

**Rebooting Mass Communication:
Using Computational and Network Tools to Rebuild Media Theory**

Katherine Ognyanova
Rutgers University

Abstract

One of the most important tasks facing media scholars in the 21st century is reexamining the relevance of classic mass communication theories in a new information environment. Major technological and social transformations have changed the practices of media production, dissemination and consumption. Deregulation in the media sector, along with the advent of digital technologies, has lowered barriers to entry, giving rise to countless sources of news and entertainment. The proliferation of distribution channels has prompted speculations about the fragmentation of the media landscape, while personalization and selective exposure trends have motivated studies of audience fragmentation.

Recent technological developments have no doubt put into question existing theoretical and methodological approaches to mass communication. At the same time, these developments have provided the tools needed to address emerging challenges in media effects research. This work argues that computational methods, large-scale digital data collection, and new modeling techniques (combined with qualitative domain knowledge) can help us gain a nuanced understanding of media influence and public opinion formation in the digital age. The chapter also highlights the need for better transparency and replicability standards in the field of communication.

Network science methods are examined as one key way of conducting investigations of social and technological interactions, as well as diffusion of information and patterns of influence among individuals, groups, and organizations. The chapter presents a network-based model of media message flow and agenda-setting processes to illustrate how the computational exploration of complex systems can produce important insights into mass communication theory.

Keywords: mass communication, media system, computational social science, network science, agenda-setting, two-step flow of communication

Reference: Ognyanova, K. (Forthcoming). Rebooting Mass Communication: Using Computational and Network Tools to Rebuild Media Theory. In B. Foucault-Welles & S. Gonzalez-Bailon (Eds.), *The Oxford Handbook of Networked Communication*. Oxford, UK: Oxford University Press.

Rebooting Mass Communication: Using Computational and Network Tools to Rebuild Media Theory

In the last couple of decades, the field of mass communication has purposefully sought to redefine itself in a new information environment. This effort has gone beyond reexamining classic theories and evaluating their relevance in the context of new media. The very concept of mass communication as both a phenomenon and a field of study has been put into question. A major work defining a potential shift towards the “demassifying” of mass communication was written by Chaffee and Metzger at the start of the 21st century. In it the authors point to contemporary trends towards increasing content personalization, availability and diversity of information channels, and enhanced individual capacity for production, dissemination and selective exposure to content (Chaffee & Metzger, 2001).

This chapter discusses briefly the challenges facing mass communication. It argues that computational methods, large-scale digital data collection, and new modeling techniques (combined with qualitative domain knowledge) can help us gain a nuanced understanding of media influence and public opinion formation. A particular emphasis is put on the importance of introducing better transparency and replicability standards in the field of communication, in order to further advance the theoretical and methodological sophistication of the discipline.

Network science methods are examined as one key way of conducting investigations of social and technological interactions, as well as diffusion of information and patterns of influence among individuals, groups, and organizations. The chapter presents a network-based model of media message flow and agenda-setting processes to illustrate how the computational exploration of complex systems can produce important insights into mass communication theory.

The end of mass communication?

Throughout most of the 20th century when dominant mass communication theories emerged, researchers operated under the conditions of a relatively uniform, centralized media system. Three major broadcast networks and a limited number of influential newspapers and magazines were credited with the shaping of public opinion in the United States (Bennett & Iyengar, 2008).

Major technological and social transformations have since changed the practices of media production, dissemination and consumption. Deregulation in the media sector along with the advent of digital technologies facilitated the emergence of countless news outlets. Information overload, proliferation of distribution channels, and a perceived shift of power from corporations to users are said to characterize the media landscape of the 21st century (Castells, 2005).

As a result of those shifts, current approaches to media studies came under scrutiny (Chaffee & Metzger, 2001). Influential theoretical works suggested that mass communication frameworks have to be reevaluated in view of the changing information environment (Bennett & Iyengar, 2008; Bennett & Manheim, 2006). One basic assumption of earlier research was that the public obtained news from a limited number of outlets with similar journalistic culture, content priorities, and gatekeeping routines. A virtually unrestricted access to diverse sources of content could violate that assumption, compromising the media’s consensus-building function (Takeshita, 2006). The improved capacity of

consumers to select their preferred messages could decrease social cohesion and lead to a segmentation of audiences (Blumler & Kavanagh, 1999). As news consumption and information access grew increasingly personalized (Tewksbury, 2005), scholars predicted a coming era of *cyberbalkanization* (Sunstein, 2007, 2009) and filter bubbles (Pariser, 2011) in which selective exposure dissolves mass audiences into small and isolated like-minded groups.

A related trend that Bennett and Iyengar (2008) refer to as *the demise of the inadvertent audience* was the unbundling of media content (Kaye & Quinn, 2010). Media companies would traditionally offer different types of news and entertainment materials packaged together. In the past, audiences had no control over the construction of those packages, nor did they have many alternatives to choose from. People in those days were more likely to watch the evening newscast while waiting for the entertainment part of the network program – or browse through the pages of a newspaper after reading the sports section. Today, it is easier to construct a media diet consisting entirely of sports or entertainment news, and find many outlets that cover exclusively one’s areas of interest.

Social media platforms provide one new pathway for inadvertent exposure to news. According to recent Pew reports, four in ten Americans get news on Facebook, and one in ten gets news on Twitter (Barthel, Shearer, Gottfried, & Mitchell, 2015). Exposure to media content through social networking sites, however, has a somewhat limited potential to increase the diversity of individual news consumption. This is due in part to homophily: our preference to form online and offline social ties with people who are similar to us (McPherson, Smith-Lovin, & Cook, 2001). The content that our social network contacts post is thus not random, but rather likely to match our thematic and framing preferences. Individuals also tend to engage more with congruous content, a practice that has important consequences on digital platforms (Bakshy, Messing, & Adamic, 2015). Online systems often track user behavior and use it to highlight content that is most likely to elicit engagement, and discount posts that seem unlikely to spark the person’s interest.

In defense of mass communication

While the industry is changing in response to technological shifts, economic pressures and new regulation, evidence suggests that both mass communication theories and mass media companies remain relevant and influential (Holbert, Garrett, & Gleason, 2010; Perloff, 2014). Even as digital platforms are ubiquitously used, newspapers, broadcast networks, and mainstream sources of online news retain an important role in the formation of public opinion (Shehata & Stromback, 2013).

At this time, the Web’s potential to cause drastic audience fragmentation seems not to be fully realized. The trend towards information proliferation is countered by *attention scarcity* (Goldhaber, 1997). Individuals have a limited amount of time they can spend on media products, and that gives an advantage to the bigger, easier to find, better-known news outlets (Nagler, 2007). Research examining audience fragmentation across traditional and online news sources (Webster, 2014) finds high levels of duplication across media outlets and no evidence of isolation in like-minded consumption groups. Attention concentration patterns are also evident online, where search engine ranking mechanisms often determine which sites will receive most of the traffic (Epstein & Robertson, 2015).

While the Internet offers an enormous wealth of information sources, people still tend to cluster around a select few. The popular news sites are owned predominantly by large media companies (Miel & Faris, 2008). Traditional news organizations, particularly newspapers and cable TV stations,

dominate the online information space (Pew Research Center, 2010, 2011). Popular web sources of local coverage are likewise limited in number and mostly affiliated with traditional media (Hindman, 2011).

Similar trends have been recorded for online platforms and services. Pew and Nielsen (2010; 2010) examined millions of blogs and found that almost all of the news stories they linked to came from traditional media. A limited number of elite actors command the attention of social media users as well (Wu, Hofman, Watts, & Mason, 2010). The most prominent Twitter accounts belong to traditional media and high-profile public personalities (Kwak, Lee, Park, & Moon, 2010).

One of the most often discussed dividing lines in media consumption practices is grounded in political ideology. While some studies find evidence of ideologically motivated selective exposure (Stroud, 2011), others suggest that partisan preferences do not lead to selective avoidance (Holbert et al., 2010). Controlling for ideology, Holbert, Hmielowski, and Weeks (2012) found a strong positive association between the use of politically divergent cable networks like FOX News and MSNBC. Gentzkow and Shapiro (2010) further reported that segregation in online news, while higher than that of most offline media use, was low in absolute terms. In a large-scale analysis of user behavior on Facebook, Bakshy et al (2015) found non-negligible levels of cross-cutting exposure. An estimated 29% of the hard news a user encountered, and 25% of the hard news they clicked on, diverged from their own political preference.

Scholars have argued that the array of new information sources has weakened considerably the power of traditional media and eliminated its gatekeeping role (Williams & Delli Carpini, 2000, 2004, 2011). Yet there is an interpretation under which those diverse sources are simply adding to the long list of exogenous factors known to have an impact on news coverage. There are still, as there have always been, many other influences, including elite news outlets, public figures, corporate lobbies, and experts. As long as the majority of Americans rely on large news organizations for information (Pew Research Center, 2015), discarding the filtering function of journalism seems premature.

Notably, the increasing number of information sources did not bring about a proportional increase in content diversity (Ognyanova, 2013). The accelerated news cycle and the demands of fast-paced online journalism create strong pressures towards homogenization of content, as little time is left for research and reporting (Boczkowski & De Santos, 2007; Mitchelstein & Boczkowski, 2009). The financial problems of journalism further contribute to content cohesion by reducing the available resources for original content and increasing everyone's reliance on a few large wire agencies (McChesney & Nichols, 2010).

The monitoring and reproducing of news from other media has turned into an institutionalized newsroom practice (Boczkowski, 2010). Elite publications have retained much of their influence – the New York Times can still confer legitimacy to an issue and trigger a public discussion around a topic that would have otherwise been ignored (McCombs, Holbert, Kioussis, & Wanta, 2011; Weber & Monge, 2011).

Another factor promoting cohesion in news content is the ongoing trend towards media concentration on a global scale. A relatively small interconnected group of multi-national media conglomerates owns a large number of high-profile news production sites (Arsenault & Castells, 2008).

As companies seek economies of scope, organizational knowledge, resources and staff are shared between the venues they own, across media formats.

New approaches to media studies

As discussed in the previous section, large media companies still play an important social role. That role, however, is more difficult to assess now than ever before. Contemporary mass communication research needs to account for digital media formats, user-generated content, proliferation of distribution channels, complex influence patterns and pathways of message diffusion.

While those are serious challenges, they are by no means insurmountable. The last few decades have brought about significant advances in the theoretical frameworks and methodological approaches of the social sciences. Large-scale digital trace data provide some of the raw material needed to examine old and new theoretical constructs. Computational social science offers the tools to test complex hypotheses encompassing multiple parts of the media system. Fast-growing fields like network science give us new ways to structure existing theories, as well as the corresponding methodological apparatus. Automated text, image, audio, and video analysis allows us to examine high volumes of multi-format media content. Last but certainly not least: scientific research practices, especially with regard to open data and replication policies, are slowly but surely improving (Crosas, King, Honaker, & Sweeney, 2015). Establishing better standards in that area is without doubt one of the key tasks communication studies will face next.

In the context of media research, computational approaches and large-scale digital datasets allow us to track the spread of interpersonal and media messages, evaluate patterns of influence, identify shifts in public opinion in near-real time, and gain a nuanced view of political and news agendas. While social media data have been widely used in this context (Freelon, 2014), other equally important datasets include large-scale media content (Neuman, Guggenheim, Jang, & Bae, 2014), web content and hyperlink structures (Weber, 2012), blogs (Almquist & Butts, 2013), discussion forums (González-Bailón, Banchs, & Kaltenbrunner, 2012), online user behavior captured through the server logs of news websites, and more. One particularly promising research approach lies at the intersection of mass communication and computational linguistics (González-Bailón & Paltoglou, 2015) – an area that has already produced important and interesting results (Kleinnijenhuis, Schultz, & Oegema, 2015; Soroka, Stecula, & Wlezien, 2015).

A key point to reiterate here (one that has been made often enough in the literature but warrants frequent repetition) is that “big data” research has its own big problems. Large sample size does not ensure representativeness (Hargittai, 2015) or guarantee that the available measures adequately reflect the theoretical constructs of interest (Shah, Cappella, & Neuman, 2015). Moreover, even the most detailed and comprehensive datasets require both domain expertise and formal theory to produce meaningful insights (Parks, 2014). Media studies are one field where combining qualitative research and computational techniques can produce especially useful results.

The ethics of data collection and use, as well as considerations regarding privacy and informed consent, add another layer of complexity. These matters are especially difficult to navigate in the context of incongruent academic, corporate, and government standards (Lazer, 2015).

As longitudinal digital records reflect and preserve an ever increasing proportion of our daily activities, the number and scope of relevant datasets is steadily growing. More importantly, new standards and tools that allow us to combine information from multiple complementary sources are becoming more common and well-established (Driscoll & Thorson, 2015; Lazer et al., 2009). This is particularly relevant for mass communication research which frequently benefits from juxtaposing several datasets: traditionally public opinion polls and media content analysis, but more recently also records from social media and other digital platforms (Conway, Kenski, & Wang, 2015; Jungherr, 2014).

At the same time, many disciplines are also facing up to greater challenges related to transparency and replicability. Large datasets are difficult to distribute, difficult to anonymize, and difficult to clean of sensitive information. They are often owned by companies that may be unwilling to open them to researchers. Extensive data cleaning procedures and complex statistical and computational methods are next to impossible to fully describe in the space of an academic paper – at least not in a way that would allow for an exact replication.

Acknowledging these issues, a number of disciplines are proposing standards and solutions to address them. Those efforts include setting up mechanisms for sharing of data, code, and detailed analysis descriptions alongside an article, as well as encouraging the publication of relevant and methodologically solid replication studies and papers with null results (Nosek et al., 2015). Such initiatives are by no means limited to the natural sciences – major journals in fields like political science have set standards requiring authors to publish their data and code or detailed analytical procedures (DART Group, 2015).

Media research, as well as the field of communication studies in general, are lagging behind as far as transparency, replication and open data standards are concerned. This is not a new problem, but is one that needs to be resolved in order to make the theoretical advances in the field less erratic and more verifiable. It is also a prerequisite required to create optimal conditions for scholars to question, reevaluate, and build upon earlier works in the field. *Communication and technology*, along with *mass communication*, are two fields particularly well-positioned to lead the charge in that respect.

Network science and the media system

Within the domain of computational social science, network research provides a set of methods and theoretical constructs uniquely suited to advance our understanding of mass communication (Ognyanova & Monge, 2012). As the discipline examines increasingly complex processes placing interpersonal and media messages in the context of larger social structures, it faces an important shift in theoretical focus. The main emphasis moves from the attributes of organizations, news stories, and consumers to social relations and interactions, influence patterns, flows of information and resources (Borgatti, Mehra, Brass, & Labianca, 2009).

This theoretical orientation reflects the current state of the media system as it moves to networked forms of content production, delivery, and consumption. Persistent industry-wide trends increase the levels of consolidation, interorganizational collaborations, local and global partnerships (Arsenault & Castells, 2008). Online and mobile formats connect newsrooms and audience members (Cardoso, 2006), making content diffusion both faster and easier to track through digital traces (Anderson, 2010; Lazer et al., 2009). Professional and personal social ties affect individual news

consumption and distribution habits (Boczkowski, 2010). News stories are placed within networks of semantic relations (Diesner & Carley, 2005) and hyperlink connections (Turow & Tsui, 2008).

Network science allows for a multilevel analysis capturing the structural determinants of social and political processes, public perceptions, media agendas, and individual behavior. Its ability to deal with complexity has also made it one of several key areas expected to advance policy research and guide media regulation (Friedland, Napoli, Ognyanova, Weil, & Wilson, 2012).

A number of major mass communication theories are grounded in distinctly network concepts, even if not always explicitly defined and tested as such. One classic example, the *two-step flow* of communication (Katz & Lazarsfeld, 1955), deals with the diffusion of news stories through social networks. Its main premise is that media messages are channeled through a particularly active audiences segment known as the *opinion leaders*. Those individuals receive, interpret, and disseminate the news among the larger public. Other theories like *agenda-setting* (Guo & McCombs, 2011; Ognyanova, 2013) and *gatekeeping* (Barzilai-Nahon, 2008) have recently been reinterpreted in network terms.

Many early media effects theories, as well as recent works lamenting the end of mass communication, exhibit a certain lack of nuance in conceptualizing influence patterns. It seems fairly clear that media messages can influence mass audiences without reaching each individual directly, simultaneously, and through a single channel or format. The concept of a “mass audience” (or, for that matter, a single “public” that has an opinion) was always just a useful simplification. It may retain its usefulness even if some members of the audience are reading stories in a physical newspaper, others see those stories as Facebook posts, and still others find them on the web through links from Twitter. The contribution of network thinking is that it gives us the instruments to track the complex patterns of message diffusion and social contagion through multiple channels, and assess their impact on individuals and larger social groups (Aral, Muchnik, & Sundararajan, 2009).

Early network works in the field of media effects tend to conceptualize social structure as a conduit for the spread of ideas and information. The focus in that context is on individuals and the connections among them. Media outlets are not seen as part of this network, though they do produce the content that propagates through it. The work of Menzel and Katz (1955) building on the two-step framework provides one canonical example of this type. Their research mapping the social ties of health professionals uncovers a multistep influence of medical journals and interpersonal relations on drug adoption.

A more flexible way to think about this system would view individuals and media outlets as embedded in a multidimensional network (see Figure 1). This type of model still examines interpersonal ties, but it also incorporates individual connections to (and potentially among) specific news sources. Friemel (2015), for instance, uses a similar approach to examine the social networks of high-school students along with their connections to various TV programs.

Works within this framework often allow for the possibility that individuals as well as media outlets can generate, selectively filter, and disseminate messages. This line of research has produced a number of studies exploring online influence patterns among news organizations and audiences, including research focusing on social media platforms (Xu, Sang, Blasiola, & Park, 2014).

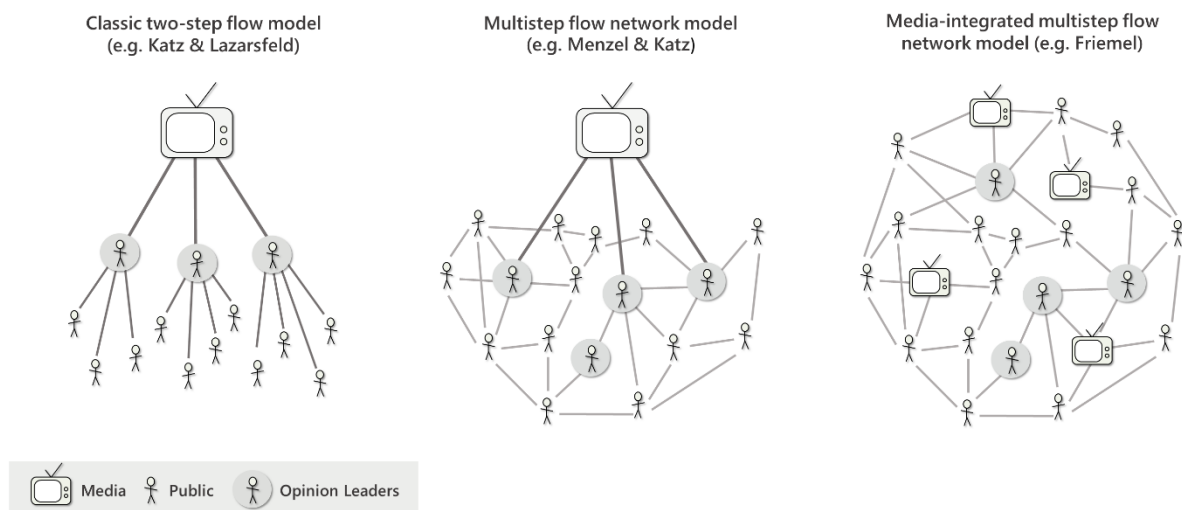


Figure 1. Early and contemporary network models of media influence.

To further demonstrate the versatility of network approaches to mass communication theories, as well as the ability of those frameworks to address key concerns facing the discipline, the next section of this chapter presents one integrated network model of the media system with applications to agenda-setting research. Agenda-setting is selected as one of the key theoretical frameworks in the field with premises challenged by the digital transformation of the media system (Bennett & Iyengar, 2008; Chaffee & Metzger, 2001). The model, described in detail below, allows for empirical examination of various aspects of the theory, as well as its performance in the context of digital platforms and potentially fragmented audiences.

A network approach to agenda-setting

One of the dominant media effects theories, *agenda-setting* suggests that media can influence the way we see the world (McCombs, 2004). Both the content and the format of news stories are said to provide cues about the social relevance of objects and events. As a result, at any given time a limited number of issues occupies the attention of journalists, citizens, and politicians. The focus of public and political attention on a narrow range of topics facilitates a shared perception of community priorities, allowing social mobilization and collective action to take place.

Agenda-setting theory in its present form was first articulated by Maxwell McCombs and Donald Shaw (1972) who studied the impact of media on the issue priorities of undecided voters. Academics have since extended the scope of the framework to also study the formation of media agendas (*agenda-building research*), investigating factors that influence the salience of items in the news. Work in that area involved exploring key external news sources (*extramedia level*), the influence of media on each other (*intermedia level*), and the internal newsroom dynamics affecting editorial decisions (Dearing & Rogers, 1996).

Elaborating the initial agenda-setting theory, research also began incorporating elements from other perspectives. Second-level studies focused on the attributes of objects in the news, spurring examinations of the theoretical links between agenda-setting, priming, and framing effects (Roessler, 2008; Shah, McLeod, Gotlieb, & Lee, 2009). The two-step flow of communication prompted investigations on the impact of interpersonal discussion on the agenda-setting process (Brosius & Weimann, 1996).

The current pressures to rethink the model of influence proposed by McCombs and Shaw emerge from parallel developments in theory and society (Williams & Delli Carpini, 2011). In order to address added layers of complexity, a new conceptualization of the agenda-setting process needs to incorporate a variety of relevant features and relationships characterizing news outlets, audience members, and social issues. A framework of this kind would benefit from the instruments provided by *network theory*: a field that specializes in the examination of complex dynamics involving attributes and relations, as well as higher-order structures. Traditional agenda-setting research relies largely on correlation and regression tests – methods that cannot easily be used to study the influence flows in the media system. Network analysis provides one way of addressing that problem.

The model presented here (see Figure 2) is structured as a dynamic multidimensional network of issues, individuals, and information sources. The following paragraphs provide a brief description of the relationship types incorporated in the framework, as well as the rationales for their inclusion. This section also sketches relevant actor and object characteristics. Finally, network mechanisms are mapped onto agenda-setting processes.

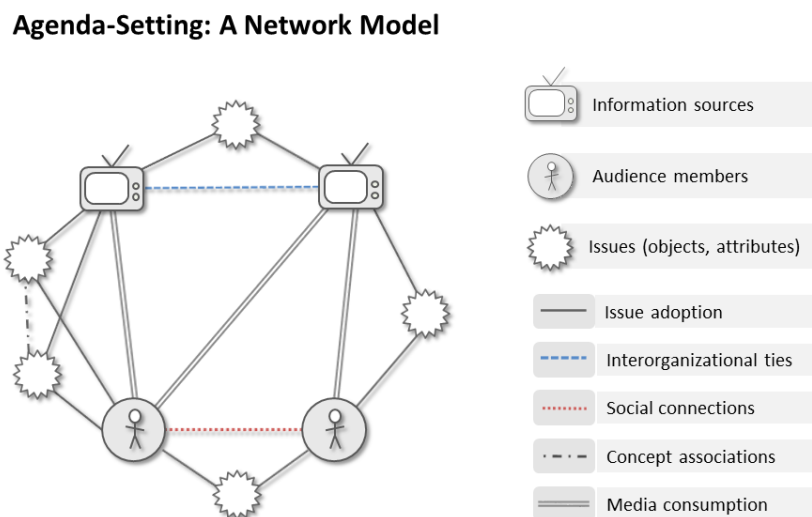


Figure 2. Agenda-setting: A network model.

Relationship typology

Issue adoption ties (issue ↔ information source/ audience member)

Key to the agenda-setting process, this type of tie indicates that an issue has become salient for media outlets or consumers. The connection between an issue and a news source is formed when the item is covered by the outlet. The link may be conceptualized in binary terms (presence/absence of connection), or weighted based on traditional *salience* dimensions, such as the placement prominence of a story or the time/space dedicated to it (Kiousis, 2004).

Similarly, an *issue adoption* link connecting an issue to an audience member is recorded when it becomes clear that an issue has captured the person's attention. This can be assessed through a typical agenda-setting survey instrument (McCombs, 2005). Alternatively, the link can be observed through digital traces (e.g. an individual posts a link to a story about the issue on a social networking platform – or mentions it in a blog post).

Media use ties (audience member ↔ information source)

Researchers have examined a number of pertinent relationships between individuals and media outlets. Higher news consumption, as well as reliance on media, are expected to enhance agenda-setting effects (McCombs & Reynolds, 2009; Wanta & Hu, 1994). In particular, exposure to a news source covering an issue is likely to increase the perceived importance of that issue (Stroud, 2011). This is, therefore, another key type of link in the model. As the literature has tested a number of related constructs (e.g. use, exposure, reliance, dependence), any of those can be substituted here. This allows for conceptualizations ranging from a binary use/no use tie to a valued link weighted by exposure time or dependence strength.

Interorganizational ties (information source ↔ information source)

A wide range of formal and informal relationships could constitute network ties between two media organizations. The list includes well-studied connections like partnership, ownership, and cross-investment (Arsenault & Castells, 2008). Baker and Faulkner (2002) suggest a number of additional link types: market exchanges, strategic alliances, joint participation in syndicates, joint political action, interlocking directorates, family ties, even joint illegal activities such as collusion.

Interorganizational relationships, both of cooperation and competition, are pertinent to the media agenda-setting process as they influence news selection (Dimmick, 2003). This may occur as a result of content sharing between outlets – or due to a transfer of organizational routines and news values.

Social ties (audience member ↔ audience member)

Social ties include friendship, kinship, and other communication connections between audience members (including friend/follow links in online social media platforms - though it is important to note that the meaning and function of those online connections should be given a serious consideration before exploring their patterns). These relationships are crucial as they provide a social infrastructure allowing for the spread of media preferences and the diffusion of news content. Interpersonal discussion is, furthermore, a major intervening variable in investigations of salience transfer between the media and public agendas (Dearing & Rogers, 1996). When conversations deal with issues covered by news media, communication can enhance agenda-setting effects (Wanta & Wu, 1992). This also means that direct exposure to specific news content may not always be a prerequisite for the effects to occur (Wanta & Ghanem, 2007).

Combining agenda-setting research with two-step and diffusion models (Brosius & Weimann, 1996) has allowed researchers to study the interaction between interpersonal and media effects. The importance of examining social and media connections in parallel is recognized in a number of theoretical traditions. One example comes from the *communication infrastructure theory* (Kim & Ball-Rokeach, 2006), a framework incorporating interpersonal and mediated effects in a community context.

Concept association ties (issue ↔ issue)

Following McCombs's (2004, 2010) characterizations, *issues* are broadly defined in the model to include any object which may draw attention, or about which one may hold an opinion. That allows research to explore general topics, specific stories or events, public figures, organizations, countries, and other objects in the news. Furthermore, under the network conceptualization described here, nodes denoted as "issues" may also be prominent object aspects or interpretations. In this way, the framework accommodates studies of second-level agenda-setting and framing (McCombs, 2004, 2005).

Links between issues may connect items that have some association in meaning, a conceptual or semantic relationship. This is another broad definition allowing for multiple operationalizations, permitting the use of relationship ontologies such as the ones adopted in semantic web projects.

As one example, attitude objects such as "*presidential elections*", "*Hillary Clinton*" and "*Jeb Bush*" could be considered conceptually associated. Such a conceptual tie between two issues may make them more likely to appear on the agenda together. Additionally, research has suggested that some issues may have a competitive relationship reducing the likelihood that they will be prominent at the same time (Djerf-Pierre, 2012).

Link direction and agency

One thing to note here is that the proposed model does not contain inherent assumptions about agency. Those could, however, be built in based on the theoretical grounding and research design of a particular study. While all relationships in the system are presented as symmetric (see Figure 2), it is possible to adopt an interpretation assuming a certain direction of influence. A directed link between individuals and media sources, for instance, would be grounded in an understanding of audiences as either active participants or passive consumers. The *issue adoption* links can also have a direction reflecting top-down processes or the view that individuals have the agency. An interesting alternative could build upon meme literature stemming from the work of Dawkins (2006), which implies that issues are the agents that propagate across hosts.

Individual and dyadic attributes

In addition to capturing the relationships between actors and objects, a network representation of agenda-setting allows for the inclusion of relevant node-level attributes. Information sources, for instance, may be characterized by revenue, geographic area, or format (e.g. radio, TV, print, online). Audience members have a range of demographic characteristics potentially influencing the agenda-setting process (Wanta, 1997; Wanta & Ghanem, 2007). Issues can also be evaluated or classified in a number of ways – e.g. by domain (politics, science, entertainment, etc.) or scope (local, regional, national, international).

Some important agenda-setting constructs are dyadic in nature and need to be operationalized not as individual properties, but as link-level attributes. One such example is *obtrusiveness*, or the extent

to which a particular issue is part of someone’s personal everyday experience (Coleman, McCombs, Shaw, & Weaver, 2008). Items like “unemployment” or “crime” may be obtrusive for some individuals and not others, making *obtrusiveness* a characteristic of the relationship between person and issue.

Network mechanisms

As discussed above, the network framework proposed here adopts some basic definitions of the agenda-setting perspective. The conceptualizations of issue, object, attribute, as well as measures of salience do also apply here.

Other concepts and processes, however, require a network interpretation. The prominence of an issue on the agenda, for instance, is traditionally assessed based on a rank-ordered list of priorities (Valenzuela & McCombs, 2009). A direct network equivalent of that measure would be the issue's *degree centrality*: the number of individuals and/or media sources directly connected to an issue, potentially weighting for the strength of those relationships (Freeman, 1979). More advanced measures could take into account the extent to which an item is embedded in the overall network, or the average number of steps to be traversed in order for the issue to reach every person/outlet included in the study (Borgatti & Everett, 2006).

Agenda-Setting: Network Mechanisms

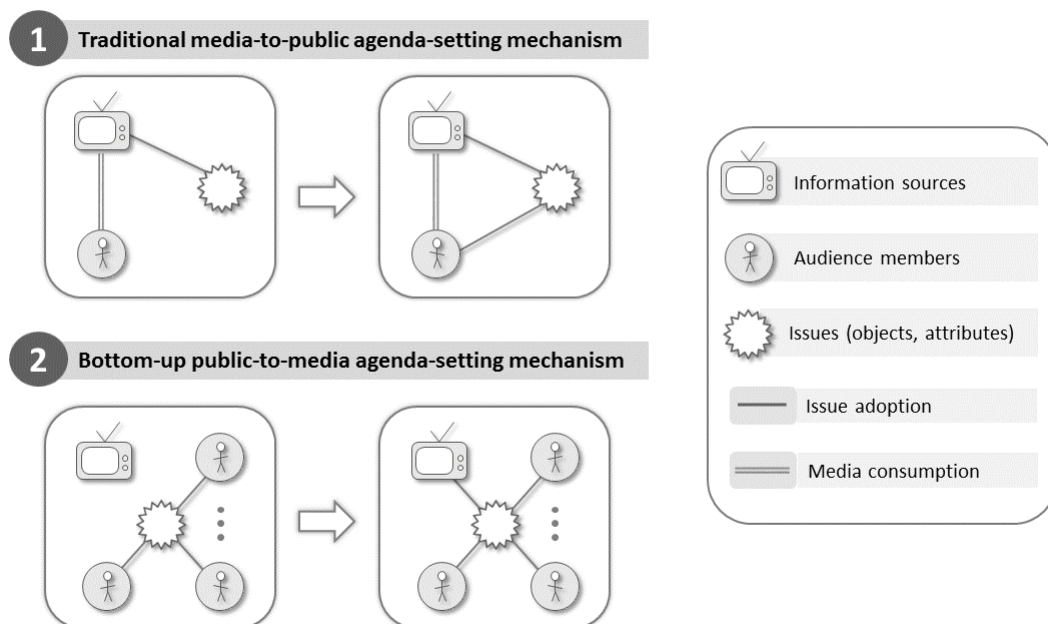


Figure 3. Network mechanisms underlying agenda-setting processes.

The basic agenda-setting process is typically defined as a transfer of salience from media to the public agenda, with effect strength evaluated through correlation analysis (McCombs, 2004). Audience members will perceive as salient an issue which features prominently in the news they consume. In network terms, this process should result in a propensity for triadic closure within a particular source-individual-issue configuration (see Figure 3, panel 1). When an information source is connected to both an audience member and an issue, there should be an increased probability for tie formation between the issue and the individual. Though it has a different theoretical grounding, this mechanism operates

somewhat similarly to the balance principle known to predict transitivity in social relations (Granovetter, 1973).

The capacity of individuals to place an issue on the media agenda could similarly be operationalized in network terms. Like its counterpart, bottom-up agenda setting can be expressed as a propensity towards the closure of triads in which an individual is linked to both an issue and a news source. However, while a single media outlet can influence a news consumer, the reverse effect is more likely to be a game of numbers. If a sufficiently large number of people have a shared concern, it may end up high on the news agenda, regardless of the media use patterns of those involved. Thus bottom-up agenda-setting effects may be produced by a preferential attachment mechanism (Easley & Kleinberg, 2010) similar to the one presented on Figure 3, panel 2. In a network context, this mechanism – also known as “*cumulative advantage*” or “*the rich get richer*” – describes a propensity to form links with nodes that are already well-connected.

Preferential attachment to popular issues is more generally one plausible generative mechanism for an agenda network of the type described here. Both news sources and individuals are likely to form connections to issues already considered important by the media and the public.

All of the processes described so far could potentially operate in conjunction to shape agenda-setting patterns. Combining those mechanisms in a single model provides a useful way to evaluate how well each one explains the observed structure. This is one advantage of taking a network approach, as it allows for the simultaneous testing of multiple complementary and competing hypotheses operating at different levels of analysis (Contractor, Monge, & Leonardi, 2011; Monge & Contractor, 2003).

Another network-centric analytical strategy aimed at predicting the adoption of issues comes from contagion and diffusion frameworks. Initially developed to track the spread of disease or technological innovations, those models have been used to study the propagation of topics through social networking platforms (Oh, Susarla, & Tan, 2008) and blogs (Leskovec, Backstrom, & Kleinberg, 2009; Leskovec, McGlohon, Faloutsos, Glance, & Hurst, 2007, April). Two types of models – *threshold* (Valente, 1996) and *cascade* (Cointet & Roth, 2009) – can be used to explore the diffusion of issues across outlets and individuals. In *threshold* models, adoption is based on the proportion of connections that have already adopted the issue. In a *cascade* model, each time an actor is "infected" with a new issue, there is a certain probability that the infection will spread to neighboring nodes.

Reducing complexity in the network model

The network model proposed here incorporates media effects, as well as intermedia and interpersonal influences. It provides a useful organizing framework encompassing different aspects and levels of agenda-setting. This comes at a cost, as data collection and analysis need to account for complex structures with multiple types of nodes and relationships. While some research questions require that level of complexity, others may not. At present, most studies in the field have focused on a single dimension of the agenda-setting process and do not incorporate the full range of elements included here.

A simple way to reduce complexity while preserving the basic ideas behind the model is to focus on a limited subset of its elements. Studies could – and many do – only investigate issue adoption

and media consumption links, discarding interorganizational, social, and conceptual associations (see Figure 4, panel 1).

The Agenda-Setting Process: Reducing Complexity

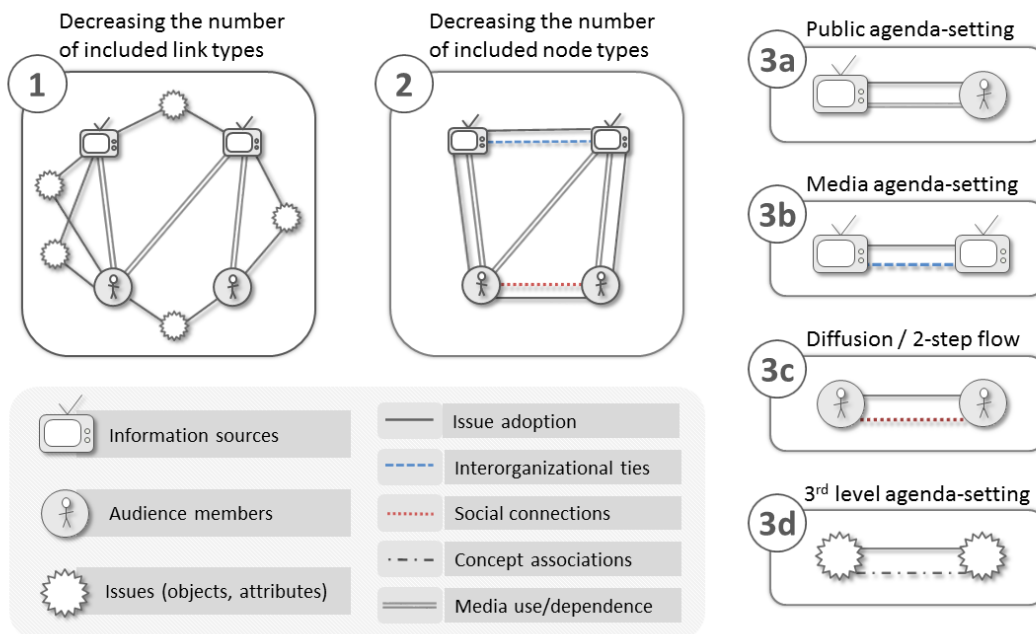


Figure 4. Reducing the complexity of networked agenda-setting models.

Another way to simplify the analysis is to decrease the variety of node types present in the model. Reducing the number of nodes (i.e. distinct sets of entities in a network) is a standard technique used with multimodal structures (Wasserman & Faust, 1994). The excluded elements are typically ones of less relevance or interest to the researcher (Borgatti, 2009). As works within the agenda-setting perspective are largely concerned with the impact of news on public opinion, the nature of particular issues is often less important than the degree of correspondence between media and audience priorities. This being the case, *issues* are one element type that can be removed from the model (see Figure 4, panel 2). In their place, a new relationship – an *agenda convergence* tie – is defined. It represents the convergence of agendas between the remaining nodes (audience members and/or media outlets), or the transfer of salience across them. The link can, for instance, be evaluated based on one of many available measures of similarity or distance, the simplest of which is the number of shared issues (Borgatti & Halgin, 2010).

Reducing complexity further, a study can focus on smaller subsets of nodes and links (Figure 4, panel 3). In the spirit of early agenda-setting research (Dearing & Rogers, 1996), researchers may opt to examine the media use and issue overlap (agenda convergence) relationships between individuals and information sources (3a).

Intermedia scholarship may similarly adopt models including interorganizational and shared issue relations between news outlets (3b). Ognyanova (2013) examines those types of ties to estimate the levels of media fragmentation in a network of U.S. news outlets from five industry sectors: newspapers, online sources, radio, cable and network TV stations. Her work finds an increase in media content homogeneity over time. The study uses stochastic actor-oriented models (Snijders et al., 2010)

to evaluate a range of factors contributing to the increasing similarity in news coverage across outlets. The dynamics of agenda convergence are found to be shaped by the story selections of popular outlets and driven by similarities in format, audience demographics, and political ideology. The analysis also shows that ownership relations lead to lower agenda convergence among outlets in the sample.

Alternatively, research can focus on similarities in media organizations in terms of their audience, rather than their news agenda. Webster and Ksiazek (2012), for instance, studied a network of media outlets and examined their patterns of audience sharing to determine the levels of audience fragmentation in the U.S.

The network of overlap (or spread) of issues across individuals is shown on Figure 4 (3c), although such research may fall outside the scope of traditional agenda-setting scholarship.

Comparisons of issue associations across different agendas present another possibility (3d). This type of model was used in a study by Guo and McCombs (2011) examining media and public agendas during Texas gubernatorial and U.S. senatorial elections. The analysis compares two issue networks. One of the networks represents conceptual associations between political figures and their attributes, extracted from media content. The other is based on similar associations reported by local residents. As the two concept maps exhibit high levels of similarity, Guo and McCombs conclude that media may be able to influence relations between objects and attributes perceived by audience members. The process is referred to as *third-level* or *network* agenda-setting (NAS). Subsequent works in this line of research have examined issue networks extracted from political content on Twitter (Guo & Vargo, 2015; Vargo, Guo, McCombs, & Shaw, 2014).

Conclusion

The agenda-setting framework described here provides a relevant example of a network approach to mass communication theories and effects. That model, or various equivalents of its reduced forms, have already been used to explore key issues facing mass communication including media homogenization (Ognyanova, 2013) and audience fragmentation (Webster, 2014).

The stronger emphasis on computational social science and network thinking (both quantitative and qualitative) is one important trend that holds potential for advancing the theoretical and methodological sophistication of media studies.

Another major factor in that respect discussed here is the increasing availability of large-scale digital trace data recording individual, group, and organizational behavior (Pentland, 2014). That includes not only the now-dominant social networking platform datasets, but also raw media content, mobile device data, online activity captured through server logs, web archival data, various relevant text corpora, and more.

Finally and of key importance: the field of communication studies as a whole, and media research in particular, need to face up to challenges related to research openness, transparency, and replicability. Journal policies and institutional practices encouraging data and code sharing, detailed analysis descriptions, and publication of replication studies, can do a lot to improve the ability of scholars to validate and build on existing research.

References

- Almquist, Z. W., & Butts, C. T. (2013). Dynamic network logistic regression: A logistic choice analysis of inter-and intra-group blog citation dynamics in the 2004 US presidential election. *Political Analysis, 21*(4), 430-448.
- Anderson, C. W. (2010). Journalistic Networks and the Diffusion of Local News: The Brief, Happy News Life of the “Francisville Four”. *Political Communication, 27*(3), 289-309.
- Arsenault, A., & Castells, M. (2008). The Structure and Dynamics of Global Multi-Media Business Networks. *International Journal of Communication, 2*, 707-748.
- Baker, W. E., & Faulkner, R. R. (2002). Interorganizational networks. In J. A. C. Baum (Ed.), *The Blackwell companion to organizations*. (pp. 520-540): Oxford: Blackwell Publishers Ltd.
- Bakshy, E., Messing, S., & Adamic, L. (2015). Exposure to ideologically diverse news and opinion on Facebook. *Science, 348*(6239), 1130-1132.
- Barthel, M., Shearer, E., Gottfried, J., & Mitchell, A. (2015). *The Evolving Role of News on Twitter and Facebook*. Washington, DC: Pew Research Center.
- Barzilai-Nahon, K. (2008). Toward a theory of network gatekeeping: A framework for exploring information control. *Journal of the American Society for Information Science and Technology, 59*(9), 1493-1512.
- Bennett, W. L., & Iyengar, S. (2008). A New Era of Minimal Effects? The Changing Foundations of Political Communication. *Journal of Communication, 58*(4), 707–731.
- Bennett, W. L., & Manheim, J. B. (2006). The One-Step Flow of Communication. *The ANNALS of the American Academy of Political and Social Science, 608*(1), 213.
- Blumler, J. G., & Kavanagh, D. (1999). The Third Age of Political Communication: Influences and Features. *Political Communication, 16*(3), 209-230.
- Boczkowski, P. J. (2010). *News at work: Imitation in an age of information abundance*. Chicago, IL: University Of Chicago Press.

- Boczkowski, P. J., & De Santos, M. (2007). When more media equals less news: Patterns of content homogenization in Argentina's leading print and online newspapers. *Political Communication*, 24(2), 167-180.
- Borgatti, S. P. (Ed.) (2009) *Encyclopedia of Complexity and System Science*.
- Borgatti, S. P., & Everett, M. G. (2006). A Graph-theoretic perspective on centrality. *Social Networks*, 28(4), 466-484.
- Borgatti, S. P., & Halgin, D. S. (2010). *Analyzing Affiliation Networks*. Lexington, KY: LINKS Center for Social Network Analysis, University of Kentucky. Lexington.
- Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network analysis in the social sciences. *Science*, 323(5916), 892.
- Brosius, H. B., & Weimann, G. (1996). Who Sets the Agenda: Agenda-Setting as a Two-Step Flow. *Communication Research*, 23(5), 561-580.
- Cardoso, G. (2006). *The Media in the Network Society: Browsing, News, Filters and Citizenship*. Lisboa, Portugal: CIES-ISCTE.
- Castells, M. (2005). Informationalism, Networks, And The Network Society: A Theoretical Blueprint. In M. Castells (Ed.), *The network society: A cross-cultural perspective* (pp. 3-45). London, UK: Edward Elgar Publishing.
- Chaffee, S. H., & Metzger, M. J. (2001). The End of Mass Communication? *Mass Communication & Society*, 4(4), 365-379.
- Cointet, J. P., & Roth, C. (2009). *Socio-semantic dynamics in a blog network*. Paper presented at the IEEE SocialCom 09 International Conference Social Computing.
- Coleman, R., McCombs, M., Shaw, D., & Weaver, D. (2008). Agenda Setting. In K. Wahl-Jorgensen & T. Hanitzsch (Eds.), *Handbook of Journalism Studies* (pp. 147). New York, NY: Routledge.
- Contractor, N., Monge, P., & Leonardi, P. (2011). Multidimensional networks and the dynamics of sociomateriality: Bringing technology inside the network. *International Journal of Communication*, 5, 682-720.

- Conway, B. A., Kenski, K., & Wang, D. (2015). The Rise of Twitter in the Political Campaign: Searching for Intermedia Agenda-Setting Effects in the Presidential Primary. *Journal of Computer-Mediated Communication*, 20, 363-380.
- Crosas, M., King, G., Honaker, J., & Sweeney, L. (2015). Automating Open Science for Big Data. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 260-273.
- DART Group. (2015). Data Access and Research Transparency: A Joint Statement by Political Science Journal Editors. *Comparative Political Studies August 2015 vol. 48 no. 9 1091-1092*, 48(9), 1091-1092.
- Dawkins, R. (2006). *The Selfish Gene* (3rd ed.). New York, NY: Oxford University Press.
- Dearing, J. W., & Rogers, E. M. (1996). *Agenda-Setting*. Thousand Oaks, CA: Sage Publications.
- Diesner, J., & Carley, K. M. (2005). Revealing social structure from texts: meta-matrix text analysis as a novel method for network text analysis. In V. K. Narayanan & D. J. Armstrong (Eds.), *Causal Mapping for Research in Information Technology* (pp. 81-108). Hershey, PA: IGI Global.
- Dimmick, J. W. (2003). *Media Competition and Coexistence: the theory of the Niche*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Djerf-Pierre, M. (2012). The Crowding-Out Effect: Issue dynamics and attention to environmental issues in television news reporting over 30 years. *Journalism Studies*, 13(4).
- Driscoll, K., & Thorson, K. (2015). Searching and Clustering Methodologies: Connecting Political Communication Content across Platforms. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 134-148.
- Easley, D., & Kleinberg, J. (2010). *Networks, Crowds, and Markets: Reasoning About a Highly Connected World* New York, NY: Cambridge University Press.
- Epstein, R., & Robertson, R. E. (2015). The search engine manipulation effect (SEME) and its possible impact on the outcomes of elections. *Proceedings of the National Academy of Sciences (PNAS)*.
- Freelon, D. (2014). On the Interpretation of Digital Trace Data in Communication and Social Computing Research. *Journal of Broadcasting & Electronic Media*, 58(1), 59-75.

- Freeman, L. C. (1979). Centrality in social networks conceptual clarification. *Social Networks*, 1(3), 215-239.
- Friedland, L. A., Napoli, P. M., Ognyanova, K., Weil, C., & Wilson, E. J. (2012). *Review of the Literature Regarding Critical Information Needs of the American Public*. Washington, DC: Federal Communications Commission.
- Gentzkow, M., & Shapiro, J. M. (2010). *Ideological segregation online and offline*: National Bureau of Economic Research.
- Goldhaber, M. H. (1997). The attention economy and the net. *First Monday*, 2(4-7).
- González-Bailón, S., & Paltoglou, G. (2015). Signals of Public Opinion in Online Communication A Comparison of Methods and Data Sources. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 95-107.
- González-Bailón, S., Banchs, R. E., & Kaltenbrunner, A. (2012). Emotions, Public Opinion, and US Presidential Approval Rates: A 5-Year Analysis of Online Political Discussions. *Human Communication Research*, 38(2), 121-143.
- Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360-1380.
- Guo, L., & McCombs, M. (2011). *Network Agenda Setting: A Third Level of Media Effects*. Paper presented at the Annual Meeting of the International Communication Association (ICA).
- Guo, L., & Vargo, C. (2015). The Power of Message Networks: A Big-Data Analysis of the Network Agenda Setting Model and Issue Ownership. *Mass Communication and Society*, 1-20.
- Hargittai, E. (2015). Is Bigger Always Better? Potential Biases of Big Data Derived from Social Network Sites. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 63-76.
- Hindman, M. (2011). *Less of the Same: The Lack of Local News on the Internet*. Washington, DC: Federal Communications Commission.
- Holbert, R. L., Garrett, R. K., & Gleason, L. S. (2010). A New Era of Minimal Effects? A Response to Bennett and Iyengar. *Journal of Communication*, 60(1), 15 - 34.

- Holbert, R. L., Hmielowski, J. D., & Weeks, B. E. (2012). Clarifying Relationships Between Ideology and Ideologically Oriented Cable TV News Use: A Case of Suppression. *Communication Research, 39*(2), 194-216.
- Jungherr, A. (2014). The Logic of Political Coverage on Twitter: Temporal Dynamics and Content. *Journal of Communication, 64*(2), 239-259.
- Katz, E., & Lazarsfeld, P. F. (1955). *Personal influence: The part played by people in the flow of mass communication*. Glencoe, IL: The Free Press.
- Kaye, J., & Quinn, S. (2010). *Funding Journalism in the Digital Age: Business Models, Strategies, Issues and Trends*. New York, NY: Peter Lang Publishing.
- Kim, Y. C., & Ball-Rokeach, S. J. (2006). Community storytelling network, neighborhood context, and civic engagement: A multilevel approach. *Human Communication Research, 32*(4), 411-439.
- Kiousis, S. (2004). Explicating media salience: A factor analysis of New York Times issue coverage during the 2000 US presidential election. *Journal of Communication, 54*(1), 71-87.
- Kleinnijenhuis, J., Schultz, F., & Oegema, D. (2015). Frame Complexity and the Financial Crisis: A Comparison of the United States, the United Kingdom, and Germany in the Period 2007–2012. *Journal of Communication, 65*(1), 1-23.
- Kwak, H., Lee, C., Park, H., & Moon, S. (2010). *What is Twitter, a Social Network or a News Media?* Paper presented at the World Wide Web Conference
- Lazer, D. (2015). The rise of the social algorithm. *Science, 348*(6239), 1090-1091.
- Lazer, D., Pentland, A., Adamic, L., Aral, S., Barabasi, A. L., Brewer, D., et al. (2009). Life in the network: the coming age of computational social science. *Science, 323*(5915), 721.
- Leskovec, J., Backstrom, L., & Kleinberg, J. (2009). *Meme-tracking and the dynamics of the news cycle*. Paper presented at the The 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, Paris, France.
- Leskovec, J., McGlohon, M., Faloutsos, C., Glance, N., & Hurst, M. (2007, April). *Cascading behavior in large blog graphs: Patterns and a model*. Paper presented at the Society of Applied and Industrial Mathematics Conference on Data Mining.

- McChesney, R. W., & Nichols, J. (2010). *The Death and Life of American Journalism: The Media Revolution that Will Begin the World Again*. Philadelphia, PA: Nation Books.
- McCombs, M. (2004). *Setting the Agenda: The Mass Media and Public Opinion*. Cambridge, UK: Polity Press.
- McCombs, M. (2005). A Look at Agenda-setting: past, present and future. *Journalism Studies*, 6(4), 543-557.
- McCombs, M. (2010). Extending our theoretical maps: Psychology of agenda-setting. *Central European Journal of Communication*, 3(2), 197-206.
- McCombs, M., Holbert, R. L., Kioussis, S., & Wanta, W. (2011). *The News and Public Opinion: Media Effects on Civic Life*. Malden, MA: Polity.
- McCombs, M., & Reynolds, A. (2009). How the News Shapes Our Civic Agenda. In J. Bryant & M. B. Oliver (Eds.), *Media Effects: Advances in Theory and Research* (3rd ed.). New York, NY: Routledge.
- McCombs, M., & Shaw, D. (1972). The Agenda-Setting Function of Mass Media. *Public Opinion Quarterly*, 36(2), 176.
- McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415-444.
- Miel, P., & Faris, R. (2008). News and information as digital media come of age, *Media Re:public*: Berkman Center for Internet & Society.
- Mitchelstein, E., & Boczkowski, P. J. (2009). Between tradition and change: A review of recent research on online news production. *Journalism*, 10(5), 562.
- Monge, P., & Contractor, N. (2003). *Theories of Communication Networks*. New York, NY: Oxford University Press, USA.
- Nagler, M. G. (2007). Understanding the Internet's Relevance to Media Ownership Policy a Model of Too Many Choices. *The B.E. Journal of Economic Analysis & Policy*, 7(1), 1-29.

- Neuman, W. R., Guggenheim, L., Jang, S. M., & Bae, S. Y. (2014). The Dynamics of Public Attention: Agenda-Setting Theory Meets Big Data. *Journal of Communication, 64*(2), 193-214.
- Nosek, B., Alter, G., Banks, G., Borsboom, D., Bowman, S., Breckler, S., et al. (2015). Promoting an open research culture. *Science, 348*(6242), 1422-1425.
- Ognyanova, K. (2013). *Intermedia agenda setting in an era of fragmentation: Applications of network science in the study of mass communication*. University of Southern California, Los Angeles, CA.
- Ognyanova, K., & Monge, P. (2012). *A Multilevel, Multidimensional Network Model of the Media System: Production, Content, and Audiences*. Paper presented at the International Network for Social Network Analysis (INSNA) Sunbelt Conference.
- Oh, J., Susarla, A., & Tan, Y. (2008). Examining the Diffusion of User-Generated Content in Online Social Networks. *SSRN*. Retrieved from ssrn.com/abstract=1182631
- Pariser, E. (2011). *The filter bubble: How the new personalized web is changing what we read and how we think*. New York, NY: Penguin Press.
- Parks, M. R. (2014). Big Data in Communication Research: Its Contents and Discontents. *Journal of Communication, 64*(2), 355-360.
- Pentland, A. (2014). *Social Physics: How Good Ideas Spread - The Lessons from a New Science*. New York, NY: Penguin Group.
- Perloff, R. M. (2014). Mass Communication Research at the Crossroads: Definitional Issues and Theoretical Directions for Mass and Political Communication Scholarship in an Age of Online Media. *Mass Communication and Society, 1*-26.
- Pew Project For Excellence in Journalism. (2010). *New Media, Old Media: The Blogosphere*. Retrieved June 21st, 2012, from www.journalism.org/analysis_report/blogosphere
- Pew Research Center. (2010). *The State of The News Media 2010: An Annual Report on American Journalism*. Washington, DC: Pew Research Center.
- Pew Research Center. (2011). *The State of The News Media 2011: An Annual Report on American Journalism*. Washington, DC: Pew Research Center.

- Pew Research Center. (2015). *The State of The News Media 2015: An Annual Report on American Journalism*. Washington, DC: Pew Research Center.
- Roessler, P. (2008). Agenda-Setting, Framing and Priming. In W. Donsbach & M. W. Traugott (Eds.), *The Sage Handbook of Public Opinion Research* (pp. 205). Thousand Oaks, CA: Sage Publications.
- Shah, D. V., Cappella, J. N., & Neuman, W. R. (2015). Big Data, Digital Media, and Computational Social Science Possibilities and Perils. *The ANNALS of the American Academy of Political and Social Science*, 659(1), 6-13.
- Shah, D. V., McLeod, D., Gotlieb, M., & Lee, N.-J. (2009). Framing and Agenda-Setting. In R. L. Nabi & M. B. Oliver (Eds.), *The Sage Handbook of Media Processes and Effects* (pp. 83-98). Thousand Oaks, CA: Sage Publications.
- Shehata, A., & Stromback, J. (2013). Not (Yet) a New Era of Minimal Effects A Study of Agenda Setting at the Aggregate and Individual Levels. *The International Journal of Press/Politics*, 18(2), 234-255.
- Soroka, S. N., Stecula, D. A., & Wlezien, C. (2015). It's (Change in) the (Future) Economy, Stupid: Economic Indicators, the Media, and Public Opinion. *American Journal of Political Science*, 59(2), 457-474.
- Stroud, N. J. (2011). *Niche news: The politics of news choice*. New York, NY: Oxford Univ Press.
- Sunstein, C. R. (2007). *Republic.com 2.0*. Princeton, NJ: Princeton University Press.
- Sunstein, C. R. (2009). *Going to Extremes: How Like Minds Unite and Divide*. New York, NY: Oxford University Press.
- Takeshita, T. (2006). Current Critical Problems in Agenda-Setting Research. *International Journal of Public Opinion Research*, 18(3), 275.
- Tewksbury, D. (2005). The Seeds of Audience Fragmentation: Specialization in the Use of Online News Sites. *Journal of Broadcasting and Electronic Media*, 49, 332-348.
- Turow, J., & Tsui, L. (Eds.). (2008). *The Hyperlinked Society: Questioning Connections in the Digital Age*. Ann Arbor, MI: University of Michigan Press.

- Valente, T. W. (1996). Social network thresholds in the diffusion of innovations. *Social Networks*, 18(1), 69-89.
- Vargo, C. J., Guo, L., McCombs, M., & Shaw, D. (2014). Network Issue Agendas on Twitter During the 2012 U.S. Presidential Election. *Journal of Communication*, 64(2), 296-316.
- Wanta, W. (1997). *The Public and the National Agenda: How People Learn about Important Issues*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Wanta, W., & Ghanem, S. (2007). Effects of Agenda-Setting. In R. W. Preiss, B. M. Gayle, N. Burrell, M. Allen & J. Bryant (Eds.), *Mass media effects research: Advances through meta-analysis* (pp. 37-51). New York, NY: Lawrence Erlbaum Associates.
- Wanta, W., & Hu, Y. W. (1994). The Effects of Credibility, Reliance, and Exposure on Media Agenda-Setting: A Path Analysis Model. *Journalism & Mass Communication Quarterly*, 71(1), 90-98.
- Wanta, W., & Wu, Y. C. (1992). Interpersonal communication and the agenda-setting process. *Journalism & Mass Communication Quarterly*, 69(4), 847-855.
- Wasserman, S., & Faust, K. (1994). *Social Network Analysis: Methods and Applications*. New York, NY: Cambridge University Press.
- Weber, M. (2012). Newspapers and the Long-Term Implications of Hyperlinking. *Journal of Computer-Mediated Communication*, 17(2), 187-201.
- Weber, M., & Monge, P. (2011). The Flow of Digital News in a Network of Authorities, Hubs and Providers. *Journal of Communication*, 61(6), 1062-1081.
- Webster, J. G. (2014). *The Marketplace of Attention: How Audiences Take Shape in a Digital Age*: MIT Press.
- Webster, J. G., & Ksiazek, T. B. (2012). The Dynamics of Audience Fragmentation: Public Attention in an Age of Digital Media. *Journal of Communication*, 62(1), 39-56.
- Williams, B. A., & Delli Carpini, M. X. (2000). Unchained reaction: The collapse of media gatekeeping and the Clinton-Lewinsky scandal. *Journalism*, 1(1), 61.

Williams, B. A., & Delli Carpini, M. X. (2004). Monica and Bill all the time and everywhere: The Collapse of Gatekeeping and Agenda Setting in the New Media Environment. *American Behavioral Scientist*, 47(9), 1208-1230.

Williams, B. A., & Delli Carpini, M. X. (2011). *After Broadcast News: Media Regimes, Democracy, and the New Information Environment*. New York, NY: Cambridge University Press.

Wu, S., Hofman, J. M., Watts, D. J., & Mason, W. A. (2010). *Who Says What to Whom on Twitter*. Paper presented at the International World Wide Web Conference, Hyderabad, India.