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# Information Flow in the 21st Century: The Dynamics of Agenda-Uptake

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Although the theory of agenda-setting is a pillar of political communication research, understanding the dynamics of public attention remains an important challenge as the communication system becomes increasingly fragmented. The development of ideologically oriented niche media and the ability of the mainstream media to carefully track the interests of their audience suggest that both public interest and niche media attention to an issue could affect the mainstream media's agenda itself. We develop and test the theory of agenda-uptake to isolate when mainstream media influences both public and niche media attention to issues *and* when public interest and niche media attention influence the mainstream media to cover an issue. Analyzing mainstream and niche media coverage along with Google Trends individual search data for 4 issues in 2008, we provide evidence that

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the dynamics of agenda-uptake are crucial to understanding the character and content of the information environment in the 21st century.

The digital information environment is a fragmented one. Indeed, describing the process of fragmentation and its consequences is the major story of the past 30 years of scholarship examining information and communication in democratic political systems. Although some scholars have provided evidence that this fragmentation has served to polarize the American public (Iyengar & Hahn, 2009; Levendusky, 2013; Prior, 2007), others note that the largest effects of the new media environment mostly affect those who are least like to be exposed to it (Arceneaux & Johnson, 2013). Crucial to any theoretical and empirical endeavor aimed at casting a revealing light on the flow of information in the 21st century is a thorough understanding of how the news media's agenda operates in an increasingly fragmented information environment.

A prominent argument considering the consequences of information and communication in political systems is that a "new era of minimal effects" is here (Bennett & Iyengar, 2008; but see Holbert, Garrett, & Gleason, 2010). Agenda-setting pioneer Maxwell McCombs (2004) expressed deep skepticism that agenda-setting will wither in a fragmented environment, noting that the opening block of network newscasts and the front page of newspapers continue to generally look the same and that "there will still be a relatively homogenous media agenda, at least until someone invents a new kind of news that eclipses the traditional news audience" (p. 149).

The agenda-setting effect is the most successful demonstration of mass media effects in political communication scholarship (McCombs, 2004). More than 400 studies demonstrate that sustained media attention to an issue predicts citizens' attention to that issue. Whether in the lab (Miller, 2007) or the field (McCombs & Shaw, 1972; Shehata, 2010), scholars find that when the mass media's agenda is accessible and relevant, it shapes the public's agenda.

Still, several questions remain concerning information flow in a democratic society, including whether the causal arrow solely flows from the media to the public, how agenda-setting operates in the digital age, and how best to measure the public's issue agenda (Weaver, 2014). We argue that changes in the media ecology have brought concomitant changes in the relationships between news organizations and their audiences that require new theory and new empirical testing about information flow in advanced industrial democracies.

We offer a 21st-century account of information flow by introducing the theory of agenda-uptake via a series of hypotheses seeking to explain the dynamics between the mainstream media, niche media, and people with respect to the issues that make it to various news outlets' agendas or sufficiently interest a

citizen to seek out more information about the issue. We make two contributions to the study of the flow of political information in modern democracies. First, we show that the direction(s) of agenda-setting's causal arrow(s) between the mainstream media (MSM), the public, and ideological media depends upon whether the MSM are in "alarm mode," "patrol mode," or both (Boydston, 2013) and on whether the issue is obtrusive, appeals to issue publics, or is a scandal. Second, we highlight a new measure of the public's issue agenda: tracking individual Internet searches about politics through Google Trends.

### THE THEORY OF AGENDA UPTAKE

Although agenda-setting is most often examined in terms of how news coverage affects the issues people find to be important, the original hypothesis was more general. Agenda-setting is about transmitting salience from the agenda of one entity to another (McCombs, 2004). Although not solely concerned with transmitting salience *from* the media agenda *to* the public, the agenda-setting research phases articulated by McCombs (2004) are heavily weighted toward studying how the media agenda affects the public agenda (Phase 1), when Phase 1 is most likely (Phase 2), and how the media's agenda affects public comprehension (Phase 3). It is almost always tested as though it is unidirectional: The news media set the public's issue agenda (Funkhouser, 1973).

Attempts to influence the media agenda are sometimes characterized as agenda-building, with influences coming from various sources. Although Scheufele and Tewksbury (2007) noted that agenda-building differs from agenda-setting in that it refers to "message construction rather than media effects," (p. 12) and Weaver and Elliott (1985) argued that agenda-building "is more concerned with how issues originate, or how subjects of news coverage become issues, than with the media-audience relationship studied so often by agenda-setting researchers" (p. 88), there is enough conceptual overlap between the two traditions to investigate the dynamics of how issues get on the agenda and what happens once different issues, via multiple media platforms, get there.

Reese (1990) noted that the media agenda is an exercise in power from competing sources, including the real world (Ader, 1995), elites (Kanervo & Kanervo, 1995), presidents (Eshbaugh-Soha & Peake, 2004; Peake & Eshbaugh-Soha, 2008; Wanta, 1992; Wood & Peake, 1998), and the public (Stevenson, Gonzenbach, & David, 1994). Rogers et al. (1991) looked at "multiple agendas," examining the media agenda, real-world indicators (AIDS cases), public policy agenda (public funding), and the general public (polling data). Studies testing what affects the media's agenda are rare and are generally conceptualized as independent from the factors affecting the public's agenda (but see Dearing & Rogers, 1996; Uscinski, 2009). McCombs (2004, p. 117) identified three factors

regarding who sets the media's agenda: major sources who provide the information for stories, other news organizations, and journalism's norms and traditions.

Notably absent from this list is public attention. In the digital media environment, technology enables multiple paths of influence (not only government officials but also private interests and foreign and domestic professional communicators acting on behalf of other interests) on the media agenda *and* the public agenda, with direct influence from independent actors through, for example, YouTube and social media. Boydston (2013) argued that eight features affect the media's agenda: *public attention*, the media's institutional structure, real events, congestion, policymaker attention, discussion diversity, context, and prior attention.<sup>1</sup> We are interested in directly testing the relevance of public attention and prior media attention.

Agenda-uptake refers to the conditions under which the salience of an issue is transferred between the agendas of multiple sets of actors. Unlike traditional claims that the agenda-setting hypothesis is "a statement about strong causal effect of mass communication on the public—the transfer of salience from the media agenda to the public agenda" (McCombs, 2004, p. 5), agenda-uptake is dynamic; the transfer of salience between agendas is multidirectional and includes the conditions under which the public can affect different kinds of news organizations' agendas. We use the term "uptake" instead of "agenda-adoption," or "agenda-melding" because of the variable—and often brief—nature of the process (see also Watt, Mazza, & Snyder, 1993).

Agenda-uptake requires that relevant actors in a news mediated environment—the mainstream news media, niche news outlets, individual media consumers and various political elites—recognize and act on the behavior of other relevant actors within the context of their own particular goals and capabilities (Sulkin, 2005). Intermediate agenda-setting has been studied (Atwater et al., 1987; Trumbo, 1995—who looked at the science press, opinion polls, and the Congressional Record agendas), but our focus is on the transfer of issue salience among multiple actors in the digital media environment. Agenda-uptake provides a theoretical link between agendas in this environment, including niche and legacy media and online searches.

We argue that various actors within the digital information environment stand to gain attention by reacting to another actor's agenda by giving attention, for a short time, to another actor's agenda at the expense of covering other issues (Boydston, 2013; Sulkin, 2005). For example, following intermediate agenda-setting work (Reese & Danielian, 1989) showing how media agendas can be shaped by different media outlets, Wu, Atkin, Mour, Lin, and Lau (2013) found Sina Weibo's (known colloquially as "China's Twitter") affected Chinese newspaper agendas.

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<sup>1</sup> See also Weaver (1994) on the potential role of "nontraditional" media with respect to fostering citizen involvement in politics.

Previous examinations of multiple information flows highlight the importance of issue attributes such as salience and complexity in generating predictions about what will set various actors' agendas (Eshbaugh-Soha & Peake, 2004; Gormley, 1986). Salience is dynamic and varies over time, especially with respect to issue type. Although there are many ways to conceive of issues, we believe that three are especially relevant for the study of agenda-uptake in an electoral environment—our focus in this article.<sup>2</sup> First, some issues are obtrusive, or ubiquitous (Uscinski, 2009), such as the state of the economy (Vavreck, 2009) or foreign policy crises (Zaller & Chiu, 1996) and are especially important when it comes to influencing citizens' voting calculations. These issues are prime candidates for the "typical" agenda-setting effect: Increased media coverage of an issue results in individuals believing that issue is important. Ubiquitous issues are regularly covered by the MSM due to their newsworthiness and because of their importance to an audience (Eshbaugh-Soha & Peake, 2004; Uscinski, 2009). In an era of "writing for clicks" and search engine optimization (Goode, 2009), modern analytic tools allow the MSM to be responsive to audience interest in their coverage. Thus, the MSM should be likely to cover ubiquitous issues more often after the public or niche news outlets show interest in the issues.

Topics that capture the attention of highly motivated policy activists are a second relevant set of political issues to examine in the study of the transmission of salience from one entity to another. Some individuals use the media to keep tabs on issues that they are uniquely dedicated to following, such as abortion (Kim, 2007). Members of these "issue publics" are politically engaged, voracious consumers of news about the topics that interest them most, and likely inspire niche-oriented outlets to cover these issues with regularity as their audiences are more ideologically oriented. Krosnick (1990) showed that the public is divided into several small issue publics, all of which tend to care about issues that are viewed as newsworthy by journalists, incentivizing media outlets to cover them even if they do not have broad appeal.

News organizations are predisposed to cover ubiquitous and issue public-oriented issues. Candidates strategically choose whether and how to attend to these issues (Vavreck, 2009). A third set of politically relevant issues that candidates must deal with, especially in election season, are often not of their own choosing: scandals (Nyhan, 2014). Just as scandals vary in their nature and applicability to a candidate's ability to govern, coverage of scandals can move through the news cycle quickly or become full-blown media "frenzies" (Gruszczynski, 2015; Sabato, 2000).

Although obtrusive, issue public-oriented, and scandalous issues have important attributes, agenda-uptake is also dependent upon the type of news coverage

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<sup>2</sup>These are provisional issues, not bread and butter (sports) or seasonal issues (elections; Boydston, 2013).

each of these issues is likely to experience in news coverage. To systematically explore how models of coverage and types of issues converge to make the transfer of salience from one entity to another more likely, we turn to Boydston's alarm/patrol hybrid model, which combines two prominent models of news coverage: the patrol model, positing that news organizations and reporters regularly walk their "beats" to relay threats to their audience, and the alarm model, in which a more efficient media sounds alarms on the rare occasions that an issue is important enough to orient citizens' attention away from their lives and toward responding to the alarm (Bennett, 2003; Zaller, 2003).

Rather than prescriptive models of how the media *should* operate, the alarm/patrol hybrid model explains how news attention *does* operate. The model conceptualizes the media's agenda into four categories. First, coverage could come in alarm mode—a short burst of coverage followed by little else. Second, the media might engage in patrol mode, providing regular, reliable, and durable attention to a topic. Third, neither mode might be operational, thus producing little to no coverage. Finally, coverage might begin with an alarm and then be followed by extensive patrolling creating a "sustained media explosion" (Boydston, 2013, p. 64).

Ubiquitous issues like an ongoing war or economic crisis fit the alarm/patrol hybrid model of coverage because many key policy actors are involved, public concern is usually high, and a variety of frames are available to discuss the issue (Boydston, 2013; Uscinski, 2009). Topics of interest to issue publics fit the patrol model of coverage as they tend to be less event driven, even though they are also characterized by public concern and elite interest (Kim, 2007). Most scandals are event driven but do not reach sustained interest levels that would cause regularized media patrols of the issue. Thus, these best fit the alarm model of coverage (Boydston, 2013, p. 65). Exceptions certainly exist to our conceptualization, and issues may experience movement between types of coverage under certain conditions, but this formulation illustrates how news coverage of important types of political issues generally works in practice.

The theory of agenda-uptake provides an explanation for when we should expect (a) the mainstream media's agenda to influence niche media's agenda and/or the public's agenda, (b) niche media's agenda to influence the mainstream media's agenda and/or the public's agenda, and (c) the public's agenda to influence the mainstream media's and/or niche media's agenda. We do not expect everything to cause everything with impunity. These expectations have theoretical roots in Trumbo's (1995) study of the agenda-setting process across specialty media, mainstream media, and aggregate public attention, though Trumbo recommends examining one issue at a time and does not distinguish between how different types of issues may be covered by various media outlets or how individual information searching may respond to or even lead those dynamics.

To test how the incentives of mainstream and new media respond to different models of coverage, public reactions, and types of issues, we choose to test the hypotheses we develop next by using data from the last 3 months of the 2008 presidential contest between Barack Obama and John McCain. On one hand, relying on an election season firmly roots us in the agenda-setting tradition. On the other hand, it is important to keep in mind that what we find may be limited to electoral cycles and be less applicable to times in between elections.

Patrol-based coverage should be less likely to foster a traditional agenda-setting effect from the MSM to the public, as issue publics are already seeking all the information they can find about an issue due to their long-standing commitment to the issue (Kim, 2009). Regular patrols signal that an issue is important, but they are not likely to engender *sustained* increases in public interest unless the salience of the patrol ratchets up considerably. However, the MSM are likely to be influenced by both increased public attention to patrol issues and increased attention from niche media. The MSM already devote resources to patrolling several issues and could quickly increase the attention they provide an issue without stressing their already diminished resources should they learn that people or competing, but niche-oriented, outlets are giving the issue more attention. Regarding niche media, attention from either audience members or the MSM would be likely to create serious incentives to ratchet up their coverage of issue public topics because niche news audiences are more ideologically oriented and actively seek out coverage of issues they care about (Stroud, 2011) and MSM attention helps provide legitimacy to niche agendas.

Our first hypotheses use the abortion issue to represent issues that focus on patrols, but relatively rarely experience highly skewed attention (alarms). The public, writ large, is not likely to pay a great deal of attention to patrols on the abortion issue—patrols that have broadly persisted since the 1970s (Wagner & Gruszczynski, 2016)—even though members of issue publics certainly will. Given that Google Trends data do not allow us to distinguish among individuals so that we might try to discern whether they are members of an issue public, we cannot precisely test how issue public members themselves react to MSM and new media coverage of “their” issues, but we can examine whether general spikes in searches for abortion precede niche media and MSM coverage. For the abortion (patrol) issue:

- H1a: The public agenda will not take up MSM or niche media’s attention to the issue.
- H1b: The mainstream media will uptake the agendas of the niche media and the public.
- H1c: Niche media will uptake the agendas of both the mainstream media and the public.

We operationalize our second set of hypotheses with issues that regularly receive both alarm and patrolling attention from the media—the economy and the war with Iraq. International affairs, defense, economic, and government performance issues typically lead the MSM’s agenda (Boydston, 2013, pp. 90, 94) due, in part, to traditional notions of newsworthiness and general reporting routines. Obtrusive issues are likely to produce a classic agenda-setting effect given how often they are covered in an alarm/patrol hybrid fashion. Modern analytic tools also allow them to be more responsive to audience interest in their coverage (Neuman, Guggenheim, Jang, & Bae, 2014); this should mean that the MSM would cover ubiquitous issues more often after the public shows an interest.<sup>3</sup> On the other hand, because the MSM are already likely to be paying substantial attention to ubiquitous issues, niche coverage of the same topics are not likely to affect the MSM’s agenda in the way niche outlets do on specialized issues they cover (Williams & Delli Carpini, 2011). Regarding niche media itself, finding their own unique take on the major issues of the day respects the traditional role of the MSM as an agenda-setter while serving niche outlets’ desires to be responsive to the interests of their users (Gruszczynski, 2015). For these issues:

H2a: The public agenda will uptake both the mainstream and niche media’s agendas.

H2b: Mainstream media will uptake the public’s agenda but not the niche media’s agenda.

H2c: Niche media’s agenda will uptake the public’s agenda but not the MSM’s agenda.

Our final hypotheses test agenda-uptake for issues containing alarms without patrols. We operationalize this by using the scandal of Barack Obama calling the McCain–Palin economic plan as something akin to putting “lipstick on a pig.” The GOP team quickly claimed this was a gender-coded attack on Palin, who famously told a joke about the difference between a pit bull and a “hockey mom” (lipstick). The Obama team called such claims a “pathetic attempt to play the gender card” (Sinderbrand, Johnson, & Welch, 2008). Boydston (2013) speculated that soft news stories like these would generate alarms while not being likely to cause future patrols.

Traditionally, we might have expected the MSM to cover only briefly a scandal like this one as it first emerged, but the era of niche news outlets pushing stories like these should pressure MSM outlets to keep attention on the potential

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<sup>3</sup> Sayre, Bode, Shah, Wilcox, and Shar (2010) showed how, when comparing MSM, YouTube posts, and online news, the MSM “led the way” in the election cycle but was somewhat supplanted by social media after the election (p. 24).

scandal for longer than they otherwise would have so the MSM can avoid niche outlets and political activists labeling the MSM for being biased when they ignore scandals that might harm one political party and benefit another (Watts, Domke, Shah, & Fan, 1999). Alarm coverage without follow-up patrols or sustained explosion should not transfer salience about these kinds of scandals to members of the public. Even though the “lipstick scandal” is an unobtrusive issue, and thus a prime candidate for agenda-setting, we do not expect the MSM to affect public searches for the issue because we do not expect the MSM’s coverage to be sustained for a long-enough period to produce the public interest (McCombs, 2004; Watt et al., 1993). For these issues:

- H3a: The public agenda will not take up mainstream or niche media’s focus on a scandal.
- H3b: The MSM will uptake the agenda of niche media attention but not the public.
- H3c: Both the public agenda and the mainstream media agenda will lead to niche media taking up the scandal onto its own agenda.

## WEB SEARCH AS A MEASURE OF THE PUBLIC’S AGENDA IN A 21ST-CENTURY MEDIA ENVIRONMENT

Crucial to the testing of our hypotheses is a reliable measure of the public’s agenda. When measuring changes in the public’s issue agenda, Gallup’s Most Important Problem (MIP) question is agenda-setting’s 800-lb gorilla. Generally used as a dependent variable to show how the media’s agenda affect the public’s agenda, Uscinski (2009) used MIP data with news coverage over decades, finding evidence ( $p < .10$ ) that the public can affect the media’s agenda.

Even in studies using more constrained thresholds of statistical significance, use of the MIP question as a gauge for the presence or absence of agenda-setting does not wholly capture media-public dynamics. First, it is impossible to know whether people are naming the issue most important to themselves or to the country (Yeager, Larson, Krosnick, & Tompson, 2011). Weaver, Graber, McCombs, and Eyal (1981) used different MIP questions to show that increased discussion in personal networks led to a greater similarity between personal issue agendas and societal issue agendas by the end of a campaign, but the careful parsing of personal and intrapersonal agendas is typically absent in agenda-setting research. The closeness of these two agendas at the end of a campaign does not mean that typical MIP questions distinguish between the two agendas at other points in time. Second, the MIP question conflates two aspects of issue salience: the importance of the issue and the degree to which it is a problem

(Wlezien, 2005). Third, MIP polling done by Gallup typically occurs on a monthly basis, which is problematic given the ever-quickening news cycle.

We use an alternative measure to tap the public's issue agenda: their own Internet search behavior. Few people Google political information that is not at least minimally important to them. We must point out that although people search the Internet for things that are important to them, they also search for things that interest them. Whereas interest and importance are certainly correlated, they are not the same thing. Although several scholars note that similar conceptual confluences exist for the MIP question, we must interpret our findings by keeping in mind that our public agenda measure captures elements of both interest and importance and is not able to distinguish between the two. Our measure is also different from intermediate agenda-setting research in that it deals with aggregated search behavior undertaken by *all* (Google) search users rather than aggregate expressions of issue importance in periodic random samples of citizens.

Google has long been the primary means to seek out information on the Internet, capturing at least 67% of the market (Henzinger, 2004). Knowing what people are searching for provides researchers with *direct measures* of the issues about which citizens are seeking to learn. We use Google Trends, a database made up of the level of searches on all possible topics that breach a minimal threshold (Choi & Varian, 2012), as our measure of public attention. Each time someone "Googles" something, Google logs and amalgamates the search with all other searches. Trends allows for explorations of public attention dynamics at a much finer and consistent level than is possible in traditional surveys of the public agenda. Google scales its search data to all other searches occurring on each day/week/month, which means that although the *level* of searches is lost in the standardization process, variation in search trends is not confounded with whether people are searching more or less on the whole during any time under analysis.

Early use of Trends data was in economics and computer science (see Choi & Varian, 2012; Ginsberg et al., 2009). Recent work has demonstrated the value of Trends in examining the political issues that citizens are actively attending to by using search queries to measure attention (Scharnow & Vogelgesang, 2011). Ripberger (2011) used Trends to study public attention to policy issues, revealing correlations between the mainstream media's reporting on policy issues and search trends within the United States.

One problem with Trends data as an attentional measure lies in whether individuals' searches for political information are picking up the same agenda dynamics of more traditional survey-based measures. Research has correlated the two, demonstrating moderate to high correlations between searches on political issues and corresponding responses to Gallup's MIP question (Scheitle, 2011).

This correspondence between the two attentional measures increases the likelihood that Trends data are of use to agenda-setting scholars.

These past examples of the success of search engine data in predicting agenda-setting and other behavioral trends are not without caveats. The principal problem with using search query data as a proxy for attention lies in several assumptions underlying the meaning of search terms used in the seeking out of information online (Ripberger, 2011). For example, those using search query data must first formulate a list of search terms related to the issue in question. This is exacerbated by the fact that the majority of search queries are merely two or three words in length and characterized by words that may not be semantically related (Sahami, Mittal, Baluja, & Rowley, 2004). Extracting the intentions underlying search engine use can be difficult; for example, a citizen searching the words “Obama” and “Muslim” may have any number of motivations: The citizen may be seeking either confirmation or refutation of Barack Obama’s oft-purported “secret” religious identification as a Muslim or simply attempting to find information about Obama’s policy stances regarding Muslim people. This is an important, albeit difficult, issue to address.

For our purposes this distinction is less important, because we are interested in *what* people want to learn about rather than *why* they want to learn about an issue. Individuals may “Google” momentary curiosities—the Kardashians come to mind—but people are not likely to search for *political* information unless there is some underlying relationship between the search and what individuals find to be important. Agenda-uptake’s focus on rapid, nearly simultaneous transfers of salience requires the ability to track systematic, albeit momentary, expressions of interest that we can measure by aggregating individual search behavior on the web.

## RESEARCH DESIGN

To test our expectations, we use Google Trends search data on the issues we selected for analysis. Whereas the classic agenda-setting literature most often makes use of traditional content analysis techniques (McCombs & Shaw, 1972), we leverage advances in machine learning and data mining (Jurka et al., 2012) to arrive at a large-scale media coverage data set. We use MemeTracker data by Leskovec, Backstrom, and Kleinberg (2009),<sup>4</sup> which includes every major topic diffusing throughout the Internet from August 2008 to February 2009. The MemeTracker data also capture lexical variations within memes and were collected through the daily tracking of 1.6 million web sites of the mainstream

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<sup>4</sup> At the time of writing, MemeTracker data were publicly available for download from <http://www.memetracker.org/data.html>.

media (i.e., *New York Times*, CNN) and niche media (i.e., Free Republic, Daily Kos, FOX News), resulting in a collection of 90 million articles.

Although the MemeTracker data measure the diffusion of terms in real time (down to the minute), we use weeks as the time unit of analysis (McCombs, 2004). We chose to focus on those sources most likely to be encountered by citizens on a daily basis and selected CNN, CBS News, ABC News, and the *New York Times* for our mainstream media sources. Following Baum and Groeling (2008) we used Free Republic and Daily Kos, which are widely viewed as conservative and liberal blogs, respectively, and FOX News and MSNBC as cable television sources that operate as niche-oriented and ideological news (Arceneaux & Johnson, 2013).

We extracted the reportage on each topic by coding each topic area within the MemeTracker data that was relevant. We undertook the coding by searching the MemeTracker database for key terms, shown in parentheses: abortion (abortion), economy (economy, economics), Iraq (Iraq), and lipstick (lipstick on a pig). The ID number of memes deemed to be relevant was noted in a script file, which was then used to code dichotomous variables indicating whether the meme was related to an issue. We computed the proportion of the media agenda occupied by each topic by dividing each meme's frequency of occurrence by the total amount of coverage present in the data, aggregated by whether the source was part of the MSM or niche media.

For the Trends data, the same search terms used for the MemeTracker data were used to collect data on the public's attention to our issues. The Trends search engine allows users to download the data in two forms: One is scaled relative to the total searches each day, and the other uses fixed scaling, wherein increases or decreases are scaled to a single time point (Google, 2014); we utilized the fixed scaling because it offers a more consistent baseline for comparison to the MemeTracker data used to track media coverage in our analysis. These data were gathered for each week from the beginning of August to Election Day in November 2008.

Because we argue that the causal arrow is dynamic and multidirectional in the agenda-uptake environment, multivariate statistical models are required to help explain the variation in and determinants of the public and media agenda. Vector autoregression (VAR) models are useful in agenda-setting studies, first because attentional trends and perturbations are rarely instantaneous—they react to attentional trends over a time lapse (Gujarati, 1995; Jerit & Simon, 2010), and second because the existence of one-way relationships between the mass media, online media, and search trends seems unlikely (see Downs, 1972; Uscinski, 2009). Thus we surmise that search attention to a particular issue  $y$  is a function of mass media attention ( $x$ ) at time  $t$ , at a time lag ( $t-I$ ), blog attention ( $z$ ) at time  $t$  and  $t-I$ , and finally as lagged searches ( $y-I$ ):

$$y = \alpha + \beta x_t + \beta x_{t-1} + \beta z_t + \beta z_{t-1} + \beta y_{t-1} + \varepsilon$$

Simultaneously, VAR equations for media attention ( $x$ ) and blog attention ( $z$ ) are modeled as functions of their lagged values and the lagged variables of the other explanatory variables:

$$x = \alpha + \beta z_t + \beta z_{t-1} + \beta y_t + \beta y_{t-1} + \beta x_{t-1} + \varepsilon$$

$$z = \alpha + \beta x_t + \beta x_{t-1} + \beta y_t + \beta y_{t-1} + \beta z_{t-1} + \varepsilon$$

We selected appropriate lag lengths for each model by first estimating lag-order selection statistics, which return estimates of changes in fit as lagged variables that are added to the VAR equations.<sup>5</sup> Unlike single-dependent variable regression models, coefficients produced by VAR models are difficult to interpret because multiple equations are estimated simultaneously. Granger causality tests are used in lieu of standard coefficient interpretations in order to assess how each of the endogenous variables affects the others in each equation. When accounting for the variance of variable  $y$  predicted by lagged values of variable  $x$ , we can demonstrate how  $x$  Granger caused  $y$ .

## RESULTS

Figure 1 presents descriptive data by plotting Google search queries against the prevalence of mainstream news media and political blog mentions of memes related to abortion, the economy, Iraq, and the “lipstick” comment during the 2008 campaign. Searches related to the economy provide the most intuitive descriptive evidence of the usefulness of the Trends data for exploring the relationships between the public, new media, and mainstream media agendas.

The economic figure in mid-September shows that MSM and niche media featured a sharp uptick in coverage of the U.S. economy, followed by a similar rise in economic search queries. The period following the next upsurge in economic media coverage was characterized by a larger increase in economic searches, followed by a punctuation of coverage by both the MSM and niche media. This descriptive evidence appears to indicate the presence of classic agenda-setting. It is also suggestive of the MSM taking up the public’s agenda.

Search queries related to Iraq, though smaller in magnitude than economy searches, likewise appear to be related to spikes in coverage by niche and MSM. The spike in Iraq coverage in August does not appear to affect searches for

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<sup>5</sup> Using both final prediction error (FPE) and Akaike’s information criterion (AIC), we arrived at lag lengths of 3 weeks for abortion (FPE = 8.4e-19, AIC = -36.116), economy (FPE = 5.9e-13, AIC = -20.642), and Iraq (FPE = 2.2e-17, AIC = -30.864), and 4 weeks for the “lipstick” comments (FPE = 1.6e-92, AIC = -207.191).

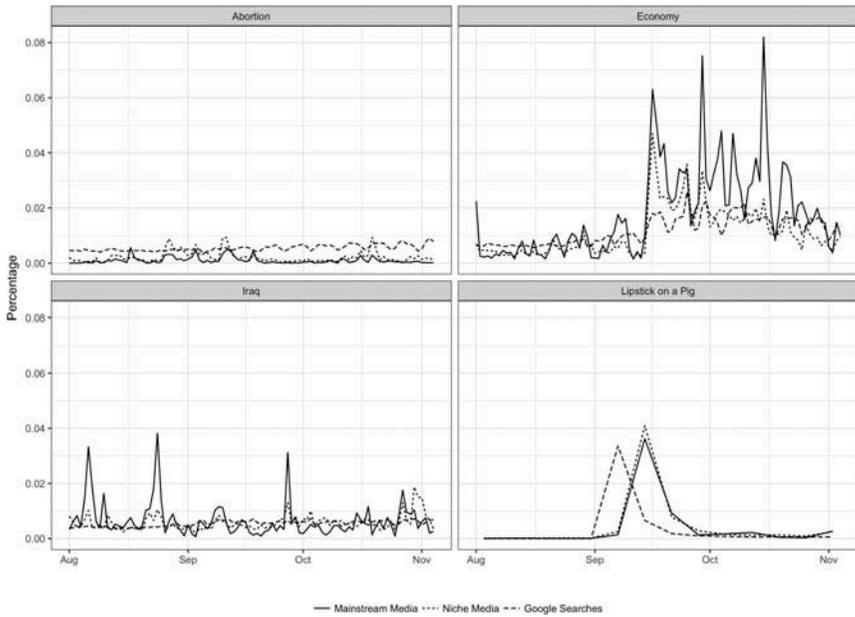


FIGURE 1 Public and media attention to issues. *Note.* Data for abortion, economy, and Iraq measured on a daily basis, whereas data for “lipstick on a pig” measured on a weekly basis.

weeks, a pattern that also manifests in September. Considering the Iraq and economic data together demonstrates how important the volume of coverage is for the transfer of salience between agendas; although search queries track quite closely to media coverage in terms of the economy, the lower preponderance of Iraq stories has a smaller apparent effect on citizens’ attention. This is consistent with previous claims that there is a threshold of coverage necessary for agenda-setting to occur (McCombs, 2004).

As expected, given the amount of coverage as compared to the economy, search queries related to abortion follow a regularized patrol pattern and appear to be much less related to mainstream media and new media coverage of those issues. The searches follow a patrol-oriented pattern, with dips in searches occurring on weekends and peaks during weekdays.

The final panel of Figure 1 examines our scandal issue by presenting variation in attention to Obama’s “lipstick on a pig” comment, which had a flurry of

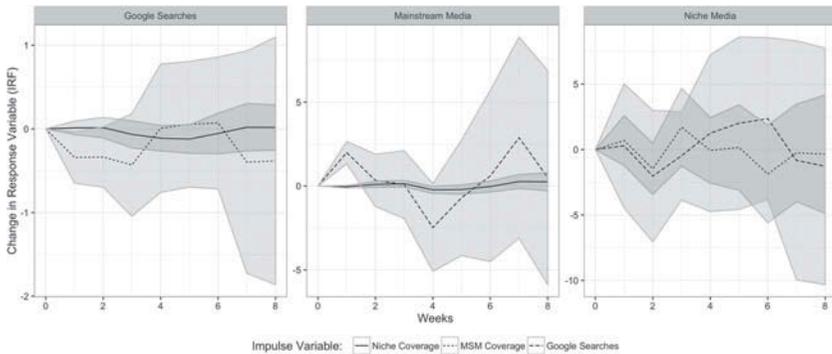
<sup>6</sup>The “lipstick on a pig” figure looks smooth because searches must reach a minimum threshold set by Google to be accessible by Trends. Queries for the issue did not reach the “daily” threshold, so our data are on a weekly basis.

coverage during the campaign, across the mainstream media, on blogs, and in public searches. Coverage came *after* search queries experienced a small spike; coverage of the comment in the mainstream and new media spiked soon after.<sup>6</sup> Perhaps due to the oft-fleeting nature of campaign controversies (Nahon, Hemsley, Walker, & Hussain, 2011) and the congestion of the news hole with respect to issues like the economic collapse (Boydston, 2013; Nyhan, 2014), and unlike the more substantive and just-noted political issues on which we reported, attention to the lipstick comments had all but ended by the end of September 2008.

The descriptive analyses of media coverage and public attention to major political issues of the 2008 campaign comports with the conditions on the ground during the campaign season; economic issues were at the forefront, a function of the mid-September economic collapse, with Iraq still occupying a substantial amount of media attention given its newsworthiness. Abortion, an issue salient to those in an issue public surrounding reproductive issues, received less attention from the candidates and a correspondingly low level of attention from the news media.

We next turn to inferential tests of the relationship between the public, mainstream media, and new media agendas during the 2008 campaign. Testing for effects within a dynamic media environment requires the use of models allowing for bidirectionality; thus, we employ VAR models. VAR models allow us to test for not only how the mass media influence the niche media and public agendas but also how the latter feed back into the former. It is important to note that the significance of coefficients in tests of Granger causality is associated not with direction but only with whether one endogenous variable Granger caused the outcome of another (Wood & Peake, 1998). The effect of the lagged values of one endogenous variable upon another endogenous variable is most often interpreted in vector autoregression with tests of Granger causality, as well as through visual inspection of impulse-response function (IRF) graphs (Brandt & Williams, 2006). Determining the direction of the relationship between variables, as well as what a “shock” in one variable does to another, requires examination of IRF graphs presented along with Granger tests (Brandt & Williams, 2006). IRF graphs show the direction and magnitude of change, in standard deviations, in the dependent variable when a shock occurs to one of the predictor variables, as well as the duration of these effects.

Consistent with H1a, individual searches on the abortion issue were not related to either blog or mainstream media coverage of the issue in the Granger tests; the absence of a relationship likewise appears in the left panel of the IRF in Figure 2. MSM coverage of abortion, on the other hand, was Granger caused by both niche media coverage and web searches on the issue as predicted by H1b. The IRF for the relationship between web searches for abortion and mainstream media coverage of abortion, located in the middle panel of Figure 2, shows that increases in Google searches led to increases in



	Google Searches		Mainstream Media		Niche Media
	$\chi^2$		$\chi^2$		$\chi^2$
Mainstream	5.52 (0.14)	Niche	25.36 (0.001)	Mainstream	2.21 (0.54)
Niche	3.17 (0.36)	Google	43.97 (0.001)	Google	2.88 (0.41)

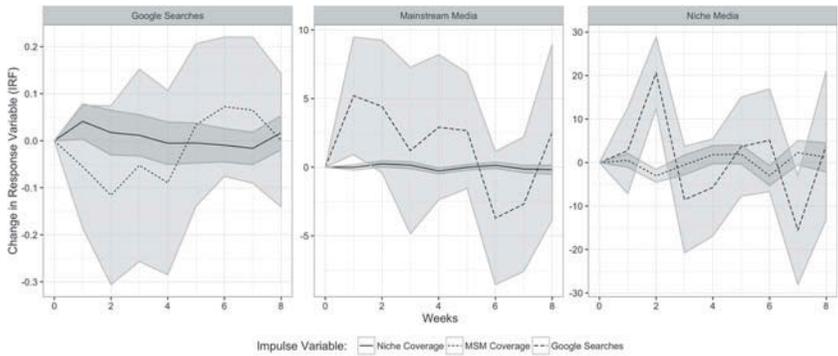
Significance levels in parentheses. “Abortion” was autoregressed with 3 lags. Shaded areas indicate 95% confidence intervals for the IRF estimates. For the left and middle panels, the darker CI is associated with blog coverage; the darker CI region in the rightmost panel is associated with mainstream media coverage.

**Interpreting IRF Graphs:** Each graph represents the predicted effect of 1-standard deviation shocks in each *Impulse* variable (denoted by different line types) on each *Response* variable (denoted by graph headers) over time. Positive (above zero) response values indicate a positive relationship between impulse and response for that time period and negative (below zero) response values indicate negative a relationship between impulse and response for that time period.

FIGURE 2 Impulse-response function (IRF) graphs and granger causality tests for abortion.

media coverage in the time immediately following the shock, but the effects quickly dissipated (see Watt et al., 1993).

Although niche media coverage of abortion Granger caused MSM coverage, Panel 2 demonstrates that increases in niche coverage of abortion did not cause a significant spike in media coverage of the issue (MSM coverage tended to spike about 2% due to niche coverage). The rightmost panel shows the effect of media coverage and Google searches on niche media attention to abortion and demonstrates that no systematic relationship existed between those variables, a finding consistent with the fact that no Granger causality was found with niche coverage as the dependent variable. H1c was confirmed, but the IRF panel and the level of significance ( $p < .10$ ) suggest we should avoid broad conclusions from this one result.



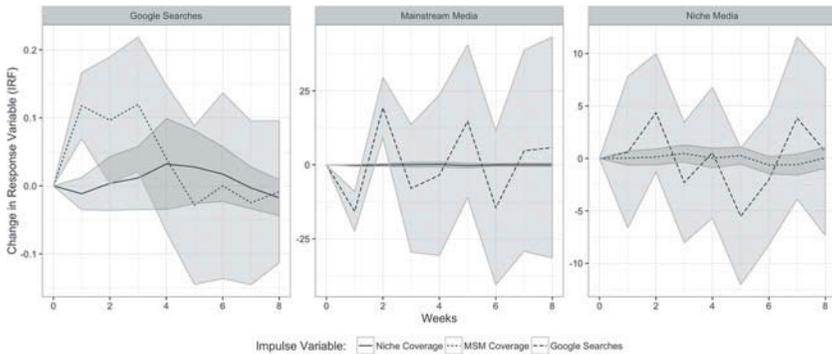
	Google Searches $\chi^2$	Mainstream Media $\chi^2$	Niche Media $\chi^2$
Mainstream	8.10 (0.04)	Niche 2.09 (0.56)	Mainstream 16.88 (0.001)
Niche	7.01 (0.07)	Google 9.51 (0.02)	Google 15.81 (0.001)

Significance levels in parentheses. “Economy” was autoregressed with 3 lags. Shaded areas indicate 95% confidence intervals for the IRF estimates. For the left and middle panels, the darker CI is associated with blog coverage; the darker CI region in the rightmost panel is associated with mainstream media coverage.

FIGURE 3 Impulse-response function (IRF) graphs and granger causality tests for Economy.

Moving to Figures 3 and 4, which present the results for the issues of the economy and Iraq, we test our hypotheses related to agenda-uptake in an environment of media and alarms and regular patrols. The Granger tests shown in Figure 3 with Google searches as the dependent variable indicate that both the mainstream and niche media have the capacity to lead to greater attention to economic issues. However, the leftmost IRF graph shows that niche news had a sudden but fleeting impact on Google searches, whereas the sustained MSM effect did not occur until later and had confidence levels lower than 95% (see Watt et al., 1993).

The middle panel of Figure 3 shows that Google searches were clearly related to mainstream media coverage, causing a large initial spike (about 8%) in coverage that persisted, supporting H2a. Consistent with H2b, blog and cable news coverage had no significant effect on MSM coverage of the economy. Finally, niche coverage of the economy was significantly related with Google searches. Spikes in Google searches on the economy created large initial spikes (about a 16% increase) in niche-oriented coverage, though the effects again



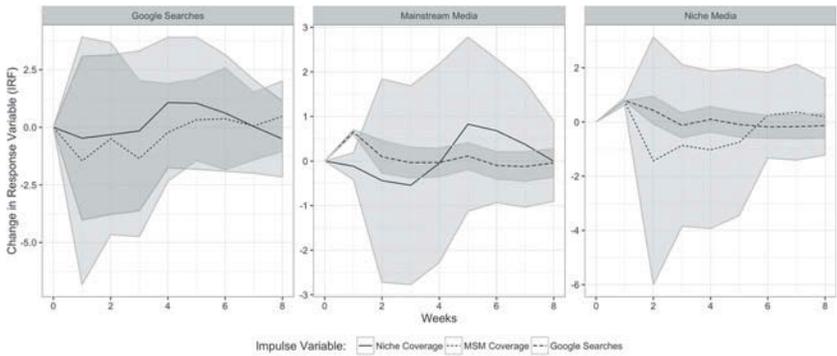
	Google Searches $\chi^2$		Mainstream Media $\chi^2$		Niche Media $\chi^2$
Mainstream	31.09 (0.001)	Niche	15.60 (0.001)	Mainstream	1.26 (0.74)
Niche	28.98 (0.001)	Google	31.75 (0.001)	Google	6.34 (0.09)

Significance levels in parentheses. "Iraq" was autoregressed with 3 lags. Shaded areas indicate 95% confidence intervals for the IRF estimates. For the left and middle panels, the darker CI is associated with blog coverage; the darker CI region in the rightmost panel is associated with mainstream media coverage.

FIGURE 4 Impulse-response function (IRF) graphs and granger causality tests for Iraq.

decreased quickly. The MSM Granger caused niche coverage; it did not meaningfully cause niche attention when viewing the right IRF panel. Thus, the relationships predicted in H2b and H2c were present, but the substantive effects ranged from short-lived to nonexistent.

Our final substantive policy issue is that of Iraq, which is not experienced with direct personal or familial experience by all citizens in the same way that the economy is (McCombs, 2004), and is thus typically more amenable to classical agenda-setting. Figure 4 shows both mainstream and niche media attention to Iraq caused Google searches querying Iraq. Whereas blog/cable coverage of the issue caused a slow and small increase in Google searches, MSM coverage caused a quick spike in searches—a demonstration of the classic agenda-setting effect. In terms of the effects of searches and ideologically oriented coverage about Iraq, both Granger caused mainstream media coverage about Iraq. Although Google searches had a large impact on MSM coverage of Iraq (an initial 10% spike), niche coverage did not. MSM had little effect on niche media coverage of Iraq, whereas Google searches had a significant effect on niche



	Google Searches $\chi^2$	Mainstream Media $\chi^2$	Niche Media $\chi^2$
Mainstream	1.26 (0.87)	Niche 7.25 (0.12)	Mainstream 261.95 (0.000)
Niche	0.33 (0.99)	Google 1047.10 (0.000)	Google 20445 (0.000)

Significance levels in parentheses. “Lipstick” was autoregressed with 4 lags. Shaded areas indicate 95% confidence intervals for the IRF estimates. For the left panels, the darker CI is associated with blog coverage; the darker CI regions in the middle and rightmost panels are associated with mainstream media coverage.

FIGURE 5 Impulse-response function (IRF) graphs and granger causality tests for “Lipstick on a Pig.”

coverage, with a large initial spike in niche news coverage following an uptick in searches.

The “lipstick on a pig” comment (Figure 5) generated controversy on the campaign trail, and actually had the highest peak of any meme within the entire MemeTracker data set. However, neither MSM nor blog coverage of the lipstick comment had any noticeable impact on Google searches related to it. Search coverage of the controversy had a significant impact on coverage by the MSM, with a spike in Google searches causing a rapid but fleeting spike in media coverage of the issue as unobtrusive issues tend to disappear from the agenda in a rapid fashion. Although the middle panel of Figure 5 appears to show a relationship between increases in niche attention and mainstream media coverage as we hypothesized in H3b, the Granger test was not significant. Niche media coverage was Granger caused by both Google searches and MSM coverage of the lipstick controversy, with spikes in both causing a correspondingly quick rise in blog/cable coverage. The effect of Google searches lasted longer than it did for MSM coverage.

## DISCUSSION

We have introduced and tested the theory of agenda-uptake via a series of hypotheses seeking to explain the dynamics between the mainstream media, niche media, and people with respect to the issues that make it to various news outlets agendas or sufficiently interest a citizen to seek information about the issue. We present evidence that supports the traditional agenda-setting effect while specifying the conditions under which the major elements of the modern media environment, including the public itself, rapidly interact with each other. By doing so, we have highlighted a new method to measure how issue agendas can be simultaneously transmitted between the mainstream media, niche outlets, and the public. Indeed, mainstream news media titans are also recognizing the value of considering the public's agenda. In October 2015, the *New York Times* announced the launch of a department specifically designed to take up the agenda of new media in real time. The *NYT*'s "Express Team" provides coverage to "issues and questions that are attracting attention across the day and around the world" (Barr, 2015, para. 3).

We have specified the conditions under which the mainstream media's agenda is influenced by the agendas of niche media outlets and the public more generally. Further, we have demonstrated the conditions under which the niche media's agenda is affected by public desires and the mainstream media's agenda. Agenda-setting endures in a fragmented era, but it is ensconced in a larger set of dynamic, sometimes fleeting, relationships between the agendas of the mainstream media, new media, and public, with effects that reflect the oft-fleeting nature of the modern news cycle. Agenda-uptake applies and expands upon earlier investigations of the agenda-setting "process," sometimes referred to as intermediate agenda-setting in a pre-fragmentation media era (Trumbo, 1995). In general, prior studies related to intermediate agenda-setting have focused on one issue at a time, examining aggregate effects on the public. Agenda-uptake is concerned with the media's ability to be reactive to individuals' information seeking behavior over a short period in the fragmented media era—given the dynamics of how different issues may affect the volume of coverage given the considerable evidence for the alarm/patrol hybrid model (Boydston, 2013). It also articulates the dynamic relationship between the agendas of different types of news media and the issue agendas of their audiences.

It is important to consider that our analysis is also confined to three types of issues and one short period—an election cycle. Whether agenda-uptake has continued past 2008 and whether it applies outside of electoral contests and to other kinds of issues are important, open questions. We believe agenda-uptake is a concept that ought to apply to news coverage outside of the election context as it fits under the larger umbrella the alarm/patrol hybrid model.

Our theoretical expectations and findings compare favorably to a recent analysis showing that for 18 of 29 issues analyzed, Twitter attention to issues preceded MSM coverage of those same issues, that in 11 of the 29 issues mainstream media coverage led social media attention, and that in five cases, Granger causality was reciprocal (Neuman et al., 2014). The directions of causality between social media and the mainstream media and the revealing of several insignificant relationships reported in Neuman et al.'s exploration of agenda-setting with "big data" fit well into the theoretical context of agenda-uptake. Careful attention to the alarm/patrol hybrid model and the nature of issues that our theory relies upon can serve as a guide for understanding big data's role in studying the information flow in the 21st century.

We have left out important elements of the modern information environment. As noted earlier, social networking platforms like Facebook and Twitter can influence how individuals and groups encounter the political world (Johnson & Perlmutter, 2010). Future work that accounts for the information present in people's social media streams and for the information individuals choose to share with others will help clarify how agenda-uptake operates. Recall that agenda-uptake is concerned with sustained attention in the aggregate. We are not able to comment on the precise factors that governed the decisions that news organizations made when assigning, reporting, and editing a story, nor can we speak to the motivations of a blogger or cable news host at a precise moment. We are also silent on the behavior of another key set of actors: political elites (Eshbaugh-Soha & Peake, 2004; Peake & Eshbaugh-Soha, 2008).

Future research would also benefit from linking agenda-uptake inquiries with agenda-building (Kanervo & Kanervo, 1995). It is possible, even likely, that the transmission of salience across agendas is related to the message construction strategies of elite actors and media outlets. In particular, the flattening of the media ecology allows more actors to be in positions to engage in successful agenda-building, which, under the right conditions, could lead to agenda-uptake across diverse sets of actors such as the mainstream media, niche media, and public.

Our analysis suggests that we have not returned to an era of minimal effects in media research. Rather, it suggests that studying how mediated information animates individual behavior and vice versa is more complex and involves more players than ever before.

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