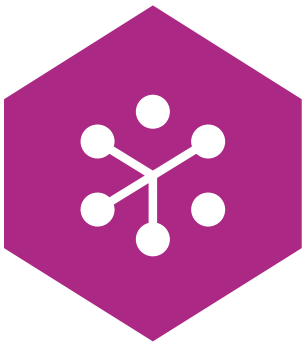

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The Instagram #climatechange Hashtag Community: Does It Impact Social Capital and Community Agency?

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Abstract: Some scholars uphold social media platforms such as Instagram as potentially powerful technologies for social change, since they allow people to connect with each other independent of place and space and reach a broader population with their message. A picture is worth 1,000 data points, and Instagram images can have a compelling, persuasive impact that may inspire others to act on an important issue like climate change. Despite this, scholars remain concerned that online "slacktivism" begins and ends with posting online. We thus chose one hashtag community to examine the potential for meaningful action via the building of social capital and novel network formation on the issue of climate change. We conducted a mixed-method analysis of Instagram posts tagged with #climatechange, looking at sentiment through text analysis and complementing it with a network analysis of user mentions. We show how, even though Instagram affords a type of interaction that has the potential to encourage social capital and network formation to effect change, this potential is currently unrealized within the #climatechange community due to the mostly unidirectional nature of comments and posts and the homophilic nature of the media.

Keywords: Social Media, Social Capital, Instagram, Climate Change, Agency, Sentiment, Network Analysis

Introduction

Climate change is a messy, complicated problem, and its solutions are beyond any one sector, any one discipline, or any one level of government to solve (Dale 2001). Some scholars even refer to it as a super wicked problem that requires unprecedented collaboration between local communities and levels of government (Levin et al. 2012). Climate change is ubiquitous; it does not respect human geographical boundaries, and local communities are on the frontline of implementing climate innovation (Dale 2008; Dale 2015; Burch 2010; Burch et al. 2014; Shaw et al. 2014). As such, modern communication channels such as social media may be critical for knowledge mobilization and transfer, helping civil society to realize potential solutions, highlight local innovations, and work toward social consensus on implementation plans. The ability of social media channels to engage diverse audiences is understudied in the academy.

The wide-scale social engagement necessitated by super wicked problems needs to involve diverse and highly plural audiences of all ages, and voices that are not necessarily "heard" at traditional decision-making tables. One example is online virtual, real-time e-dialogues and recent conversations such as the *Climate Imperative* and *Post-Cop 21* (Dale 2016). Tending to level the communication playing field, social media platforms may also be useful for creating the conditions necessary to engage communities in climate action, particularly since they are already widely used and have, in their relatively short history, offered unprecedented reach for activism and grassroots organization (Benkler 2006; Drache 2008). Even the science of climate change can potentially benefit from digital and social communication, if researchers engage in using more diverse channels than traditional peer-reviewed journal articles. For example, in previous research, virtual communication was seen as a key element for creating distributed networks

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essential for climate change research communications and for building new practitioner/research knowledge collaborations (Newell and Dale 2015).

Hashtag communities—that is, online communities formed when people use a specific hashtag to share information on a topic or issue—have been highlighted as communication tools that can involve the diverse audiences needed for meaningful dialogues on topics such as climate change (Drache 2008; Shirky 2010; Rambukkanna 2015). However, more work needs to be done to understand if the potential of these communities can be harnessed deliberately. More specifically, if these communities are to become a productive space for dialogue on climate change, they must go beyond merely dialogue, or what some term "slacktivism" (Morozov 2009), and begin to facilitate community engagement around concrete actions. They must be designed to meet the necessary conditions for encouraging individual and collective agency and novel network formations, so that people can both discuss the issue with others and also feel empowered to act (Ling and Dale 2013).

While previous research has looked at climate change on such platforms as Twitter and blogs (Alam and Shahriar 2013; Williams et al. 2015), the literature related to climate change communities on the popular image-sharing platform Instagram is still quite limited. Thus, this article builds on previous research related to platforms such as Twitter to explore the potential role of Instagram in building dialogue, reveals points of consensus and conflict, and shows how social capital network formation can potentially lead to citizen agency with respect to climate change. To do so, we examine social capital and its relation to community and individual agency. We then consider the potential of digital participatory technologies and the networks they create. Next, we conduct both a sentiment analysis and a network analysis of the #climatechange community on Instagram to determine what, if any, conditions for social change and collective agency exist. We show that the #climatechange community on Instagram has the potential to foster the kind of discussion that would build community capital appropriate to inspire action, but additional measures must be taken to move the community from online slacktivism to real-world action.

Social Capital, Agency, and Change

Agency, or the feeling that one has about one's ability to effect change, is achieved in communities through a combination of bonding, bridging, and linking social capitals, also known as "strong" and "weak" ties (Narayan-Parker 1999; Onyx and Bullen 2000; Putnam 2001; Woolcock 2001). When applied to changes that must occur beyond the sphere of any one individual, such as climate change, agency must not only be considered as an individual trait, but also a communal one, since large problems require that a community of people can collaborate and work together for the common good (Newman and Dale 2007). While there is a relationship between individual agency and community agency (Ling and Dale 2013), social capital is the grease, the lubricant that moves whole communities to action; however, the role that social media in the digital age can play is a complicated concept to unpack.

At its basic level, bonding social capital refers to relationships between closely tied individuals such as family members or close friends (Woolcock 2001). Bridging social capital can connect weakly tied groups or individuals, providing greater access to diversity, innovation, and resources (Granovetter 1973). Finally, linking social capital connects the community to resources, ideas information, as well as formal institutions outside the community (Ling and Dale 2013). Social capital can serve both a positive and negative social purpose. While online social networks initially bridge disparate communities (Wellman and Gulia 1999), social networks, as they grow, demonstrate a tendency towards homophily, or the tendency of groups to form from similar actors, and then become more similar with time. Thus, more research needs to be conducted on social media channels to evaluate the degree of homophily of thought and "like" congregating towards "like," and, more importantly, strategies to offset this tendency.

There are still ongoing debates as to the effect that social media and networked digital technologies have on social capital, and its corresponding link with community agency. In a general sense, broadcast media has long been critiqued based on the assumption that it limits community agency. For example, in their foundational work, Lazarsfeld and Merton (1971) coined the term "narcotizing dysfunction" to understand the ways that media in some ways create passivity in the publics that consume them. This debate continues with new digital and social media. While some scholars have argued that networked digital media create new conditions for social capital across spatial and temporal boundaries (Rainie and Wellman 2012; Shirky 2010; Drache 2008), others have argued that these technologies are part of a suite of developments that have effectively robbed communities of their social capital (Putnam 2001; Postman 1992). According to Ling and Dale (2013), not all forms of social capital are created equal, and some are more closely related to agency than others. They identify bonding and bridging social capital as being necessary for community agency, along with "the presence or absence of 'connectors'; the degree of openness to new ideas and individuals; the structural resilience of networks; [and] capacity to resolve power and conflict issues" (Ling and Dale 2013, 6). Importantly, along with these factors, they also note that a trigger, or some reason to act, must be present that mobilizes the community. This means that in order to determine any online communities' potential to effect meaningful social change, we must examine those communities for evidence of the types of social capital that can be mobilized in the presence of a trigger.

Communication and Climate: Networked Potentials

Networked digital communication technologies, such as social media, have been proposed as ways to build social capital and mobilize often disparate communities. Since networked individuals tend to reach out and form groups of like-minded people (Wellman and Gulia 1999; Rainie and Wellman 2012; Castells 2012), social media is often seen to move people from an individual orientation into communities of choice. As such, these technologies have been strategically used and implemented in successful social movements (Castells 2012; Rainie and Wellman 2012). Furthermore, these technologies are seen to level the playing field, giving anyone with a computer and Internet connection equal footing in a world in which broadcast power becomes less relevant.

Politically, social media channels such as Twitter, blogs, and Facebook have been studied extensively to show what influence these communication tools might have over public opinion. In fact, recent measures indicate that young people, sometimes known as millennials, get the majority of their news from social media rather than broadcast television, radio, or newspapers (Mitchell and Holcomb 2016). Blogs in general, and microblogs such as Twitter in particular, can be important places for people to discuss their opinions on a range of topics. As such, activity on these platforms can be mined to understand or predict trends in public opinion (Auer, Zhang, and Lee 2014; Asur and Huberman 2010).

When people self-organize virtually, there are both positive and negative benefits from their digital connection to a wide range of similarly minded, but weakly tied individuals (Benkler 2006; Granovetter 1973; Wellman and Gulia 1999). Weak social ties are part of every network, and can be highly beneficial to accelerate innovation by bringing more diverse people with different experience together based on a shared interest. Conversely, individuals that are too similar, or communication networks in which one or two influencers dominate the conversation, may not provide the benefits of weakly tied networked individuals. Instead, we may see the presence of filter bubbles or online echo chambers (Benkler 2006)—a critique that has been leveled at Twitter in particular in the past (Williams et al. 2015). Other scholars have referred to this as homophily. This phenomenon may limit the success of networks, as a diverse set of bridging ties within a group increases a group's agency, and diverse group membership is an important element of any social movement (Newman and Dale 2007).

Slacktivism and Social Media

Despite the potential of social media for allowing online bottom-up organization of communities and information sharing within global communities of choice, online social and political movements are critiqued for being ineffective at creating real and meaningful change in the world. The tendency of social media platforms is to encourage posting about an issue, but doing little more is often derisively referred to as "slacktivism" (Morozov 2009; Sherer 2015; Boulton 2017). It is characterized as "a sort of lazy and phony form of activism that appears on social media in the form of likes, shares, or follows…[which is] an inevitable obstacle that activists attempting to use these technologies must overcome" (Sherer 2015). Importantly, some feel that slacktivism not only distracts from meaningful action such as real-life protests, strikes, or community engagement, it also replaces it. In a sense, it "gives those who participate in 'slacktivist' campaigns an illusion of having a meaningful impact on the world without demanding anything more than joining a Facebook group" (Morozov 2009). In other words, when people join a social media community or post an angry comment about an issue, they feel they have done an action to help mitigate that issue, even if they do nothing else.

Other scholars take issue with this black and white, all or nothing view of online action and online activist communities. For example, Shirky (2010) suggests that posting online is a gateway that can lead to many different types of online and offline action. Similarly, Boulton (2017), researching the #KONY2012 campaign—much maligned for its degree of online-only engagement—suggested that even if the campaign only succeeded in making the issue of human rights "cool" among a group of young people, it still can be considered to have a positive impact not captured by the idea of slacktivism, making it a case study in social issue communication across different social media platforms that included the micro-blogging services Twitter and Instagram.

Microblogs: Twitter and Instagram

Originally described as a "form of blogging that lets you write brief text updates of less than 200 characters" (Java et al. 2007, 56), microblogs are now also understood to include short video (as in the case of the platform Vine), image posts (as in the case of Instagram), and also short text or mixed text/images/video (as in Tumblr or Twitter) (Boothe-Perry 2013; Thirumuruganathan et al. 2016). Microblogs have gained increased attention within the scholarly community in recent years. For example, they have been examined for ways in which they facilitate information sharing during natural disasters (Vieweg et al. 2010), public relations and marketing (Ratkiewicz et al. 2010), finance (Oh and Sheng 2011), and education (Holotescu and Grosseck 2010), just to name a few applications. Other scholars have examined how networks form and are maintained (Newman and Dale 2007; Java et al. 2007), how hashtags help to transmit and categorize information (Efron 2010), and the ways microblog posts can be mined for marketing purposes, intelligence, and disaster mitigation (Ikawa, Enoki, and Michiaki 2012; Shen et al. 2009; Li and Li 2013).

Unlike other microblogs, Instagram is primarily image-focused, offering users the opportunity to take a picture or a short video and share these with a network of friends as well as the general public of Instagram users (Hu, Manikonda, and Kambhampati 2014). Instagram is mainly accessed through mobile devices, though images can be viewed via a traditional web browser. In part, researchers note that Instagram's popularity has been fueled by the growth of mobile applications and the uptake of mobile devices over the last half decade or so (Saloman 2013). This mobile-first affordance of the platform, along with the tendency of hashtags to connect disparate communities of networked individuals (Shirky 2010), have made Instagram an invaluable tool during such protests as the #ByeFelipe campaign against sexual harassment (Shaw 2016).

There is still more work to be done related to understanding how people are using hashtags on short or microblog-style social media platforms like Twitter and Instagram to engage with climate change-related communities, and whether these communities demonstrate the criteria needed to inspire collective agency. In an important article on networks of climate change communication on Twitter, Williams et al. (2015) reviewed several climate-related hashtags to show evidence of online filter bubbles and echo chambers related to climate change discourses taking place. This finding built on such work as Sharman (2014), who examined online climate change skeptic blogs, Gallois, Ogay, and Giles (2005), who studied Twitter community ingroups and outgroups, and Postmes, Spears, and Lea (2000), who studied email discussion. Each indicated that in political or polarizing discussions, people tend to self-organize into networks of like-minded people. Unfortunately, a network of people with similar views will not do very much to convey the "facts," share research information, or stimulate a broader conversation. Further, they tend to reinforce the backdrop of influential traditional media sources that suggest uncertainty in the climate change argument, even when it is not present in the scientific community (Bailey, Giangola, and Boykoff 2014). Furthermore, online influencers often show a disproportionate ability to shape and encourage online discussion of issues (Bergie and Hodson 2015), a phenomenon that, with respect to climate change, has been termed the "DiCaprio effect" as a result of the outsized influence that actor Leonardo DiCaprio has shown in the climate change space (Leas et al. 2016).The presence of such influencers may or may not help the problem, as they can also act as bridges between communities to combat the polarization that otherwise occurs (Ling and Dale 2013).

Communicating through Imagery

According to Moser (2010), the act of communicating climate change to public audiences faces numerous human nature disconnecting challenges, including lack of visibility of causes, far proximity of impacts, a lack of immediacy, and indirect experience with impacts. These challenges lead to a need for climate change communicators to employ "clearer, simpler metaphors, imagery, and mental models" coupled with compelling and consistent storytelling to reach lay audiences (Moser 2010, 36). Similarly, in an in-depth, qualitative study on how the public engages with global warming, Smith and Joffe (2013) found that visual information was particularly important for communicating about global warming since it renders the issue concrete. While visualization of climate change is important to concretize the issue, Ballantyne, Wibeck, and Neset (2016) concluded that images symbolizing human suffering and loss due to climate change also symbolized a sense of helplessness that could lead to public disengagement about the issue, suggesting that images can both foster engagement and lead to decreases in feelings of agency if they are not used carefully.

Compared to the research on Twitter and blogs, there is much less research related to Instagram and climate change. Most articles discuss the potential for Instagram as a persuasive communication tool; for example, Ballew, Omoto, and Winter (2015) argue that Instagram offers the benefit of "experiential content" in addition to providing a social networking function. Other work has shown the ways that Instagram and other social media can be used as tools to disseminate scientifically accurate information about climate change to a broad public (Bowman et al. 2015). As described above, images of climate crisis can indeed be persuasive and there is a need to see if they achieve their intended effect. However, unlike Twitter, researchers have not yet looked at how certain concepts, like climate change, travel across networks of users in Instagram or whether the communities of people sharing content on Instagram demonstrate the characteristics of bridging and linking social capital that could be used to inspire community action in the presence of an event or trigger.

Methods

Hashtags are a type of categorization that arises democratically from user posts. Originating on Twitter, but also prevalent on other platforms such as Instagram, Tumblr, and Facebook, hashtags allow users to identify posts on a similar subject and self-organize into online communities of practice. Hashtags thus follow a power law distribution insofar as the most popular hashtags, such as #climatechange, are used by a large majority of people interested in discussing the topic online (Gruzd and Haythornthwaite 2013; Small 2011). Data was collected using the hashtag #climatechange, since a search of Instagram showed this to be the most popular hashtag related to climate change. While #climate is also used, its ambiguity as a term meant that it also captured posts that were not as relevant to the climate change community.

Following Williams et al. (2015) and Gruzd and Haythornthwaite (2013), we conducted a network analysis in order to understand whether Instagram is already useful or has the potential to get the message of climate science out to an audience beyond the echo chamber of agreement found in Williams et al.'s study of Twitter. We used Netlytic (netlytic.org) to scrape Instagram for #climatechange beginning June 30, 2016 and ending July 30, 2016. Netlytic is an open source tool developed in Canada at Ryerson University's Social Media Lab, using funds from the Social Science and Humanities Council of Canada. This method has been previously employed by Gruzd and Haythornthwaite (2013), among others, for understanding social network activity. Netlytic scrapes up to 10,000 public Instagram posts per hour using the /tags/tag_name/media/recent Instagram API tags (Gruzd 2016). In this case, we used #climatechange and scraped for any public post tagged with the hashtag during our time period. Our search returned a total of 8,342 posts by 4,394 unique users.

Once the data was collected, we used the frequencies of positive and negative adjectives to group posts according to sentiment in order to conduct a search for posts demonstrating the conditions for bonding and bridging capital. Next, we used a common community-detection algorithm called FastGreedy to sort the posts into community networks based on how the information was shared (see detailed explanation in Orman, Labatut, and Cherifi 2012). The first network, a name network, shows who mentions whom. In Instagram, this corresponds to @mentions in a post. The second network, a chain network that illustrates who replies to whom, can provide evidence of a conversation occurring and how often that conversation stretches beyond a specific affinity network or online community of practice. Name and chain networks were visualized using a distributed recursive layout (DrL) in order to minimize noise and highlight affinities in the large dataset (Martin, Gruzd, and Howard 2013). The FastGreedy algorithm allowed us to understand how users were self-sorting into communities through discussion related to the hashtag (Orman, Labatut, and Cherifi 2012). This algorithm groups communities based on a bottom-up approach and according to user posting behavior (i.e. mentions). Finally, we exported our scraped data to Gephi in order to identify users with the highest number of connections to it. For this, we examined two centrality measures—degree centrality and betweenness centrality—to determine the flow of conversation and identify high centers in the data set.

Interactions on Instagram were mapped on network-using nodes, which varied in size based on the levels of connection to other users. The levels of connection were determined by how many other users either mentioned each user, or were mentioned by them. In this way, we excluded any user who may be connected to a large number of people, but is not actively participating in discussion using the hashtag. We excluded these users because we were primarily concerned with the message of climate change and how it spreads across networks. We used various measures, described below, to understand the properties of each community within our climate change network. These characteristics help to show message flow and how homogenous our networks may be.

Network Characteristics

Networks exhibit several characteristics that can be used to understand how messages may travel across them. Centralization is a measure of network density; in other words, it shows how easily information flows between participants. In a highly centralized network, a few influencers dominate the conversation. In contrast, a network with a low centralization will have many participants communicating with one another more freely (Sinclair 2009). There are many different ways to measure centralization. In our case, we were interested in two centrality measures: 1) degree centralization, which is the number of links a person has to and from them (Valente et al. 2008), or for the purposes of our main analysis, how many times Instagram users mention each other; and 2) betweenness centrality, which is "a measure of the extent to which a vertex lies on the paths between others," and can be considered a measure of how influential a node is within the network (Newman 2005, 40).

Density shows how close participants are in a network. A dense or close-knit community will exhibit many connections or many participants talking with many others. In contrast, a less dense network will show fewer connections (Arie and Mesch 2016; Gruzd 2016).

Reciprocity shows two-way communication. It illustrates the amount of possible discussion in the network. A low reciprocity suggests that a few people are dominating the conversation, in contrast to a high reciprocity, which suggests a more even playing field (Takhteyev, Gruzd, and Wellman 2012).

Modularity shows how much or how little individual communities in the network are connected to each other. It is this measure that can show the presence of echo chambers or filter bubbles. A high level of modularity suggests that individual network communities do not intersect, meaning there is very little collaboration or conversation across communities. In contrast, a low level of modularity suggests that individual network communities can bridge the gaps between themselves and other communities, which suggests less of an echo-chamber effect (Nematzadeh et al. 2014). In our case, we follow Newman's (2006, 2) definition of modularity which is "the number of edges falling within groups minus the expected number in an equivalent network with edges placed at random."

Results

Keyword Analysis

Our analysis began with sentiment-based keyword extraction. To this end, we categorized the comments in each post using an algorithm that used word lists to sort based on positive or negative adjectives to identify sentiment. Following de Voogd, Chelala, and Schwarzer (2012), we used computer identification of negative and positive words, augmented by human coding to conduct a sentiment analysis of our data set. We drew our word lists from Zozanga (2011) (see the Appendix), and focused on identifying positive versus negative adjectives (which we labeled feelings-good and feelings-bad). Since bonding social capital requires the building of community and trust, we were looking for evidence of posts with positive sentiment, in which users were engaging in pro-social behavior or community supporting behavior, and whether the pro-social commenting was greater than, less than, or equal to the negative sentiment, or anti-social posting.

Once the posts had been categorized according to word use, we found that posts with adjectives indicating positive feelings (1,148 posts with positive adjectives were found) greatly outnumbered posts using adjectives indicating negative feelings (288 posts with negative adjectives were found). In posts with positive sentiment, we found evidence of language use in service of bonding or maintaining a community. Words like "great" and "good" are most prevalent and are mainly used to show support for what someone else has posted; for example, "great photo!" or "good shot." This, along with the prevalence of other adjectives indicating positive feelings (i.e. "fantastic photo" or "this pic is wonderful"), when examined in more detail,

generally show evidence that some users at least are using the comments in a pro-social way. This type of posting behavior is expected on Instagram, which is built around the idea of community through image-sharing (Ballew, Omoto, and Winter 2015). Positive comments can also be understood as one type of behavior that supports bonding and bridging capital in online social networks (Liu and Brown 2014).

The feelings-bad category mostly captures negative adjectives that people are using because they are concerned about the consequences of climate change. It also contains forty-nine posts suggesting that climate change might be a "lie" and eighteen posts in which a small community of people post that climate change is a hoax. These relatively few posts that belong to the climate skeptic community show that even a hashtag community like #climatechange can include dissenting viewpoints.

Networked Communication

Does the #climatechange network on Instagram enhance enabling conditions that increase community agency in such a way that it contributes to social change? Our sentiment analysis of the comments suggests that there is evidence of posting behavior that could serve to reinforce community through bonding and bridging social capital. As Ling and Dale (2013) have written, however, social action and agency also require the presence of connectors, a resilient network, and the capacity to resolve power and conflict issues. To determine if these conditions might exist in our network, following Williams et al. (2015) and Gruzd (2009), we conducted a network analysis of the #climatechange network on Instagram. We identified who was replying to whom in order to find connectors in the network and see if the network formation contributes to deliberative discussion, since deliberative discussion would be more useful for resolving issues of power and conflict (Small 2011; Bergie and Hodson 2015).

The #climatechange Instagram posts were examined for name and chain networks. A name network in this case refers to Instagram posts that mention other users. For example, a user could be tagged in a post, or mentioned in the post caption. A chain network refers to Instagram post comments. Anyone who posts a comment on another post will be recorded in the chain network diagram. The name network had 1,670 nodes, and 2,621 edges, with 5,899 total names found. The chain network had 3,503 nodes, and 3,594 edges, with 3,503 total names found. This indicates that there are more people tagged or mentioned in Instagram posts than there are people commenting on Instagram posts. However, we were primarily interested here in finding evidence of dialogue, since more sustainable communities are those that engage in dialogue about their meaning (Etzioni 2000). In order to understand conversation in our analysis of community networks, we focused on the chain network, as this shows response to each Instagram post and gives a better idea of how messages may or may not spread across the #climatechange community. The properties of both networks are detailed in Table 1.

Table 1: Network Properties: #climatechange Name and Chain Networks on Instagram

Network Property	*Value (Name Network)*	*Value (Chain Network)*
Diameter	254	24
Density	0.000030103828	0.000030516082
Reciprocity	0.097055764099	0.00091542158
Degree Centralization	0.009195326597	0.11618390510
Modularity	0.901444798481	0.89760766555

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A network analysis of both the name and chain networks shows evidence of a number of distributed online communities which, though they may have similar messages, are mostly

isolated from one another. In fact, the network as a whole shows a very low density, low reciprocity, and high modularity (see Table 1). Like Williams et al.'s (2015) Twitter analysis, our network analysis of both the name network, or who mentions whom, and the chain network, or who replies to whom, shows a high degree of modularity, indicating a strong community structure with little interaction between different clusters or communities. Our analysis also showed a very low density, which indicates that users are generally only replying to one or two other users. A low reciprocity supports this finding, showing very little dialogue in the Instagram discourse, with most posts being one-way only. Finally, a degree centralization value closer to 0 than 1 shows that in contrast to previous research on Twitter (Small 2011; Bergie and Hodson 2015), influence in the Instagram network is relatively distributed, with information flowing freely between participants. An analysis of user clustering behavior relative to the #climatechange hashtag supports this. FastGreedy enabled us to identify five main communities within the #climatechange network. As seen in Figure 1, these communities have only a few connectors between them, and while they are relatively distributed, for most participants, betweenness centrality measures do suggest the presence of a small number of Instagram influencers.

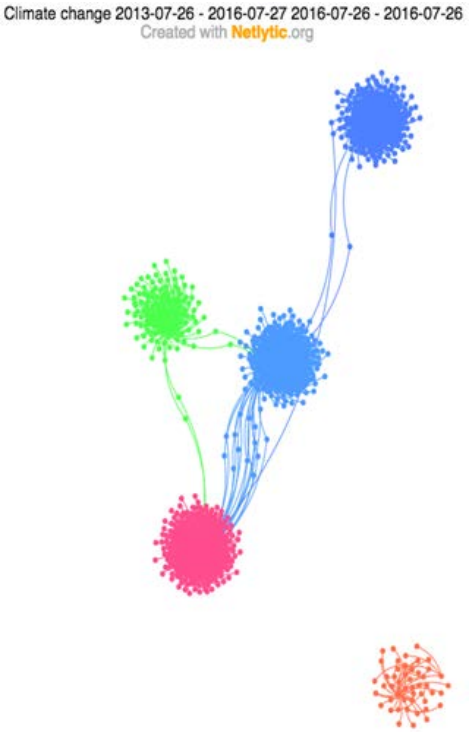

Figure 1: Five Distinct Communities were Identified via Network Analysis with a Few Connectors between Them
Netlytic.org 2017

Finally, we used Gephi to identify the top ten nodes in the network relative to betweenness and degree centrality. These nodes or users in the network have the largest number of other nodes connecting either to or from them, and sometimes serve as connectors between communities. In the case of understanding our #climatechange networks, the presence of nodes with a high degree of betweenness centrality can indicate the presence of influencers. When considered with in-degree (or posts mentioning the user) and out-degree (or posts in which the user mentions others) centrality measures, we can get a good idea of whether dialogue is occurring and which users serve as connectors within each network. In the chain network of 3,503 nodes in the

#climatechange community on Instagram, there were only ninety-three nodes that registered any measure of betweenness centrality at all. Table 2 shows the top twenty-five of these in descending order. If a user is a public figure or organization, their name is repeated verbatim. If not, in the interest of user privacy and confidentiality, we have used the placeholder [user] to indicate a user who is not a public figure.

Table 2: Most Influential Posters as Measured by Betweenness Centrality

ID	*Betweenness Centrality*	*In Degree*	*Out Degree*
natgeo	212.5	182	40
leonardodicaprio	148	193	4
aluciaproductions	97.5	64	4
amivitale	56.5	38	5
pitbull_updates	51	4	14
[user]	26.5	2	8
loves_arctic	23.5	2	19
natgeotravel	23	20	3
[user]	16	1	2
[user]	15	1	9
everydayclimatechange	14	3	4
raghavjuyal	14	5	2
unfccc	13	8	2
[user]	13	1	14
[user]	10.5	2	2
[user]	10	2	2
[user]	8	1	1
[user]	7	1	6
[user]	7	2	3
[user]	7	2	2
greenecosummit	6	1	6
ralphleehopkins	6	22	2
[user]	6	2	4
[user]	6	2	2

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As shown in Table 2, the users most likely to demonstrate centrality in terms of betweenness or degree are users who already have a public profile or are of celebrity status. Furthermore, the public users tend to have much higher in-degree centrality measures, whereas non-public figure users tend to have higher out-degree centrality measures. While this finding supports the presence of connectors in the network, it also suggests a broadcast, rather than dialogic, orientation within the network. The low number of betweenness centrality and degree connected individuals also supports the findings in Table 1 regarding network modularity, centralization, and reciprocity. In other words, few individuals are mentioning each other, and those who are mentioned tend to be celebrities or public figures and receive more mentions than they give, somewhat weakening the potential of Instagram for social capital and agency.

Discussion

Instagram Sentiment

Our textual analysis of the Instagram posts shows some promising trends which, in some ways, support the work by Ballew et al. (2016) and Leas et al. (2015). Posts and comments demonstrate pro-social and community building behavior among a mostly non-hierarchical group of participants as a whole, which could support both bonding and linking social capital. The hashtag community as a whole also shows five distinct smaller communities that are for the most part connected by at least a few connectors. While the positive sentiment is promising insofar as it shows efforts at community building textual behaviors, negative sentiment analysis is also promising, since it shows the presence of climate skeptics/people who believe climate change is a hoax. This shows that the hashtag has the possibility to reach beyond an immediate community of people who already believe that climate change is a problem.

Social Capital and Network Formation on Instagram

In their study of climate change networks on Twitter, Williams et al. (2015) reported a large degree of embeddedness within communities of like-minded users and the relative lack of communication across different communities, even when the communities are sharing similar messages. Quite simply, the majority of Instagram users who use the hashtag #climatechange are not engaging in dialogue, but rather positional ideologies. Furthermore, the betweenness centrality and degree centrality measures indicate mostly one-sided mentions dominated by influencers. While text comments include pro-social or community building posts, these tend to occur much more often for high-profile influential users than they do for lower-profile, community users. Thus, our network analysis shows high out-degree outward hub-and-spoke formation, which has more in common with a dominant group of radio stations in a large system of receivers than it does with the multi-point to multi-point view of social media discussed by proponents of an online public sphere.

Community, Agency, and Social Capital

In order for a community to be able to act in the presence of an initiating event or trigger, it is necessary for social network formation that has "openness to new ideas and individuals; structural resilience; [and] capacity to resolve power and conflict issues" (Ling and Dale 2013, 6). Our textual analysis shows efforts to build bonds with others and to set up an environment in which conflict resolution can occur; however, these currently occur in a mostly uni-directional way from lower influence to higher influence users. The presence of alternative viewpoints in the #climatechange community gives evidence to support an openness to ideas and individuals that may be an affordance of Instagram as a platform. The #climatechange network hosts influential users, as determined by betweenness centrality measures, and these users could potentially serve as connectors under the right circumstances. Despite this, the low network density does not suggest that this network is resilient. Network resilience is characterized by the level of connectivity, or density of links within a network (Janssen et al. 2006). Our #climatechange network has a density close to 0, indicating a network in which few people speak with one another. As no initiating event or trigger occurred during our sampling time frame, we could not measure the impact of such an event on the community in real time.

Degree centralization is impacted by the presence of a few very influential accounts, meaning that in the absence of influencers, the community would be less centralized and information would flow freely between participants. This may explain why any social platform in early days is more effective at leveling the communication playing field for people looking to organize. Once influential users dominate the conversation, the communities take on a more

broadcast than dialogic character. However, this does not mean that engaging with the #climatechange community on Instagram is merely slacktivism. Like with #KONY2012, it may be most useful to think of platforms like Instagram as one tool in the social activist's toolkit. It can help build awareness of an issue or campaign among a broad variety of users, particularly when celebrity voices are part of the discussion. Unlike traditional broadcast media, there are several opportunities to build social agency and community through the platform, particularly if large and influential accounts are encouraged to increase their out-degree posting behavior to inspire dialogue among the many people who follow them. Therefore, anyone who is interested in using a tool like Instagram to mobilize a community and build the agency needed for action on an issue like climate change needs to pay particular attention to how influencers can be used to mobilize the community and create additional conditions for change.

Limitations and Future Directions

This exploratory study represented a pilot, taking the case study of #climatechange on Instagram and inquiring whether the criteria for community agency might exist on this platform. The findings show both promise as well as challenges that could be explored further in future research. This study is currently limited by the fact that we examined one (albeit the most popular) hashtag on one particular social network. Thus, to ensure the findings remain consistent across social networks and climate or activist-related hashtags, future studies could examine this issue in greater scope. For example, researchers could look at the discussions of #climatechange on Facebook to see whether this social platforms contains more or fewer opportunities for community agency. Similarly, social networks could be compared for a single hashtag, or multiple hashtags could be compared across a single social network. We also recommend that this study be conducted in languages other than English in order to locate global communities and to see if these trends persist outside of English-speaking social media users. Finally, we deliberately chose to examine our hashtag during a month when we knew no major climate change news or events had occurred. Future work could compare a month like this one to a month in which climate change events were prevalent, or a month following a climate-related weather event, to see if the presence of an event helped to drive #climatechange conversations forward.

Conclusion

Given the anarchy and spatial outreach of Information Communications Technologies (ICTs), it is surprising to see the degree of traditional broadcast-style interactions occurring in the medium and the same degree of homophily as in traditional face-to-face meetings. One would think that it would be boundary-spanning in many diverse ways, but it still favors the domination of "celebrity" voices in a way that suggests that networks may not remain resilient in the absence of influencers, or some sort of interpersonal mediation. There has been critique of the environmental movement's failure to communicate in a positive way to empower people to act or to present solutions or actions that individuals can take (Dale 2016). Similarly, ICTs can be hostage to vested interests and, without mediation, they can dominate due to their access to resources individuals do not have.

When people neither see that solutions are possible nor themselves as part of the solution to climate change, they disengage (Ling and Dale 2013). This is especially problematic when the climate challenge is so ubiquitous, when we cannot "see" the collective impacts of our day-to-day decisions until we reach threshold effects, which may be too late. As noted above, while images can and do inspire emotion and response, Instagram is currently best used as a tool to communicate climate change messaging, and much more research needs to be done to see if this links to increased action on the ground, both individually and collectively. While not quite slacktivism, this means that very deliberate and strategic community building that makes use of

influencers is needed if this medium is to reach its full potential for increasing collective action on climate change. In other words, the platform itself currently supports some, but not all of the conditions necessary for building individual agency and social capital, specifically new network formation for social change, which leads a community to engage in collective change. It is our conclusion that if social media is to be optimized for social change, there needs to be a human element, which is active moderation of some kind that can separate the wheat from the chaff.

REFERENCES

Alam, Md. Mahmudul, and Shahriar Shawon Muhammad. 2013. "Climate Change Awareness in Asia: An Assessment of the Climate Asia Blog." *Asian Politics and Policy* 5 (3): 492–95. https://doi.org/10.1111/aspp.12052.

Arie, Yossef, and Gustavo S. Mesch. 2016. "Spatial Distance and Mobile Business Social Network Density." *Information, Communication & Society* 19 (11): 1572–86. https://doi.org/10.1080/1369118X.2016.1140804.

Asur, Sitaram, and Bernardo A. Huberman. 2010. "Predicting the Future with Social Media." In *Web Intelligence and Intelligent Agent Technology (WI-IAT), 2010 IEEE/WIC/ACM International Conference* 1: 492–99. https://doi.org/10.1109/WI-IAT.2010.63.

Auer, Matthew R., Yuman Zhang, and Priscilla Lee. 2014. "The Potential of Microblogs for the Study of Public Perceptions of Climate Change." *Wiley Interdisciplinary Reviews: Climate Change* 5 (3): 291–96. https://doi.org/10.1002/wcc.273.

Bailey, Adriana, Lorine Giangola, and Maxwell T. Boykoff. 2014. "How Grammatical Choice Shapes Media Representations of Climate (Un) Certainty." *Environmental Communication* 8 (2): 197–215. https://doi.org/10.1080/17524032.2014.906481.

Ballantyne, Anne Gammelgaard, Victoria Wibeck, and Tina-Simone Neset. 2016. "Images of Climate Change—A Pilot Study of Young People's Perceptions of ICT-based Climate Visualization." *Climatic Change* 134 (1–2): 73–85. https://doi.org/10.1007/s10584-015-1533-9.

Ballew, Matthew T., Allen M. Omoto, and Patricia L. Winter. 2015. "Using Web 2.0 and Social Media Technologies to Foster Proenvironmental Action." *Sustainability* 7 (8): 10620–48. https://doi.org/10.3390/su70810620.

Benkler, Yochai. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven: Yale University Press.

Bergie, Brett, and Jaigris Hodson. 2015. "The Twitter Citizen: Contributing to Civil Society Discussion or Adding to the Noise." In *Hashtag Publics: The Power and Politics of Networked Discourse*, edited by Nathan Rambukkanna, 255–66. New York: Peter Lang.

Boothe-Perry, Nicola A. 2013. "The Friendly Lawyer: Professionalism and Ethical Considerations of the Use of Social Networking during Litigation." *University of Florida Journal of Law and Public Policy* 24. http://commons.law.famu.edu/cgi/viewcontent.cgi?article=1062&context=faculty-research.

Boulton, Christopher. 2017. "In Defense of 'Slacktivism': How KONY 2012 Got the Whole World to Watch." In *Debates for the Digital Age: The Good, the Bad, and the Ugly of Our Online World*, edited by Danielle Sarver Coombs and Simon Collister, 321–32. Toronto: Praeger.

Bowman, Sarah R., Geert Biermans, Andrea Hicks, Dragan M. Jevtić, Jose Luis Rodriguez-Gil, and Erica K. Brockmeier. 2015. "A Guide for Using Social Media in Environmental Science and a Case Study by the Students of SETAC." *Environmental Sciences Europe* 27 (1). https://doi.org/10.1186/s12302-015-0062-5.

Burch, Sarah. 2010. “In Pursuit of Resilient, Low Carbon Communities: An Examination of Barriers to Action in Three Canadian Cities.” *Energy Policy* 38 (12): 7575–85. https://doi.org/10.1016/j.enpol.2009.06.070.

Burch, Sarah, Alison Shaw, Ann Dale, and John Robinson. 2014. “Triggering Transformative Change: A Development Path Approach to Climate Change Response in Communities.” *Climate Policy* 14 (4): 467–87. https://doi.org/10.1080/14693062.2014.876342.

Castells, Manuel. 2012. *Networks of Outrage and Hope: Social Movements in the Internet Age.* London: Polity.

Dale, Ann. 2001. *At the Edge: Sustainable Development in the 21st Century*. Vancouver: UBC Press.

———. 2008. “Governance for Sustainable Development: As if it Mattered?” In *Innovation, Science and Environment 2009–2010. Special Edition—Charting Sustainable Development in Canada 1987–2007*, edited by G. Toner and J. Meadowcroft, 54–71. Montreal: McGill-Queen’s University Press. https://doi.org/10.1108/meq.2009.08320dae.003.

———. 2015. “Prioritizing Policy. Protecting Nature by Ensuring that the Law is for the Land.” *Alternatives Magazine* 41 (1): 77–79. https://crcresearch.org/articles/prioritizing-policy-protecting-nature-ensuring-law-land.

———. 2016. “The Climate Imperative Series.” https://www.changingtheconversation.ca/node/97.

Dale, Ann, and Lenore Newman. 2006. “An Online Synchronous E-Dialogue Series on Nuclear Waste Management in Canada.” *Applied Environmental Education and Communication* 5 (4): 243–51. https://doi.org/10.1080/15330150601059308.

———. 2007. “Homophily and Agency: Creating Effective Sustainable Development Networks.” *Environment, Development and Sustainability* 9 (1): 79–90. https://doi.org/10.1007/s10668-005-9004-5.

Dale, Ann, and Jennie Sparkes. 2007. “Protecting Ecosystems: Network Structure and Social Capital Mobilization.” *Community Development Journal* 43 (2): 143–56. https://doi.org/10.1093/cdj/bsm007.

de Voogd, Leendert, Pascal Chelala, and Steve Schwarzer. 2012. “Do Social Media Affect Public Discourses? A Sentiment Analysis of Political Tweets during the French Presidential Election Campaign.” Accessed January 15, 2018. https://www.vigiglobe.com/wp-content/uploads/2015/10/AAPOR_TNS_2012_06_01.pdf. (site discontinued)

Drache, Daniel. 2008. *Defiant Publics: The Unprecedented Reach of the Global Citizen*. Cambridge, UK: Polity.

Efron, Miles. 2010. “Hashtag Retrieval in a Microblogging Environment.” In *Proceedings of the 33rd International ACM SIGIR Conference on Research and Development in Information Retrieval*, 787–88. Geneva: ACM. https://doi.org/10.1145/1835449.1835616.

Etzioni, Amitai. 2000. “Toward a Theory of Public Ritual.” *Sociological Theory* 18 (1): 44–59. https://doi.org/10.1111/0735-2751.00087.

Gallois, Cindy, Tania Ogay, and Howard Giles. 2005. “Communication Accommodation Theory: A Look Behind and a Look Ahead.” In *Theorizing About Intercultural Communication*, edited by W. Gudykunst, 121–48. Thousand Oaks: Sage.

Granovetter, Mark S. 1973. “The Strength of Weak Ties.” *American Journal of Sociology* 78 (6): 1360–80.

Greenberg, Josh, Graham Knight, and Elizabeth Westersund. 2011. “Spinning Climate Change: Corporate and NGO Public Relations Strategies in Canada and the United States.” *International Communication Gazette* 73 (1–2): 65–82. https://doi.org/10.1177/1748048510386742.

Gruzd, Anatoliy. 2009. “Studying Collaborative Learning Using Name Networks.” *Journal of Education for Library and Information Science* 50: 237–47. http://www.jstor.org/stable/40732586.

———. 2016. “Netlytic: Software for Automated Text and Social Network Analysis.” https://netlytic.org.

Gruzd, Anatoliy, and Caroline Haythornthwaite. 2013 “Enabling Community through Social Media.” *Journal of Medical Internet Research* 15 (10). https://doi.org/10.2196/jmir.2796.

Hodson, Jaigris, I. V. Wilkes, and Chris Daellenbach. 2015. “Content Aggregation as a means to Identify Trends: The Case of the iPhone 5s.” *Journal of Digital & Social Media Marketing* 3 (3): 249–61. http://www.ingentaconnect.com/content/hsp/jdsmm/2015/00000003/00000003/art00008.

Holotescu, Carmen, and Gabriela Grosseck. 2010. “Learning to Microblog and Microblogging to Learn. A Case Study on Learning Scenarios in a Microblogging Context.” In *The 6th International Scientific Conference eLearning and Software for Education Bucharest*, 15–16. Bucharest: ADLA. https://www.ceeol.com/search/article-detail?id=129045.

Hu, Yuheng, Lydia Manikonda, and Subbarao Kambhampati. 2014. “What We Instagram: A First Analysis of Instagram Photo Content and User Types.” In *Proceedings of the International Conference on Weblogs and Social Media*, n.p. Oxford, UK: AAAI. https://www.aaai.org/ocs/index.php/ICWSM/ICWSM14/paper/viewFile/8118/8087.

Ikawa, Yohei, Miki Enoki, and Michiaki Tatsubori. 2012. “Location Inference using Microblog Messages.” In *Proceedings of the 21st International Conference on World Wide Web*, 687–90. Lyon, France: ACM. https://doi.org/10.1145/2187980.2188181.

Janssen, Marco, Örjan Bodin, John Anderies, Thomas Elmqvist, Henrik Ernstson, Ryan R. J. McAllister, Per Olsson, and Paul Ryan. 2006. “Toward a Network Perspective of the Study of Resilience in Social-Ecological Systems.” *Ecology and Society* 11 (1). http://www.jstor.org/stable/26267803.

Java, Akshay, Xiaodan Song, Tim Finin, and Belle Tseng. 2007. “Why we Twitter: Understanding Microblogging Usage and Communities.” In *Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 Workshop on Web Mining and Social Network Analysis*, 56–65. San Jose, CA: ACM. https://doi.org/10.1145/1348549.1348556.

Lazarsfeld, Paul F., and Robert K. Merton. 1971 (1948). “Mass Communication, Popular Taste and Organized Social Action.” In *The Process and Effects of Mass Communication. Revised Edition*, edited by Wilbur Schramm and Donald F. Roberts, 554–78. Urbana, IL: University of Illinois Press.

Leas, Eric C., Benjamin M. Althouse, Mark Dredze, Nick Obradovich, James H. Fowler, Seth M. Noar, Jon-Patrick Allem, and John W. Ayers. 2016. “Big Data Sensors of Organic Advocacy: The Case of Leonardo DiCaprio and Climate Change.” *PloS one* 11 (8). https://doi.org/10.1371/journal.pone.0159885.

Levin, Kelly, Benjamin Cashore, Steven Bernstein, and Graeme Auld. 2012. “Overcoming the Tragedy of Super Wicked Problems: Constraining our Future Selves to Ameliorate Global Climate Change.” *Policy Sciences* 45 (2): 123–52. https://doi.org/10.1007/s11077-012-9151-0.

Li, Yung-Ming, and Tsung-Ying Li. 2013. “Deriving Market Intelligence from Microblogs.” *Decision Support Systems* 55 (1): 206–17. https://doi.org/10.1016/j.dss.2013.01.023.

Ling, Chris, and Ann Dale. 2013 “Agency and Social Capital: Characteristics and Dynamics.” *Community Development Journal* 49 (1): 4–20. https://doi.org/10.1093/cdj/bss069.

Liu, Dong, and B. Bradford Brown. 2014. “Self-disclosure on Social Networking Sites, Positive Feedback, and Social Capital among Chinese College Students.” *Computers in Human Behavior* 38: 213–19. https://doi.org/10.1016/j.chb.2014.06.003.

Martin, Jennifer M. Grek, Anatoliy Gruzd, and Vivian Howard. 2013. "Navigating an Imagined Middle-Earth: Finding and Analyzing Text-based and Film-based Mental Images of Middle-Earth through TheOneRing.Net Online Fan Community." *First Monday* 18 (5). https://doi.org/10.5210/fm.v18i5.4529.

Mitchell, Amy, and Jesse Holcomb. 2016. "State of the News Media 2016." *Pew Research Center*. http://www.journalism.org/2016/06/15/state-of-the-news-media-2016/.

Morozov, Evgeny. 2009. "The Brave New World of Slacktivism." *Foreign Policy* 19 (05). http://foreignpolicy.com/2009/05/19/the-brave-new-world-of-slacktivism/.

Moser, Susanne C. 2010. "Communicating Climate Change: History, Challenges, Process and Future Directions." *Wiley Interdisciplinary Reviews: Climate Change* 1 (1): 31–53. https://doi.org/10.1002/wcc.11/

Narayan-Parker, Deepa. 1999. *Bonds and Bridges: Social Capital and Poverty*. Vol. 2167. Washington, DC: World Bank Publications. http://documents.worldbank.org /curated/en/989601468766526606/Bonds-and-bridges-social-and-poverty.

Nematzadeh, Azadeh, Emilio Ferrara, Alessandro Flammini, and Yong-Yeol Ahn. 2014. "Optimal Network Modularity for Information Diffusion." *Physical Review Letters* 113 (8). https://doi.org/10.1103/PhysRevLett.113.088701.

———. 2005. "The Role of Agency in Sustainable Local Community Development." *Local Environment* 10 (5): 477–86. https://doi.org/10.1080/13549830500203121.

Newell, Robert, and Ann Dale. 2015. "Meeting the Climate Change Challenge (MC3): The Role of the Internet in Climate Change Research Dissemination and Knowledge Mobilization." *Environmental Communication* 9 (2): 208–27. https://doi.org/10.1080/17524032.2014.993412.

Newell, Robert, Ann Dale, and Celia Winters. 2016. "A Picture is Worth a Thousand Data Points: Exploring Visualizations as Tools for Connecting the Public to Climate Change Research." *Cogent Social Sciences* 2 (1). https://doi.org/10.1080/23311886.2016.1201885.

Newman, Mark E. J. 2005. "A Measure of Betweenness Centrality based on Random Walks." *Social Networks* 27 (1): 39–54. https://doi.org/10.1016/j.socnet.2004.11.009.

———. 2006. "Modularity and Community Structure in Networks." *Proceedings of the National Academy of Sciences* 103 (23): 8577–82. https://doi.org/10.1073/pnas.0601602103.

Oh, Chong, and Olivia Sheng. 2011 "Investigating Predictive Power of Stock Micro Blog Sentiment in Forecasting Future Stock Price Directional Movement." In *32nd International Conference on Information Systems: Knowledge Management and Business Intelligence.* Shanghai, China: ICIS. http://citeseerx.ist.psu.edu/viewdoc /download?doi=10.1.1.651.1224&rep=rep1&type=pdf.

Onyx, Jenny, and Paul Bullen. 2000. "Measuring Social Capital in Five Communities." *The Journal of Applied Behavioral Science* 36 (1): 23–42. https://doi.org/10.1177/0021886300361002.

Orman, Günce Keziban, Vincent Labatut, and Hocine Cherifi. 2012. "Comparative Evaluation of Community Detection Algorithms: A Topological Approach." *Journal of Statistical Mechanics: Theory and Experiment* 2012 (8). https://doi.org/10.1088/1742-5468.

Postman, Neil. 1992. *Technopoly: The Surrender of Culture to Technology.* New York: Vintage Books.

Postmes, Tom, Russell Spears, and Martin Lea. 2000. "The Formation of Group Norms in Computer-Mediated Communication." *Human Communication Research* 26 (3): 341–71. https://doi.org/10.1111/j.1468-2958.2000.tb00761.x.

Putnam, Robert D. 2001. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster.

Rainie, Lee, and Barry Wellman. 2012. *Networked: The New Social Operating System*. Boston: MIT Press.

Rambukkana, Nathan. 2015. *Hashtag Publics: The Power and Politics of Discursive Networks*. New York: Peter Lang Publishing.

Ratkiewicz, Jacob, Michael Conover, Mark Meiss, Bruno Gonçalves, Snehal Patil, Alessandro Flammini, and Filippo Menczer. 2010. "Truthy: Mapping the Spread of AstroTurf Memes in Microblog Streams." *arXiv preprint arXiv:* 1011.3768. https://doi.org/10.1145/1963192.1963301.

Rheingold, Howard. 2007. *Smart Mobs: The Next Social Revolution*. New York: Basic Books.

Salomon, D. 2013. "Moving on from Facebook: Using Instagram to Connect with Undergraduates and Engage in Teaching and Learning." *College and Research Libraries News* 74 (8). https://crln.acrl.org/index.php/crlnews/article/view/8991/9770.

Sharman, Amelia. 2014. "Mapping the Climate Sceptical Blogosphere." *Global Environmental Change* 26: 159–70. https://doi.org/10.1016/j.gloenvcha.2014.03.003.

Shaw, Alison, Sarah Burch, Freya Kristensen, John Robinson, and Ann Dale. 2014. "Accelerating the Sustainability Transition: Exploring Synergies between Adaptation and Mitigation in British Columbian Communities." *Global Environmental Change* 25: 41–51. https://doi.org/10.1016/j.gloenvcha.2014.01.002.

Shaw, Frances. 2016. "'Bitch I Said Hi': The Bye Felipe Campaign and Discursive Activism in Mobile Dating Apps." *Social Media + Society* 2 (4). https://doi.org/10.1177/2056305116672889.

Shen, Yang, Shuchen Li, Ling Zheng, Xiaodong Ren, and Xiaolong Cheng. 2009. "Emotion Mining Research on Micro-Blog." In *Web Society, 2009. SWS'09. 1st IEEE Symposium*, 71–75. Langzou, China: IEEE. https://doi.org/10.1109/SWS.2009.5271711.

Sherer, Elizabeth. 2015. "Cyberactivism, its Past and its Future." *Digital America*, April 6, 2015. http://www.digitalamerica.org/cyberactivism-its-past-and-its-future-elizabeth-sherer/.

Shirky, Clay. 2010. *Cognitive Surplus.* New York: Penguin.

Sinclair, Philip Andrew. 2009. "Network Centralization with the Gil Schmidt Power Centrality Index." *Social Networks* 31 (3): 214–19. https://doi.org/10.1016/j.socnet.2009.04.004.

Small, Tamara A. 2011. "What the Hashtag? A Content Analysis of Canadian Politics on Twitter." *Information, Communication & Society* 14 (6): 872–95. https://doi.org/10.1080/1369118X.2011.554572.

Smith, Nicholas, and Helene Joffe. 2013. "How the Public Engages with Global Warming: A Social Representations Approach." *Public Understanding of Science* 22 (1): 16–32. https://doi.org/10.1177/0963662512440913.

Takhteyev, Yuri, Anatoliy Gruzd, and Barry Wellman. 2012. "Geography of Twitter Networks." *Social Networks* 34 (1): 73–81. https://doi.org/10.1016/j.socnet.2011.05.006.

Thirumuruganathan, Saravanan, Nan Zhang, Vagelis Hristidis, and Gautam Das. 2014. "Aggregate Estimation over a Microblog Platform." In *Proceedings of the 2014 ACM SIGMOD International Conference on Management of Data*, 1519–30. Snowbird, UT: ACM. https://doi.org/10.1145/2588555.2610517.

Valente, Thomas W., Kathryn Coronges, Cynthia Lakon, and Elizabeth Costenbader. 2008. "How Correlated are Network Centrality Measures?" *Connections (Toronto, Ont.)* 28 (1): 16–26. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2875682/.

Vieweg, Sarah, Amanda L. Hughes, Kate Starbird, and Leysia Palen. 2010. "Microblogging during Two Natural Hazards Events: What Twitter may Contribute to Situational Awareness." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1079–88. Atlanta, GA: ACM. https://dl.acm.org/citation.cfm?id=1753326.

Wellman, Barry, and Milena Gulia. 1999. "Net Surfers Don't Ride Alone: Virtual Communities as Communities." In *Networks in the Global Village*, edited by Barry Wellman, 331–66. Boulder, CO: Westview.

Williams, Hywel T. P., James R. McMurray, Tim Kurz, and F. Hugo Lambert. 2015. "Network Analysis Reveals Open Forums and Echo Chambers in Social Media Discussions of Climate Change." *Global Environmental Change* 32: 126–38. https://doi.org/10.1016/j.gloenvcha.2015.03.006.

Woolcock, Michael. 2001. "The Place of Social Capital in Understanding Social and Economic Outcomes." *Canadian Journal of Policy Research* 2 (1): 11–17. https://www.researchgate.net/profile/Michael_Woolcock2/publication/269576288_The_Place_of_Social_Capital_in_Understanding_Social_and_Economic_Outcome/links/57c77f6c08ae28c01d4f84ee.pdf.

Zozanga. 2011. "List of English Adjectives." Accessed January 3, 2018. http://www.zozanga.com/grammar/adjectives/listofadjectives.htm. (site discontinued)

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APPENDIX: WORD LISTS FOR SENTIMENT ANALYSIS

FEELINGS (BAD)	ANGRY
FEELINGS (BAD)	ANNOYED
FEELINGS (BAD)	ANXIOUS
FEELINGS (BAD)	ARROGANT
FEELINGS (BAD)	ASHAMED
FEELINGS (BAD)	AWFUL
FEELINGS (BAD)	BAD
FEELINGS (BAD)	BEWILDERED
FEELINGS (BAD)	BORED
FEELINGS (BAD)	CLUMSY
FEELINGS (BAD)	CRAZY
FEELINGS (BAD)	FLIPPED-OUT
FEELINGS (BAD)	CREEPY
FEELINGS (BAD)	CRUEL
FEELINGS (BAD)	DANGEROUS
FEELINGS (BAD)	DEFEATED
FEELINGS (BAD)	DEFIANT
FEELINGS (BAD)	DEPRESSED
FEELINGS (BAD)	DISGUSTED
FEELINGS (BAD)	DISTURBED
FEELINGS (BAD)	DIZZY
FEELINGS (BAD)	DULL
FEELINGS (BAD)	EMBARRASSED
FEELINGS (BAD)	ENVIOUS
FEELINGS (BAD)	EVIL
FEELINGS (BAD)	FIERCE
FEELINGS (BAD)	FOOLISH
FEELINGS (BAD)	FRANTIC
FEELINGS (BAD)	FRIGHTENED
FEELINGS (BAD)	GRIEVING
FEELINGS (BAD)	GRUMPY
FEELINGS (BAD)	HELPLESS
FEELINGS (BAD)	HUNGRY
FEELINGS (BAD)	HURT
FEELINGS (BAD)	ILL
FEELINGS (BAD)	ITCHY
FEELINGS (BAD)	JEALOUS
FEELINGS (BAD)	JITTERY
FEELINGS (BAD)	LAZY
FEELINGS (BAD)	LONELY
FEELINGS (BAD)	NASTY
FEELINGS (BAD)	NERVOUS
FEELINGS (BAD)	OBNOXIOUS
FEELINGS (BAD)	PANICKY
FEELINGS (BAD)	SCARY
FEELINGS (BAD)	SELFISH
FEELINGS (BAD)	SORE
FEELINGS (BAD)	TENSE
FEELINGS (BAD)	TERRIBLE
FEELINGS (BAD)	TESTY
FEELINGS (BAD)	THOUGHTLESS
FEELINGS (BAD)	TIRED
FEELINGS (BAD)	TROUBLED
FEELINGS (BAD)	UPSET
FEELINGS (BAD)	UPTIGHT
FEELINGS (BAD)	WEARY
FEELINGS (BAD)	WICKED
FEELINGS (BAD)	WORRIED

FEELINGS (GOOD)	AGREEABLE
FEELINGS (GOOD)	AMUSED
FEELINGS (GOOD)	BRAVE
FEELINGS (GOOD)	CALM
FEELINGS (GOOD)	CHARMING
FEELINGS (GOOD)	CHEERFUL
FEELINGS (GOOD)	COMFORTABLE
FEELINGS (GOOD)	COOPERATIVE
FEELINGS (GOOD)	COURAGEOUS
FEELINGS (GOOD)	DELIGHTFUL
FEELINGS (GOOD)	DETERMINED
FEELINGS (GOOD)	EAGER
FEELINGS (GOOD)	ELATED
FEELINGS (GOOD)	ENCHANTED
FEELINGS (GOOD)	ENCOURAGED
FEELINGS (GOOD)	ENERGETIC
FEELINGS (GOOD)	ENTHUSIASTIC
FEELINGS (GOOD)	EXCITED
FEELINGS (GOOD)	EXUBERANT
FEELINGS (GOOD)	FAIR
FEELINGS (GOOD)	FAITHFUL
FEELINGS (GOOD)	FANTASTIC
FEELINGS (GOOD)	FINE
FEELINGS (GOOD)	FRIENDLY
FEELINGS (GOOD)	FUNNY
FEELINGS (GOOD)	GENTLE
FEELINGS (GOOD)	GLORIOUS
FEELINGS (GOOD)	GOOD
FEELINGS (GOOD)	HAPPY
FEELINGS (GOOD)	HEALTHY
FEELINGS (GOOD)	HELPFUL
FEELINGS (GOOD)	HILARIOUS
FEELINGS (GOOD)	JOLLY
FEELINGS (GOOD)	JOYOUS
FEELINGS (GOOD)	KIND
FEELINGS (GOOD)	LIVELY
FEELINGS (GOOD)	LOVELY
FEELINGS (GOOD)	LUCKY
FEELINGS (GOOD)	NICE
FEELINGS (GOOD)	OBEDIENT
FEELINGS (GOOD)	PERFECT
FEELINGS (GOOD)	PLEASANT
FEELINGS (GOOD)	PROUD
FEELINGS (GOOD)	RELIEVED
FEELINGS (GOOD)	SILLY
FEELINGS (GOOD)	SMILING
FEELINGS (GOOD)	SPLENDID
FEELINGS (GOOD)	SUCCESSFUL
FEELINGS (GOOD)	THANKFUL
FEELINGS (GOOD)	THOUGHTFUL
FEELINGS (GOOD)	VICTORIOUS
FEELINGS (GOOD)	VIVACIOUS
FEELINGS (GOOD)	WITTY
FEELINGS (GOOD)	WONDERFUL
FEELINGS (GOOD)	ZEALOUS
FEELINGS (GOOD)	ZANY
FEELINGS (GOOD)	GREAT

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The International Journal of Interdisciplinary Environmental Studies is one of seven thematically focused journals that support the Interdisciplinary Social Sciences Research Network. The Research Network is comprised of a journal collection, book imprint, conference, and online community.

The journal presents studies that exemplify the disciplinary and interdisciplinary practices of the social sciences. As well as articles of a traditional scholarly type, this journal invites case studies that take the form of presentations of practice—including documentation of socially engaged practices and exegeses analyzing the effects of those practices.

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