Networks, big data, and intermedia agenda-setting: an analysis of traditional, partisan, and emerging online U.S. news

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Abstract

This large-scale intermedia agenda-setting analysis examines U.S. online media sources for 2015. The Network Agenda Setting Model showed that media agendas were highly homogeneous and reciprocal. Online partisan media played the leading role in the entire media agenda. Two elite newspapers—The *New York Times* and the *Washington Post*—were found to no longer be in control of the news agenda and were more likely to follow online partisan media. This paper provides evidence for a nuanced view of the Network Agenda Setting Model; intermedia agenda-setting effects varied by media type, issue type and time periods.

Keywords: network agenda setting, intermedia agenda setting, partisanship, computational social science

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Since the 1950's scholars have assessed the influence news media have on each other (e.g., White, 1950; McCombs, 2013). In an agenda-setting context, researchers have assessed the ability media have to influence each other in terms of salience of coverage. This effect is known as intermedia agenda setting (McCombs, 2005). That is, can certain media tell others what issues and attributes are worthy of coverage? Do certain media tend to control the agendas for others?

Scholars have made substantial contributions to intermedia agenda-setting theory as it applies to more modern times (Sweetser, Golan and Wanta, 2008; Meraz, 2011). However, these studies usually look at a handful of media organizations such as the *New York Times* and CNN and specific issues (Golan, 2006). They do not address the full range of media and issue types that exist in today's political and social environment. With the explosion of media choices that audiences have today, it stands to reason that different media types will have different intermedia agenda-setting effects for different issues.

The role of partisanship in the current mediascape has received careful scholarly attention. The past two decades have come with an increase in partisan news production (Stroud, 2011). Studies suggest that audiences have shifted away from more traditional news sources to more partisan ones (Hollander, 2008). It has been long cautioned that partisan selective exposure to news content can inhibit a healthy democracy (Janis and Mann, 1977; Mutz and Martin, 2001). In response to this audience shift, some evidence suggests that select mainstream media have begun to become more attentive to — and ultimately influenced by — the agendas of partisan media (Meraz, 2011). Other work takes an opposing view, claiming that mainstream, non-partisan media are still the influencers (Sweetser, Golan and Wanta, 2008; Lee, 2007). Addressing this disconnect, the present study examines a representative sample of partisan and non-partisan media.

Partisanship is not the only way to distinguish media from each other. Some media are traditional and have roots in offline media. Others are non-traditional, and have always been hosted online (Banning and Sweetser, 2007). Some are nationally circulated, and are presumed to have a much greater effect on society (McCombs, 2005; Meraz, 2011). Moreover, news agencies (a.k.a. newswires) have also been long shown to have greater intermedia agenda-setting prowess (McCombs and Shaw, 1976). These media types have yet to be investigated in concert with each other in one intermedia agenda-setting analysis.

This study presents a comprehensive analysis that is representative of all U.S. news found online for one year. Using computer-assisted analysis, the research goes beyond a case study and spans all media types, summing to over 48 million articles. It also presents an exhaustive manual content analysis that splits 2,760 news websites into a list of media categories. This study examines intermedia agenda-setting effects using the Network Agenda Setting (NAS) approach, a model that considers the agenda-setting effects from a networked perspective (Guo and McCombs, 2011). While traditional agenda-setting theory focuses on the transfer of salience of discrete issues and attributes, the NAS model considers whether a bundle of elements can be transferred from one agenda to another. Drawing upon this model, the present study constructs networks of issues to represent different media agendas. It then uses temporal causal models and the Granger causality test to assess mutual impacts. Overall, this study hopes to contribute to intermedia-agenda setting theory by taking an exhaustive and nuanced perspective to address the various influences in which media of different types can have on each other.

Intermedia Agenda Setting

According to agenda-setting theory, issues that are emphasized in the news media will be considered as important among the public (McCombs & Shaw, 1972). This describes the first level of agenda setting. The second level of the theory focuses on attributes that describe a given issue and asserts that the salience of attributes can also be transferred from the media to the public agenda (McCombs, Llamas, Lopez-Escobar & Rey, 1997). With the media's agenda-setting effect on the public long established (see McCombs, 2013), the question of who sets the *media* agenda has become another important research area to explore. While agenda-building theory examines how the media agenda is shaped by external sources such as public relations efforts (Kiousis, Popescu, and Mitrook, 2007), intermedia agenda setting addresses the interplay between different media types and whether certain media influence each other (Reese and Danielian, 1989).

Exactly why intermedia agenda setting occurs has been a topic of interest amongst scholars. McCombs has suggested that elite journalists have special power in the intermedia-agenda setting process (2005, p. 549):

> Journalists routinely look over their shoulders to validate their sense of news by observing the work of their colleagues, especially the work of elite members of the press, such as the *New York Times*, *Washington Post*...

In the similar vein, research has shown that junior newspaper reporters often mimic the coverage of more senior journalists, and journalists at larger organizations (Breed, 1955). This flow has been described by Breed as "arterial" in nature, starting from larger arteries and spreading out throughout to smaller media (p. 277). Beyond journalists mimicking peers and colleagues, others have argued that journalists cover the same stories due to their similar backgrounds. Dearing and

Rogers (1996) has observed that journalists often share professional norms and values because they take like-minded college courses. These similarities in education and background can dictate their perceived importance of issues, regardless of the divergent stances they may have on any given issue.

Beyond journalist routines, others have put forth the argument that elite news media may continue to hold an intermedia agenda-setting effect online due to the unique nature of Internet (Meraz, 2011). Characteristics of website networks (e.g., webpages connected to other webpages through links) tend to continue to favor websites that are well-visited and well-linked to (Barabási and Albert, 1999). This advantage, also known as the power law, may allow for elite news media to exhibit a stronger intermedia agenda-setting effect online than they did in the offline era. In a 2009 analysis of *The New York Times* and *The Washington Post,* Hindman revealed that the online market share for the two elite media organizations were roughly 2.5 times the share of the media had offline. Meraz (2011) has shown that coupled with the popularity of elite news media online, the tendency for elite media to cite fellow elite news media sources for information increases the likelihood that popular media will share similar agendas. Further, the "birds of a feather" argument suggests that because news now exists in a network of connected websites, elite and other types of news media are now more motivated to behave similarly (McPherson, Smith-Lovin & Cook, 2001). As a result, it stands to reason media agendas will be more convergent than divergent (Meraz, 2011; Lee. 2007). Beyond the roots of why intermedia agenda-setting occurs, specific dynamic relationships between media have been established in the literature. The following sections offer a review by media type.

Newspapers and Television

Researchers have consistently found that two nationally circulated, daily newspapers the *New York Times* and the *Washington Post* are agenda setters in the U.S. media landscape (McCombs, 2005). Gilbert, Eyal, McCombs, and Nicholas (1980) revealed that the *New York Times* is an important source in intermedia agenda setting across the United States. Reese and Danielian (1989) found that drug coverage in the *New York Times* and the *Washington Post* influenced that of other newspapers such as the *Los Angeles Times* as well as the reporting on network television news. This suggests that "elite" newspapers (i.e., the *New York Times*, and the *Washington Post*) have an effect on less elite media (i.e. local newspapers and television news networks). Golan (2006) assessed the influence the *New York Times* had on national television news network coverage of international events. The results showed that ABC, CBS and NBC all followed the agenda of the *New York Times*. Taken together, these results suggest that the *New York Times* and the *Washington Post* influence other traditional news media including newspapers, televisions and radio. To date, there are no known studies that test this intermedia agenda-setting effect in an online environment across different types of issues, making it ripe for testing in this analysis.

H1: When compared to the reverse relationship, the agenda of the *New York Times* and the *Washington Post* will be more likely to set the issue agenda of other traditional media.

The Role of News Agencies

White (1950) first examined the concept of intermedia agenda setting by investigating the news selections of a rural wire news editor in the Midwest United States. The researcher documented the profound influence news agencies (a.k.a. wire services) had on daily newspapers, a finding supported by a large number of following studies. For example, McCombs and Shaw (1976) found a substantial correlation of .64 between the overall agenda of local newspapers and that of news agencies with White's 1949 data. In the same study the two authors also took data from a replication performed in 1966 and found the intermedia agenda-setting effect to have increased to .80. They posited that the increase was likely due to the smaller number of wire services available to local newspaper editors. Whitney and Becker (1982) performed a content analysis of news coverage in daily newspapers and in the Associated Press, and similar patterns of convergence were revealed.

The mediascape has undoubtedly changed in the last 30 years (Banning and Sweetser, 2007; Napoli, 2011). While the two major U.S. news agencies—the Associated Press and United Press International—still thrive in the U.S. marketplace, they now are competing against a plethora of other news sources. News agencies still deliver breaking news and continued coverage, but so do a whole host of online media. The vast amount of new competition makes the replication and validation of these agenda-setting effects necessary.

H2a-b: When compared to the reverse relationship, news agencies will be more likely to set the agenda for (a) the *New York Times* and *Washington Post* and (b) other traditional media.

The Emergence of Online News Media

The influx of blogs and other online news websites has brought about contradictory perspectives of intermedia agenda setting between traditional media (e.g., newspapers, television news channels, radio) and online media (Heim, 2013; Meraz, 2011). Some have argued that traditional news media rely on issues brought up in blogs to obtain more specialized knowledge and analysis (Meraz, 2011), while others have claimed that blogs usually feature stories from traditional media (Lee, 2007). Vargo, Basilaia and Shaw (2015) note that both are true. Through a case study of issues on the microblogging platform Twitter, the researchers showed that blogs were able to offer breaking news coverage on events driven by real-world cues. In these cases, traditional media appeared to have less of an influence on the micro-blogging agenda. However, for issues that encompassed ongoing debate, such as political issues and economic policies, traditional media offered greater agenda-setting effects on microblogs.

Among a wide variety of online news media outlets, partisan media have played a particularly important role in U.S. politics (Stroud, 2011; Hollander, 2008). The advent of the early 2000's came with an explosion of political news blogs, or websites dedicated to writing political news. These media outlets tend to be partisan in nature, and often express partisan political viewpoints (Meraz, 2011). Early intermedia agenda-setting research presented inconsistent results in terms of the relationship between partisan media and traditional media agendas. During the 2004 U.S. presidential campaign, Lee (2007) compared the news coverage in eight partisan blogs (e.g., PoliPundit.com and The Left Coaster) and national news media such as the *New York Times*, CNN and *Time Magazine*. Using rank order correlations, the findings showed that the blog issue agenda significantly corresponded to the agenda of the mainstream media. In another study of the same election Sweetser, Golan and Wanta (2008) found the same effect using cross-lag analyses. They too suggested that the issue salience was transferred from the mainstream media (e.g., network television broadcasts) to political blogs (e.g., official campaign-sponsored blogs), and not vice versa. More recently, Heim (2013) analyzed the 2008 U.S. presidential caucuses and again found that the national mainstream media were able to set the attribute agendas of political blogs (e.g., Talking Points Memo, and Daily Kos).

Research has also showed the opposite influence. Meraz (2011) performed a time-series analysis between 18 partisan blogs, the *New York Times* and the *Washington Post* and the respective newsroom political blogs for the national media. Overall, the study found the "dilution of traditional media's singular agenda-setting power over all web publics" (p. 187) and, in particular, affirmed the growing influence of the progressive political blogs in setting other media agendas. However, given that more studies found the traditional media set the agenda of online partisan news media, this study tests if this type of relationship exists online:[1]

H3a-b: When compared to the reverse relationship, the agenda of (a) the *New York Times* and the *Washington Post* and (b) other traditional media is more likely to set the issue agenda of partisan online news sources.

Aside from partisan media, other emerging online news websites have also begun to draw large audiences (Meraz, 2011). The BuzzFeed, Gawker and Yahoo generate hundreds of millions of page views a day (Quantcast, 2016). These websites are usually supported by journalists and are not rooted in any traditional, offline media. What is also distinctive about these online news sites is that an apparent lack of partisanship (Beckett, 2015). BuzzFeed for instance, covers a whole host of news with original reporting, and is now being recognized a reputable media source (Tandoc and Jenkins, 2015). Scholars suggest that, "traditional news organizations seem to positively welcome BuzzFeed's entry into the journalistic field, both as a transformative force and as a potential ally for preservation" (Tandoc and Jenkins, 2015, ahead of print).

These online media sources are inherently different from traditional media and online partisan media and therefore should be treated as a separate media category in an analysis of media effects. Here we refer to these non-traditional, non-partisan news media as "emerging news media" and explore the effects of these media in this online media environment, a subject that has not yet been studied.

H4a-b: When compared to the reverse relationship, emerging news media are more likely to set the issue agenda of (a) the *New York Times* and the *Washington Post* and (b) other traditional media.

Finally, with five media types defined in this review, no studies have performed a comparative analysis to assess the degrees to which differing media set the agenda at large. To advance our knowledge of influence amongst online U.S. news media, understanding these agenda-setting influences are important. As such, it is ripe to investigate the degree to which each media type has predictive power over all U.S. news coverage for various issues.

RQ1: Which media group was most likely to set the news agenda for all U.S. news media at large?

Network Agenda Setting Model

To test first and second level agenda-setting theory, scholars usually examine the rank order of issues (i.e., first level) or attributes (i.e., second level) on the media agenda and then compare it with the rank order of these elements on the public agenda. When it comes to intermedia agenda setting, researchers explore whether the rank-order of issue or attribute salience can be transferred from one media agenda to another.

Grounded in an associative network model of memory (e.g., Anderson, 1983; Anderson & Bower, 1973), the Network Agenda Setting (NAS) Model considers the media effect from an associative perspective. The model asserts that the news media can transfer the salience of a bundle of issues and/or attributes to the public's mind (Guo and McCombs, 2011). That is, the ways in which the news media associate different issues and/or attributes will influence how the audience members associate these elements. While the first and second level of agenda setting focus on the salience transfer of *individual* and *separate* issues and/or attributes, the NAS model—known as the third-level agenda setting—considers whether the constructed *association* can be transferred between agendas.

In the past few years, a number of empirical studies have been conducted to test the model in various socio-cultural contexts (see Guo and McCombs, 2016). For example, based on data from the 2002 Texas gubernatorial election Guo and McCombs (2011) compared the ways in which a major Texas-based newspaper associated different personal attributes (e.g., leadership, credibility and intelligence) to portray the two political candidates with the ways Texas residents described the candidates. Results showed a significant correspondence between the media and public network agenda. Vargo et al. (2014) examined the NAS model on tweets collected during the 2012 U.S. presidential election and found similar results. According to these studies, the news media not only can tell us what to think and how to think about it, but also how to *associate* different elements to make sense of the social reality.

More recently, researchers have extended the NAS model to the arena of agenda building and found that public relations campaign messages could to some degree shape the media agenda in terms of network connections (e.g., Kiousis et al., 2015; Neil et al., 2016). In the context of intermedia agenda setting, a networked perspective suggests that the network salience of issues and attributes in one type of media will influence the network salience in another. To date, Vu, Guo and McCombs' (2014) is the only study to compare different media agendas from a network agenda-setting perspective. Based on five years of aggregated data 2007-2011, Vu, Guo and McCombs (2014) analyzed issue networks in newspapers, cable and network television, radio and online publications, and found that the network issue agendas of these different news channels were highly similar. However, the study did not attempt causality tests. The present study seeks to further contribute to intermedia network agenda setting by analyzing a more exhaustive list of media organizations and by establishing temporal causal relationships between different media agendas.

Method

This paper uses the Global Database of Events, Language, and Tone (GDELT)'s Global Knowledge Graph (GKG) as its primary source of news. GDELT was created as an open-source initiative at Georgetown University by political scientist Kalev Leetaru, a leading expert in computational content analysis (Leetaru, 2015; Leetaru, 2012a). GDELT is constantly "monitoring local news outlets in every corner of the world in more than one hundred languages to identify the people, locations, counts, themes, emotions, narratives, events and patterns undergirding global society" (Leetaru, 2015, p. 43).[2] As of early 2016, over 100 academic studies have used or cited GDELT news data in disciplines ranging from political science to medicine (e.g., Hammond and Weidmann, 2014; De Waal et. al., 2014). GDELT has a sophisticated web crawler, which ingests news stories from the web each day and processes them (Leetaru and Schrodt, 2013). It then clusters the stories based on similarities (Schrodt, 2010).

Coding for Issue Type

At the time of analysis, 285 themes existed in the GDELT dataset. Themes in GDELT represent core topics of discussion that encompass a broad range of things from affect to major political issues. To establish a theme, a computer system developed for the GDELT project is trained to recognize keywords in text that is associated with that theme.[3] Example themes are: "Econ_Bankruptcy," "Econ_Cost of living," "Military_Cooperation," and "Refugees."

To make better sense of the diverse political themes discussed in the dataset, we created a new list of issues that unified the themes identified in GDELT and those in previous agenda-setting research (e.g., Neuman, Guggenheim, Jang, and Bae, 2014). A total of 16 issues were included in the list: taxes, unemployment, economy, international relations, border issues, healthcare, public order, civil liberties, environment, education, domestic politics, poverty, disaster, religion, infrastructure and media and Internet. These issues have been thought to broadly encompass all of the current, ongoing political issues facing the United States, while preserving a relatively manageable amount of analyses to be run (16, one per issue). Human coders assigned the GDELT themes to one of the 16 issue constructs. Of the 285 GDELT themes, two coders agreed on 271 of the 285 assignments ($\alpha = .841$). In all cases, the disagreement was settled by excluding the debated theme, erring on the side of precision. Excluded themes had definitions that would allow certain uses cases to valid, but other uses to be inaccurate.

Coding for Media Type

The current analysis focused on U.S. media sources. In 2015, 53,967,878 articles from 86,905 U.S. online media outlets were found to have mentioned at least one of the 16 issues. Because each media organization needed to be manually assessed, not all of them could be analyzed. The decision was made to code enough media to cover 90 percent of all articles. Sorting by the number of stories a media outlet published that contained an issue in the database, the top 4,930 media websites were analyzed.[4] Of the selected websites, 62 were inaccessible at the time of analysis and as such were excluded from the sample. Websites that were hosts to press releases (i.e., PRWeb and PRNewswire) and government websites (i.e., whitehouse.gov, usda.gov) were also excluded from the analysis.[5] In total, 2,760 media outlets were included the analysis.

In doing so, all media outlets that published over five relevant articles per day were included in the final analysis. Through a manual content analysis coders were instructed to classify each news website into one of the categories found in Table 1.[6] Two coders independently coded a representative, random sample of 100 media outlets and reached an intercoder reliability coefficient of .988 (Krippendorff's alpha), suggesting that the results of media categorization were reliable (Riffe, Lacy and Fico, 2014). Of the 2,760 media sources in the data, all but 13 fit into the categories presented here. 13 media were traditional (not online only), but partisan in nature (e.g., Fox Business, Townhall, etc…). Since this category was small in number of media articles, it was not included as a separate media type. These media however included in the "All Media" media grouping.

<Insert Table 1 about here>

Data Preparation for NAS Analysis

GDELT CKG data were downloaded in its raw csv format. A computer-assisted content analysis was then performed using Python. Each file was iterated through by row. Each article from each row was also iterated through. When an article contained a media source that matched one identified media type through the manual content analysis as described above, it was further analyzed to see if it contained a keyword found to match one of 16 pre-defined issue constructs. If an article matched a known media source and multiple known issues, all possible unordered pairs of issues were identified. These pairs in network analysis are regarded as ties (Wasserman and Faust, 1994). For example, if an article mentioned economy, border issues, and civil liberties, it will be determined that the article constructed three ties, (1) a tie between economy and border issues, (2) a tie between economy and civil liberties, and (3) a tie between border issues and civil liberties. All ties were summed by day and by media type. Each tie's corresponding weight (i.e., strength) was summation of the number of stories that mentioned that issue pair (e.g., economy and foreign policy) for that media type, for that given day. Eigenvector centrality was then calculated for each issue. Eigenvector centrality is a measure that takes into account the approximate importance of each node in a graph (Ruhnau, 2000). The assumption is that each node's Eigenvector centrality is the sum of the centrality values of the nodes that it is connected to. In a NAS approach, this can be interpreted as the number of times other issues were linked to a given issue, making it a measure of how connected that issue was in the networked issue agenda. This measure is very similar to degree centrality, which has been used in previous NAS studies (e.g., Vargo et al., 2014).

Time Series Modeling

The data were treated as a time series. Temporal causal models were constructed for each issue, and for each media type. The term causal here refers to Granger causality. Time series X is said to "Granger cause" another time series Y if regressing for Y in terms of past values of both X and Y results in a better model for Y than regressing only on past values of Y. Granger Causality presents a key statistical advantage of temporal causal models when compared to Autoregressive Integrated Moving Average (ARIMA) time series models, which do not have as clear cut statistical measures for causality (Meraz, 2011).

Using OLS regression, five days of time lags were tested through the regression of each media network's agenda against its past agenda until the latter no longer predicted its present agenda. Relationships were regressed based on a media type's past agenda and the agenda of the other media types according to the research questions and hypotheses. For one example, in examining H1 the network issue agenda of the *New York Times* and *Washington Post* was regressed on their own agenda in the past week and other traditional media's network issue agenda. Running F-tests provided values of significance in which Granger causality could be determined. This method has been used to determine causality in recent intermedia agenda-setting work (Meraz, 2011). All tests were run at five lags, i.e., one-day-lag, two-day-lag, three-day-lag, four-day-lag, and five-day lag, respectively. While OLS models can assign best fit for one lag, including lags of multiple days allows the research at present to address different types of agenda-setting relationships that differing stories can have. For example, Vargo, Shaw and Basilaia (2015) show that different news stories (i.e., real-world cues vs. ongoing debates) can yield different agenda-setting effects at different lags. In investigating multiple lags for each issue type, we can assess the varying effect of different story types at several time points.

Results

Table 2 summarizes the results, which provides a list of issues that one medium "Granger caused" another. Figure 1 visually represents the intermedia agenda-setting effects across media categories. Tables 3-5 provide three examples of the Granger causality test results, which will be explained when discussing the given test.

<Insert Table 2 and Figure 1 about here>

H1 posited that the *New York Times* (*NYT*) and the *Washington Post* (*Post*) would exhibit a network agenda-setting (NAS) effect on other traditional news organizations. Of the 16 issues tested for Granger causality, nine showed at least one lag[7] that showed a causal relationship. In other words, the two newspapers were found to lead the other traditional media on nine specific issues over a one-day time frame. However, when considering the alternative relationship — that other traditional media led the *NYT* and *Post* agendas — 11 issues received causal support for at least one lag. For this reason, we cannot give support to H1. While some issues received robust support (i.e., healthcare, environment and disaster issues) with at least three lags (i.e., three time frames) being significant, the majority of support was given to issues with the reverse hypothesis.

H2a posited that the news agencies would exhibit a NAS effect on *NYT* and *Post*. For the impact of news agencies on the *NYT* and *Post*, eight of the 16 issues tested for Granger causality showed at least one lag of causal relationship. Economy, environment, poverty, disaster and infrastructure issues received robust support, with at least three lags being significant. On the other hand, when considering the other direction — the *NYT* and *Post* agendas influenced the news agencies' agendas — nine issues received causal support for at least one lag. Taken together, a reciprocal relationship emerges, with no media offering clear causality across the majority of issues.

The same pattern was found when it came to the interplay between the news agencies and other traditional media outlets (H2b). While the news agencies "Granger caused" the agenda of the traditional media on eight issues, the reverse relationship was found significant on nine issues. Therefore, we must reject H2 and conclude that the news agencies and the traditional news organizations demonstrated a reciprocal relationship.

H3a investigated the NAS effect the *NYT* and *Post* had on online partisan news media. 10 issues had at least one significant Granger causality result (see Table 3). All five lags were significant for six issues: unemployment, economy, border issues, healthcare, civil liberties, and religion. Four lags were significant for the issue religion. The majority of issues were Granger causal and were so at many time lags. However, when considering the alternative relationship — that online partisan news media caused the *NYT and Post* agendas — 12 issues received causal support for at least one lag. The results showed that causality occurred across issues at different time lags. Thus, we conclude that the *NYT* and the *Post* and partisan media exhibited a significant NAS effect for the majority of issues on each other, but did so at different time periods.

<Insert Table 3 about here>

In addressing H3b, we found an even stronger connection between other traditional news media and online partisan media. The results showed that the network agenda of these traditional media outlets "Granger caused" the agenda of online partisan media in terms of 15 out of 16 issues, excepting for the issue of public order. Though we also found the reverse relationship significant on 11 issues, the evidence leans in support of traditional media taking the leading role in this pairwise comparison (see Table 4).

<Insert Table 4 about here>

H4a questioned whether the emerging media would exhibit a network agenda-setting effect on the *NYT* and *Post* (see Table 5). For the impact of emerging media on the *NYT* and *Post*, 11 of the 16 issues tested for Granger causality showed at least one lag with a causal relationship. Nine issues received robust support, with at least four lags being significant. On the other hand, when considering the other direction — the *NYT* and *Post* agendas influenced the emerging media's agendas — only six issues received causal support for at least one lag. Therefore, moderate evidence was found to support that the emerging media set the agenda of the *NYT* and *Post*.

<Insert Table 5 about here>

H4b questioned whether the emerging media would exhibit a network agenda-setting effect on other traditional news organizations. Nine of the 16 issues tested for Granger causality showed at least one lag that showed a causal relationship. Among them, six issues received robust support, with at all five lags being significant. On the other hand, when considering the reverse hypothesis — that traditional media agendas influenced the emerging media's agendas — 11 issues received causal support for at least one lag. Therefore, we conclude that the news agencies and other traditional news organizations demonstrated a reciprocal relationship.

When considering all five types of media as predictors for the U.S. media issue agenda at large (RQ1), online partisan media offered the largest number (*n*=13) of significant Granger causal relationships. 10 of the 13 issues observed the relationship at four or more time lags. No other media type had more than nine significant issues. In other words, our results showed that online partisan media were the agenda setters in the U.S. mediascape in 2015.

Discussion

This study conducted a large-scale, comprehensive intermedia agenda-setting analysis on a representative sample of U.S. online media sources for an entire year. Based on the Network Agenda Setting Model and the use of Granger causality tests, the results revealed the interactions between different media agendas from a nuanced, networked perspective. Overall, the results showed that news media of different types set each other's network agenda to various degrees. When considering NAS effects at large, these relationships ultimately determine how people connect and relate issues together to construct social realities. In particular, a few patterns are worthy of further discussion.

Overall Power: Who Leads?

In general, we found the network agendas of various media outlets to be highly interdependent, symbiotically networked and homogeneous. Media choices have increased dramatically during the past few years. Yet, the agendas of various media outlets were similar. To further illustrate this point, Table 6 shows the data when centrality scores were averaged for the entire year. The resulting 16 average centrality scores (one per issue, per media type) were then subjected to a rank order correlation. The result shows that the relative importance of issues for each media type were largely the same for 2015. All media pairings scored a correlation equal to or greater than r = .915. This suggests that there still is a consensus among various media organizations as to what issues remain the most important and central in society today. This particular result is in line with the key assertion of intermedia agenda setting (McCombs, 2005) as well as many recent intermedia agenda-setting studies (e.g., Vu et al., 2014).

We also found that the media agendas are reciprocal (see Figure 1). In our data news does not appear to flow in a unidirectional nature. Instead this paper shines a light on the networked relationships that these media are intertwined in. One possible explanation for this finding is the increasingly networked nature of news agendas online. Future research in agenda setting may find that the networked relationships different media share is as important as the time order function (who leads whom). Such view may allow intermedia agenda setting to become more multidirectional and more complex in the way it explains agenda influence.

In particular, the strongest connection was found between the agenda of online partisan media and that of emerging news media. Both media types are digitally native, and it is logical to surmise that they pay attention to each other. As McCombs (2005) once suggested of different types of traditional media, it appears that emerging media and online partisan media are "looking over their shoulders" at each other's coverage.

Unlike previous research, the results showed that the *New York Times* and the *Washington Post* did not play a leading role in this online environment. The evidence in fact supported the opposite. That is, the two "elite" newspapers were more likely to be "Granger caused" by other types of media organizations. The finding is in line with observations made by scholars that highlight how the gatekeeping role of elite news media has been challenged by the participatory culture in this digital era (e.g., Jenkins, 2006). Journalists tend to renegotiate the boundary of journalism and are more likely to embrace a hybrid logic of adaptability and openness (Lewis, 2012). This may help explain why the two elite newspapers in this study were found to follow the news coverage in other media, especially online-only media, in many cases.

The Power of Partisan Media

Particularly significant was the causal relationship from online partisan media to the two elite newspapers (see Table 2). Further, our results show that online partisan media did the best job of explaining the entire U.S. media agenda for 2015. This speaks to the change in the current media environment, particularly the "long tail" environment, in which mainstream media influence is now second to niche media organizations (Napoli, 2011). The finding also echoes Meraz (2011) in asserting that mainstream media have begun to become more attentive to — and ultimately influenced by — the agendas of partisan media. Specifically, our findings suggest that partisan media are not only better at setting the importance of issues, but also how central issues are relative to others in media coverage. The authors here suspect that this may be due to the fact that partisan media are more aggressive at breaking stories online. Compared with the traditional media, partisan media are less bound by journalistic conventions such as objectivity and balance, allowing them to post information almost immediately (Levendusky, 2013). The traditional media still emphasize their journalistic professionalism and therefore they verify facts and seek out additional sources before posting stories to their websites. Regardless of why, our data suggest they are leading the overall trends. In addition, the influence of online partisan media spanned a wide variety of issues, ranging from hard news (e.g., the economy and international relations) to education and individual liberties.

This finding is concerning as it is long believed that partisan media significantly contribute to the polarization in American politics (Janis and Mann, 1977; Mutz and Martin, 2001). This study was not designed to measure a possible rise in partisan media, or measure polarization. It does show partisan media were successful in predicting which issues were covered by other media. One possible effect of such coverage could be an increase in the overall polarization of media coverage in the United States, across all media types. On the other hand, just because a story originates from partisan media, it does not mean the same partisan viewpoints will still be attached with it in other media. The question remains whether audiences respond to such stories in other media in a partisan manner, regardless of how they are covered. The increasing power of partisan media in today's media landscape warrants further scholarly examination as to the consequences of these effects.

Issue by Issue: Trends Across Media

This paper presents strong evidence that the NAS effect varies by issue. Just because the media agendas throughout this study were reciprocal *across all issues* does not mean no media exert agenda issue leadership *for specific issues*. For example, while the *New York Times* and the *Washington Post* were not dominant when considering the overall effects, they consistently set the network agenda of other media on the issue of healthcare. This may indicate that the Affordable Care Act continued to capture a large amount of media attention in 2015 and most media organizations followed the two elite newspapers for coverage of the legislation and its implications. The result is also in line with Vargo, Shaw and Basilaia's (2015) argument that traditional elite media offer greater agenda-setting effects for issues in the ongoing debate.

When it came to emerging news media, they were the most powerful in setting the agenda of civil liberties, poverty, and religion. This shows that online news media can empower voices and raise injustices from minority groups. The authors here suggest that these emerging media may have a social justice power that other, more traditional media do not. Such a finding is worthy of further replication and further explication. Future research should also consider grouping different topics into meaningful categories to systematically investigate the agenda-setting effects of different media sources in terms of different types of issues such as obtrusive versus unobtrusive issues (McCombs, 2013) and issues with uncertainty versus those without (Maurer & Holbach, 2015).

Problems with a Big Data View

This study took as large of a view as possible when it came to U.S. online news coverage. It spanned many media types and many issues. As a result, the sheer number of Granger causality tests that were required to address the hypotheses and research questions were expansive (n = 480). As such, Type 1 error is inevitable for any given test. However, each test was treated as a small piece of evidence for the larger picture. Only results were the overwhelming majority (12 out of 16) of tests were significant were conclusions drawn and the null hypothesis abandoned. This reduces the likelihood that Type 1 error altered the findings in this paper, but it also diminishes the confidence that any one test should be treated with.

Still, with such a large sample and so many tests, it is hard to granularly focus on any specific media pairing and issue result (i.e., emerging media vs. online partisan media and civil liberties). In some cases, our analysis shows that for one specific media pairing that an effect is occurring in one direction in a breaking manner (i.e., 1-day lag) but in the other direction for ongoing news coverage (i.e., 2-5 day lags). Future analyses could pay greater attention to breaking versus on-going issues and the differing observed effects. For instance, it may be advantageous to develop hypotheses not just by media type and by issue type, but also at the level of speed of the effect. Further explicating the nature of breaking versus ongoing news coverage may yield more nuanced results.

In general, teasing out trends with a large number of tests proves difficult. Future big-data work in agenda setting should embrace statistics that allow for the testing of multiple relationships with more than two actors (i.e., media types). Given that the media do not function in silos, it would be advantageous to adopt models that consider many different dependent variables at the same time. Future work may also consider modeling techniques from computer science, such as machine learning, to better build predictive models and consider more relationships in concert.

Over Generalization of Agenda-setting Effects

Our intermedia agenda setting study here appears to be one of nuance. Effects are highly dependent on media type, issue type and even time periods (e.g., breaking vs. ongoing). The majority of the previous intermedia agenda-setting studies surveyed here focus on a small number of media and issues. Moreover, most address time as stationary, or at one period. Our results here show the danger of extrapolating broader theory from such studies. While one medium may lead for a specific issue (e.g., as emerging media did for civil liberties) it may likely not for another. This may vary across time, and the effects themselves may be seen at different lags (i.e., days). As such, it may be no longer sufficient to address agenda-setting influences in such broad terms. If our data show anything that is broadly applicable, it is that agendas are reciprocal across different issues and different time periods, with no media taking a clear lead. One medium does not run the show in any given case. Instead, they are interconnected. Further nuance is now necessary when discussing agenda-setting related effects.

Limitations and Future research

This study is limited in several aspects. First, though our use of Granger test of causality demonstrated some "lead and follow" patterns between different media agendas, it is important to note that our study did not rule out potential extraneous variables (e.g., real-world cues, public opinion, press release, government websites) that might influence the relationship. Future research should consider analyzing the potential impact of these variables on the news agenda and explore theoretical concepts such as agenda building.

Second, as the first big-data analysis that uses GDELT dataset to examine online intermedia agenda setting, our study focuses on the salience transfer of *issues* only. Given that GDELT themes include both issues and attributes, future research should consider analyzing NAS effects in terms of attributes, or a combination of issues and attributes. For example, GDELT dataset identifies a number of different aspects of economy, e.g., "Econ_Bankruptcy," "Econ_Cost of living", and "Econ_Debt." Researchers could investigate how news media associate different attributes of the economy issue, and then determine which medium leads and which follows.

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Table 1

Operationalization of Media Types

Media type	News websites	*n**
The *New York Times* and the *Washington Post*	nytimes.com and washingtonpost.com	2
News agencies	ap.org and upi.com	2
Traditional Media	Websites of newspapers or TV/radio broadcasters excl. WaPo & NYT	1910
Online Partisan Media	Online-only, partisan news website (e.g. Huffington Post, RedState, Salon)	65
Emerging (Non-partisan Online) Media	Online-only, non-partisan news website (e.g., CNET, Gawker, Buzzfeed, Lifehacker)	768
All Media	All archived media sources in GDELT**	2760

**Number of media included in type*
*** This category includes all the recorded media sources in GDELT*

Table 2

Issues That Returned Significant Granger Causality Statistics

	NYT & Post	News Agencies
NYT & Post		3, 4, 5, 7, 10, 12, 13, 14, 15
News Agencies	6, 12, 14	
Traditional	3, 4, 6, 7, 9, 11, 12, 13, 15	2, 3, 7, 9, 10, 12, 13, 15
Online Partisan	2, 3, 5, 6, 8, 9, 12, 13, 14, 15	1, 2, 3, 5, 6, 9, 11, 12, 14, 15
Emerging	1, 3, 5, 6, 9, 12, 13	3, 5, 6, 9, 12, 13, 14, 15
All	6, 9, 11, 12, 13, 16	2, 7, 9, 10, 15

*Columns reflect predictors

	Traditional	Online Partisan
NYT & Post	1, 3, 4, 5, 6, 8, 9, 12, 14, 15, 16	1, 2, 3, 4, 5, 8, 9, 10, 12, 14, 15, 16
News Agencies	5, 6, 8, 10, 11, 12, 14, 15, 16	1, 3, 4, 8, 10, 12, 13, 14
Traditional		3, 4, 6, 8, 9, 10, 11, 12, 14, 15, 16
Online Partisan	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16	
Emerging	1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
All	3, 4, 6, 7, 11, 12, 14, 15, 16	3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

*Columns reflect predictors

	Emerging	All
NYT & Post	2, 3, 4, 5, 8, 9, 12, 13, 14, 15, 16	1, 3, 4, 5, 6, 8, 9, 12, 14, 15, 16
News Agencies	1, 5, 6, 8, 9, 11, 12, 14	1, 3, 5, 6, 8, 10, 11, 12, 14, 15
Traditional	2, 5, 8, 10, 11, 12, 13, 14, 16	2, 3, 4, 5, 6, 9, 11, 12, 13, 14
Online Partisan	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16
Emerging		1, 3, 4, 5, 9, 11, 12, 14, 15
All	1, 2, 3, 8, 11, 12, 13, 14, 16	

*Columns reflect predictors
Issue Key:
1 = Taxes, 2 = Unemployment, 3 = Economy, 4 = International Relations,
5 = Border Issues, 6 = Healthcare, 7 = Public Order, 8 = Civil Liberties
9 = Environment, 10 = Education, 11 = Domestic Policy, 12 = Poverty,
13 = Disaster, 14 = Religion, 15 = Infrastructure, 16 = Media

Table 3

Granger Test of Causality of the New York Times and the Washington Post on Online Partisan Network Issue Agendas

Lag	Taxes	Unempl.	Econ.	Intl. Rel.	Border Iss.	Healthcare	Pub. Order	Civil Lib.
1 - *F*(1,361) =	2.9	6.79**	16.17**	0.5	19.06**	6.90**	0.67	4.60*
2 - *F*(2,352) =	1.3	4.15*	8.90**	1.16	7.09**	5.78**	0.81	5.11**
3 - *F*(3,353) =	0.65	3.29*	6.34**	0.39	5.69**	4.34**	0.71	3.73*
4 - *F*(4,354) =	0.97	2.87*	4.31**	1.03	3.59**	4.12**	0.54	3.76**
5 - *F*(5,345) =	0.55	2.82*	3.70**	0.65	3.97**	3.36**	0.33	3.01*

Lag	Enviro.	Educat.	Dom. Pol.	Poverty	Disaster	Relig.	Infrastruc.	Media
1 - *F*(1,361) =	6.15*	2.45	0.18	4.91*	1.63	15.63**	5.12*	1.36
2 - *F*(2,352) =	2.7	0.58	0.63	1.46	3.86*	6.98**	1.71	0.93
3 - *F*(3,353) =	1.31	1.5	1.4	0.66	4.46*	3.76*	1.07	0.81
4 - *F*(4,354) =	1.65	2	1.07	1.58	3.32*	3.31*	0.68	0.94
5 - *F*(5,345) =	1.24	1.65	0.84	1.3	3.13*	2.94*	0.73	1.3

$p < .05$; $**p < .01$

All lag times are in days (e.g., 2 = 2 days).

Table 4

Granger Test of Causality of Traditional Media on Online Partisan Network Issue Agendas

Lag	Taxes	Unempl.	Econ.	Intl. Rel.	Border Iss.	Healthcare	Pub. Order	Civil Lib.
1 - $F(1,361)$ =	7.40**	9.60**	17.41**	5.08*	18.12**	13.43**	0.52	7.35**
2 - $F(2,352)$ =	3.62*	4.55*	7.89**	1.88	6.87**	5.94**	0.16	3.13*
3 - $F(3,353)$ =	2.07	3.05*	4.81**	2.03	3.93**	5.79**	0.97	2.23
4 - $F(4,354)$ =	1.79	2.27	4.54**	1.83	3.01*	3.98**	1.67	2.91*
5 - $F(5,345)$ =	1.59	2.15	4.20**	1.79	2.36*	3.15**	1.61	2.24

Lag	Enviro.	Educat.	Dom. Pol.	Poverty	Disaster	Relig.	Infrastruc.	Media
1 - F(1,361) =	8.55**	2.03	7.34**	11.85**	0.05	29.81**	12.50**	8.21**
2 - F(2,352) =	4.87**	4.15*	5.37**	9.42**	3.17*	12.32**	5.31**	3.52*
3 - F(3,353) =	3.11*	2.52	3.66*	5.60**	4.37**	6.89**	4.62**	2.33
4 - F(4,354) =	2.98*	3.47**	3.39**	4.66**	3.29*	5.86**	3.62**	1.83
5 - F(5,345) =	2.23	2.68*	3.14**	3.89**	2.71*	4.95**	3.46**	1.37

*p < .05; ***p < .01*

Table 5

Granger Test of Causality of Emerging Media on the New York Times and the Washington Post Network Issue Agendas

Lag	Taxes	Unempl.	Econ.	Intl. Rel.	Border Iss.	Healthcare	Pub. Order	Civil Lib.
1 - $F(1,361)$ =	1.61	4.67*	14.53**	14.93**	20.57**	0.24	1.84	25.02**
2 - $F(2,352)$ =	0.59	2.74	5.89**	7.41**	10.32**	0.01	1.44	9.59**
3 - $F(3,353)$ =	0.28	2.43	4.19**	4.78**	6.38**	0.46	1.02	6.17**
4 - $F(4,354)$ =	0.52	1.33	3.24*	3.60**	4.19**	0.35	1.52	4.96**
5 - $F(5,345)$ =	1.35	1.15	2.86*	3.00*	3.64**	0.86	1.79	4.80**

Lag	Enviro.	Educat.	Dom. Pol.	Poverty	Disaster	Relig.	Infrastruc.	Media
1 - $F(1,361)$ =	9.52**	3.58	0.55	12.42**	8.74**	18.13**	7.75**	18.42**
2 - $F(2,352)$ =	3.28*	1.32	0.84	5.61**	6.77**	7.70**	4.31*	10.40**
3 - $F(3,353)$ =	2.34	1.06	0.86	3.59*	6.21**	5.18**	2.42	7.16**
4 - $F(4,354)$ =	1.45	1.67	0.66	2.96*	4.62**	4.14**	2.01	5.76**
5 - $F(5,345)$ =	1.33	2.1	0.55	2.45*	4.09**	3.42**	1.58	5.01**

*p < .05; ***p < .01*

Table 6

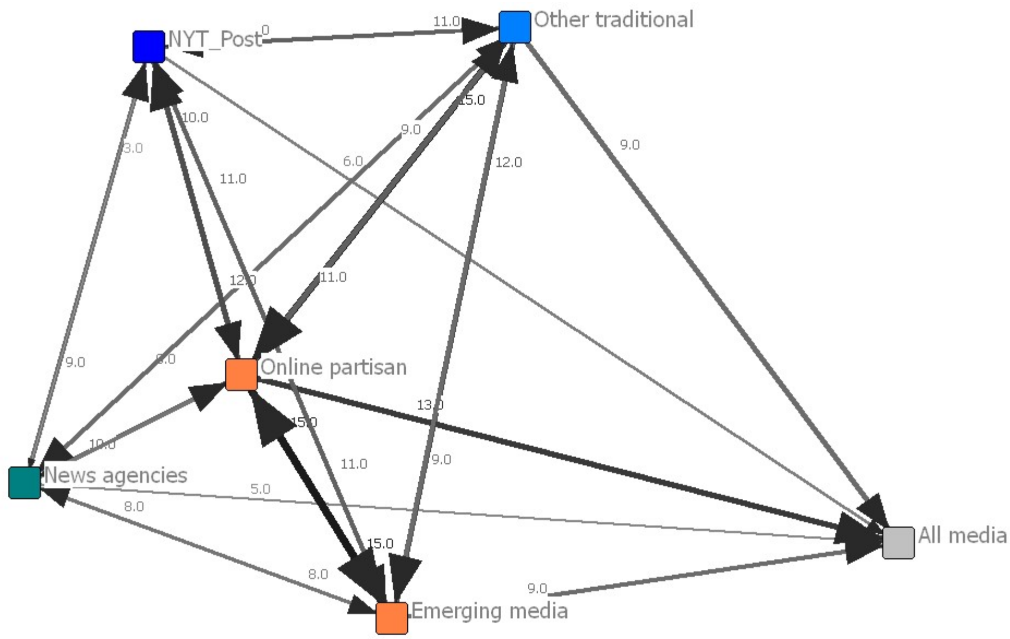
Spearman Rank Order Correlations for Issue Centrality Scores by Media Type

	NYT & Post	News Agencies	Traditional	Online Partisan	Emerging	All
NYT & Post		.956*	.944*	.974*	.953*	.953*
News Agencies			.915*	.950*	.918*	.926*
Traditional				.947*	.953*	.982*
Online Partisan					.976*	.968*
Emerging						.979*
All						

*Correlation is significant at the 0.01 level (2-tailed).

Figure 1

Directed Granger Causality Graph



Note:
1. Line weight and the size of arrowhead was adjusted to reflect the number of issues that were found significant Granger-causal relationship for each media pair comparison.
2. The arrows denote the direction of Granger causality test.
3. Numbers on paths represent the number of significant Granger Causality tests that existed in that direction (e.g., online partisan media predicted 11 issues for other traditional media, but when considering the revers relationship, only 15 issues were significantly predicted).

Endnotes

[1] This study adopts Meraz's (2011) definition for partisan political blogs, which the author defines as top, independent, *online only* news sources that are left-leaning or right-leaning in nature. This analysis coded for left-leaning versus right-leaning as well. However, Meraz (2011) and Sweetser, Golan and Wanta (2008) ultimately found no differences between the groups and conflated them to deliver a more generalizable narrative. Beyond this, Lee (2007) not only conflated groups, but found "political blogs cover the election with virtually the same agenda, regardless of their liberal or conservative political leaning" (p. 745). No clear hypotheses have been developed to distinguish between left and right-leaning media, so left-leaning and right-leaning were not broken out into subgroups. Here we also abandon the use of the word "blog" because the terminology has changed with the ubiquitous nature of online news media. The use of the word blog has decreased in usage 200% from 2007 (Google Trends, 2016). Its usage now reflects an individual's collection of Internet posts and is no longer primarily used to identify alternative non-traditional news websites (Gurak and Antonijevic, 2008). According to The International Encyclopedia of Language and Social Interaction, "blogs often employ first-person narratives and place high value on individual interaction" (Gurak and Kays, 2015; pg. 61). Instead, the term "online partisan media" is adopted with the same definition as political blogs to replicate the grouping and compare results with Meraz (2011) and others.
[2] Sources that GDELT uses to identify news include all coverage from Associated Press, United Press International, Washington Post, the New York Times, and all national and international news from Google News with the exception of sports, entertainment, and strictly economic news.
[3] Leetaru (2012b) offers concrete detail on the underlying algorithms used. In validating a theme, the system includes the manual review of randomly selected articles as verification that the algorithm used is accurate (a.k.a., externally valid) and on par with leading computer-assisted classification systems (Leetaru, Perkins and Rewerts, 2014; Leetaru, 2012b).
[4] While it is a limitation that not all media in the data were analyzed, given the small sample sizes of media not included, and the proportion of the dataset that was analyzed, it is extremely unlikely that results would have varied significantly. Doubling the media sample size would have only allowed for 6.6 percent more of the data to be analyzed.
In doing so, all media outlets that published over five relevant articles per day were included in the final analysis.
[5] There was not a separate category for magazines in this analysis. We acknowledge that magazines could have been included as traditional media, but in our analysis very few magazines existed. We felt it best to exclude this type because the raw number of media included was too few to be representative. This could be due to the nature of how GDELT collects news data.
[6] While groups varied in size, an inspection of the number of stories for each group was robust, with no media and issue combo having less than 3,865 articles for 2015 (news agencies and unemployment). This suggests that time series data was not sparse and not a limitation. Moreover, while centrality scores may have trended higher for media groupings with more outlets (and more articles), centrality data used for the time series was differenced and therefore stationary. This prevents inherent differences between small and large media groups. Instead, each data point is the difference the centrality score deviated from the mean.

[7] The study examined NAS effects using lags of five days respectively. "One lag" refers to a one-day lag; "Two lags" refers to a two-day lag; and so on.