



Round-trip agenda setting: Tracking the intermedia process over time in the ice bucket challenge

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S Mo Jang

University of South Carolina, USA

Yong Jin Park

Howard University, USA

Hoon Lee

Kyung Hee University, Republic of Korea

Abstract

Despite the social media's agenda-setting power, the literature provides little understanding of how social media agendas survive and last long enough to trigger substantial public discussions. This study investigates this issue by tracking the ice bucket challenge campaign over an 18-week period. This article claims that the pattern of the intermedia process evolves over time along with the issue-attention cycle. We observed a round-trip intermedia agenda setting where the direction is reversed as the agenda waxes and wanes. Both social and mainstream media continued to generate a heightened level of issue attention after the buzz was cooled down.

Keywords

Attention cycle, ice bucket challenge, intermedia agenda setting, social media, Twitter

A growing body of research (Conway et al., 2015; Groshek and Groshek, 2013; Neuman et al., 2014) has challenged the original notion of media agenda setting wherein the elite

Corresponding author:

Mo S Jang, School of Journalism and Mass Communications, University of South Carolina, 800 Sumter Street, Room 122, Columbia, SC 29201, USA.

Email: mo7788@gmail.com

media set the agenda for the public. Studies have indicated that media agenda setting may be processed in a reverse direction, showing that mainstream media agendas are often led by user-generated content, including blogs (Meraz, 2011), online forums (Neuman et al., 2014), Facebook comments (Jacobson, 2013), Twitter postings (Conway et al., 2015), and YouTube videos (Sayre et al., 2010). Scholars have welcomed this bottom-up process that may empower the voices of ordinary users and enhance citizen participation (Lewis, 2012; Shirky, 2011). Additionally, campaign practitioners have realized the potential to set the agenda themselves and communicate directly with the public, bypassing the elite media's gatekeeping procedure.

Despite evidence that reverse agenda setting occurs in some domains (Conway et al., 2015; Ragas et al., 2014), the relationship between elite and social media has proven difficult to specify. Some researchers (Groshek and Groshek, 2013; Weeks and Southwell, 2010) have indicated that elite media still hold the dominant power of agenda setting, but a study of 29 public issues in the United States (Neuman et al., 2014) showed that the direction of intermedia agenda setting varies significantly depending on the type of issue. Conway et al. (2015) observed inconsistent patterns where the intermedia influence can be top-down, bottom-up, or reciprocal. While demonstrating the strong potential of reverse agenda setting, the extant research has provided little information about the intermedia process, which is when and how traditional or reverse agenda setting occurs.

This research advances our understanding of social media campaigns and intermedia agenda-setting process by considering a key factor that has largely been neglected in the literature: the issue-attention cycle (cf. Ragas et al., 2014). Specifically, the key argument of this article is that the pattern and direction of the intermedia process may evolve along with the development of agendas (Downs, 1972). For example, as user-generated agendas wax and wane, the initial agenda-setter (e.g. social media) may not function as a constant agenda-setter but rather lose ground to elite media regarding the issue. Through this focus on timing, this article examines how the temporal dynamics of user-generated agendas change over time within the complex media environment. This investigation also speaks to the important debate concerning how elite and social media mutually influence or compete against one another with regard to the agenda-setting initiative. Finally, the study compares the level of issue attention before and after the campaign to document the influence of short-term social media campaigns.

The ice bucket challenge of 2014 offers a perfect example of a user-generated agenda that subsequently prevailed in both traditional and social media. This unprecedentedly successful viral campaign created over 17 million videos, featuring a variety of public figures that participated in the campaign. This event significantly boosted awareness of amyotrophic lateral sclerosis (ALS), raising funds of over US\$220 million in 2014 (Holan, 2014). Using this context, we assess the long-term dynamics of the elite media–social media relationship at three different points in time over 18 weeks during which the viral campaign spikes and declines dramatically.

Intermedia agenda setting

Unlike research on agenda setting that investigates how the media agenda influences the public agenda, intermedia agenda setting considers the transfer of issue salience among

various media outlets. Prior research traditionally sought to identify a leading news organization that influences other media content (McCombs and Shaw, 1976). For example, the *New York Times* or *Wall Street Journal* appeared to be a leading news agency, influencing the state of the union address, evening newscast, and financial journalists (Gilberg et al., 1980, Golan, 2006; Ragas and Tran, 2015). Other studies examined the relationships between campaign ads and media coverage (Sweetser et al., 2008) and online news media and other traditional media (Vonbun et al., 2015). These studies suggest that the intermedia process is attributed to shared sources among news reporters (e.g. pack journalism) or news organizations' tendency to 'report on a report' (Denham, 2010: 315). Moreover, Vonbun et al. (2015) suggest that the digitalized news production system tends to increase the agenda-setting power of online media although this study did not consider social media in their analysis.

Emerging social media sites and various online platforms have given new relevance to the question of intermedia agenda setting. Acknowledging the democratic potential of participatory digital culture, media scholars began to explore the possibility of the bottom-up intermedia process whereby user-generated content influences the elite media agenda (Groshek and Groshek, 2013; Jacobson, 2013). By exchanging opinions and disseminating facts freely via networked platforms, social media users can now develop a unique public agenda, potentially influencing mainstream media agendas and eventually policy-making decisions. Moreover, as digital dialogues are widely available for research, researchers celebrated the opportunities to explore public conversations that have been identified as a critical element of the dynamics of the public sphere but have been hardly fully captured via traditional research methods (Katz and Lazarsfeld, 1955).

Empirical evidence regarding the social media's agenda-setting power is mixed. Research examining the relationship between news media and political blogs suggests that traditional media may be more reliant on blogs than the other way round (Meraz, 2011). Similarly, Jacobson's (2013) cross-lagged analyses added evidence to the reverse agenda setting, showing that Facebook comments about *The Rachel Maddow Show* led the topics discussed in the actual program. Other studies, however, are somewhat at odds with these findings. Groshek and Groshek (2013) found limited evidence of bottom-up intermedia agenda setting, maintaining that traditional media such as the *New York Times* and CNN still function as leading agenda-setters.

Neuman et al. (2014) provided one of the most comprehensive analyses in this topic. Using a large dataset of news articles, blogs, forums, and the Twitter firehose over the calendar year of 2012, they investigated the directions of intermedia agenda setting for 29 important public issues in the United States. In 18 of 29 tests, changes in attention on social media led those in traditional media. In 11 of 29 tests, traditional media led social media attention. For six of these cases, the relationship was reciprocal. Although these results indicated the prevalence of reverse agenda setting, the literature continues to have little idea of why the direction of intermedia agenda setting varies across different issues. Although the findings from the 2012 data suggest that the intermedia process flows downward in terrorism issues but flows upward in environmental issues, this may not always be the case. As the authors indicated in the conclusion, the literature needs to specify the conditions and factors that determine the directions of intermedia agenda setting.

Challenges to sustained issue attention

To generate sustained public attention and bring about meaningful public policy responses, not only must an issue occupy a substantial amount of media space for the moment, but it must also survive over time. If an agenda dominates today's news headlines but decays in a day or two, the impact of such an agenda will be limited. Thus, concerns have emerged regarding the volatile nature of attention spans. Most agendas fail to attract enduring attention even when they address a persistent problem of critical importance to society (Downs, 1972). Media attention to an agenda shrinks mostly due to boredom of the audience (Neuman, 1990) as well as due to new agendas that crowd out existing agendas from the media agenda (Geip, 2011; Jang and Pasek, 2015; Waldherr, 2014). The former refers to the audience's social and psychological constraints, and the latter concerns technical constraints from the traditional media environment.

The first challenge stems from the fact that human beings have finite amounts of time and attention capacity. The literature on citizen competence has observed that most people prioritize their pressing matters of family, job, and leisure and assign little energy to follow social issues (Converse, 1964). Similarly, research in cognitive psychology has also supported this view, depicting humans as cognitive misers (Fiske and Taylor, 1991). Due to social and psychological constraints, it is not realistic to expect ordinary citizens to pay continued attention to seemingly distant and fleeting issues.

Another barrier to getting sustained attention involves the technological limits of the mass media. Due to limited newspaper space and broadcast airtime as well as limited journalistic resources, potential news topics compete against one another for space in the constant size of news holes. For example, when crises or spectacular focusing events arise, such news events increasingly use broadcast space and allow limited room for other news events. To describe the way in which media agendas are managed, researchers studying agenda setting (McCombs, 2014; McCombs and Zhu, 1995; Zhu, 1992) introduced the notion of issue competition. The limited capacity of the mass media in terms of production and broadcasting induces zero-sum competition among news agendas (Jang and Pasek, 2015). Any agenda that draws increasing attention necessarily displaces other existing agendas.

Acknowledging the difficulties of retaining public attention for a long time, Downs (1972) noted the concept of the issue-attention cycle. This model addresses a general pattern of public attention wherein some problems leap into prominence, take the center stage of attention, and then – though largely unresolved – gradually fade away. He proposed that each issue-attention cycle consists of the pre-problem stage, alarmed discovery, debates for solutions, gradual decline, and the post-problem stage. Although these five steps are not uniformly applicable to various social problems (Peters and Hogwood, 1985), the issue-attention cycle provides insight into how public attention dramatically fluctuates over time. Interestingly, Downs (1972) attributed the systematic rise and fall of collective attention to the operation of news organizations. He expressed concerns about how constraints on mass media, such as journalistic routines, limited resources, and periodical publishing processes, make it difficult to sustain issue attention for an extended time.

Digital attention span

Talking about public affairs is a crucial factor that promotes civic engagement (Huckfeldt et al., 2004; Jang et al., 2014; Valenzuela et al., 2012). User-generated media, particularly Twitter, have received extensive scholarly attention in this regard because a main function of the service is to facilitate public conversations online at minimal cost. By allowing users to express views and share opinions about social issues and events, Twitter, similarly to other social media, is expected to cultivate civic values in the electronic public sphere.

Mixed views have emerged about the attention span in digital media. On one hand, because limits on content production and dissemination seem to have lost their binding force in a digital world, we may expect expansion of the issue-attention span. The quantity of information that can be conveyed over the web is even larger than can be published and broadcast with either a daily newspaper or 24 hours of airtime (Hilbert and Lopez, 2011). A nearly unlimited number of users can be information producers who are empowered to generate and broadcast information online without going through the gatekeeper of an elite news organization (Goode, 2009; Shoemaker and Vos, 2009). Moreover, the online venue may be able to accommodate a full range of issues without prioritizing some agendas over others. In particular, an increasing number of tweets about one agenda need not result in a decrease in the number of tweets about other agendas. Thus, substantial technical constraints that were critical in the traditional media environment are not necessarily relevant any more.

On the other hand, despite technological developments in the digital era, ever-present psychological constraints may work as significant barriers to the expansion of attention span. Concerns have been growing about the volatile nature of digital attention span. Because user-generated agendas or viral online messages tend to rely on momentary popularity and unsystematic trends, Twitter conversations may have difficulty serving as a forum for public discussion. Analyzing the patterns of tweets surrounding 37 noteworthy events that occurred in 2013 and 2014, Guggenheim and Pasek (2015) found that most tweets are initial reactions to an event and the discussion of social issues on Twitter typically has an incredibly short half-life. The results indicated that Twitter functions primarily as a mechanism for disseminating news and other information but may not be a proper window into public discussion.

One important caveat of this line of research, however, is that it has not seriously considered the possibility that the digital attention span may expand through the intermedia process. In fact, practitioners are already using both social media and traditional mass media not only to promote their causes but also to prolong the issue-attention span. An agenda that initially originated in social media may lengthen its attention span by shifting the discussion venue to the elite media. Moreover, elite media agendas may gain even greater momentum through heated conversations in social media. Either way, it is essential to consider the intermedia process to understand the digital lifespan of issue attention. Focusing on the former possibility in particular, this study examines how user-generated agendas that are later transmitted to traditional media survive and sustain attention over the lifespan of the agendas.

Present study

This study examines how the intermedia process evolves along with the progress of the issue-attention cycle. This investigation uses the context of the ice bucket challenge that went viral on social media during the summer months of 2014 and successfully raised awareness of ALS, also known as Lou Gehrig's disease. The campaign gained tremendous popularity online, resulting in more than 17 million ice bucket challenge videos shared among more than 440 million viewers (Steel, 2014). As the challenge videos became contagious due to the nature of the name-calling strategy, the ALS Association began receiving unanticipated donations that exceeded over US\$220 million between July and 12 December 2014 (Mahoney, 2015). The viral videos caught the attention of ordinary social media users, as well as the famous, including Bill Gates, LeBron James, George W. Bush, and Oprah Winfrey (Steel, 2014).

The case of the ice bucket challenge offers a critical example to investigate the question of attention dynamics in the emerging media environment. Unlike previous research on intermedia agenda setting, it is not the primary goal of this study to discover whether user-generated content influences the mainstream news media. In fact, it may not be of particular interest to confirm that reverse agenda setting occurs in this viral campaign. We naturally observed that this meme phenomenon initially consisted of user-generated videos shared on social media and later became a news topic in mainstream media, not the other way around. Thus, this study moves beyond the seemingly obvious question about the existence of reverse agenda setting. Instead, we seek to explore how the known case of reverse agenda setting changes over time with the rise and fall of the user-generated agenda and discuss the long-term implications of online campaigns that earned tremendous popularity over a relatively short period of time.

To address this issue, first, we test the intermedia agenda setting at multiple points in time. As noted above, the ice bucket challenge started as a viral social media campaign. Hence, we expect that for the first phase of the campaign, user-generated content precedes news content produced by professional journalists:

H1a. News stories about the ice bucket challenge follow tweets about the same topic.

H1b. News stories about ALS follow tweets about the same topic.

However, once the user-generated agenda went viral and received news coverage from the mainstream media, it is not very clear whether the direction of intermedia influence remained the same or reversed. It is also possible that the influence became reciprocal or completely disappeared. Thus, we ask the following research question:

RQ1. How does the pattern of intermedia agenda setting change over time?

Then, one important inquiry is whether the level of attention to agendas returned to its previous relatively low levels or remained higher after the attention spike. If the level of attention declines from the peak but still remains higher than the initial low stage, one

may argue that intense attention even over a short term matters significantly. Once an agenda peaks, both mass media and individual users may be increasingly responsive to the agenda (Ragas et al., 2014). This has immense implications for public relations and campaign practitioners who seek out such continued awareness and responsiveness. Downs (1972) argued, ‘problems that have gone through the cycle almost always receive a higher average level of attention, public effort, and general concern than those still in the pre-discovery state’ (p. 14). Along these lines, Baumgartner and Jones (1991) employed the evolutionary concept of punctuated equilibria (Gould and Eldredge, 1977) to explain the temporal dynamics of public attention. Their punctuated equilibrium model suggests that issue attention does not necessarily follow the cycle or revert to the previous level. Instead, once issue attention undergoes the agenda-setting process, a sudden shift occurs, resulting in an unpredictable, ‘stepped’ or ‘punctuated equilibrium’ attention dynamic (Baumgartner and Jones, 1991). According to this perspective, we anticipate that both mainstream and social media talk about ALS more frequently after the explosion of the viral phenomenon than before the campaign. Note that we only compared the level of media attention concerning ALS, not the ice bucket challenge. When we compare the volume of search results over time, an increasing popularity of certain search terms may be often observed. This may stem from the fact that people use increasingly consistent language that refers to the same thing. However, to minimize this concern, we used three potential search terms (ALS, amyotrophic lateral sclerosis, and ‘Lou Gehrig’s Disease’), all of which indicate ALS. We did not find any evidence that ALS was called or used in a different way before the burst of the ice bucket challenge:

H2a. The number of tweets about ALS after the ice bucket challenge campaign is greater than the number of tweets about ALS before the campaign.

H2b. The number of news stories about ALS after the ice bucket challenge campaign is greater than the number of news stories about ALS before the campaign.

Methods

Data

The data for this study were provided by a private vendor, Sysomos Media Analysis Platform. As Twitter’s open access policy via Application Programming Interface (API) has become increasingly restricted, it is necessary to purchase data from a certified third-party firm to capture the full ‘firehose’ of all tweets. Importantly, Sysomos also monitors entire archives of online news sites (e.g. nytimes.com, cnn.com, news.yahoo.com) by collecting news from copyrighted data feed providers, excluding public user comments.

Media attention to the ice bucket challenge

Metadata attached to media content allow us to filter the entire dataset based on time, location, language, and web domain. Using this filtering process, our analysis was limited to media content from the United States that was written in English. We

collected Twitter and online news articles using two separate sets of search keywords. We used 'ice bucket challenge' for one dataset and 'ALS OR amyotrophic lateral sclerosis' OR 'Lou Gehrig's Disease' for the other. To examine H1s and RQ1, our data involved media content over an 18-week period, spanning from 25 July 2014 to 27 November 2014. This data collection resulted in a total of 50,405 news stories and 1,380,313 tweets for the ice bucket challenge and 87,373 news stories and 1,042,195 tweets for ALS-related search inquiries. In addition, we were able to compile the daily volume of tweets and online news stories. To compare the level of media attention before and after the ice bucket challenge (H2s), we compiled the data between 1 January and 30 June for both 2014 and 2015.

The extant literature does not offer a clear guideline of the duration of each stage because the pattern and speed of attention spikes vary significantly across different issues. Thus, we looked into the trend of media attention to the ice bucket challenge to see the relevance of Downs' issue-attention cycle consisting of five stages. Notably, it was almost impossible to discriminate the first three stages of the issue cycle: the pre-problem stage, alarmed discovery, and debates for solutions as the social media buzz came and went so quickly. Thus, we split our timeline into three stages combining the first three. Based on the ups and downs of attention spikes, every 6-week period may serve as a proper period for differentiated attention stages. In terms of Downs' concept, the next phase indicates the gradual decline stage; however, the social media contagion did not display a 'gradual' decline, but a rapid drop. Finally, the third period may be considered the post-problem stage where attention spikes no longer exist. However, these applications of Downs' cycle may not work perfectly with the fleeting nature of social media phenomena. As the goal of this article is not to test Downs' issue cycle but to track down any changes of the intermedia process over time, we do not push this concept further.

The first stage involves most of the summer when the viral campaign gained enormous popularity. However, it also includes a declining period after the peak due to the relatively volatile nature of attention dynamics. The largest amount of news articles ($M=879$) and tweets ($M=30,319$) were produced for the ice bucket challenge in this initial stage (25 July to 4 September). The ALS-related search terms also generated the largest volume of news articles ($M=1093$) and tweets ($M=21,958$) in the first stage. The second stage reflected a continued decline, generating 235 news articles and 2016 tweets on average for the ice bucket challenge. Similarly, the popularity of ALS-related search terms ebbed away in the second term, producing averagely 549 news stories and 1936 tweets every day. The last period showed the cooled down stage, showing 86 and 438 news articles and 529 and 920 tweets on average for the ice bucket challenge and ALS.

Spam tweets (e.g. Twitter bots) are significant impediments to obtaining valid, high-quality data. Sysomos employs four main methods to judge whether posts are spam or actual content run by real people (see Neuman et al., 2014: 198 for details of these methods). As a result, approximately 40 percent of what Sysomos crawls is discarded as spam.

We included retweets in our analysis because the literature indicates that they are an effective indicator for the extent to which messages are perceived as important in the network (Larsson and Moe, 2012).

Validation of search terms

'Ice bucket challenge' and other search terms representing ALS seemed to have strong face validity in signifying attention to this campaign or related disease. We tried to use some variations of 'ice bucket challenge' as possible search terms but decided not to include them. They only increased noise without contributing much. Thus, we consider a search term 'ice bucket challenge' the most parsimonious and representative parameter. For ALS, we found that keywords including ALS, amyotrophic lateral sclerosis, or 'Lou Gehrig's Disease' generate the least noise.¹

It should be noted that automated content analysis may yield misleading returns by including extraneous texts. Thus, using procedures described by Stryker et al. (2006), we assessed the precision of our search terms. Like Type I errors, precision refers to the 'ability to avoid extraneous ones' (Stryker et al., 2006: 413). We had two independent coders review a random sample of 100 tweets and 100 news articles from the Sysomos database for each search phrase. For search terms for the ice bucket challenge, 100 percent of tweets and 100 percent of news articles were determined to be relevant. For search terms for ALS, 91 percent of tweets and 95 percent of news articles were deemed accurately retrieved. Thus, the average precision estimate was 97 percent. Average intercoder reliability is .87 (Cohen's Kappa), and the overall agreement reached 98 percent between two coders.

Covariates

The literature suggests that time-series data tend to be susceptible to the product of trend and cyclical forces (Beckett, 2013). The total amount of online content has increased dramatically over time (Hilbert, 2012). Additionally, research recommends that periodicity in the volume of media content should be controlled (Hester and Dougall, 2007; Neuman et al., 2014). In particular, news content shows a strong weekly cycle due to the strict schedule for publication or broadcasting (Berkowitz, 1992; Riffe et al., 1993). For this reason, it is important to control for long-term changes and cyclical processes that might influence patterns of behavior in the online news media and on Twitter. To incorporate these processes – and thus account for these daily variations from our assessment of the daily volume of media content – we controlled for days of the week in all statistical analyses. Each day of the week was treated as a dummy for all analyses.

Results

To assess the intermedia process between online news and social media content, we employed a time-series analysis based on the methodological framework of Granger (1969) causality. The Granger analysis tests whether the current value of y can be better predicted by past values of x and y together, than by past values of y alone. If past values of x are able to predict y above and beyond y 's own past values, then x is said to Granger-cause y (Granger 1969; Freeman, 1983). The Granger analysis allows us to determine the temporal order between two time-series data x and y if we run this analysis twice

Table 1. Granger analysis between Twitter and online news.

Phase	Intermedia influence		Ice bucket challenge	ALS
	From	To	Chi square	Chi square
First 6 weeks (25 July to 4 September)	News	Twitter	10.55	4.43
	Twitter	News	52.20***	93.92***
Second 6 weeks (5 September to 16 October)	News	Twitter	23.54***	14.00*
	Twitter	News	21.85***	14.69*
Third 6 weeks (17 October to 27 November)	News	Twitter	41.44***	21.02***
	Twitter	News	12.92	4.47

ALS: amyotrophic lateral sclerosis.

* $p < .05$; *** $p < .001$.

with x and y exchanged. In other words, we can examine the direction of intermedia effects between news and social media.

As a first step, we tested each vector autoregression (VAR) for stationarity (Beckett, 2013). This test detects whether impulsive spikes, trends, cycles, and seasonal variations cause unrecoverable deviations from the average. We found that all of our VARs satisfied the conditions of stationarity, negating the need for differencing (Box et al., 2015). Next, we determined a lag length or the amount of time we would lag the independent variables in our regressions. Previous research with daily time-series data showed that agenda-setting effects mostly occur in a week or less (Roberts et al., 2002). Roberts et al. (2002) indicate that the 7-day lag generates the greatest effects for the relationship between traditional news and online content. Recently, Neuman et al. (2014) confirmed that statistical criteria for lag selection, such as Akaike Information Criterion (AIC) and Schwarz' Bayesian Information Criterion (SBIC), indicate that a time lag of up to 7 days is an optimal lag. Following this suggestion, this study included 1- to 7-day lags. Note that using 7-day lags in Granger analysis indicates that all time-lag variables ranging from 1- to 7-day lags (from X_{t-1} to X_{t-7}) were included in the analysis. Then, to control for potential weekly periodicity, we added six dummies that represent days of the week to our Granger analyses.

Table 1 summarizes the results of the Granger analyses. To determine the temporal order of news content and tweets for both the ice bucket challenge and ALS, we ran Granger analysis repeatedly. Moreover, we ran this analysis for three different phases. As seen in the first two columns in Table 1, we first looked into the intermedia influence for the first 6 weeks when the campaign gained sensational publicity. The results revealed that online news coverage of the ice bucket challenge and did not Granger-cause the Twitter volume of the campaign, but the possibility of bottom-up intermedia influence, from Twitter to online news, was detected. The analysis with ALS yielded the same pattern, supporting H1a and H1b.

Figure 1 shows trend lines of Twitter and news coverage for 18 weeks (126 days) regarding ice bucket challenge and ALS. Figure 1 illustrates that news media, compared to Twitter, exhibited a clearer weekly cycle where the daily volume was lower on

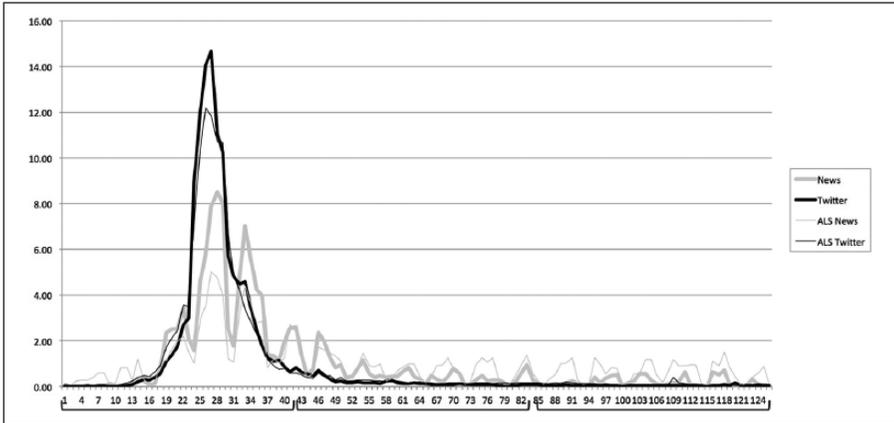


Figure 1. Trends in Twitter and online news about ice bucket challenge and ALS from 25 July 2014 to 27 November 2014. Data are normalized (i.e. mean scaled).

weekends. This reflects the difference between online news in which journalistic resources are increasingly restricted on weekends and Twitter in which users do not have such limitations even on weekends. Additionally, we see that Twitter about both ice bucket challenge and ALS spiked and declined ahead of online news about the same topic. This confirms our idea that social media users initiated messages about the campaign and ALS, to the extent that mainstream news media accepted such an atmosphere of social media buzz. At least for the first phase, we did not identify the top-down influence from mainstream to social media.

Next, to follow up the variations of these relationships, we ran the same analysis with the data from the second and third 6 weeks. As events unfolded and the popularity cooled down a bit, the reciprocal pattern of linkage emerged between mainstream and social media. These results including reverse agenda setting and mutual interactions seem to pose a challenge to the long celebrated concept of one-way media agenda setting and represent the increasing potential of successful user-generated agenda setting. The Granger analysis of the last 6 weeks presented interesting results. The bottom-up arrow did not appear to be significant anymore. On the other hand, news content did show an intermedia influence over tweets for both the ice bucket challenge and ALS. These findings constitute the ‘round-trip agenda setting’ between different media outlets. The full regression results are available in an Online Appendix.

Finally, we conducted one-way analyses of variance (ANOVAs) to test H2a and H2b. The goal of these analyses is to examine whether the number of tweets and news content about ALS after the campaign (post-problem stage) is greater than the number of tweets and news content about ALS before the campaign (pre-problem stage). The core question here is whether media attention to this issue has been increased to a different level even after such a viral campaign is over. To make this comparison reasonable, we collected data from online news articles and tweets about ALS between 1 January and 30 June for both 2014 and 2015. Additionally, the total volume of tweets

over two time frames was compiled and used as a covariate.² On average, 42,124,861 posts were tweeted daily for the first 6 months in 2014, and on average, 42,987,936 posts were daily produced for the first 6 months in 2015. The analysis of covariance (ANCOVA) results controlling for the total Twitter volume supported our expectations. The number of tweets generated about ALS over 6 months in 2015 ($M=2821.00$, standard deviation (SD)= 2679.51) was significantly larger than the number of tweets generated over 6 months in 2014 ($M=2086.27$, $SD=584.66$), $F(1, 360)=10.44$, $p<.001$, even after the total volume difference, $F(1, 360)=22.64$, $p<.001$. Similarly, the number of news stories about ALS over 6 months in 2015 ($M=355.14$, $SD=249.02$) was significantly larger than the number of tweets generated over 6 months in 2015 ($M=223.91$, $SD=185.45$), $F(1, 360)=28.60$, $p<.001$. Unfortunately, the total news volume data were not available, so ANOVA instead of ANCOVA was conducted for H2b. Overall, H2a and H2b were supported.

Discussion

Scholars have welcomed social media as a digital venue for public discussions about a wide range of social issues. In particular, the potential of ordinary users directly contributing to the formation of media and public agendas without the rigor of the gatekeeping process has motivated researchers to demonstrate such phenomena. Accordingly, the extant research has reported ample evidence that social media conversations can influence mainstream media agendas. However, a critical assessment that has been neglected in the current literature is the examination of how user-generated agendas survive and last long enough to trigger substantial public discussions and eventually policy responses. This study spoke to this issue by closely following the case of the ice bucket challenge over an 18-week period. The results revealed that the direction of the intermedia process shifted from bottom-up to top-down along with the rise and fall of the agenda over time. The implications of these findings are described below.

To assess how the intermedia agenda setting evolved, we ran Granger analysis at three different points in time. The analysis with the first phase showed that the news media mentions followed Twitter messages in either case when ‘ice bucket challenge’ or ALS was chosen as our key search terms. The opposite direction of the intermedia process was not detected in our analysis. These results corroborated our natural observation that this meme phenomenon originated from social media and then widely circulated across various media outlets including elite media.

We conducted the same Granger analysis for the second and third phases when the popularity of the issue cooled down substantially. These analyses captured interesting changes. During the second phase, we found mutual interactions between mainstream and social media. Once mainstream media recognized the enormous popularity of this campaign in the digital world, they might have begun to generate new information that was relayed to social media. The analysis with the third phase indicated that the intermedia agenda setting returned to one-way traffic but in a reverse direction. Twitter messages no longer influenced news content. Instead, news media took the initiative and greater control of the conversation about the ice bucket challenge and ALS although the volume of messages transmitted was significantly downsized.

The results reflect the volatility of issue conversations in social media and at the same time stress the significance of the mainstream media. Although the conversations were initiated and exploded in social media, Twitter messages begun to fade away before news content did. The volume of tweets spiked dramatically up to 12 times the daily average volume over 18 weeks, but the heat was quickly extinguished. The fleeting fluctuations of tweets indicate that the digital attention cycle progresses more swiftly than the traditional attention cycle. In contrast, our findings highlighted the important role of the elite media. When the popularity of user-generated content declined, news media gain strength to exert the agenda-setting influence over social media. This observation ascertained the view that news media contributed to extending the level and duration of attention to the campaign issue. These small but sustained efforts are important because they may represent a continued adaptation of programs established during the initial surge of activity (Peters and Hogwood, 1985).

Finally, we hypothesized that the level of social media attention after the peak of the viral campaign was greater than the level of attention before that peak. Our results lent support to this trend. The evidence shows that once social media users became aware of and active in the campaign, the media activity cyclically decreased from the peak but did not revert to prior low levels. This is consistent with Baumgartner and Jones' (1991) notion of punctuated equilibria suggesting that the agenda-setting process is cumulative and asymmetrical. After going through destabilizing events, such as the ice bucket challenge campaign, the issue-attention cycle does not return to a predictable periodic cycle, but forms a new punctuated equilibrium. In this newly established punctuated equilibrium, the public's perception of and responsiveness to the issue are expected to be significantly different from the past.

These findings offer mixed interpretations of Twitter's role as a forum for open discussion. On the one hand, it is still questionable whether Twitter can offer sustained attention to cause meaningful social change. Despite scholars' expectations that social media function as an alternative public arena independent of commercial and technical media constraints (see Entman, 1989; Neuman et al., 2014; Shirky, 2011), scholars have expressed concerns about the evanescent nature of social media exchanges. Given that the current findings also display the volatile dynamics of social media conversations, practitioners should give serious consideration to the length of as well as the level of attention.

On the other hand, the findings also hinted at some hopeful signs. First, although social media presented their volatile nature as a potential problem for a digital public sphere, we found evidence that this drawback can be moderated by the use of elite media. By reversing the direction of intermedia agenda setting, the mainstream media may be able to rekindle a dying fire and offer a fresh perspective on the agenda. For this reason, it is critical for social media practitioners to think over how their user-generated agendas fit and are effectively appreciated by the mainstream media. Moreover, it is highly recommended that practitioners should consider the possibility of the 'round-trip' intermedia agenda setting when designing social media campaigns and messages.

Another positive finding regarding user-generated media is that the issue, once having been through the issue-attention cycle, obtained a higher level of social media attention after rather than before the peak. Given that the public's perception of important agendas

is formed through a cumulative process over time, even an incredibly short attention spike may be helpful in achieving successive programs. In fact, it should be noted that the ALS association raised US\$100 million in July and August 2014, but the donations did not stop even after the peak of media attention to the campaign. By the end of 2014, the organization raised US\$220 million in total between July and December. This suggests that, once an issue achieves increased awareness, the effects may last for a while even after mainstream and social media no longer pay much attention to the issue.

Several limitations should be considered to assess this study. First, little is known about how attention accrues over time. This viral phenomenon may be due to reciprocal peer pressure from ordinary users through a name-calling strategy as well as active participation by public figures, which generated a large amount of retweets and replies. Additionally, it is still unknown whether the event caused already active users to generate even more tweets or the event attracted tweets from infrequent users. Second, despite the ample evidence of intermedia agenda setting, the underlying mechanism should be further clarified. For example, the transfer of issue salience from mainstream to social media could occur via many pathways. Ordinary users might create and distribute digital messages in response to news articles, but it is equally possible that journalists and other offline elites monopolize the flow of information even on Twitter (Ausserhofer and Maireder, 2013; Meraz, 2009). If the same elites dominate both online and offline at the same time, the consistency in conversation topics between mainstream and social media is not so surprising. To tease out the underlying processes, future studies should consider individual-level characteristics as well as content features.

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Notes

1. To see the extent to which two search terms (ice bucket challenge and ALS) were related, we ran correlation analyses for each medium. Ice bucket challenge and amyotrophic lateral sclerosis (ALS)-related search terms were highly correlated for both media ($r = .94$, $p < .001$ for online news; $r = .99$, $p < .001$ for Twitter).
2. The total number of tweets produced between 1 January and 30 June for both 2014 and 2015 was compiled via another third-party data vendor, Crimson Hexagon.

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Author biographies

S Mo Jang is assistant professor in the School of Journalism and Mass Communications, University of South Carolina (PhD, Communication, University of Michigan, 2014). His research focuses on new media and public opinion about science and social issues. His work appears in the *Journal of Communication*; *Public Opinion Quarterly*; *New Media and Society*; *Global Environmental Change*; *Science Communication* among others.

Yong Jin Park is associate professor, Radio TV, Film, School of Communications, Howard University (PhD, Communication, University of Michigan, 2009). His research centers on social and policy/political implications of new communication technologies, spanning the field of communication policy, media institutions, and new media users. His works (will) appear in *Communication Research*, *New Media and Society*, *Telecommunications Policy*, *Journal of Broadcasting & Electronic Media*, *Government Information Quarterly*, *Journal of Communication*, *Journal of Information Policy*, *Sociology Compass*, *The Information Society*, and *Info: Journal of Policy, Regulation, and Telecommunications*.

Hoon Lee is assistant professor, Department of Journalism and Communication, Kyung Hee University (PhD, Communication, University of Michigan, 2013). His research centers on social media and political communication. His works (will) appear in *Communication Research*, *Mass Communication and Society*, *Journal of Broadcasting & Electronic Media*, and *Computers in Human Behavior*, among others.