The Dynamics of Issue Frame Competition in Traditional and Social Media

By
LAUREN GUGGENHEIM,
S. MO JANG,
SOO YOUNG BAE,
and
W. RUSSELL NEUMAN

This study examines the dynamics of the framing of mass shooting incidences in the U.S. occurring in the traditional commercial online news media and Twitter. We demonstrate that there is a dynamic, reciprocal relationship between the attention paid to different aspects of mass shootings in online news and in Twitter: tweets tend to be responsive to traditional media reporting, but traditional media framing of these incidents also seems to resonate from public framing in the Twitterverse. We also explore how different frames become prominent as they compete among media as time passes after shooting events. Finally, we find that key differences emerge between norms of journalistic routine and how users rely on Twitter to express their reactions to these tragic shooting incidents.

Keywords: big data; framing; social media; mass shootings; Twitter; word clouds; time series analysis

Public debates over politically relevant issues and events are often marked by contests about how an issue should be understood and interpreted. This occurs partly because political issues are typically complex and outcomes of policy difficult to predict. As a result, issue frame competition is abundantly evident, often celebrated with comedic flourish in nightly disputes between Comedy Central's Jon Stewart

Lauren Guggenheim is a senior researcher at the Center for Political Studies at the Institute for Social Research, University of Michigan. Her research interests include public opinion, political communication, and social media.

S. Mo Jang is an assistant professor in the School of Journalism and Mass Communications at the University of South Carolina. His current research focuses on social media and public opinion.

Soo Young Bae is an assistant professor of communication at the University of Massachusetts, Amherst. She is interested in the social and political impact of new communication technologies, with a particular focus on the dynamics of user interaction and information flow in social media platforms.

DOI: 10.1177/0002716215570549

and Fox News. The task of defining problems and constructing storylines about issues means that the news inevitably highlights some elements of issues and ignores others. Framing, according to Entman's (1993) now classic definition, "is to select some aspects of a perceived reality and make them more salient in a communication text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (p. 52). If one particular frame becomes dominant and others are downplayed or ignored entirely, Entman reminds us, the scope of public policy debate concerning an issue can become limited and distorted.

Researchers have examined the over-time rise and fall of different, and potentially competing, frames in the news. Attention to such framing dynamics has taken several different forms, including exploring shifts in the use of frames by news organizations or other elites over time (e.g., Glazier and Boydstun 2012; Gamson and Modigliani 1987; Simon and Xenos 2000), the effects of frame competition in the media environment (Chong and Druckman 2007, 2010; Shah et al. 2002; Sniderman and Theriault 2004), and the duration of framing effects (Druckman and Nelson 2003; Lecheler and de Vreese 2011, 2013). Thus far, however, there has been relatively little attention to framing dynamics in social media and between social and traditional media. In this article, we examine how the social media platform, Twitter, and a representative index of traditional media (i.e., CBS, CNN, Associated Press, etc.) might influence one another over time, and we investigate the framing characteristics of these components in the online public sphere. Because framing can affect the scope of policy debate, examining the dynamics between these media should help us to better understand how social media can set or change the tone or focus of a debate. We have chosen the issue of mass shootings, which has attracted some attention in the framing literature (Chyi and McCombs 2004; Haider-Markel and Joslyn 2001; Lawrence and Birkland 2004; Muschert and Carr 2006; Schildkraut and Muschert 2014). In the spirit of this volume, we take advantage of evolving big data resources, which permit a particularly rich view of frame competition.

Framing and Dynamics

In a recent study (Neuman et al. 2014), we examined the overall agenda-setting relationship between patterns of attention in the traditional and social media on a variety of public issues. One dominant finding was that the attentional dynamics of traditional and social media are highly correlated, perhaps an unsurprising result. More surprising, and possibly counterintuitive, was that the over-time patterns of leading and lagging spikes of attention indicated a picture of reciprocal causation rather than one-way media agenda setting. We also found that the same was true for attention to different issue frames or what some have

W. Russell Neuman is a professor of media technology at New York University and Evans Professor of Media Technology, Emeritus at the University of Michigan. His research focuses on media effects in the evolving media environment, higher education, and technology policy.

called second-level agenda setting (McCombs 2004), but our conclusions were preliminary and the description of the analysis abbreviated. We take the opportunity here to explore these dynamics more fully.

Background of mass shootings, 2012–2014

The way in which issues and problems are framed, of course, is important for understanding the dynamics of public support for different policy measures. Reports show that more than nine hundred people have been killed in mass shootings in the past seven years (Kepple et al. 2013). While there is no official definition of a mass shooting, the FBI refers to mass murder as incidents in which a perpetrator kills four or more people, to differentiate it from serial murder. In general, the term *mass shooting* is typically associated with a single episode of shooting in a single location (Follman et al. 2013), and often occurring in public settings with indiscriminate choices of victims (Bjelopera et al. 2013).

During the period of our investigation, from April 2012 to April 2014, several high-profile mass shootings occurred. In June 2012, a mass shooting occurred in a movie theater in Aurora, Colorado, leaving twelve people dead and more than sixty others injured. In December 2012, a shooting at the Newtown, Connecticut, elementary school resulted in the deaths of twenty children, six staff members, and the shooter. There were several other salient mass shootings that occurred during this period, including one at the Navy Yard in Washington, D.C., and a second shooting at Fort Hood in Texas. Although mass shootings constitute only a small fraction of gun violence, they are highly salient and receive disproportionate attention from the public (Bjelopera et al. 2013; Drake 2013). The Pew Research Center (2012a) reported that 57 percent of American adults reported watching news about the Newtown shootings very closely, while 49 percent reported the same of the Aurora shootings. The Newtown school shooting in particular stimulated both popular and congressional support for policy action, but enthusiasm for making changes diminished over the course of 2013, resulting in no national policy measures (although many states enacted legislation, both in favor of and opposed to stricter gun regulations; Yourish et al. 2013) and only a small amount of movement in overall public opinion (Pew Research Center 2012b).

Frame dynamics in the traditional and social media

Although the traditional commercial media is often thought to set the agenda for the public and influence which frames citizens receive, researchers have also demonstrated that some news outlets set the agendas for other ones in a process known as intermedia agenda setting (e.g., Golan 2006; Danielian and Reese 1989). This process likely extends to the framing and interpretation of news events, since news organizations may look to each other to determine not only what to cover, but also which elements of an event or issue are worth covering and in what way. Despite some similarities, it is not clear that issue framing dynamics in the traditional and social media would appropriately be conceptualized as an intermedia process. That is because while Twitter, for example, could

be relied on by many, including journalists (Farhi 2009; Hermida 2010), as a resource for news and entertainment much like a traditional news medium, it does not have a coherent editorial voice or an editorial process but rather represents a particular facet of expressed and, in this case, electronically mediated public opinion. Therefore, we simply identify the issue of temporal priority and potential influence among public social media and commercial online news media in the evolving new media environment as frame dynamics.

In previous work, we examined the dynamics for sets of two competing frames for ten public issues (Neuman et al. 2014).[1] We found that online discussion forums, Twitter, and blogs frequently set the framing agenda for traditional news and that traditional news often set the framing agenda for the other social media in these binary comparisons. Likewise, Heim (2013) found that the attributes of candidates discussed in the top political blogs and the traditional news were correlated with each other prior to the 2008 Iowa Democratic presidential caucuses. Moreover, he found that news influenced coverage of candidate attributes in top neutral- and liberal-leaning blogs, and that neutral blogs influenced liberal ones; however, he found no evidence that blogs influenced the attributes that the traditional media covered despite previous evidence of traditional agenda setting links between the two during a presidential campaign (Wallsten 2007). In another election study outside the U.S. context, Lee, Lancendorfer, and Lee (2005) found that Internet bulletin boards were able to influence candidate attributes in newspaper coverage. This lack of consistent evidence of bidirectional framing "effects" may have to do with the issue, the type of social media, the specific frame, and the time period of the relationship under investigation. Nevertheless, an interactive framing dynamic between Twitter and the traditional media seems likely for mass shootings in light of our previous findings.

In this study we examine several frames drawing on Iyengar's work (1990, 1991) but with a focus on issue-specific frames, in our case the issue of gun violence (e.g., see Borah [2011] on the difference between general frames, which cut across issue domains and issue frames). Iyengar (1990) raised concerns that episodic frames prevail in the news media, highlighting individual victims or cases. On the other hand, much less frequently occurring are thematic frames that take a broader perspective and may focus on causal interpretation and treatment recommendation. Iyengar (1990, 1991) suggested that the way news media assigns causal and treatment responsibility for social issues (e.g., poverty) plays a significant role in shaping public policy support. For example, when reporting a mass shooting incident, the event may be framed as a description of a perpetrator and victims (episodic framing). It is also possible that news media trigger discussions of responsibility and the prevention of such tragedies (thematic framing). Research on the issue of gun control suggests that gun access laws, violent video games, and mental illness are often cited as contexts and potential causal factors associated with mass shootings (Haider-Markel and Joslyn 2001). These latter frames resonate with Iyengar's notion of thematic framing in the news reports for this issue domain (see Table 1).

The shooter/victim event frame reflects the notion of episodic framing (Iyengar 1990, 1991) by focusing on individual actors in mass shooting episodes,

TABLE 1
Issue Frames Associated with Mass Shooting Events

Episodic	Thematic
Shooter/victim event frame	Gun control/gun rights frame
	Violent video games frame
	Mental illness frame

primarily perpetrators and victims (see also Chyi and McCombs 2004). The gun control/gun rights frame is based on the notion that controlling gun access will reduce gun violence, and tends to be a position aligned with Democrats, as it was during the Columbine shooting, for example (Haider-Markel and Joslyn 2001). When discussing this frame, however, those with alternate positions make use of related ideas, such as the Second Amendment, or describe the issue as gun ownership. Seeking to more completely avoid attention to gun control, others have argued that violent media, in particular video games, influence mass shooters, especially younger ones. Likewise, the mental illness frame has been discussed relative to several mass shootings (Schildkraut and Muschert 2014; Lawrence and Birkland 2004). Together, gun control, violent media, and mental illness constitute the three most dominant issue frames in this corner of the public sphere (Schildkraut and Muschert 2013). Moreover, because they point to different causes and policy solutions, and are frequently championed by different and sometimes partisan interests, they may often be in competition with one another. Our research, then, examines the temporal order of these frames in traditional media relative to social media.

Research Question 1 (RQ1): Does the time series evidence suggest that the spikes in attention to particular issue frames in the commercial online media appear to influence issue framing in social media or the other way around?

The interaction of issues and events in frame dynamics

Media and public attention to political issues and their corresponding frames, as we have noted, are highly dynamic. Downs (1972), for example, theorizes an issue-attention cycle in which the public goes through several stages of waxing and waning attention to a policy issue. Although Downs's focus was the cycle of a single issue—the environment—frames likewise can surge and decline in popularity as time passes. Researchers have established that the popularity of different frames rises and falls over time (e.g., Gamson and Modigliani 1987; Muschert and Carr 2006), and some have found that attention given to different issue frames in the media (McComas and Shanahan 1999; Brossard, Shanahan, and McComas 2004) and among the public (Zhou and Moy 2007) goes through cycles or stages.

Events punctuate the issues on the agenda, and this process can help to explain why the framing of an issue changes over time. For example, Birkland (1998) described how "focusing events"—ones that are sudden, dramatic, and harmful—can simultaneously shock the media, public, and policy-makers into paying attention to a previously dormant issue, or shift the debates surrounding a current issue on the agenda. Zhou and Moy (2007) contended that online discussion of events by intensely interested netizens can even help to propel events into becoming issues and change the frames used to interpret events. Moreover, reporters tend to be event focused. As a large and salient event first occurs, journalists work to get the information out, focusing on who, what, when, where and [if possible] why (the "five Ws") (Chyi and McCombs 2004). Over time, however, other frames appear.[2] Journalists, via a dynamic process known as frame changing, may actively reframe issues to extend the life of a story (Chyi and McCombs 2004).

While journalists are involved in frame changing for issues, others with different incentives also have a hand in changing the popularity of frames or trying to maintain the status quo. For example, Glazier and Boydstun (2012) suggested that presidents try to shape frames, but to do so in keeping with a consistent frame or storyline that resonates with a policy position they would like to advance. Birkland (1998) argued that in the wake of focusing events, interest groups may seize the opportunity to reestablish their arguments and mobilize their followers to enact policy change. Moreover, an intermedia framing process, as described above, could accomplish the dynamic changing of frames. For instance, an elite news outlet such as the *New York Times* might run an investigative reporting series that changes frames on long-standing issues, which would then be picked up in other outlets across the media landscape. Or, more specifically for our case, the social media may react counter-intuitively to traditional frames, which could go viral. In one example (Neuman et al. 2014) the social media forcefully responded to an obscure quotation in the news that "job creators" are everyday hardworking people, which stood in stark contrast to traditional media and elite frames of "job creators" as those at the top who provide jobs to others. Similarly, in another study, Sayre and colleagues (2010) found YouTube could influence newspaper coverage and provide a forum for minority voices following an event. Our research questions in this section deal with how frames differ within media and change in response to events.

RQ2: Are the dynamic patterns of issue framing distinctively different in the social and in the online traditional commercial media?

RQ3: How are framing dynamics within each medium affected by individual mass shooting events?

Methods

Big data and the opportunity to study frame dynamics

The availability of large corpuses of text and the means to analyze them have supplemented the way researchers examine news and other political content.

Though most content analyses have been conducted with human coders, automated methods have become increasing popular in the field of political communication. Framing researchers initially conducted studies of traditional news using coding software to automate traditional content analysis (e.g., Kellstedt 2000; Shah et al. 2002; Simon and Xenos 2004). However, big data techniques provide researchers greatly expanded opportunities for exploring broad patterns over large periods and expansive samples of media but also detailed fine-grained studies of word use, word associations, and conceptual relationships.

One drawback of Twitter for framing analysis is that it allows only very short posts (with a firmly imposed limit per tweet of 140 characters), complicating the search for longer phrases or the co-presence of several words or arguments that might typically constitute a frame. On the other hand, analyzing single words or short catch phrases is promising. For example, because they are widespread, tracking and analyzing memes (i.e., short catch phrases) has proven fruitful (Leskovec, Backstrom, and Kleinberg 2009), and memes may align with frames. Likewise, some frames have become so ingrained that a short label or metaphor is sufficient to stand in for a frame or evoke a related schema (Jang and Lee 2014; Lakoff and Johnson 1980).

Dataset

To explore our research questions, we collected Twitter data and online news from traditional media in English and based in the United States for a two-year period, spanning April 10, 2012 to April 9, 2014. The data came from two third party data providers: Marketwired's Sysomos platform and Topsy.com. The former provided us with online news stories from traditional media and the latter with the Twitter "fire hose" (i.e., all publicly available tweets). Keyword searches enabled us to compile the number of Tweets and news articles that mentioned our chosen terms or phrases for each day over the course of two years. Our sampling units were thus each individual tweet or online news story. First, to identify content related to mass shootings, we generated five key identifying phrases that uniquely represent mass shootings. For example, we reasoned that any tweets and articles containing "mass shooting," "mass shootings," Aurora, Newtown, "Sandy Hook," or "navy yard" were attending to mass shootings. We collaboratively reviewed the keywords to see if they were present or absent in our searches, eliminating a dozen keywords. We did this for both media streams. Over 730 days, we found 5,803,950 tweets and 1,068,116 online news stories related to mass shootings.

Then, within this identified dataset, we developed a second set of keyword phrases that appeared to correspond to four issue frames and reviewed them again. These four sets of keywords were "victim," "victims," "shooter," "killer," and "gunman" for the shooter/victim event frame; "gun control," "gun regulation," "gun ownership," and "second amendment" for the gun control/gun rights frame; "game" and "games" for the video game frame; and "mental," "psychological," and

"illness" for the mental illness frame. We sought unique elements of public rhetoric that clearly linked to single frames of the more complex issue while avoiding being too inclusive. Hence, the daily volume of media content with a reference to one or more of the search terms constituted our issue frame vectors. There were 708,124 tweets and 345,866 traditional stories corresponding to the shooter/victim frame; 33,898 tweets and 167,427 stories for the gun control frame; 61,662 tweets and 111,542 stories for the video game frame; and 97,259 tweets and 125,729 stories for the mental illness frame.

Prior research indicates that keyword-based analysis may yield misleading results by including irrelevant texts and excluding relevant texts. Like Type I and Type II errors, the information retrieval literature calls them recall (*the ability to accurately include relevant items*) and precision (*the ability to avoid irrelevant ones*). Using procedures that Stryker et al. (2006) have proposed, we assessed the precision of our search phrases. We did not assess recall because the descriptive distribution of various frames was not the goal of this study. The precision rate was estimated by the proportion of relevant tweets among retrieved tweets. Two coders evaluated a random sample of 800 tweets (200 tweets per frame). Intercoder reliability was .974 (Cohen's Kappa) and the agreement reached 99 percent between two coders. The precision estimate was 89.3 percent.

Results

The first research question dealt with the direction of potential issue framing effects between social and traditional media. To address this question, we relied on Granger analysis. This method tests whether x Granger-causes y by examining the relationship between past values of x and the current value of y, holding past values of y constant. 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). In other words, we look for whether current attention to a keyword set in Twitter is predicted by past values of both Twitter and traditional news attention to those keywords. As a first step, we set up a lag length, or the amount of time we would lag the independent variables in our regressions. Studies using daily data find agenda setting occurs in a week or less (Roberts, Wanta, and Dzwo 2002; Wanta 1997). Those also incorporating online news (Roberts, Wanta, and Dzwo 2002) and social media (Neuman et al. 2014) suggest seven-day lags are most appropriate. Relying on these previous agenda setting studies, along with the statistical criteria for lag selection (i.e., AIC, HQIC, and SBIC) and reasoning about attention to frames in the media streams, we opted for seven-day lags in our analyses.

Next, we tested each vector auto regression (VAR) for stability (Becketti 2013). This test indicates whether each of our models is stationary (i.e., that there are no impulse events, or explosive attention to events that cause substantial, unrecoverable deviations from the average level of attention). All of our models passed this statistical test. We then used Granger analysis to determine whether

TABLE 2
Cross-Correlations of Mass Shooting Keyword Sets between Twitter and Traditional Media

Frame	Lag	TM->TW	TW->TM	Frame	Lag	TM->TW	TW->TM
Shooter/victim event	–7	.063	.177	Video game	–7	.160	.263
	–6	.079	.233		–6	.213	.311
	–5	.018	.286		–5	.271	.431
	–4	.173	.377		–4	.361	.428
	–3	.228	.494		–3	.408	.514
	–2	.312	.532		–2	.435	.569
	–1	.447	.657		–1	.574	.695
	0	.827	.827		0	.759	.759
Gun control	–7	.048	.169	Mental illness	–7	.183	.328
	–6	.069	.209		–6	.190	.380
	–5	.071	.278		–5	.211	.473
	–4	.099	.342		–4	.223	.536
	–3	.150	.386		–3	.278	.599
	–2	.207	.446		–2	.378	.601
	–1	.299	.432		–1	.487	.682
	0	.404	.404		0	.663	.663

NOTE: The cross-correlations reported are based on analyses using the raw data. TW = Twitter; TM = traditional media.

attention to keyword sets on Twitter predicted attention to keyword sets in traditional online media and vice versa. Because previous analyses of over-time Twitter data and news suggest that the overall volume of posting or stories varies depending on day of the week (Neuman et al. 2014; Jang and Pasek, in press), we controlled for each week day, excluding Saturday (although results were the same without day-of-week controls). Additionally, we tested the bivariate cross correlations for each of the lags in both directions excluding the controls. Results in Table 2 show that the associations between the two series are positive.[3]

Table 3 shows the results of our Granger analysis. The findings indicate that the attentional dynamics to various keyword sets in each media tend to reflect a pattern of influence in both directions. Twitter appears to set the frames for traditional online news in each case except the shooter/victim keywords, and the reverse is true for traditional online media, except for the shooter/victim keywords and the gun control keywords from traditional media to Twitter. The shooter/victim finding may not be surprising if we consider that the keywords used to identify the shooter/victim frame focused on factual descriptions of events, a journalistic norm less likely to be echoed on Twitter. Overall, however, our results suggest that tweets tend to be responsive to the varying frame emphases in the traditional media, and frame emphases in traditional media likewise resonate with public framing trends as evidenced in the Twitterverse. It is

TABLE 3
Granger Analysis of Mass Shooting Keyword Sets between Twitter and Traditional Media, April 2012–April 2014

	Twitter Granger Causes	Online News	Online News Granger Causes	Twitter
Frame	Chi-Square	*P* Value	Chi-Square	*P* Value
Shooter/victim event	12.87	0.075	3.32	0.854
Gun control	62.77	0.000	11.01	0.138
Video game	127.56	0.000	47.02	0.000
Mental illness	163.95	0.000	16.26	0.023

NOTE: The data are in levels. The Chi-Square reported is a Wald test, which is a joint test of all of the lags for each of the variables in the equation.

important to keep in mind that both Twitter and the traditional media may be responding to an evolving interpretive zeitgeist and elite framing of significant events.

Although we used Granger analysis to investigate the temporal order of keywords between social and traditional media, visualized word clouds may allow us to determine differences in how mass shootings are discussed and provide insight into framing within each medium (beyond the issue frames we derived from previous research). Word clouds show the most commonly used words in content visually arranged so that the size of a word corresponds to the frequency of its appearance in a text; the word clouds here show the number of tweets or articles containing a word relative to the total number of these texts in our dataset. We compared word clouds about individual mass shootings occurring during the two-year time period for which we followed the issue. These events include the Washington, D.C., Navy Yard shooting (September 16, 2013) and the shooting at Fort Hood, Texas (April 2, 2014). Word clouds were created from tweets and online news mentioning "Fort Hood" and "Navy Yard" from the period beginning one day prior to the event and ending three weeks after the event.

First, we examined how similar the word clouds in each medium were to one another using cosine similarity analysis (Tan, Steinbach, and Kumar 2006). This procedure treats each word cloud as a vector and measures the cosine of the distance between them to come up with a semantic similarity score on a scale from 0 to 1, taking into account both the co-presence of each word and word frequency. In other words, cosine similarity is based on comparing a list of word frequencies in one text with the frequency in another text, or in our case, between two sets of documents. Cosine similarity is comparable to other similarity measures including Euclidean distance, Pearson correlation, and Jaccard similarity. A score of 1 would indicate the clouds were identical, while a score of 0 would mean they had nothing in common. In the case of both shootings, we found that the Twitter and traditional news clouds were moderately similar, indicating, in light of our second research question, that some dynamics are the same

FIGURE 1A
The Fort Hood Shootings in Online News, April 1–April 23, 2014

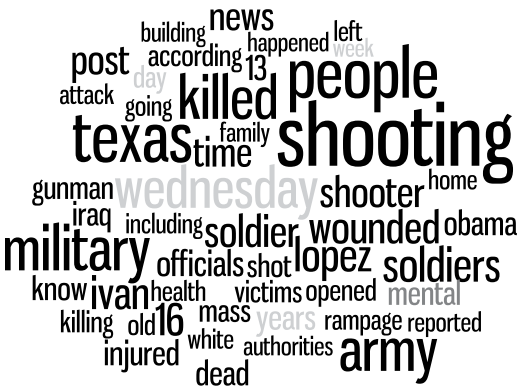
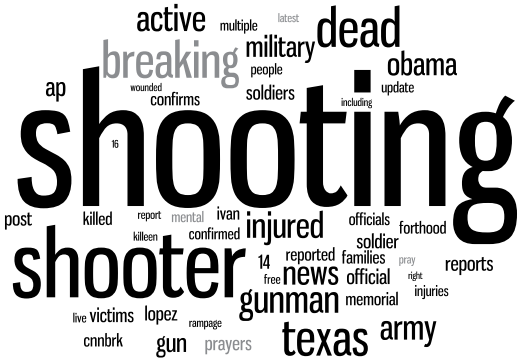


FIGURE 1B
The Fort Hood Shootings on Twitter, April 1–April 23, 2014



and some are different; the Fort Hood shooting had a cosine similarity of .596 and the comparison of the two mediums for the Navy Yard shooting had a cosine similarity of .612. Examining the words in the clouds more directly, as we do below, sheds more light on the ways in which the dynamics in Twitter compare to traditional news.

A visual comparison of the word clouds reveals interesting differences. First, the words in the traditional news appear to conform more closely to the five Ws of journalism relative to the words on Twitter. For example, the case of Fort Hood (Figure 1A) includes information suggesting the time points corresponding to "when," such as the words Wednesday, day, years, and week, while Twitter mentions only "latest" and "breaking" (Figure 1B). The Twitter word clouds (Figures 1B and 1D) mention "prayers," "pray," and "thoughts," suggesting many postings are expressions of sympathy and emotional resonance. Twitter word

FIGURE 1C
The Navy Yard Shootings in Online News, September 15–October 7, 2013

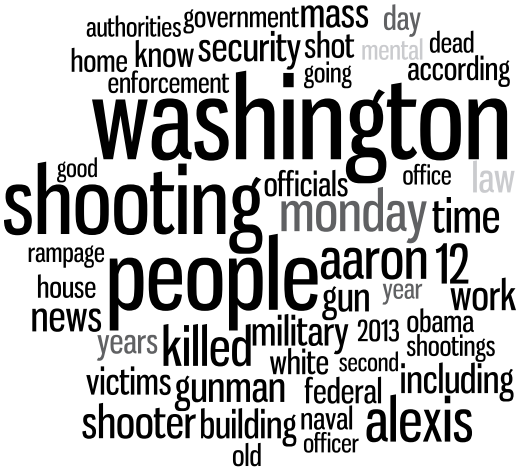
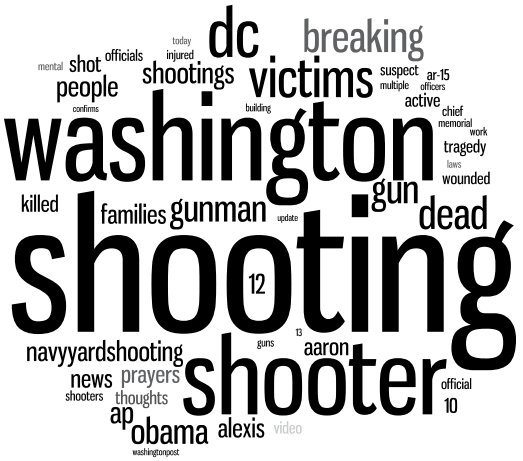


FIGURE 1D
The Navy Yard Shootings on Twitter, September 15–October 7, 2013



clouds also mention "breaking" prominently, which suggests users announce news as the story develops. Additionally, the distribution of words is more even in the traditional media (Figures 1A and 1C) whereas a few words appear to be focused on heavily in Twitter (Figures 1C and 1D). Combined with the notion of breaking stories, it appears that Twitter had been heavily used to broadcast news to followers and express sympathy and other emotional reactions, while the

traditional news, with its focus on the five Ws, was following norms of data gathering and news writing.

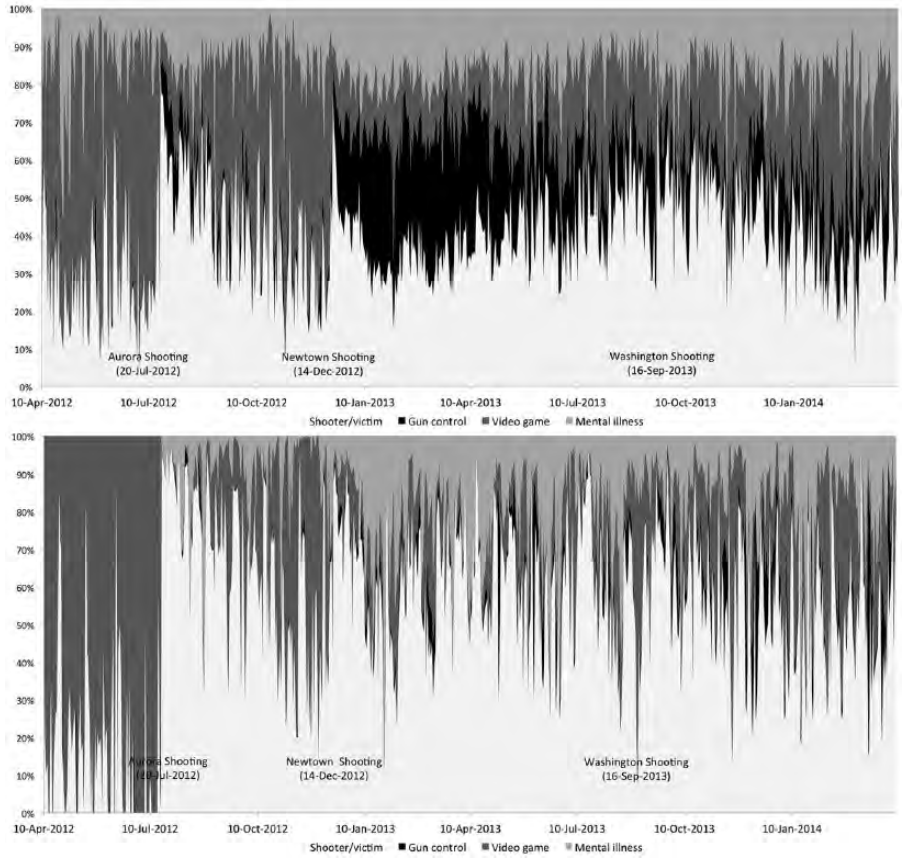
Although these word clouds allow us to examine differences in use patterns between the traditional media and Twitter, they also appear to confirm that some of the frames identified and analyzed in the mass shooting literature are indeed mentioned, if not elaborated on. Words constituting the shooter/victim frame are present, including the names of the perpetrators, and the words "victim," "shooter," and "gunman." They refer to the word "mental," which is typically associated with mental illness or health. The Twitter cloud for the Navy Yard (Figure 1D) shooting mentions "video," which could be a reference to video games but could also be directing viewers to clips of reporting or other videos. Without closer analysis of content and the context of these words, the words are a starting point for semantic analysis. Likewise, searching on the issue rather than the individual shooting events may lead to different, more frame-related information.

Finally, we analyzed how the keyword sets evolved over time in response to national mass shooting incidents. This analysis addressed the second and third research questions related to changing dynamics of issue frames. Figure 2 tracks four bundles of keywords related to mass shooting frames within each medium, normalizing the frequency of mentions to 100 percent for each day. Visual inspection allows us to see that tragic events dramatically shift the dynamics of frames in traditional media and Twitter. Several patterns emerge. First, both media place greater emphasis on shooters and victims immediately after the shooting incidents. This tendency is especially obvious in the event of Aurora and Newtown shootings in which the incidents occurred in a more public space (movie theater and elementary school, respectively) and the perpetrators were students. Second, the traditional media rekindled the discussion of the gun control issue after the Newtown shooting, although they lost interests over time (in six months). This parallels the policy outcomes at the national level (Hayes 2013). In contrast, it is much less clear that Twitter focused on gun control after the incidents. This limited discussion of gun control in Twitter relative to other keyword sets is in line with recent research suggesting that the 140-character limit social media message does not offer an optimal venue for discussing policy-related social problems, although it is good for disseminating news and expressing emotions (Guggenheim and Pasek 2013). Finally, it is noted that video game controversies are enduring themes that are relatively less fluctuating in the event of the mass shooting incidents.

Discussion

In this article, we have shown, via an analysis of keyword sets, how multiple frames compete for attention over time, both within and between social media and online news, with a focus on the issue of mass shootings. We found evidence of both issue framing effects from the traditional online news to Twitter, as

FIGURE 2
Trends in the Proportion of Frames on Mass Shootings: Twitter (bottom) and Traditional Media (top)



assessed by traditional Granger time-series measurement, as well as the other way around. For gun control, video game, and mental illness frames—all competing explanations for the causes of mass shootings—Twitter influenced the traditional media, and except for gun control, the traditional media influenced Twitter. This suggests that Twitter users are responsive to news coverage, and that traditional news appears attentive to public responses to frames as reflected in Twitter spikes and trends. We find that the five Ws of journalistic routine influence the way reporters covered the stories in traditional media, in contrast to the Twitter stream, which quickly passes on basic information but emphasizes dismay and expressions of sympathy. Both sets of findings are in line with our earlier work on agenda setting dynamics (Neuman et al. 2014) and event longevity on Twitter (Guggenheim and Pasek 2013).

The dynamic relationship between traditional and social media mass shooting frames further challenges the notion that the traditional media sets the agenda, instead suggesting mutual influence with social media and even independent responses to shooting events. While these events pushed gun control into the traditional news spotlight, Twitter users were less likely to engage in ongoing discussions of this frame. Rather than suggest that the Twitterverse cares little for gun control, we believe that some media may be better suited than others to deal with certain frames either because of limits on space for adequate discussion or because the conventions of the medium make other types of expression or frames more common. Combined with differences in character from traditional media in how events are discussed, social media has the potential to add to public discussion. As such, policy-makers should consider the multiple messages and frames of an issue within the broader media environment.

It is important to point out that although the use of Granger causality is widely accepted for analysis of the relative timing of spikes and valleys in time series data, in our case from mediated attentional streams, it is not causality in the traditional sense as derived from random assignment in experimental design. Although we have compelling reasons to think that Twitter and online news might be mutually influential, it is possible that we have not accounted for all potential influences of third variables. Additionally, our ability to learn about frames in the data was limited by the keywords we chose. Future studies might be able to consider alternate keywords and revised conceptions of the issue frames themselves. We also examined only one social medium—Twitter—to get a more nuanced look about how framing dynamics of mass shootings might work both within and between social media. There are advantages to this approach, since different social media may operate in unique ways. On the other hand, we are not able to generalize to other social media from this analysis such as the blogosphere, or YouTube or Facebook commentaries. Our case study of issue framing regarding mass shootings, however, reveals a dynamic interplay among event occurrences, journalistic routine, and the public responsiveness to those processes.

Notes

1. There are debates in the literature about whether second-level agenda setting (attribute agenda setting) and framing are conceptually interchangeable (e.g., McCombs, Shaw, and Weaver 1997; McCombs 2004). We use second-level agenda setting and framing interchangeably here.

2. Note that this contrasts with Iyengar's (1991) argument that most news frames tend to be episodic, focusing on the individuals in the stories rather than linking individual instances or stories within a larger context. However, Iyengar focused on television, which may not have as much time or space to devote to stories as the *New York Times*, which Chyi and McCombs (2004) investigated. Additionally, Chyi and McCombs focused on a single very salient event—the Columbine shootings—which may have contributed to this difference.

3. Additional information on cross correlations and model coefficients is available from the lead author.

References

Becketti, Sean 2013. *Introduction to time series using Stata*. College Station, TX: Stata Press.

Birkland, Thomas A. 1998. Focusing events, mobilization, and agenda setting. *Journal of Public Policy* 18 (1): 53–74.

Bjelopera, Jerome P., Erin Bagalman, Sarah W. Caldwell, Kristin M. Finklea, and Gail McCallion. 2013. *Public mass shootings in the United States: Selected implications for federal public health and safety policy*. Congressional Research Service Report, R43004. Washington, DC: U.S. Government Printing Office.

Borah, Porismita. 2011. Conceptual issues in framing theory: A systematic examination of a decade's literature. *Journal of Communication* 61 (2): 246–63.

Brossard, Dominique, James Shanahan, and Katherine McComas. 2004. Are issue-cycles culturally constructed? A comparison of French and American coverage of global climate change. *Mass Communication and Society* 7 (3): 359–77.

Chong, Dennis, and James N. Druckman. 2010. Dynamic public opinion: Communication effects over time. *American Political Science Review* 104 (4): 663–80.

Chong, Dennis, and James N. Druckman. 2007. A theory of framing and opinion formation in competitive elite environments. *Journal of Communication* 57:99–118.

Chyi, Hsiang I., and Maxwell McCombs. 2004. Media salience and the process of framing: Coverage of the Columbine school shootings. *Journalism & Mass Communication Quarterly* 81 (1): 22–35.

Danielian, Lucig H., and Stephen D. Reese. 1989. A closer look at intermedia influences on agenda setting: The cocaine issue of 1986. In *Communication campaigns about drugs: Government, media, and the public*, ed. Pamela J. Shoemaker, 47–66. Mahwah, NJ: Lawrence Erlbaum.

Downs, Anthony. 1972. Up and down with ecology: The issue-attention cycle. *Public Interest* 28:38–51.

Drake, Bruce. 2013. Mass shootings rivet national attention, but are a small share of gun violence. *Fact Tank*. Washington, DC: Pew Research Center.

Druckman, James N., and Kjersten R. Nelson. 2003. Framing and deliberation: How citizens' conversations limit elite influence. *American Journal of Political Science* 47:728–44.

Entman, Robert M. 1993. Framing: Toward clarification of a fractured paradigm. *Journal of Communication* 43 (4): 51–58.

Farhi, Paul. 2009. The Twitter explosion. *American Journalism Review* 31 (3): 26–31.

Follman, Mark, Gavin Aronsen, Deanna Pan, and Maggie Caldwell. 28 December 2013. U.S. mass shootings, 1982–2012. *Mother Jones*. Available from http://www.motherjones.com.

Gamson, William A., and Andre Modigliani. 1987. The changing culture of affirmative action. In *Research in political sociology*, vol. 3, eds. Richard G. Braungart and Margaret M. Braungart, 137–77. Greenwich, CT : JAI Press.

Glazier, Rebecca A., and Amber E. Boydstun. 2012. The president, the press, and the war: A tale of two framing agendas. *Political Communication* 29 (4): 428–46.

Golan, Guy. 2006. Inter-media agenda setting and global news coverage: Assessing the influence of the *New York Times* on three television evening news programs. *Journalism Studies* 7 (2): 323–33.

Granger, C. W. J. 1969. Investigating causal relations by econometric methods and cross spectral methods. *Econometrica* 34:424–38.

Guggenheim, Lauren, and Josh Pasek. 2013. Binders full of tweets: Stimulus-response curves in twitter reactions to news events. Paper presented at the Political Communication Pre-Conference at the 11th Annual American Political Science Association Meeting.

Haider-Markel, Donald P., and Mark R. Joslyn. 2001. Gun policy, opinion, tragedy, and blame attribution: The conditional influence of issue frames. *Journal of Politics* 63 (2): 520–43.

Hayes, Danny. 14 July 2013. When the Senate gun control bill died, so did the story. *Washington Post*. Available from http://www.washingtonpost.com.

Heim, Kyle. 2013. Framing the 2008 Iowa democratic caucuses: Political blogs and second-level intermedia agenda setting. *Journalism & Mass Communication Quarterly* 90 (3): 500–19.

Hermida, Alfred. 2010. Twittering the news. *Journalism Practice* 4 (3): 297–308.

Iyengar, Shanto. 1990. Framing responsibility for political issues: The case of poverty. *Political Behavior* 12:19–35.

Iyengar, Shanto. 1991. *Is anyone responsible? How television frames political issues*. Chicago, IL: University of Chicago Press.

Jang, S. M., and Hoon Lee. 2014. When pop music meets a political issue: Examining how "Born this way" influences attitudes toward gays and gay rights policies. *Journal of Broadcasting & Electronic Media* 58 (1): 114–30.

Jang, S. M., and Josh Pasek. In press. Assessing the carrying capacity of Twitter and online news. *Mass Communication & Society*.

Kellstedt, Paul M. 2000. Media framing and the dynamics of racial policy preferences. *American Journal of Political Science* 44 (2): 245–60.

Kepple, Kevin A., Janet Loehrke, Meghan Hoyer, and Paul Overberg. 2 December 2013. Mass shootings toll exceeds 900 in past seven years. *USA Today*. Available from http://www.usatoday.com.

Lakoff, George, and Mark Johnson. 1980. *Metaphors we live by*. Chicago, IL: University of Chicago Press.

Lawrence, Regina G., and Thomas A. Birkland. 2004. Guns, Hollywood, and school safety: Defining the school-shooting problem across public arenas. *Social Science Quarterly* 85 (5): 1193–1207.

Lecheler, Sophie, and Claes H. de Vreese. 2011. Getting real: The duration of framing effects. *Journal of Communication* 61:959–83.

Lecheler Sophie, and Claes H. de Vreese. 2013. What a difference a day makes? The effects of repetitive and competitive news framing over time. *Communication Research* 40 (2): 147–75.

Lee, Byoungkwan, Karen M. Lancendorfer, and Ki J. Lee. 2005. Agenda-setting and the Internet: The intermedia influence of Internet bulletin boards on newspaper coverage of the 2000 general election in South Korea. *Asian Journal of Communication* 15 (1): 57–71.

Leskovec, Jure, Lars Backstrom, and Jon Kleinberg. 2009. Meme-tracking and the dynamics of the news cycle. In *Proceedings of the 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 497–506. New York, NY: ACM.

McComas, Katherine, and James Shanahan. 1999. Telling stories about global climate change: Measuring the impact of narratives on issue cycles. *Communication Research* 26 (1): 30–57.

McCombs, Maxwell. 2004. *Setting the agenda: The mass media and public opinion*. Cambridge: Polity Press.

McCombs, Maxwell, Donald L. Shaw, and David Weaver. 1997. *Communication and democracy: Exploring the intellectual frontiers in agenda-setting theory*. Mahwah, NJ: Lawrence Erlbaum.

Muschert, Glenn W., and Dawn Carr. 2006. Media salience and frame changing across events: Coverage of nine school shootings, 1997–2001. *Journalism & Mass Communication Quarterly* 83 (4): 747–66.

Neuman, W. R., Lauren Guggenheim, S. M. Jang, and Soo Young Bae. 2014. The dynamics of public attention: Agenda-setting theory meets big data. *Journal of Communication* 64 (2): 193–214.

Pew Research Center. 17 December 2012 (2012a). *Public divided over what Newtown signifies: Parents shield young children from news coverage*. Washington, DC: Pew Research Center. Available from http://www.people-press.org.

Pew Research Center. 20 December 2012 (2012b). *After Newtown, modest change in opinion about gun control: Most say assault weapons make nation more dangerous*. Washington, DC: Pew Research Center. Available from http://www.people-press.org.

Roberts, Marilyn, Wayne Wanta, and Tzong-Horng (Dustin) Dzwo. 2002. Agenda setting and issue salience online. *Communication Research* 29 (4): 452–65.

Sayre, Ben, Leticia Bode, Dhavan Shah, Dave Wilcox, and Chirag Shah. 2010. Agenda setting in a digital age: Tracking attention to California Proposition 8 in social media, online news and conventional news. *Policy & Internet* 2:7–32.

Schildkraut, Jaclyn, and Glenn W. Muschert. 2013. Violent media, guns, and mental illness: The three ring circus of causal factors for school massacres, as related in media discourse. *Fast Capitalism* 10 (1). Available from http://www.uta.edu/huma/agger/fastcapitalism/10_1/schildkraut10_1.html.

Schildkraut, Jaclyn, and Glenn W. Muschert. 2014. Media salience and the framing of mass murder in schools a comparison of the Columbine and Sandy Hook massacres. *Homicide Studies* 18 (1): 23–43.

Shah, Dhavan V., Mark D. Watts, David Domke, and David P. Fan. 2002. News framing and cueing of issue regimes: Explaining Clinton's public approval in spite of scandal. *Public Opinion Quarterly* 66 (3): 339–70.

Simon, Adam, and Michael Xenos. 2000. Media framing and effective public deliberation. *Political Communication* 17 (4): 363–76.

Simon, Adam F., and Michael Xenos. 2004. Dimensional reduction of word-frequency data as a substitute for intersubjective content analysis. *Political Analysis* 12 (1): 63–75.

Sniderman, Paul M., and Sean M. Theriault. 2004. The structure of political argument and the logic of issue framing. In *Studies in public opinion*, eds. Willem E. Saris and Paul M. Sniderman, 133–65. Princeton, NJ: Princeton University Press.

Stryker, Jo Ellen, Ricardo J. Wray, Robert C. Hornik, and Itzik Yanovitzky. 2006. Validation of database search terms for content analysis: The case of cancer news coverage. *Journalism & Mass Communication Quarterly* 83 (2): 413–30.

Tan, Pang-Ning, Michael Steinbach, and Vipin Kumar. 2006. *Introduction to data mining*. Boston, MA: Pearson Addison Wesley.

Wallsten, Kevin 2007. Agenda setting and the blogosphere: An analysis of the relationship between mainstream media and political blogs. *Review of Policy Research* 24 (6): 567–87.

Wanta, Wayne 1997. *The public and the national agenda: How people learn about important issues*. Mahwah, NJ: Lawrence Erlbaum.

Yourish, Karen, Wilson Andrews, Larry Buchanan, and Alan McLean. 10 December 2013. State gun laws enacted in the year since Newtown. *New York Times*.

Zhou, Yuqiong, and Patricia Moy. 2007. Parsing framing processes: The interplay between online public opinion and media coverage. *Journal of Communication* 57 (1): 79–98.