Politically Polarized Online Groups and their Social Structures formed around the 2013-2014 crisis in Ukraine

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Introduction

The end of the Cold War in 1991 introduced great change and a wave of hope for people living in the former Soviet Union. Satellite states, such as Ukraine, seized this historical opportunity and declared their independence from the former USSR. However, Ukraine's transition to a modern and independent state has not gone smoothly. In 2004, the country experienced its first major political upheaval, popularly dubbed the "Orange Revolution." Cries of "Razom nas bahato! Nas ne podolaty!" ("Together, we are many! We cannot be defeated!") swept through Kyiv's Independence (Maidan) Square. Thousands of Ukrainians raised their voices and stood up together to demand real political change in their country. But instead of change, the Orange Revolution ushered in a period of malaise; with power passing from one corrupt political faction to another. In the fall of 2013, Ukrainians once again started gathering in Maidan Square, at first in the hundreds but quickly grew into the hundreds of thousands. They gathered to protest the then Ukrainian Government's unexpected decision to back away from a highly anticipated trade and association agreement with European Union. This decision would dash the hope of millions who wanted to forge closer ties with the west.

At first, the protests appeared to be similar to the 2004 Orange Revolution, with angry protesters, makeshift barricades and riot police. But something was different about these protests. This time, the protesters and their supporters were equipped with more than just their ideals and homemade protest signs; many in the crowd now carried smartphones and other Internet-enabled devices in their pockets. They were ready to provide live updates, shoot pictures and videos on a moment's notice, and instantly share them on social media with supporters across the country and beyond. This indicates a striking difference between the 2013/14 Ukraine Crisis and the Orange Revolution of 2004. During the Orange Revolution less than 10% of Ukrainian used the Internet (Lysenko & Desouza, 2010). Social media websites such as Youtube, Twitter and Instagram did not even exist, and Facebook was just about to be launched. In 2013, armed with these new information and communication technologies, Ukrainians across the country were able to follow the protests in Maidan in real-time. They could find out when and where to join the protest or

even organized their own demonstration by informing and connecting with like-minded individuals. This unprecedented access, by both pro and anti-government supporters, to different social media sites was a game changer during the 2013/14 Ukraine Crisis.

In this paper we focus on the use of a popular social networking site in Ukraine called Vkontakte (VK). We are interested in studying how, and for what purposes, the two opposing camps in the Ukraine Crisis used VK. One camp was made up of Anti-Government, Pro-Western groups that supported the protests in Maidan Square and the other camp was made up of Pro-Government, Pro-Russian groups that opposed them. As network scholars, we want to know if there would be any observable structural differences or similarities in social networks formed by VK groups in these opposing camps. As this conflict is still ongoing, the paper only focuses on the early part of the conflict from when the protests in Maidan Square escalated and turned deadly in early 2014, until the Presidential election in Ukraine at the end of May 2014.

Literature Review

Social media has been described as a driving force behind many political and social movements around the globe. The #Occupy movements (Jensen & Bang, 2013; Thorson, et.al., 2013; Croeser & Highfield, 2014), revolutions and protests in the Middle East, so called Arab Spring (Khondker, 2011; Aday, et.al., 2012), including the 2009/2010 protests in Iran (Burns & Eltham, 2009; Chatfield, et.al., 2012) and the 2011 Egyptian revolution (Khamis & Vaughn, 2011; Eltantawy & Wiest, 2011) are all events that involved, and heavily relied on, social media use. Although Internet scholars are still debating the specific role that social media played during these unrests, many agree that social media are effective information and communication tools for organizing collective action and sharing up-to-date information among themselves and the public at large.

The recent crisis in Ukraine is the latest example of the importance of social media in modern collective action. Based on our review of various social media websites and posts, it becomes obvious that groups in both camps (Pro-Maidan and Anti-Maidan) used social media websites like Facebook, Twitter and Youtube to organize protests, share real-time information about police and military movements, call for donations and financial support, and share information with other group members. Furthermore, it was not just members of these groups that had their eyes on social media. Politicians and elected officials in Ukraine also used social media to share latest updates and political statements with the public. Law enforcement agencies monitored social media posts to anticipant where the next rally would occur. Some of the most influential and active social media users during the crisis in Ukraine were journalists. In a recently published essay, Szostek (2014) describes how dissent and activist journalists in Ukraine used social media to shape public's perception of Yanukovych's government and ensure accurate reporting of Pro-Maidan demonstrations in Kyiv.

One of the most popular social networking sites used during the crisis in Ukraine was Vkontakte, also known as VK (vk.com). Founded in 2006, the social networking website now reports over 260 million registered users and over 100 million active users, primarily from the former Soviet Union republics, including Russia (over 97 million users), Ukraine (over 27 million users) and

Belarus (over 5 million users) [1]. Based on the user interface and functionalities, VK largely resembles Facebook, where a user can create a profile (public or private) and then start "friending" other users. VK users can exchange messages with one another privately or post/repost messages and share various media content publicly. They can also interact with content on the VK website through 'liking' or leaving their comments. Similarly to Facebook, VK users can organize a public or private group, or a community page.

Because of the prominence of this website in Ukraine and its active use among Pro-Maidan and Anti-Maidan activists, we decided to use the website as a case study for our research. We focused our analysis on four activist groups (two Pro-Maidan and two Anti-Maidan). We wanted to examine network structures of these highly polarized groups and learn whether there are traceable differences or similarities in their underlining social network structures. Our expectation is that the types of emergent social networks (group's footprint) would likely depend on the function and purpose of each group. What we do not know is whether and to what extent the ideology of a particular group shapes their network structure? To answer this question and establish baseline metrics in this line of research, we will rely on Social Network Analysis (SNA).

SNA has already proven to be a very useful method in studying different types of organizations that operate in either physical, digital or hybrid environments. For the purposes of this literature review, we examined studies on how different activist groups used social media, paying special attention to the types of network measures and procedures used to analyze group interaction and emerging connections. Since there are few studies that looked at the use of VK in the political context, and even fewer that relied on SNA to examine group dynamics[2], we turned to the literature on the use of the two largest social networking sites in the world - Twitter and Facebook.

Due to Twitter's accessibility, it is one of the most popular social media platforms used for various protests. As a result, there is a large volume of literature that specifically examines the use of Twitter to support collective action. Morales, Losada and Benito (2012), for example, examined the 2010 #SOSInternetVE Twitter protest that was organized to support freedom of information on the Internet in Venezuela. Morales, Losada and Benito found that highly connected Twitter accounts in this network significantly reduced distance between group members and increased the speed of information flow. The study also found the formation of different communities of tightly connected nodes. The largest cluster formed around opposition

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media and journalists, suggesting that more traditional forms of media are still influencing information flow on Twitter.

Another work that investigated the use of Twitter to support a protest, conducted by Theocharis (2013) examined how Twitter was used during the 2010 universities protests against the UK government's education cuts and increased tuition policy. The study found that despite the presence of highly connected accounts in the network, the network structure was decentralized and supported effective information sharing (with or without help from influential accounts). This observation differs from the previous case, where the influential accounts appeared to be critical for fast information dissemination, possibly due to the fact that unlike the previous case, this protest had a strong offline component, in the form of a series of demonstrations happening in London, which probably created opportunities for protesters to meet face to face and form stronger bonds.

In the final Twitter example, Khonsari, et.al. (2010) examined Twitter use by opposition groups during the 2009 presidential elections in Iran. As in the previous example, the authors found a decentralized network that still included a number of highly connected nodes. However, unlike the previous case, the Iranian network was more fragmented and consists of two main connected clusters. The largest cluster (70% of nodes) included primarily people who opposed the government and another (24% of nodes) consisted of government supporters.

To further inform our work, we also reviewed studies that examined the use of Facebook for collective action. These are highly relevant studies because of the similarity in structure between Facebook and VK. The similarity is seen in the reciprocal types of connections (if you are my friend, I am yours) and similar functionalities (e.g., forming a group, leaving comments on friend's page, etc.).

In an experiment conducted by Kwon, Stefanone and Barnett (2014), the researchers found that one of the strongest factors that determined whether a person would join an activist group was the percentage of their friends who already joined it (so called a Personal Network Exposure rate). This suggests that networks of activist groups on Facebook would likely represent denser structures of nodes consisting of members who had likely known each other before joining the group. However, joining a group because you know an existing group member does not necessarily mean that you, or your friends, completely agree with other group members. This is especially evident in a study by Mascaro and Goggins (2011), where they examined discussion networks formed among members of a US-based political group on Facebook called "Join the Coffee Party Movement". Using SNA, the researchers observed both advocacy and dissenting behaviour in this group. Both proponents and opponents of the group appeared to be prominent in the network structure; however, according to the authors, the network around opponents was less centralized.

In sum, the previous work suggested that the social network of an activist-type group would most likely have a decentralized structure (potentially with few highly connected nodes). This structure could also be subdivided into smaller clusters that may be formed around people with similar professional background (e.g., journalists versus politicians) and/or similar interests

(group proponents versus opponents). In cases when both proponents and opponents are present, the cluster around opponents might be less centralized, suggesting their weaker status and less organized behaviour in the group. We also noted that due to the dominance of reciprocal (and often close) relationships on websites like VK and opportunities for group members to meet face to face during offline protests, group networks formed on these websites are expected to be dense. These insights will help us focus on examining important network characteristics and guide us through the analysis of the four VK groups in this study.

Method

For this study, we used VK's web search interface to identify relevant groups from the two opposing camps. Only publicly accessible groups - one that does not require users to log in or join the group - were considered for the study. We then selected two of the most popular (as reflected by the group total number of members) Pro-Maidan and Pro-Western groups on VK (further referred to as PRO1 and PRO2) and the two most popular Anti-Maidan and Pro-Russian groups (further referred to as ANTI1 and ANTI2). To identify Pro- and Anti-Maidan groups, we searched for any groups that included the word "Maidan" or "AntiMaidan" in their name (in Russian and Ukrainian, both spelled the same) or groups that they are linked to.

Once we selected two groups from each camp, we collected all publicly available data about each group and their respective members using a client application developed specifically for this research. This application relied on VK's public API (Application Program Interface) which offered several methods to access different data points about VK's public groups and their members including:

- Communities - to get information about groups and group members
- Wall - to get post and comments from a community wall
- Friends - to get information about group members' friendship relations
- Likes - to get information about "likes" that members and visitors leave on posts and comments they support

To ensure that we would be able to establish as complete a picture as possible, we used all four API methods to gather publicly available information about the groups and their members[3]. The VK API, though useful, had many limitations, which complicated data collection. For example, the API had a 3-requests-per-second limitation, as well as limits on the total number of requests an application can make to each of the four available API methods. As a result, to download all of the available content from each group, we had to request the data from VK around the clock, in sequence over a two-week period between May 25, 2014 and June 11, 2014.

The retrieved data was stored as a set of CSV (Comma Separated Values) and GraphML files. The CSV files included the actual content of posts as well as information about the number of comments, likes and reposts that each post received. The GraphML files were used to store

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[3] Note: In recognition of the sensitive nature of the topic and ongoing nature of this conflict, we have decided not to publish any groups' names, or names of group members to ensure their privacy, and not to include direct quotes from users posted to the group.

information about the self-declared friendship ties among group members. For users with public profiles, GraphML also included some basic user information such as their location, gender, date of birth. To analyze and visualize network data we used *igraph*, a social network library for a popular statistical package *R*. Due to the large size of the networks, ranging from 60k to 141k members and from 192k to over 330k ties, we had to use a powerful server (Dell PowerEdge T620 with 64Gb Ram, 32core Intel Xeon processor E5-2600) to visualize and analyze these networks. Table 1 shows some descriptive statistics for each group in our sample.

In addition to visualizing the network data and conducting a social network analysis, we also manually examined the pages for each of the groups and reviewed their general structure and content of discussion threads (if available). Furthermore, we reviewed group materials such as group rules, videos, and photos, as well as read 100 most recent posts and corresponding comments (if available) to get a sense of how the group operated and what types of discussions and interactions were happening on their pages.

Table 1. Groups' Descriptive Statistics

	PRO1	PRO2	ANTI1	ANTI2
Num. of Nodes	141542	96402	60506	69029
Num. of Connections	338344	221452	280678	192273
Density	0.000034	0.000048	0.000153	0.000081
Diameter	19	19	16	21
Clustering Coefficient	0.08	0.09	0.09	0.13
#Islands	35696	26364	15119	26357
Degree Centralization	0.0048	0.0073	0.0815	0.0260
Num. of Friends < 5 or empty	7.62%	9.27%	9.35%	8.71%

Results: Posting Behaviour and User Engagement

PRO1 group

The first group in our sample is PRO1. At the time of the data collection, PRO1 consisted of 141,542 members and 338,344 connections among them. The group was formed in early April 2014 to support Maidan and Antiterrorist Operation (ATO) conducted by the Ukrainian Government in Eastern Ukraine.

Since PRO1 is an open group, anyone could join it. However, moderators of the group can ban anyone from the group, temporarily or permanently, for a number of offences specified in the group. Offences include posting ads, spam, provocative messages, off-topic comments, as well as repetitive or old news. Moderators can also be banned if they abuse their administrative privileges. The group prohibits the use of profanity, slang and deliberate distortion of words. Trolling and abusive behaviour towards other members are also prohibited.

Despite these strict rules, or maybe because of them, the group was a place for very active discussions. As of May 25, 2014, there was the total of 6317 posts, on average 132 posts per day, attracting both supporters and proponents of Maidan and ATO. Figure 1 shows the number of posts, comments, likes, and reposts. By following peaks and valleys on this chart, we are able to see communication patterns over time and can identify what topics generated the most engagement from group members. For example, based on the number of likes, the most popular post in this group was an emotionally charged message about the tragic death of 48 people during the clashes between Anti- and Pro- Maidan activists in Odessa on May 2, 2014[4].

As expected, "liking a post"[5] is the most popular type of user engagement activity in the group, followed by reposting (sharing posts with one's own VK friends) and then commenting on a post. On average, each post received about 190 likes (126 median). Although 'liking' is the simplest form of group engagement, it is crucial for the involvement of less active group members and non-members. It also signals the group's interests and motivations to visitors. Additionally, 'liking' can potentially help develop a sense of community by showing what posts and comments other group members find interesting and what ideas they support.

Notably, when comparing users' interactions such as 'liking' in PRO1 with the number of original posts, we found that the number of likes and reposts highly correlates with the number of original posts (0.77 and 0.82 correspondently). In other words, more posts trigger more user interactions and more sharing. This pattern may suggest that it is not just about posting "interesting" or "provocative" content, but also about having a core group of users who are willing and ready to engage with and dissimilate posts originated in the group.

In contrast to liking and reposting, commenting on a post requires more effort and is often done by more active members. Thus it is not surprising that it was the least most "popular" user interaction type among group members.

The spikes in the Comments line in Figure 1 suggest that the commenting feature was disabled and re-enabled a few times. PRO1 is not unique in restricting the commenting feature. Moderators of PRO2 and ANTI2 have also disabled it, likely due to the overwhelming task of reviewing such a large number of comments that each post may generate.

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[4] Source: http://www.bloomberg.com/news/2014-05-19/ukraine-investigator-sees-chloroform-behind-odessa-deaths.html

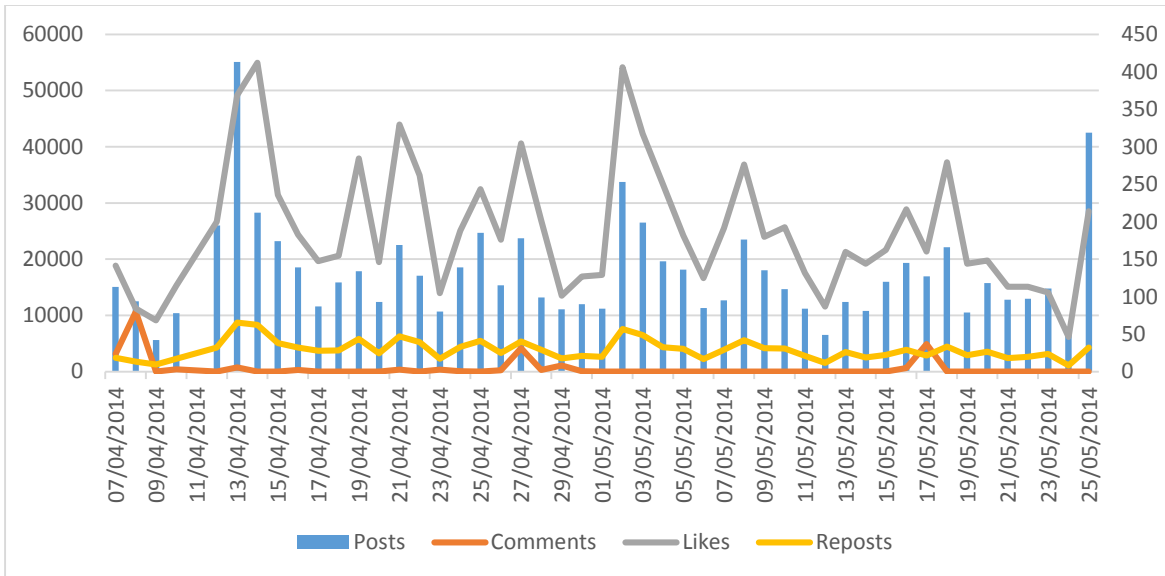[5] Notably, even non-group members can "like" something in the group.

Figure 1. User Engagement in PRO1

Note: Since there are significantly more comments than original posts, the number of posts per day is shown using the horizontal bars and their values are displayed on the secondary axis to the right.

PRO2 group

PRO2 consisted of 96,402 members with 221,452 connections among them. As stated on their page, the broad objective of this group was to "*unite and coordinate the activities of civil society in Ukraine*", "*restart system of government*" and *"achieve European integration."* Unlike PRO1, this group is more explicit about banning any Anti-Maidan messages. The group's rules also prohibit spam, racist, Nazi, anti-Semitic, communist, anti-Ukrainian messages.

PRO2 was formed in early January 2014. Since then, there have been 4379 posts, on average 35 posts per day. Based on the manual review of some recent posts, most of them were reposts of news stories from an online newspaper called Ukraine Online (ukr-online.com). Figure 2 shows the number of posts, comments, likes, and reposts over time. It appears that in early March 2014 (right before the March 16 referendum on whether Crimea should join Russia), the moderators' posting pattern drastically changed. The number of daily posts doubled and the commenting feature was disabled (likely due to spam, controversial messages and/or inability to moderate a large volume of comments). Up until that point, the number of likes and reposts was generally proportional to the number of posts (similarly to PRO1). However, after the change, the relationship between the number of posts and the number of likes and reposts became less predictable. The Pearson correlation for the whole time period indicates only a weak correlation (0.42 and 0.33). This suggests that by increasing posts and disabling the commenting feature, the group moderator(s) might have discouraged user engagement. This is indirectly supported by the fact that the number of users of this group dropped since the data collection ended in May from 96402 to 94833 as of August 9, 2014.
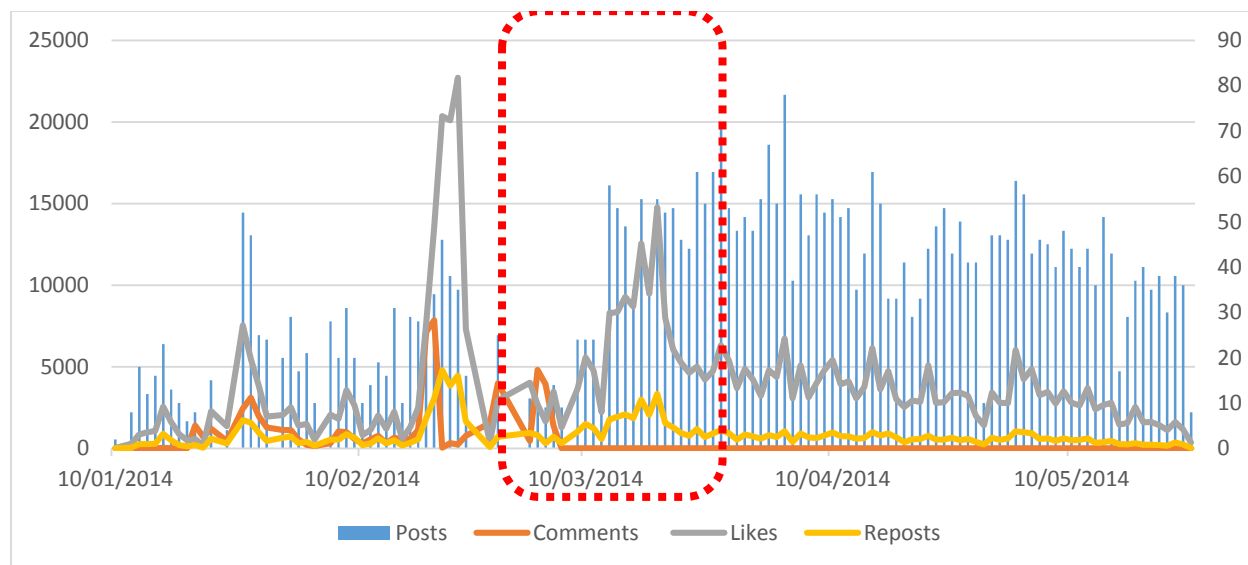
Figure 2. User Engagement in PRO2

After the commenting feature was disabled, the discussion board became the only place for group members to engage one another "verbally". There were two main threads that existed on the discussion board: a general discussion and a thread for reporting so-called "trolls." The group discussions were primarily about recent events and included highly charged debates between Pro- and Anti-Maidan posters. Based on our manual review of some recent comments, it appeared that only few people were engaged in the discussion within the forum. This suggests that the group might have been primarily used by others as a source of recent news regarding the Ukraine Crisis rather than as a platform for collective action. This use would seem to be out of sync with the group's main objective *"unite and coordinate the activities of civil society in Ukraine."*

ANTI1 group

ANTI1 group supported Anti-Maidan activities in Donbas, an Eastern region of Ukraine. The group was initially used to organize Anti-Maidan protests in the Donbas area. However, after activists proclaimed the region to be the Donetsk People's Republic on April 7, 2014, the group became the place to recruit volunteers, military personnel and other professionals to support the cause of the Republic. The group was also a place to share recent news about the Republic and military actions by its militia. During the data collection, there were 60506 participants who shared 280678 friendship ties with one another.

Between February 25, 2014 and May 25, 2014 (the data coverage period), there were 1258 posts, about 14 posts per day (see Figure 3). Like in PRO1, liking and reposting patterns closely followed posting behaviour (correlations equaled to 0.68 and 0.69), suggesting that its users actively followed and engaged with the group content.

The discussion board section of the group contained 15 threads with most popular topics including a general discussion, how to join the rebellion, and opinions about the events. It

appeared that these discussion threads were started in early March 2014 around the time of the referendum in Crimea.
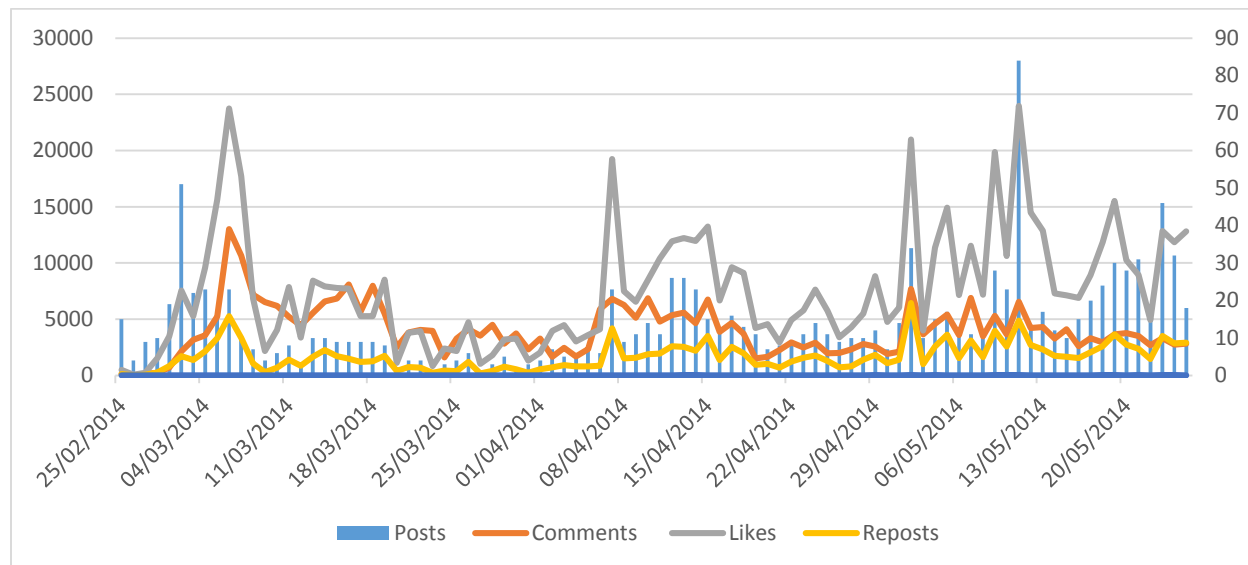

Figure 3. User Engagement in ANTI1

ANTI2 group

In existence since 2011, ANTI2 originally focused on Anti-American and Pro-Russia discussions. However, since the events on Maidan in early 2014, the group shifted its focus to support Anti-Maidan activism, including the support of two self-proclaimed republics – Donetsk and Lugansk People's Republic. At the time of the data collection, the group contained 69029 members and 192273 friend connections among them.

Between January 1, 2014 and May 25, 2014, the moderators posted 8842 posts, with an average of 39 posts per day. Based on the review of most recent posts, the group primarily reposted news stories originally published on NewRussianNews.ru. As with the other groups in our sample, the commenting features was disabled (on May 4, 2014). The discussion board was also disabled[6] by the group administrator, due to the inability to moderate the discussion. Thus, at the time of writing this paper (August 2014), the group primarily served as an information source.

Although the posting pattern in ANTI2 was similar to PRO2 (both groups increased the number of daily posts, both groups frequently reposted online news stories), ANTI2 differed from PRO2 in the relative number of likes and reposts, which increased proportionally to the increased number of posts over time (see Figure 4). Also, unlike PRO2, the number of users had increased from 69029 to 108902 within two months, suggesting a growing interest in joining this group[7].

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[6] As of July 28, 2014, there was only one discussion thread (started on July 9, 2014) with about 460 posts. Recent discussion topics included how to help rebels in Donbas and how to avoid fighting territories by civilians.

[7] At the time of this research, we did not analyze user profiles to identify whether any of the new members were fake or real accounts.
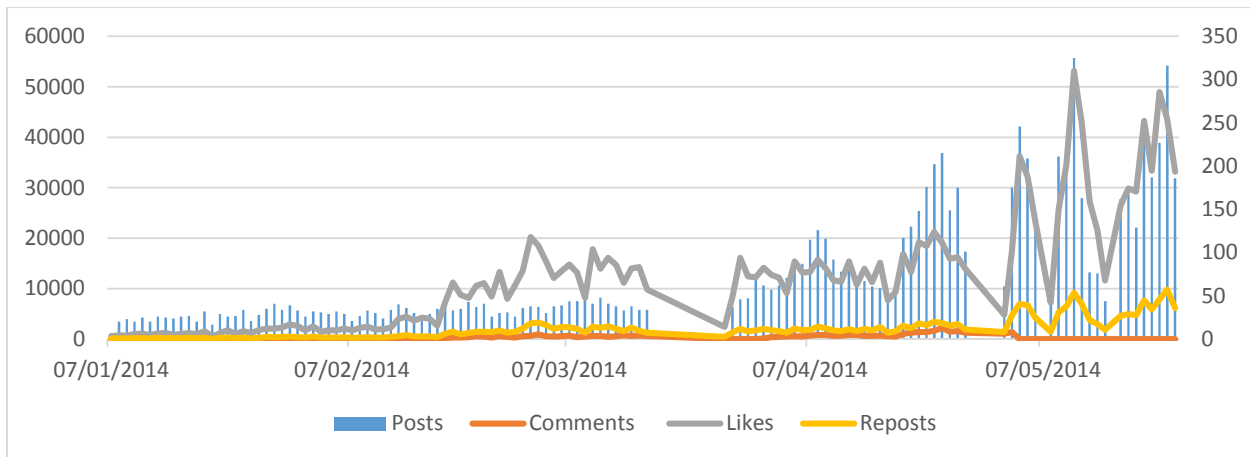
Figure 4. User Engagement in ANTI2

Note: The two visible gaps in the timeline (one in March and another in April) indicate the two time periods for which VK API did not return any results, likely due to some technical issues with their API service.

Results: Social Networks

PRO1 network

To better understand group dynamics, we visualized and analyzed the social network of group members in PRO1 (see Figure 5). The nodes in the network visualization represent VK users, and the connections represent self-reported friendship ties. Due to the large network size, only the largest connected component (where all nodes are connected to at least one other node) is shown in the visualization[8]. Isolated nodes and small, disconnected clusters are not visible.

Based on the visual examination, the largest connected component of the network is composed of two interconnected clusters, a large one and a smaller one. The visualization of the clusters shows that people share closer connections among members found within each cluster, than with people in the network as a whole. Each cluster is likely to represent people who share some interests and/or background (a well-documented phenomenon of so called *homophile*). Based on the clusters visualized for PRO1, it appears that the largest cluster primarily consists of people from Ukraine (yellow color nodes), and the smaller cluster primarily contains people from Russia (red color nodes). People from other countries (green color nodes) appear to be spread evenly across both of the clusters.

One possible explanation for this network configuration is that the smaller cluster, whose members are mostly from Russia, shares the group's Pro-Maidan views but might not necessarily

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[8] In all four networks, the largest connected component consisted of the majority of nodes. In the PRO1, PRO2, and ANTI1 networks, it represented 70-73% of members; in ANTI2, it included a relatively smaller majority (58% of all members), primarily due to the large number of isolated nodes (35%).

have friends from Ukraine among PRO1 group members on VK. Because of this they are not directly connected to the main, largest cluster whose members mostly hail from Ukraine.

Another possibility is that people in the smaller cluster are opposing the group's views. They may be joining the PRO1 group with malicious intent in order to monitor its messages, post misinformation, antagonize other group members, or even try to discredit the group and make it less attractive to others to join. The latter possibility is in line with some of the previous work discussed in the Literature Review section.
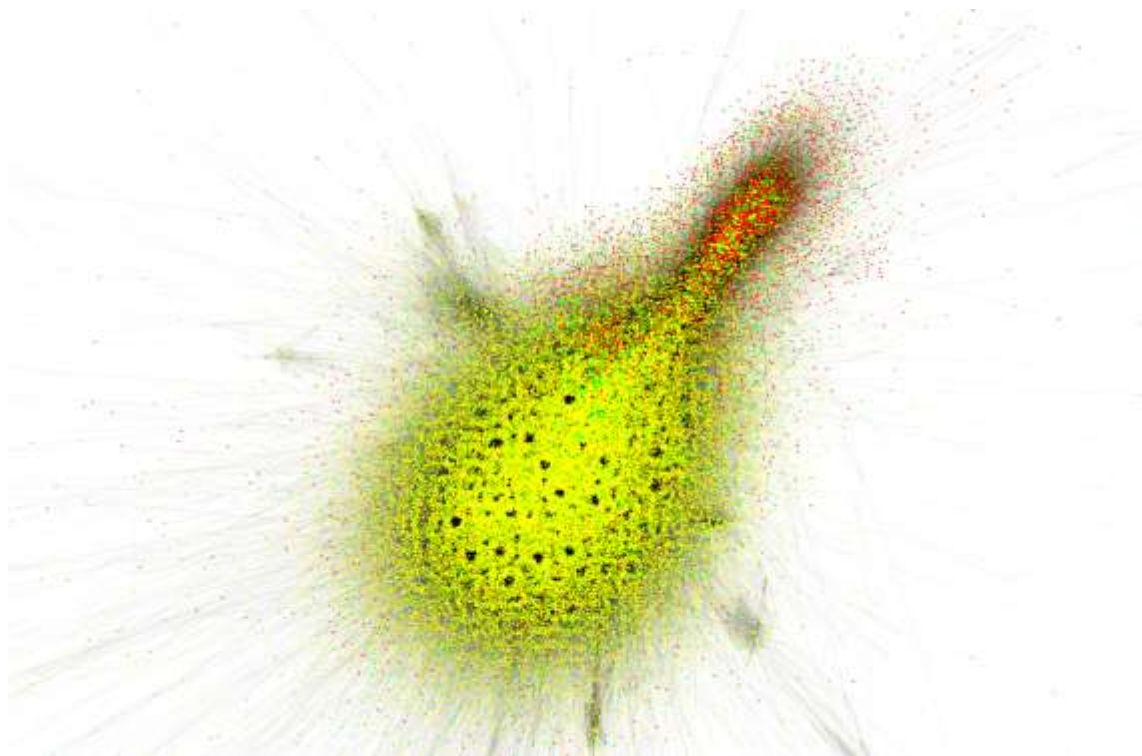

Figure 5. PRO1 VK Friends Network

Note: Only the largest connected component is visualized. Yellow color nodes – users from Ukraine; Red color nodes – users from Russia, Green color nodes – users from other countries. The layout algorithm is LGL (Large Graph Layout).

PRO2 network

Structurally, the PRO2 network is very similar to PRO1 (See Figure 6). Both networks have the same diameter (the longest path between any two nodes) and a similar clustering coefficient. Just as PRO1, the PRO2 network displays a large, densely connected main cluster (of primarily people from Ukraine) and a smaller cluster (that looks like a "comet tale") of people primarily from Russia. The slight difference from the visualization of PRO1 is that the smaller cluster splits into two parts. Perhaps the split separates users from different geographical areas or users who share different interests.

Another difference from the PRO1 visualization is that the PRO2 network has higher density (more ties relatively to the number of possible ties). This may suggest that people who participate in PRO2 are more tightly connected on VK than people who are members in the PRO1 group.
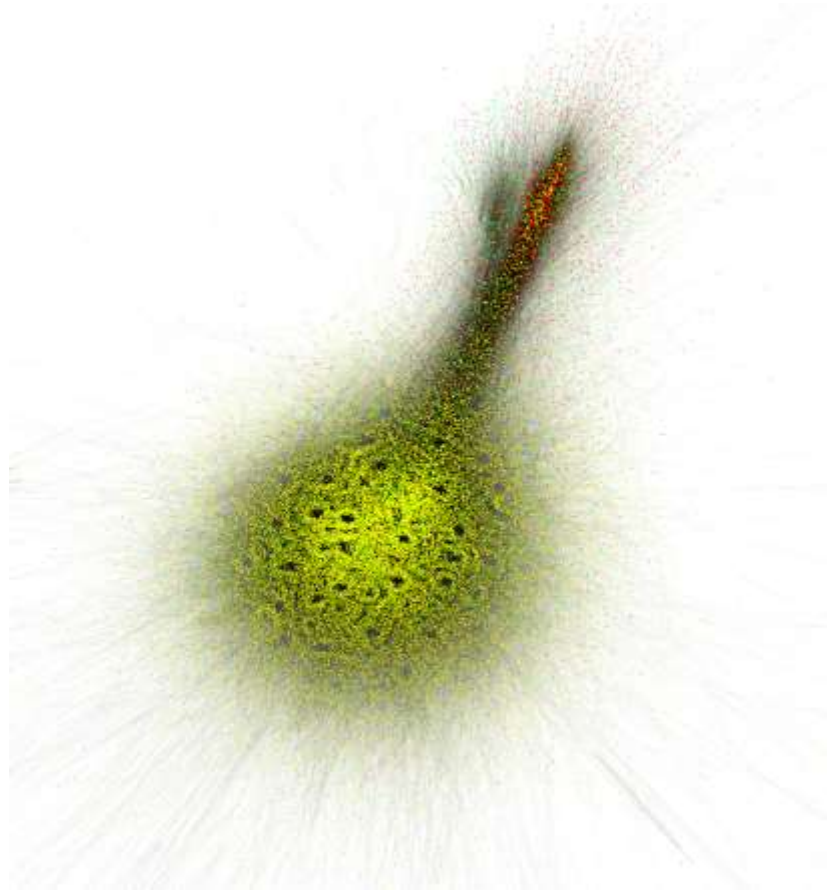

Figure 6: PRO2: VK Friends' Network

ANTI1 network

Based on the network visualization of ANTI1 (Figure 7) there are two clusters, similarly to PRO1 and PRO2: the larger cluster consists primarily of users from Ukraine, and the smaller cluster is a mixture of users from Russia and Ukraine. Unlike the PRO1 and PRO2 networks, the "Russian" cluster in ANTI1 is more pronounced and better integrated with the main cluster. This suggests its importance and influence in the network overall. This also suggests that there may be two types of people from Ukraine in this group: those without direct ties to Russia (in the larger cluster) and those who are closely related to people from Russia.

Although the network size (the total number of group members) is smaller than in either PRO1 or PRO2, the density of the ANTI1 network is higher than either of the previous two networks (0.00015 vs 0.000034 in PRO1 and 0.000048 in PRO2). This density suggests that more group members were likely friends with each other on VK in ANTI1 than in the other two networks. The presence of tightly connected members may signify a stronger (online) community. This density, coupled with the fact that ANTI1 primarily focuses on activities within one province in

Ukraine (Donetskaya Oblast), may suggest that people in the group are also geographically close to one another, and thus more likely to friend each other on VK.

Additionally, the degree centralization for this network[9] is higher - 0.0138 than in PRO1 and PRO2, comparing to 0.0048 in PRO1 and 0.0073 in PRO2. This suggests that the "degree" power (as represented by the number of direct connections) is concentrated within fewer hands than in PRO1 and PRO2. Concentration of power may suggest a hierarchical group structure with only a few influential people in the group.
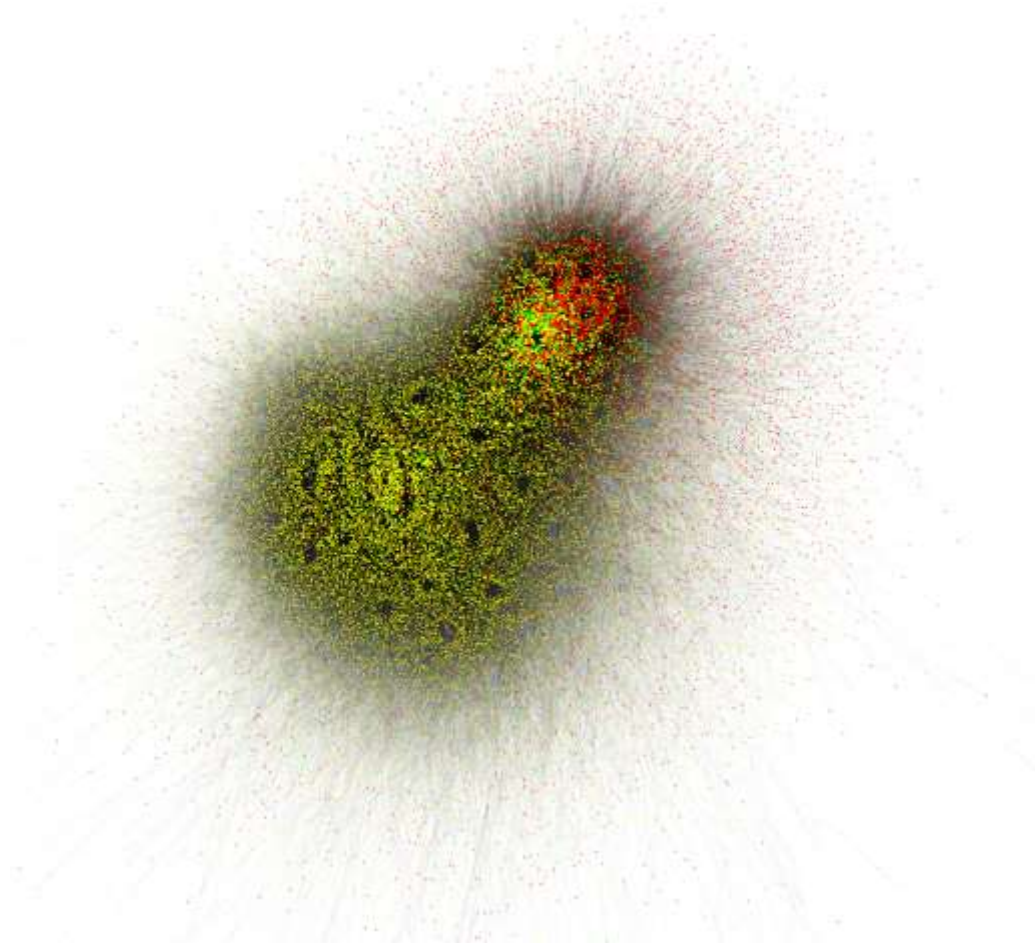

Figure 7: ANTi1 Friends' network

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[9] Network centralization is computed based on "the centrality scores of the vertices within the network: more variation in centrality scores means more centralized network" (Nooy, Mrvar, and Batagelj, 2011, p.120)

ANTI2 network

The social network of ANTI2 is set apart from the four networks in the dataset (see Figure 8). Instead of two pronounced clusters, as we saw it in the other three networks, ANTI2 is primarily organized in one densely connected cluster, reflected in the network's high clustering coefficient of 0.13 (see Table 1). A high clustering coefficient may signify a stronger agreement among the group members.

Unlike the previous three networks, the ANTI2 network visualization also shows tighter inter-connections between people from Russia and Ukraine. This suggests that group members share similar views on the events in Ukraine, regardless of being from Russia or Ukraine. The groups' overwhelming Pro-Russian rhetoric supports this expectation.
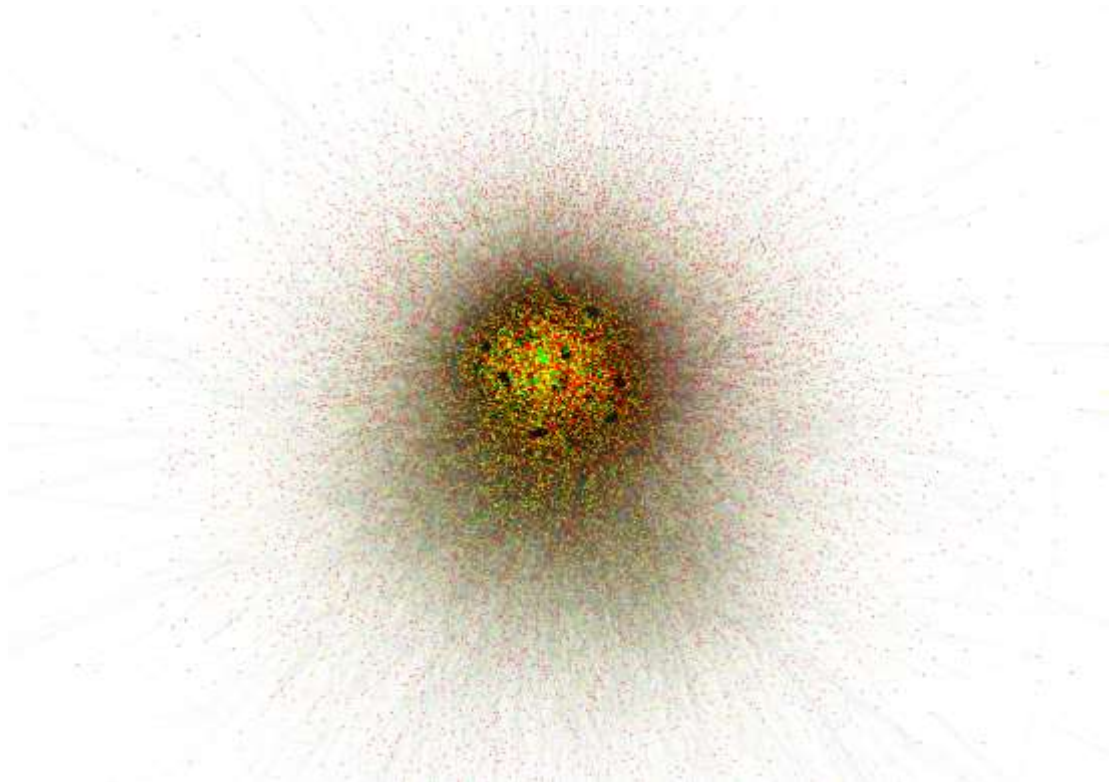

Figure 8: ANTI2 VK Friends' network

Conclusions

In this paper we set out to examine user engagement patterns and online social networks of four VK groups. Two groups were Pro-Maidan and two were Anti-Maidan. Our main goal was to compare these four groups functionally and structurally, considering their differences in the type of political ideology that they support. We found both similarities and differences in our analysis.

Comparing Groups based on Posting Patterns and User Engagement
PRO2 vs ANTI2 - Groups with Limited User Engagement

Based on the posting patterns and user engagement, PRO2 is more similar to ANTI2, since both groups primarily play the role of an information source for their members. Both groups mainly

feature reposts of news stories from a single online source (PRO2 features news from a Pro-Ukrainian site and ANTI2 from a Pro-Russian site). Both groups also disabled the commenting feature for posts. Despite these similarities, PRO2 appears to be losing support, while ANTI2 is gaining support, based on a more detailed examination of the number of likes and reposts over time. More specifically, the beginning of the decline in user engagement in PRO2 can be traced back to early March when the number of moderator's posts per day increased. Initially, users reacted to the increased number of posts in kind, by more actively liking and reposting the group's posts. After the initial and brief spike in user engagement, it gradually slowed down (see Figure 2). One of the possible reasons for this negative trend is that users could not keep up with the increased number of posts and felt overwhelmed. Perhaps not coincidentally, this happened around the time when the commenting feature was disabled by the group administrator (see Figure 2, how the red line that represents the number of comments per day flattened in early March). The closure of the commenting feature might have caused some dissatisfaction among members and could have led to their less active participation in the group.

Although ANTI2's commenting feature had also been disabled, this did not seem to discourage user engagement. In fact, the number of members in ANTI2 went up by 1.6 times within just a two-month period from June 2014 to August 2014. This trend is especially peculiar because ANTI2 does not offer its members many opportunities to interact with one another. There are several possible explanations regarding why ANTI2 has gained members while PRO2 has not. ANTI2 was founded two years prior to the conflict in Ukraine in December of 2011. Thus, it is likely that it had a longer period of time to attract and cement the core group of followers. This is especially evident from the network representation of this group - a single, densely connected cluster, which suggests close relationships within its group members (see Figure 8). This is unlike the other three groups in the study, where each group was primarily divided into two clusters, likely representing some differences among group members and dividing them into two camps (see Figure 5-7).

One possible way to differentiate between the two groups (PRO2 and ANTI2) is to look at their clustering coefficient; a social network analysis property that can be used to detect closely connected groups. ANTI2 has the highest value of this measure (0.13) among the four groups in the study which clustering coefficients ranged from 0.8 to 0.9. In the future work, we are interested in investigating whether by disabling the commenting and discussion features, the group attracted more group members by eliminating opportunities for "trolls" and other users to start conflicts. Although ANTI2 has a limited set of tools for deliberation and collective action, it may still be a good place for people to keep up with latest news and discover other relevant resources, organizations and people to follow.

PRO1 vs ANTI1 - Groups with Higher User Engagement
PRO1 and ANTI1 are somewhat different from PRO2 and ANTI2. Functionally, both groups allow discussions among their members; either by commenting on moderators' posts or posting messages to discussion threads. However, what sets them apart from each other is that PRO1 is organized as a news sharing and discussion space for its members, and ANTI1 focuses on supporting collective action, such as organizing protests or recruiting volunteers for militia.

Although ANTI1 does not publish as many posts per day as PRO1, its posts do generate a steady number of likes and reposts which would suggest the presence of a generally engaged audience. One of the possible reasons for the popularity of ANTI1 is its narrow focus on a specific geographic area in Ukraine – Donbas. Additionally, ANTI1 has clearly defined goals and calls for action. From a network perspective, this is evident by a denser network structure (see Figure 7), which is 2 to 4 times denser than the other three groups. The density suggests that there are more people who know each other (friends on VK) among the ANTI1 members than in the other groups.

Comparing Groups based on Network Structures

From a network perspective, the two groups that appear structurally similar are PRO1 and PRO2. The largest connected component for both of the networks consists of two very pronounced and interconnected clusters: the larger cluster contains primarily people from Ukraine (yellow color nodes) and the smaller cluster - primarily people from Russia (red color nodes) (see Figure 5 and 6). Our working hypothesis is that the smaller cluster might be made of people who are likely to disagree with the group's main objectives and are there to engage other members in verbal disputes. This supposition is supported by our review of some of the messages posted to the discussion thread by group members. Based on the content of the messages, it is clear that both PRO1 and PRO2 attracted people on both sides of the issue: for and against the protest in Maidan Square. As a result, the presence of heated debates and the use of abusive language are quite common.

The ANTI1 network also resembles the structure of the PRO1 and PRO2 networks: a visible two-cluster structure, with the larger cluster of mostly people from Ukraine, and the smaller cluster with a concentration of members from Russia (and other countries) (see Figure 7). The structure of ANTI1, shows the smaller cluster as more pronounced and more integrated with the main cluster which may be expected as this group has a strong Pro-Russian orientation. Also, if we examine the size of the nodes in the ANTI1 network visualization, where the node size represents the number of friendship connections, it appears that the smaller ("Russian") cluster contains more members with more connections (higher degree centrality), depicted by larger nodes, than the larger ("Ukrainian") cluster. This would imply that more connected, and potentially more influential members of this group are located in the smaller ("Russian") cluster. This pattern is supported by a relatively higher degree centralization of this network. Degree centralization is a global network measure that helps to identify whether "power" in the network is evenly distributed across all members (when degree centralization = 0) or concentrated in the hands of a few (degree centralization approaching 1). In the extreme case, when one person is connected to everyone in the network, but his/her friends do not know each other (so called a "star" configuration), degree centralization is equal to 1. When comparing degree centralization values across the four networks, ANTI1 has the largest value (0.0815) which is 17 and 11 times higher than in PRO1 and PRO2 and 3 times higher than in ANTI2. This may be indicative of more pronounced leadership structure in this group.

Finally, ANTI2 stands out as the most structurally different among the four networks. This is the only network in our sample that consisted of one densely connected component (see Figure 8).

Study Implications and Future Work

This study is helping us better understand how, and for what purposes, various activist groups use social media, specifically VK during the 2014 conflict in Ukraine. In a broader context, this work is also starting to reveal some possible relationships between group goals and membership composition (on the one side), and user engagement behaviour and social network properties (on the other). Furthermore, this work identified a number of indicators based on user interaction and network structure that other community researchers can begin examining and applying to online communities outside VK. Online community organizers can also learn from this work to examine what influences the success and longevity of an online group.

Our future work will build on this initial research by performing a more detailed content analysis of the posts and discussion threads in these groups and comparing the results with the results derived using social network analysis. Furthermore, the results in the current study suggest a number of hypotheses that will be tested statistically by using Exponential Random Graph Modeling. We are particularly interested in examining user properties such as gender and location information, and their possible effect on participation in the group.

Finally, since the current work primarily focused on examining the largest, most connected component, in the social graphs, isolates (users who joined the group, but do not have any "friends" there) have been largely excluded from the analysis. However, the numbers of isolated node in the four networks are significant, ranging from 24% to 35%. In the future, we will explore the roles of isolates in the group whether they are there to lurk, spam, troll, or whether they are just fake accounts.

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References

Aday, S., Farrell, H., Lynch, M., Sides J., & Freelon, D. (2012). New media and conflict after the Arab Spring. *United States Institute of Peace*, (80). Retrieved from http://www.usip.org/sites/default/files/PW80.pdf

Burns, A., & Eltham, B. (2009). Twitter free Iran: An evaluation of Twitter's role in public diplomacy and information operations in Iran's 2009 Election Crisis Presented at the Communications Policy & Research Forum 2009, University of Technology, Sydney (pp. 322–334). Retrieved from http://networkinsight.org/verve/_resources/Burns_Eltham_file.pdf

Chatfield, A., Akbari, R., Mirzayi, N., & Scholl, H. J. (2012). Interactive effects of networked publics and social media on transforming the public sphere: A survey of Iran's leaderless "Social Media Revolution." In *2012 45th Hawaii International Conference on System Science (HICSS)* (pp. 2552–2562). doi:10.1109/HICSS.2012.336

Croeser, S., & Highfield, T. (2014). Occupy Oakland and #OO: Uses of twitter within the occupy movement. *First Monday*, *19*(3). doi:10.5210/fm.v19i3.4827

Duvanova, D., Semenov, A., & Nikolaev, A. (2014). Do social networks bridge political divides? The analysis of VKontakte social network communication in Ukraine. *Post-Soviet Affairs*, *0*(0), 1–26. doi:10.1080/1060586X.2014.918453

Eltantawy, N., & Wiest, J. B. (2011). The Arab Spring social media in the Egyptian revolution: Reconsidering resource mobilization theory. *International Journal of Communication*, *5*(0), 18.

Jensen, M. J., & Bang, H. P. (2013). Occupy Wall Street: A new political form of movement and community? *Journal of Information Technology and Politics*, *10*(4), 444–461. doi:10.1080/19331681.2013.803948

Khondker, H.H. (2011). Role of the New Media in the Arab Spring. *Globalization*, *8*(5), 675–679.

Khonsari, K. K., Nayeri, Z. ., Fathalian, A., & Fathalian, L. (2010). Social network analysis of Iran's Green Movement: Opposition groups using Twitter. In *2010 International Conference on Advances in Social Networks Analysis and Mining (ASONAM)* (pp. 414–415). doi:10.1109/ASONAM.2010.75

Kwon, K. H., Stefanone, M. A., Barnett, G. A. (2014). Social network influence on online behavioral choices exploring group formation on social network sites. *American Behavioral Scientist*, *58*(10), 1345–1360. doi:10.1177/0002764214527092

Mascaro, C. M., & Goggins, S. P. (2011). Brewing up citizen engagement: The Coffee Party on Facebook. In *Proceedings of the 5th International Conference on Communities and Technologies* (pp. 11–20). New York, NY, USA: ACM. doi:10.1145/2103354.2103357

Morales, A. J., Losada, J. C., & Benito, R. M. (2012). Users structure and behavior on an online social network during a political protest. *Physica A: Statistical Mechanics and Its Applications*, *391*(21), 5244–5253. doi:10.1016/j.physa.2012.05.015

Nooy, W. de, Mrvar, A., & Batagelj, V. (2011). Exploratory social network analysis with Pajek. Cambridge University Press.

Sahar Khamis, & Katherine Vaughn. (2011). Cyberactivism in the Egyptian revolution: How civic engagement and citizen journalism tilted the balance. *Arab Media and Society*, (14).

Szostek, J. (2014). The media battles of Ukraine's EuroMaidan. *Digital Icons*, (11). Retrieved from http://www.digitalicons.org/

Theocharis, Y. (2013). The wealth of (occupation) networks? Communication patterns and information distribution in a Twitter protest network. *Journal of Information Technology & Politics*, *10*(1), 35–56. doi:10.1080/19331681.2012.701106

Thorson, K., Driscoll, K., Ekdale, B., Edgerly, S., Thompson, L. G., Schrock, A., Swartz, L., Vraga, E.K., Wells, C. (2013). Youtube, Twitter and the Occupy Movement: Connecting content and circulation practices. *Information Communication and Society*, *16*(3), 421–451. doi:10.1080/1369118X.2012.756051