns. We use the Taiwanese campaign as a case study of efforts to attract global audiences, initially through online activism and later through the grassroots-funded NYT ad and reframed messages (Liu et al., 2024). Our results indicate that the Taiwanese campaign yielded only limited success. Despite growing over time, it largely failed to engage international elites and influencers and to significantly break the boundaries of the Taiwanese Twitter space. The various growth indicators we examined also suggest that the NYT ad had a modest impact on the campaign. Nevertheless, our main goal was to develop a systematic approach for evaluating campaigns. The approach suggested could be used in the future to evaluate more and less successful campaigns and, in the case of the latter, could be useful for identifying obstacles to growth.

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Appendix A: Network Structures in Each Time Period.

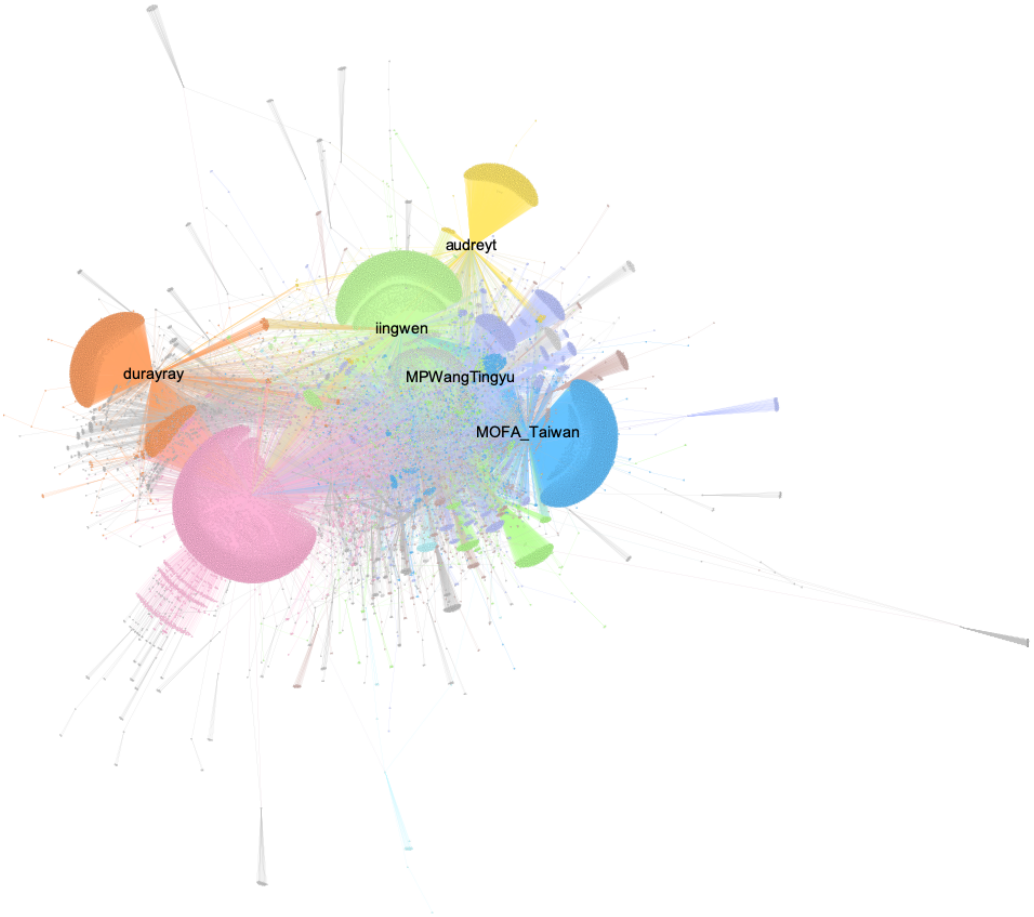

Figure S1. The relationships among users who posted messages on Twitter between 9 February and 29 February 2020 (T1).

Note. The network maps illustrate the relationships among users who posted messages on Twitter using the hashtags #TWforWHO and #TaiwanCanHelp over time. These network maps display the clusters and key users with a high-degree range. The colors indicate community detected by Louvain.

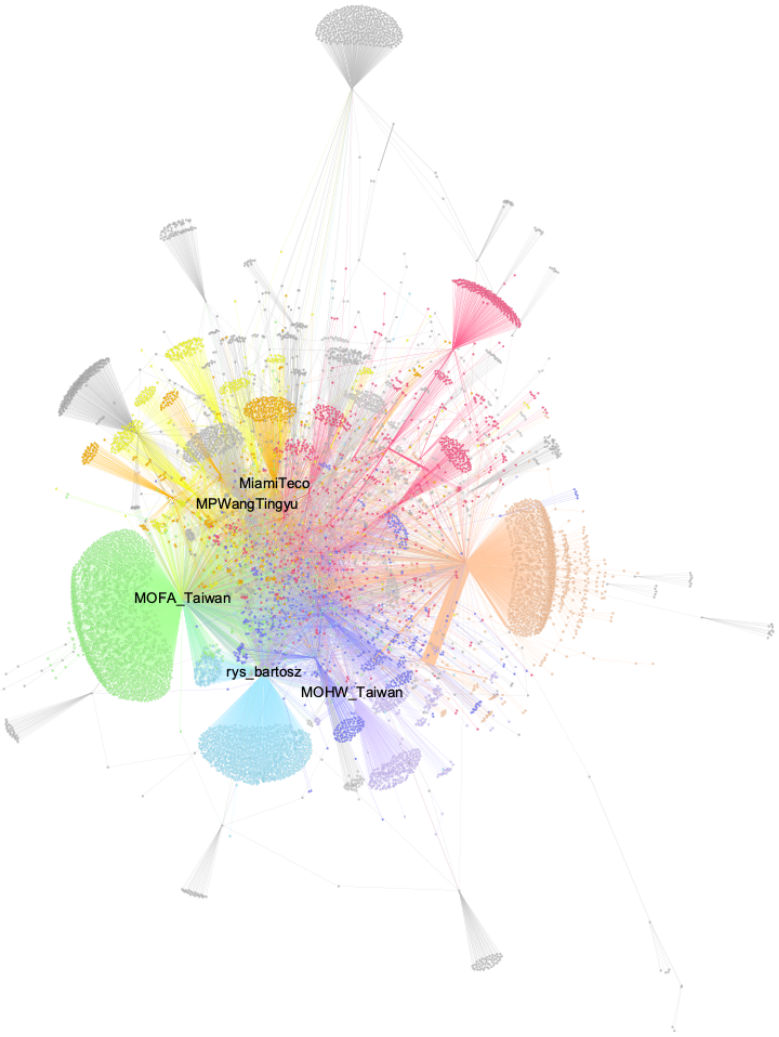

Figure S2. The relationships among users who posted messages on Twitter between 1 March and 21 March 2020 (T2).

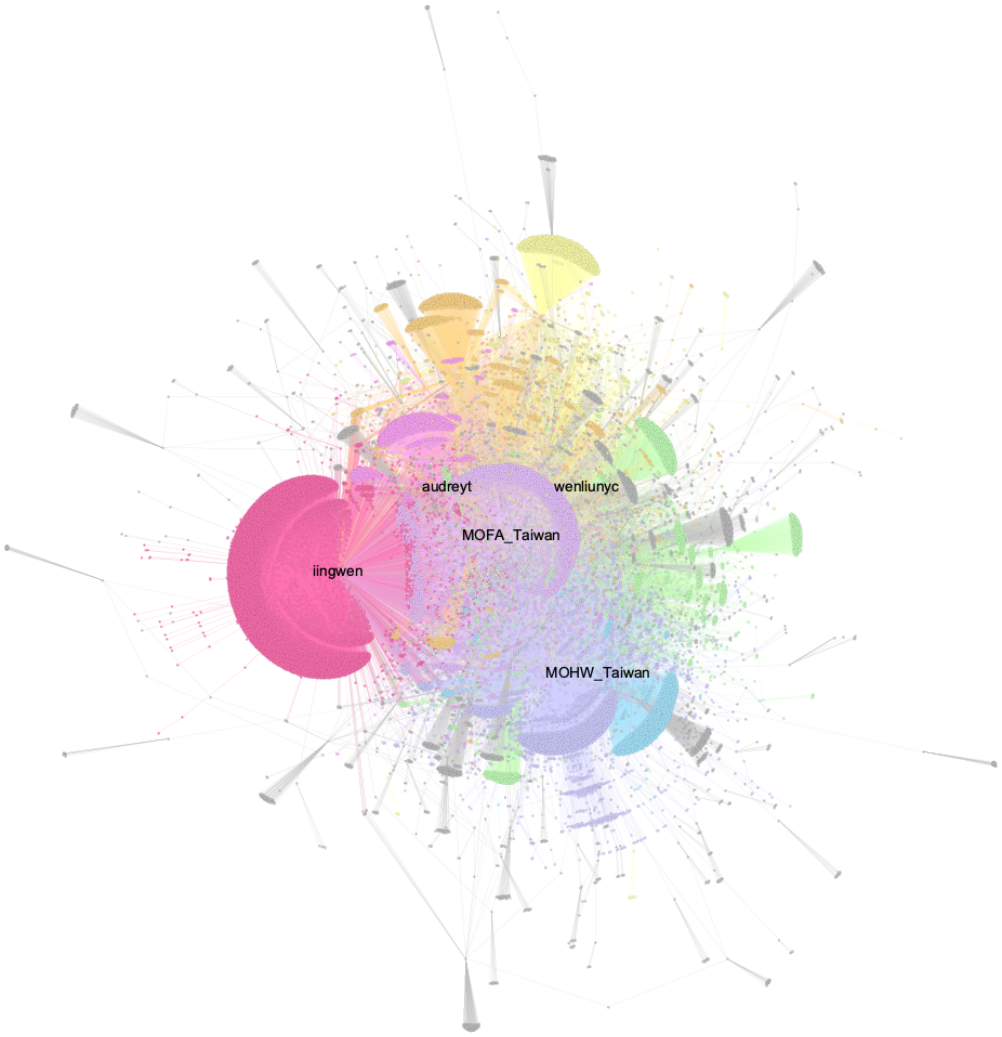

Figure S3. The relationships among users who posted messages on Twitter between 22 March and 11 April 2020 (T3).

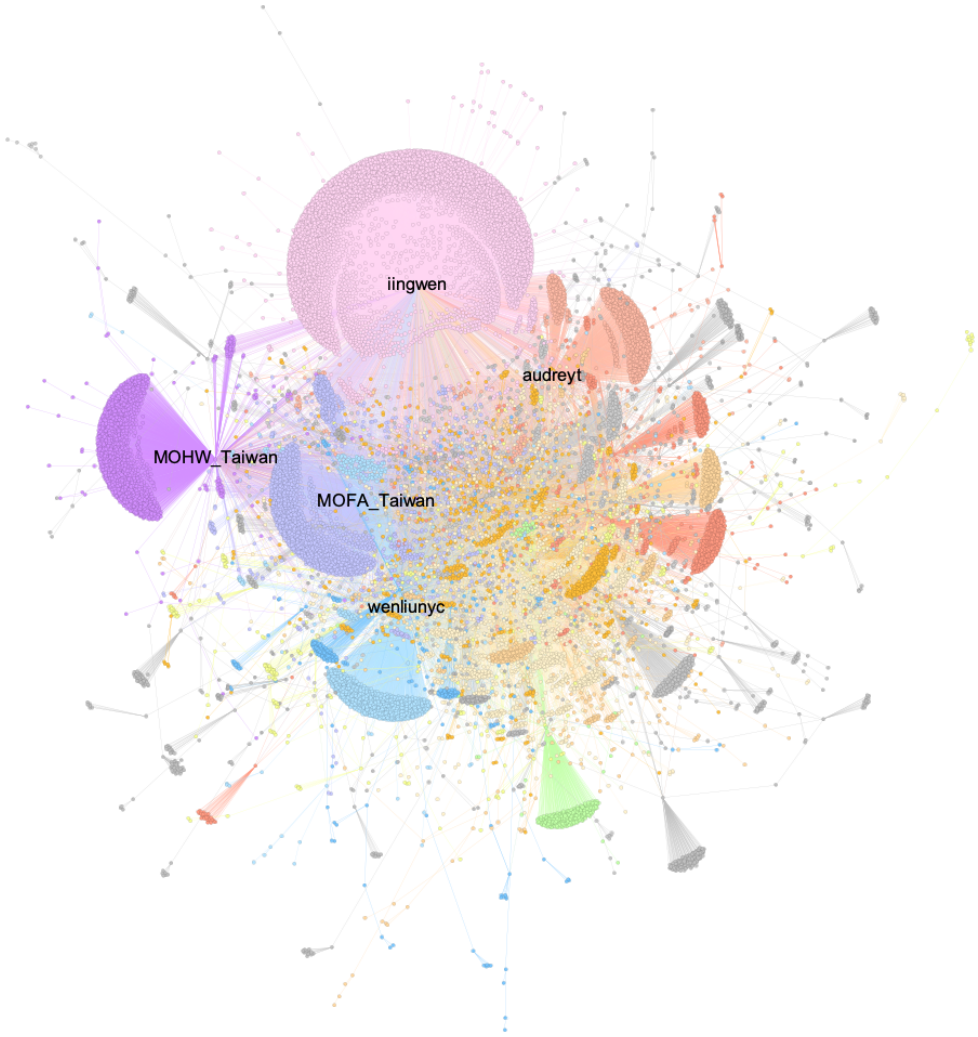

Figure S4. The relationships among users who posted messages on Twitter between 12 April and 2 May 2020 (T4).