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Mapping Controversies with Social Media: The Case for Symmetry

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Abstract

This article assesses the usefulness for social media research of controversy analysis, an approach developed in Science and Technology Studies (STS) and related fields. We propose that this approach can help to address an important methodological problem in social media research, namely, the tension between social media as *resource* for social research and as an empirical *object* in its own right. Initially developed for analyzing interactions between science, technology, and society, controversy analysis has in recent decades been implemented digitally to study public debates and issues dynamics online. A key feature of controversy analysis as a digital method, we argue, is that it enables a symmetrical approach to the study of media-technological dynamics and issue dynamics. It allows us to pay equal attention to the ways in which a digital platform like Twitter mediates public issues, and to how controversies mediate "social media" as an object of public attention. To sketch the contours of such a symmetrical approach, the article discusses examples from a recent social media research project in which we mapped issues of "privacy" and "surveillance" in the wake of the National Security Agency (NSA) data leak by Edward Snowden in June 2013. Through a discussion of social media research practice, we then outline a symmetrical approach to analyzing controversy with social media. We conclude that the digital implementation of such an approach requires further exchanges between social media researchers and controversy analysts.

Keywords

social media, science and technology studies, controversy analysis, Edward Snowden, digital methods, Twitter, social research methodology

Introduction

According to the popular online magazine Slate, outrage is the dominant mode of engagement with social media.[1] But what about controversy? Just a glance at the lists of "trending topics" on popular platforms like Twitter, Instagram, or Facebook reveals a host of scandals, debates, disputes, and polarizing campaigns. However, if something akin to controversy is prominent in social media, it is nevertheless particular types of controversies. Many disputes and debates unfolding in these settings are concerned with events and problems pertaining to some aspect of social media and/or digital culture itself, as in the case of the #gamergate scandal foregrounding misogynism in digital media industries as well as in online debate spaces, or mobilization around Facebook's dubious or illegal practice of scanning private messages (#scan) on Twitter.[2] This reflexive quality of controversies—about things digital, unfolding on digital platforms—has by no means gone unnoticed in social, cultural, and anthropological studies of digital media technologies and culture (Bruns & Burgess, 2011; Crawford, 2013; Kelty, 2005). However, this feature of digital and social media controversies also has important *methodological* implications, which we would like to discuss in this article.

Controversies unfolding in social media settings bring into relief a feature of controversies as a research object that has long interested scholars in media, social, and cultural studies (Latour, 2005; Lievrouw, 2009): they present researchers with *a multi-faceted object*. Controversies unfolding in digital media settings invite us to investigate both the substantive issues at stake in the controversy as well as the formative role played by mediating technologies in the enactment of these controversies. This long-standing methodological issue makes itself felt with special urgency in recent projects aiming to implement controversy analysis as a digital method. Over the last decade or so,

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researchers working at the intersections of Science and Technology Studies (STS) and digital media studies have taken a keen interest in the affordances of digital networked technologies for the analysis of public controversies about technology, science, and society (Bruns & Burgess, 2011; Marres, 2015; Rogers & Marres, 2000; Rogers, Sánchez-Querubín, & Kil, 2015; Venturini, 2010). These authors agree that digital networked media technologies open up important opportunities for the development of this classic social research method, in the form of scaled-up, fine-grained, visual, real-time, and/or participatory forms of analysis. However, at the same time, the project of implementing controversy analysis as a digital method raises challenging methodological issues about the assumed objectives—and indeed the very object—of controversy analysis as a form of media-based research. There is a tension within these approaches between their ambition to use digital media *instrumentally*, to map controversies unfolding beyond these settings, and their pre-occupation with partly sui generis dynamics which are particular to digital networked media settings, at least to an extent (Marres, 2015).

In our view, this ambivalence around the object of research arises especially forcefully when implementing controversy analysis as a social media method. Indeed, this methodological issue seems of *special* relevance to social media research and here merits serious engagement, for two main reasons: first, as this broader methodological problem is opened up anew in social media research, it provides opportunities to devise alternative ways for addressing it, and perhaps to help formulate distinctive research agendas for this emerging field. Second, engaging with the methodological issue of ambivalence offers opportunities to expand the on-going dialogue between two inter-disciplinary fields, STS and digital media studies. While exchanges between these fields have been happening for some time (Gillespie, Boczkowski, & Foot, 2014; Lievrouw & Livingstone, 2002; Wajcman & Jones, 2012), much of the "mutual interventions" between the two fields have focused on the exchange of concepts and analytic frameworks, less so of methods and methodology (Van Loon, 2011; though there are of course exceptions, including Anderson & Kreiss, 2013). In this article, we discuss an approach developed in STS with the aim of clarifying its methodological relevance to social media research.

To begin with, we will provide some brief background and key principles of controversy analysis in STS and some related work in sociology and media studies. We then discuss recent attempts to implement controversy analysis as a digital method, with a special focus on social media. We argue that recent efforts in this area bring into relief the aforementioned tension surrounding the framing of digitally mediated controversy as both an empirical object and method: while some controversy analysts approach social media primarily as a *resource* for identifying key positions and key points of contention in controversies, others deploy controversies first and foremost as an *occasion* to study the workings and relevance of social media platforms themselves.

We will argue that this ambivalence, uncertainty, or variability in the framing of controversy analysis as a social media method is problematic, and needs to be explicated, but that the resulting tensions may also be productive and, indeed, may inform further development of the approach. To clarify why we think this is so, we will discuss different ways in which the problematic may be addressed *in social media research practice*, arguing in favor of a symmetrical approach to controversy analysis' object. We will distinguish between three different ways of delineating the empirical object of controversy analysis in social media research, or three methodological tactics in researching public issue formation with social media:[3] one that privileges the instrumental capacities of social media (to research substantive controversies), one that foregrounds the media-specificity of controversies unfolding in social media, and a last, symmetrical approach which aims to "empiricize" the question of "what" is the object of social media research (the controversy or social media), and to answer it on a case-to-case basis. We will outline these three approaches using examples taken from our own research practice, focusing on a project in which we examined issue formation around privacy and surveillance on Twitter with tools of online network and textual analysis. We want to stress that in discussing empirical materials, our aim is not to present a "case study" or "findings" but rather to offer a practice-based demonstration of a methodological issue that arises when analyzing controversies with social media, and different possible ways of addressing this issue.

Controversy Analysis as an STS Method and the Role of Media and Media Technology

Controversy analysis is a methodology developed in the interdisciplinary field of STS for the study of public disputes about science and technology, and the interaction between science, innovation, and society more broadly.[4] This work goes back many decades; one important historical marker is the work of the Edinburgh School in the sociology of science. David Bloor (1982), for example, analyzed the historical controversy between Robert Boyle and Thomas Hobbes about the corpuscular theory of matter, showing how this 17th-century controversy was not only about epistemic issues but political ones as well. His sociological study of controversy showed how competing knowledge claims contained within them assumptions about how to imagine social order. Furthermore, Bloor and his colleagues posited that in the midst of a scientific controversy, neither side has "truth" on its side, and the analyst should therefore set aside true and false and treat all positions as scientifically viable. Doing so reveals that all sides have to make arguments that include a socio-political dimension because they can't rely on "but it's true because we've proven it to be true." One of the central tenets of controversy analysis as developed by Bloor and his colleagues, then, was the "symmetry principle": the idea that

both "true" knowledge and discredited "false" knowledge (or epistemic content) have a socio-political dimension and that, accordingly, we must always be studying both at the same time: the knowledge content and the political position taking, the epistemic configuration, and the power constellation.

Controversy analysis was also crucial in the subsequent development of Actor–Network Theory (ANT), which extended the symmetry principle to develop a new approach to controversies. According to actor–network theorists like Michel Callon (1986) and Bruno Latour (1987), the Edinburgh approach was "overly theoretical": they argued that when analyzing controversies, we should not decide on conceptual grounds how science and society, and knowledge and politics are related (or not), we should treat controversies as "empirical occasions"—events that render legible and "researchable" relations between a whole variety of heterogeneous actors from science, society, politics, industry, and so on. Furthermore, in developing their approach, in empirical studies of historical and contemporary controversies around innovations like the diesel engine and the electric car, Latour and Callon proposed that not just truth and falsity should be treated symmetrically, so should human and non-human actors (nature, microbes, scientific instruments, etc.). In their account, controversy and innovation unfold in social and epistemic, political, and technical dimensions all at once, and indeed, the merit of controversies as research objects is that they render visible "heterogeneous entanglements" between different types of entities.

ANT then critiqued the overreliance of the earlier, sociological (post-Marxist) approach to controversy analysis on rigid conceptual categories, such as the imputation of "interests" to actors. In the ANT account, social studies of controversies should not seek to impose their own theoretical definition of what is at stake in controversy. Rather, they should "follow the actors" (both human and non-human) in their (competing) attempts to define the controversy (Latour, 1987), or as we would say today, we should map the issues (Marres & Rogers, 2008; Rogers & Marres, 2000). Controversy analysis enables an "empiricist" style of inquiry: in moments of controversy, when identities are at stake and assumptions become unsettled, we must suspend our (conceptual) assumptions as to what are the constituent elements of the empirical phenomenon under study. It also means that the social researcher should not decide on conceptual grounds *where* the controversy takes place or what sorts of actors, resources, and technologies matter to its potential settlement. This "radical empiricist" approach[5] raises many thorny issues, but one of the consequences of the refusal to posit a stable social ontology is that ANT pays special attention to *mediations*. ANT studies of controversy tend to foreground the ways in which objects of controversy (e.g. the electric car) are mediated by technical inscriptions, representations, and spokespeople, all producing partial versions of the things at stake. Each attempt by actors to articulate the controversy changes the controversy—representations are inevitably performative to the extent that the very production of an account of the controversy entails the attempt to displace and shift the balance of forces (Latour, 1992; and see also on this point Hilgartner, 2000).

Indeed, in later studies, controversy analysts were forced to confront the role of public media in the mediation of techno-scientific issues (Gieryn, 1999; Hilgartner, 1990; Lewenstein, 1995; Nelkin, 1987). Studies of public disputes about, for example, nuclear power (Nelkin, 1971), genetically modified (GM) foods (Jasanoff, 2005), and road construction (Barry, 2001) paid special attention to the ways in which media, particularly news media, participate in the articulation of science and innovation, often framing them as topics of public debate and controversy. Yet, the media have historically been approached with some reticence in STS: much of the work was initially primarily interested in tracking the trajectory of scientific disputes "within science," and from this perspective, the media do not necessarily have any significant impact on the trajectory of controversy (Pinch, 1994). Others suggested that "the media" selectively direct attention and resources in techno-scientific controversies (Callon, Lascoumes, & Barthe, 2001), but without necessarily affecting the substantive knowledge content or regulatory regimes. And while the situated locations in which controversy unfold have been investigated in great detail by controversy analysts, including the laboratory (Latour, 1987), the scientific literature (Leydesdroff, 1989), and policy think thanks (Stilgoe, 2012), rarely have public media been investigated with the same ethnographic rigor as a site of scientific controversy (Barry, 2001; Gregory & Miller, 1998).

It is therefore not surprising that when STS researchers turned to the Internet to analyze controversies in the late 1990s, they were primarily using digital settings in a rather instrumental fashion, to analyze public controversies about science and technology that occurred in but extended beyond them, such as climate change and GM food debates (Beck & Kropp, 2011; Rogers & Marres, 2000). At the same time, however, it was clear from the start that the significance of the Web as a site of controversy derived from the proliferation of new digital, networked *practices* for the conduct of controversy across social and public life, as well as from the specific analytic techniques of online data analysis enabled by digital settings, such as network analysis. Furthermore, the enactment of controversy in digital networked settings directs attention to the interactions among a variety of actors—including civil society, the media, science, government, and industry—in the articulation of public issues. It is clear, then, that digital media settings open up a broad range of opportunities and challenges for controversy analysts, and on social media platforms, many of these recent developments can be seen to intersect and, perhaps, come to a head.

These developments signal possible transformations in the ways in which we conduct public controversies in our societies and cultures, transformations that we should research *empirically*. But recent attempts to implement controversy analysis as a digital method have revealed some

methodological complications. These can be summed up in the question: what are we analyzing when analyzing controversies online? Are we studying controversies as they unfold in our societies around some substantive topic (e.g. agricultural policy, as in Burgess and Sauter's [2015] study of hashtag publics), or are we studying digital media dynamics (as in the case of Rogers' [2009] study of the fate of 911 conspiracy theories in Google returns for the query "911")?[6]

The formative ambiguity deriving from mediation presents a long-standing concern in media and communication studies (Lievrouw, 2009; see also Bolter & Grusin, 2000),[7] but coming from STS, it can be taken as an invitation to formulate another "symmetry principle," this time specifically for the study of controversies with online media technologies. This version of the symmetry principle pertains not to "knowledge" and "politics," but to "content" and "media." It states that when analyzing controversies unfolding in digital media settings, we should not explain "failed controversies" in terms of the influence of media-technological dynamics (e.g. the capture of the controversy by dubious search engine ranking logics), while explaining the "robust controversies" that we detect online in terms of topical dynamics (e.g. by stakeholders in agriculture policy organizing into an online issue community). Instead, we should assume that failed and successful controversies are both likely to be marked by media-technological and issue dynamics.

A concern with the relations between media-technological and content dynamics in controversy is certainly not new nor is it specific to digital settings. Among others, it has previously been explored in debates about the media-specificity of public debate and issue formation (Corner, Richardson, & Fenton, 1990; Meyrowitz, 1997; Morley, 2006). But the methodological contribution that STS approaches to controversy analysis can make to its clarification remains to an extent unexplored (though see Hilgartner, 2000), and it seems to us that there is something about the analysis of controversy *with social media* that makes it both more feasible and useful to explore this contribution in more detail.

Controversy Analysis as a Social Media Method

Current attempts to harness social media for controversy analysis build on earlier Web-based methods of online controversy analysis and visualization. From the late 1990s onwards, researchers in fields as diverse as sociology, media studies, computing, and STS have developed digital techniques to analyze controversies unfolding on websites, blogs, and the result pages of search engines. Much of this work drew on established methods of scientometrics, translating citation analysis into methods for the analysis and visualization of hyperlink networks (Rogers & Marres, 2000; Scharnhorst & Wouters, 2006), and used methods of textual analysis to interrogate the substantive dynamics of controversies online, as in blog analysis of climate and 911 controversies (Foot & Schneider, 2004; Prabowo, Thelwall, Hellsten, & Scharnhorst, 2008). The rise to prominence of social media platforms over the last 10 years or so has both provided a new impulse to implement controversy analysis by digital means but also raised new challenges.

"Social media" hold significant promise for controversy analysis for two main reasons: first, they signal a further mainstreaming and/or wider uptake of digital media technologies in and across social, professional, and public life (Gerlitz & Lury, 2014), thereby extending their empirical relevance as a setting for societal controversies. Second, they make available *more richly structured* data than Web data as such. Regarding the latter, well-known platforms like Facebook and Twitter significantly broaden the "grammars of action" (Rieder, 2013), presenting researchers not just with text and links, but also shares, mentions, likes, followers, tags, retweets, and so on. These *inform-actional formats* (Marres, 2015) organize activities online, but they also make these activities available for analysis (Thielmann, 2012).[8] As such they significantly "boost" the empirical and analytic value of digital settings for social research.

Especially relevant for controversy analysis is that these digital action formats can be deployed to analyze "topical activity" or social and political content dynamics online. Thelwall, Sud, and Vis (2012) have analyzed "reply chains" on YouTube to detect debating activity, identifying especially active or "hot" or controversial topics (religion, as opposed to music) and the variation in topical engagement over time and between topics. In the project "Political Hashtags," Weber et al. (2013) sought to detect the political "leaning" of hashtags on Twitter, by analyzing which actors are associated with these hashtags. As already noted, Bruns and Burgess (2011) and Burgess and Sauter (2015) analyzed the formation of "issue publics" around specific hashtags, including those related to agricultural advocacy in Australia, with the latter drawing explicitly on STS work on controversy analysis. Papacharissi and de Fatima Oliveira (2012) have used computational discourse analysis to study social and political engagement with a specific hashtag (#egypt) developing an account that foregrounds the role of drama and affect in the formation of publics. This work combines network and content analysis to unearth "heteregenous communities" forming around contested topics in social media. Controversy researchers have also turned to Wikipedia to analyze controversy dynamics, as in the work by Borra et al. (2014) and Yasseri, Sumi, and Rung (2012), which rely on platform-specific formats (the edit, the fork) to detect the relative controversiality of Wikipedia articles on substantive topics including climate change, Sigmund Freud, 911, and so on. Finally, a younger generation of scholars is testing the capacities of social media platforms like Facebook for the qualitative study of controversies across settings, combining network analysis with discourse analysis (Birkbak, 2013; Plantin, 2011).

This brief overview makes clear that the development of controversy analysis as a social media method is very much an inter-disciplinary endeavor, which draws on a variety of methodological traditions. Perhaps it is partly for this reason that many of these projects evince the ambiguity we invoked in the introduction: while their overriding ambition seems to deploy social media platforms in an instrumental fashion, namely, as empirical settings-tools for the analysis of substantive dynamics of controversies online, several of these projects are primarily concerned with elucidating dynamics specific to the digital media platforms at hand, answering questions such as "Which topics are especially conversation-inducing *on YouTube* (Thelwall et al., 2012)?" "Which topics become subject to political storms *on Wikipedia* (Yasseri et al., 2012)?" As such, *platform-specific* research on controversies online brings into especially stark relief the methodological question raised above: are these projects seeking to analyze controversy dynamics as they unfold *across and beyond* digital settings, or do controversies here primarily serve as useful occasions for analyzing the formative properties of digital media environments themselves (Procter et al., 2013)?

This ambiguity of the "empirical object" of controversy analysis as a social media method does certainly not go unrecognized, for example, when the empirical object of social media research is defined as "communication flows in society" (Bruns & Stieglitz, 2012) or "social media networks" (Smith et al. 2014).[9] Previous discussions of Web-based methods also highlighted the Janus faced nature of online research, with Foot and Schneider (2004) noting that some forms of analysis were concerned with "web-based phenomenon," while others investigate the connections with "factors exogenous to the Web." However, it seems that several features of online platforms combine to make this issue particularly pronounced in social media research. One reason is the often-noted reliance of much social media data analysis on application programming interfaces (APIs), which means that platform architecture can exert significant influence on research design (boyd & Crawford, 2011; Marres & Weltevrede, 2013). (As Thelwall et al. [2012] note in their study of YouTube comments: "A more general limitation is that the results are based upon convenience data *in the sense that the factors analyzed are those that happen to be reported by YouTube* (e.g., commenter age, gender and location)" (p. 14, authors' emphasis). Platform APIs tend to be designed to provide data *pertaining to the whole platform*, encouraging hashtag- or location-based queries on "the whole" of the platform, which has some ethical advantages,[10] but it does mean that much social media analysis—including analyses of controversies—tend to adopt the standpoint of the platform.

The issue of "platform bias" in social media research has received a fair amount of attention in recent years (Driscoll & Walker, 2014; Tufekci, 2014). However, it strikes us that much of the debate about platform bias assumes a fairly stable methodological framework—broadly in line with "scientific empiricism." What we are interested in here is how the problem of platform bias forces *a methodological choice* onto social media researchers: are we configuring social media platforms to research empirical phenomena that transcend it, that is, to conduct social (media) research? Or are we researching social media themselves, that is, engaging in social media studies? This methodological choice is in some ways problematic, we would like to show, insofar as it (a) may be difficult to sustain in empirical practice and (b) may end up reducing the empirical scope of social media research. *While we may set out to do social research with social media, we may easily end up studying platform-specific dynamics, and the other way around*. And this variability of the empirical focus may actually be necessary in, and a strength of, social media research, insofar as it encourages us to follow through our empirical inquiries "wherever they may lead." It may then *not* be in the best interest of social media research to make this methodological choice once and for all—or at least not too quickly, and not too soon. However, at the same time, we think it is important to explicate this methodological tension.

In proposing this, we align ourselves with the argument by Rogers (2013) that the role of social media architectures in the organization of controversy in these settings *cannot* be reduced to a methodological problem-to-be-solved, that is, as a source of "corruption" of the quality of data that threatens the validity or reliability of social media–based research and therefore has to be contained or neutralized. Adopting a performative perspective on the role of socio-technical settings in the enactment of social and public life, Rogers (2013) and Gerlitz and Helmond (2013) have shown that the "influence of the setting" also presents an important, positive empirical question for digital controversy analysts (see also Gillespie, 2014). The implementation of controversy analysis as a social media method, in the above projects of Thelwall, Borra, Vis et al., one could say, seeks to render this platform performativity empirically productive, deploying selected features of the setting (links, tags) to analyze content dynamics online. However, elsewhere Marres (2015) has argued that this empirical deployment of platform settings comes at a price. The uptake of platform-specific methods results in *slippage* in the framing of the empirical object of controversy analysis: digital controversy analysis detects, visualizes, and analyzes a broad range of issues, scandals, and conflicts, but it is often difficult to say to what extent these bursts in topical activity derive from platform dynamics and/or from issue dynamics.

To be sure, this problem is sometimes a specific one that can be alleviated through specific measures (e.g. in conducting hyperlink analysis of controversy networks on the Web, it is a good idea to block links to "purely technical" addressees [e.g. Firefox]). But in other cases, the problem is a more open-ended one: it has to do with the ways in which the chosen setting (social media platforms) and methods (reliant on platform devices) conspire to render particular phenomena

available for analysis, in a way that renders impossible any neat distinction between object and method (Cicourel, 1964). In the practice of social media research, it is often difficult to make clear-cut distinctions about what belongs to the "empirical object" and what belongs to the socio-technical apparatus of research. Such lack of clarity arises, for example, when controversy analysis encounters a hashtag like #FF, which stands for #FollowFriday, an invitation to select new users to follow every Friday. The question is as follows: does the presence of such a tag in a Twitter data set indicate noise, a tell-tale symptom of bad research design, and thus requiring exclusion, or does it present a positive contribution to the controversy under study?

The mixture of methodological and empirical issues that is brought into relief by the uptake of controversy analysis in social media research then raises some tricky questions about the framing of its empirical object. These questions can perhaps never be neatly resolved; the question is how seriously to take these issues, and when to do so. Some social media researchers might prefer to adopt a straightforward empirical framework in conducting controversy analysis, and look for ways to contain the methodological problem of "platform bias." From this perspective, engaging with more "fundamental" questions—"what are we analysing when researching controversies with social media?"—threatens to distract from the challenging technical and analytic work at hand. But we would like to propose a different way into (and out of) the problem: the methodological ambiguity of controversy analysis does not just present a general or formal problem, it equally confronts us *in practice*, in the actual work of trying to do controversy analysis with social media data tools.[11] In the remainder of this article, we therefore want to discuss some concrete tactics that can be deployed in online controversy research to render the issue of ambiguity tractable.

Three Ways of Analyzing Controversies with Social Media: Precautionary, Affirmative, Empiricist

No doubt the most familiar way of dealing with the influence of social media platforms on the enactment of controversy online is to adopt a "precautionary approach" toward the problem of "platform bias." Assuming a largely negative understanding of the contribution of digital platforms to controversy, the researchers aim to clean the data and remove platform artifacts (for a discussion, see Rogers, 2013). A clear example can be found in the treatment of bots in social media research. For example, when setting out to map controversies around "privacy" on Twitter in the summer of 2013, we were struck by the predominance of generic content associated with the hashtag #privacy on Twitter. Among the hashtags used most often in combination with #privacy, we found astrological signs (#pisces, #aquarius, etc.) and generic media terms like "#blog" and "#email," something that was probably due to marketing bots hijacking trending topics on Twitter.[12] Our instinctive response was to "remove the bots," to delete from our data set all tweets using these generic hashtags. The objective, when operating in this mode, is to secure the empirical viability of social media analysis: to make sure that we are mapping the issues and not allow our analysis to be hijacked, in turn, by "platform artefacts," that is, the bots attracted to popular topics.

One of the limitations of a precautionary approach, however, is that it assumes a largely negative understanding of the participation of digital platforms and its attendant devices in controversy online. The "performative" approach to the role of digital devices in controversy, discussed above, is designed to replace this with a more positive appreciation. Examples of a more affirmative approach to "the influence of setting" can be found in studies that compare country-specific search engines for their "representation" of a given topic (Koed Madsen, 2012; Rogers, 2013). Precisely because digital platforms rely on medium-specific metrics to identify sources relevant to a topic, this work proposes, they can reveal relevant inflections in the mediation of controversial topics. In other words, precisely because engines count links, consider timestamps, and so on, they are able to reveal the political charges of "content" that controversy analysts are interested in. A comparison of query returns for "elderly care" in country-specific Googles by Niederer et al. revealed significant differences among countries, with charity organizations featuring prominently in some, while in other cases, public sector institutions featured more prominently.[13]

However, one could say that the affirmative approach works only as long as the above problem of methodological ambiguity can be bracketed. Here, the question "are we studying media-technological effects OR substantive issue dynamics?" is the wrong question. However, this becomes difficult or unhelpful to sustain when this *critical* question arises in social media research: what exactly are we analyzing when mapping "privacy" debates on Twitter? Are we just following links to news stories posted on Twitter? If so, why are we not analyzing news media content? In this regard, we would like to propose a third approach to mapping controversies with social media platforms, one that places this very concern with ambiguity center stage—by turning it into an *empirical* question. This third approach seeks to operationalize the symmetry principle that we derived from STS approaches to controversy analysis above: in analyzing controversies with social media, can we pay equal attention to how social media mediate the "content" of the controversy and to how the controversy mediates the role of social media?

When analyzing controversies with social media, we then make it our empirical task to investigate which effects belong to media technologies, which to the issues, and which to both. Rather than assuming a stable object of analysis, the qualification of the empirical object here becomes the objective of research. This, in turn, requires that our research design is as *symmetrical* as possible in its treatment

of media-technological, social, and issue dynamics. Such an approach has the aspiration—difficult to attain, but we believe worth striving for—of attending both to platform-specific dynamics and to the substantive dynamics of controversies.[14]

Testing the Three Approaches: Mapping Privacy after Snowden with Twitter

The above three approaches each belong to different methodological—or philosophical—universes, which we could arguably label as (a) scientific empiricist, (b) performative, and (c) radically empiricist. However, from a practice-based perspective, the three tactics may well be complementary, and the question then becomes under which conditions they are most useful, and what their specific merits are. Here, we take up this question by discussing some examples from our own social media research practice, focusing on a pilot project in which we turned to Twitter to detect controversies and issue formation in relation to privacy in June 2013, the period in which Edward Snowden publicly leaked National Security Agency (NSA) files.

We chose this focus because both the issue (privacy) and the event (NSA leak) operate in several dimensions: privacy is a long-standing concern of activism and advocacy in digital culture, with significant ethical, technical, and economic dimensions. The NSA leak, furthermore, not only received significant attention from news media—the Guardian newspaper played a key role in publicizing the leaked documents—it also addressed and connected with digital activist networks, gaining much exposure across the Web and online platforms, including Twitter. As such, this case is highly ambiguous—in the positive sense—making the composition of the issue and the relations between different mediators (social media, news media, advocacy and activist networks, and so on) complex and multi-faceted.[15]

The above diagrams (Figure 1) provide an initial indication of how the issue of privacy changed on Twitter in the wake of the Snowden leaks.[16] These figures depict hashtags that were prominently associated with the phrase "my privacy" on Twitter before and after the Snowden affair broke in June 2013. It suggests that the composition of the "privacy issue" changed significantly during this period. Perhaps, counter-intuitively, they suggest that communication around privacy on Twitter became *more generic* in the wake of the NSA leak: before the leak, concern with privacy was associated with the practice of "jailbreaking" smartphones, provocative phrases such as "I have a gun" and "you don't know me," as well as specific regulatory issues such as the European Union (EU) data protection act. After the leak, these more specific terms were crowded out by front-page keywords such as "nsa" and "prism," although the latter were also associated with more distinctively "social"

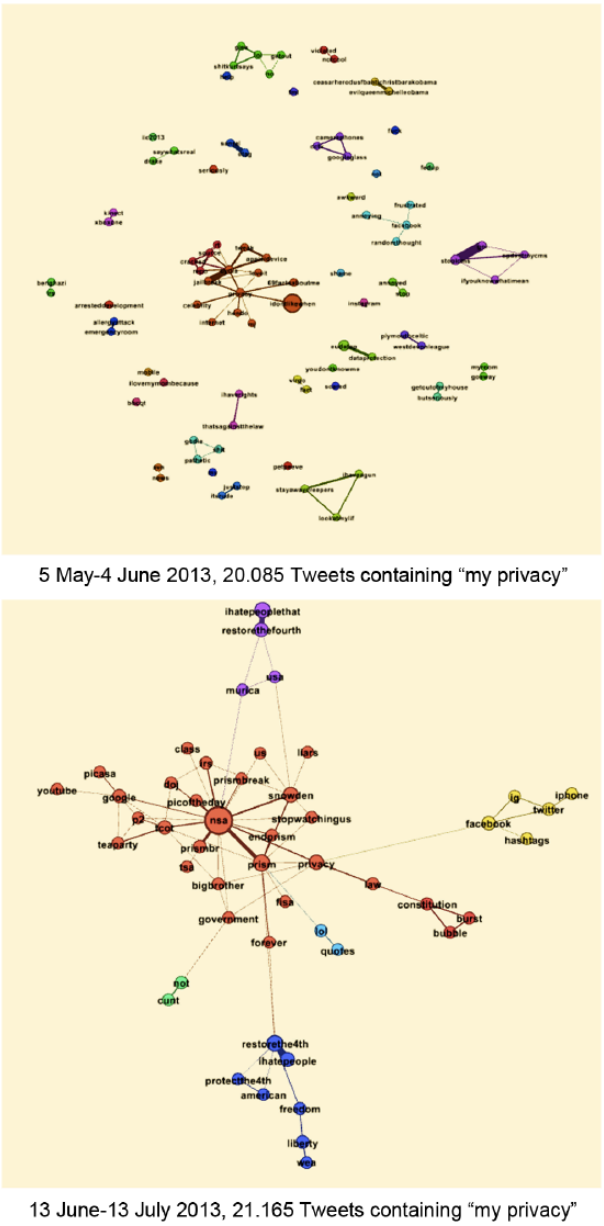

Figure 1. Co-hashtag network pre (top) and post (down) Snowden, Courtesy of Hjalmar Bang Carlsen.

campaign terms like "stopwatchingus" and "bigbrother." In this regard, the figure, in our view, demonstrates the potential of social media analysis to capture the re-composition of issues in the wake of public controversy. However, the figure equally raises critical questions: To what degree do these hashtag clusters reveal something about *privacy*? Or do they rather tell us about the media platform in question, Twitter?

In our account below, we test the ability of our three empirical approaches to deal with this question. For this study, we derived our data from TCAT, the online tool for

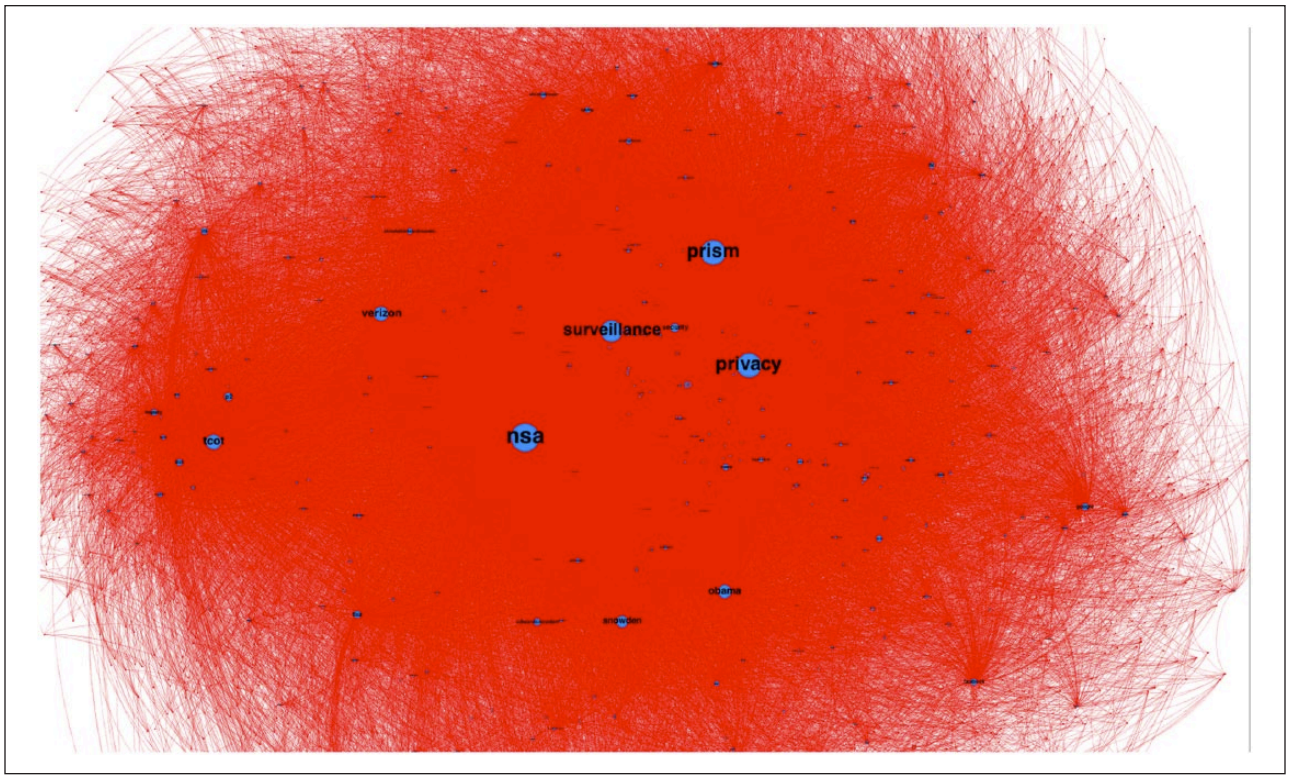

Figure 2. Hashtag-user bi-partite network, all data. Nodes sized by degree count (number of connections) and arranged using Force Atlas 2.

Twitter data capture and analysis developed by the Digital Methods Group at the University of Amsterdam (Borra & Rieder, 2014), which includes a number of tools developed as part of the Economic and Social Research Council (ESRC)-funded project Issue Mapping Online led by Marres (http://www.issuemapping.net) at Goldsmiths, University of London. Our data set is based on two queries—"privacy" and "surveillance"—and includes all tweets containing these words between 6 and 12 June, the period in which the NSA leak occurred. We initially included both terms as it seemed the NSA leak especially resonated across these two topics.[17]

In Precautionary Mode

At the outset of any Twitter research, it seems intuitively sensible to adopt a precautionary approach, not least because of the "unclean" quality of any data gathered via Twitter's API, as in the case of our "bot-infested" privacy data set discussed above. Cleansing our data of such generic content also serves a practical purpose: data reduction is often a practical necessity in online data analysis. At the start of our investigation, we turned to Gephi, the popular tool for network analysis and visualization, in order to visualize the whole data set and to delete from it any data that did not directly pertain to our controversy, the NSA leaks. We began by extracting from our data set a network of hashtags and users. In this bi-partite network (Figure 2), users (red nodes) are connected to the hashtags they use (blue nodes); the more times they use them, the stronger the connection (thicker lines). One of the advantages of this measure is that it mirrors a key commitment of controversy analysis as an STS method: to investigate connections between content and actors, between substantive knowledge claims and the social/political positions of users.

Presented with such a "hairball," we could have taken several approaches to data cleaning. One simple option was to remove the top end of the graph—the nodes #privacy and #surveillance were part of the query, so their presence in the graph is not surprising or illuminating.[18] However, we didn't want to upset the thematic coherence of the network at this early stage, and we made the simple if not unproblematic decision to remove the bottom end of the graph, filtering out users tweeting less than 5 times and excluding hashtags used less than 50 times.

However, no doubt the "easiest prey" for such acts of data cleaning are the aforementioned bots, and data visualization offers a useful way to find them. In examining our network, we noted several suspiciously thick edges between certain nodes (see Figure 3). These indicate a single user deploying a single hashtag over and over—which might represent an overzealous user, but more likely an automated bot.[19] In our precautionary efforts to clean the data and maximize the issue specificity of our data set, the shorthand of the *thick edge* presented itself as a readily available and useful target. Table 1

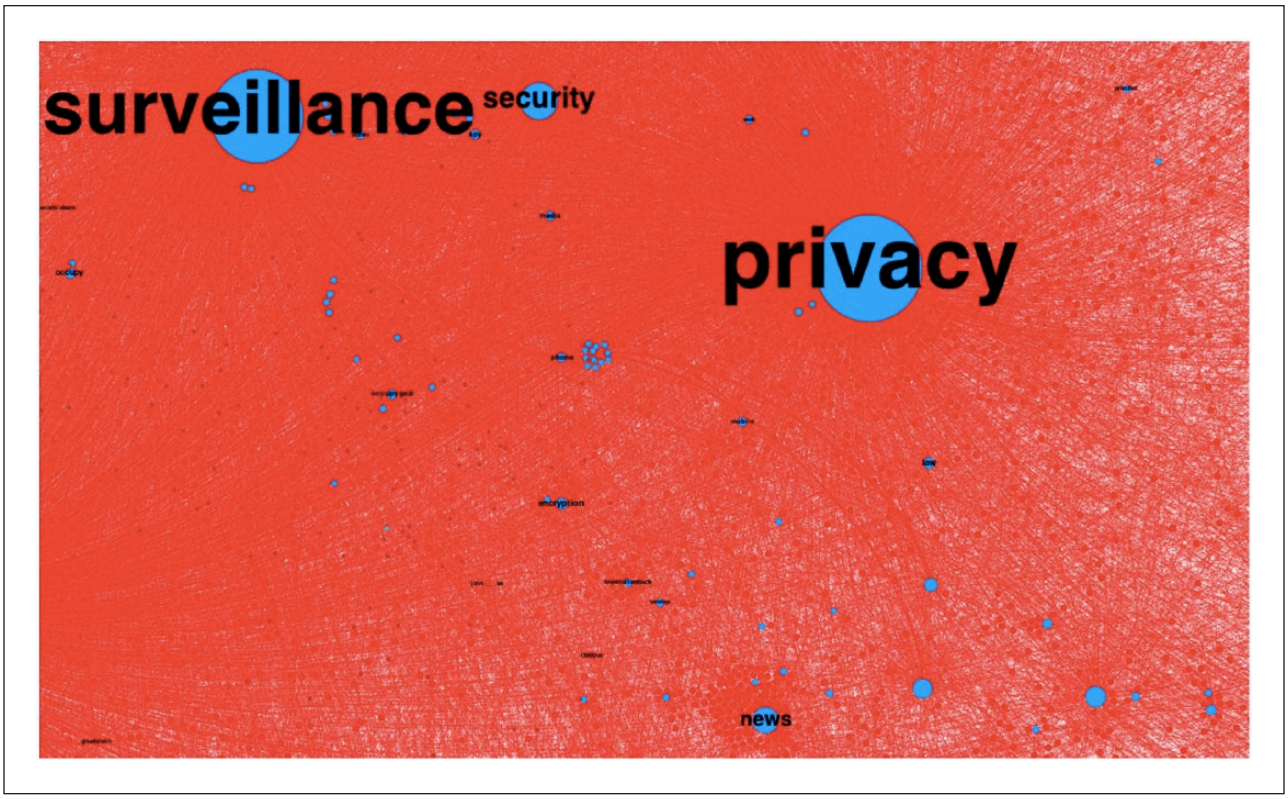

Figure 3. Hashtag-user network minus bottom end, detail of bots (thick edges).

Table 1. Top Edge Weights.

User	Hashtag	Count
Oursurveilance	Surveilance	1871
Oursurveilance	Home	1230
eudytw80uz	ebay	492
eudytw80uz	pager	492
eudytw80uz	privacy	410
eudytw80uz	surveilance	328
Oursurveilance	security	274
krfront	**krf**	**264**
eudytw80uz	uk	246
electronic_time	surveilance	232
oursurveilance	camera	185
electronic_time	home	175
…	…	…
liberationtech	**surveilance**	**96**

lists the edges with the highest counts—the most uses of a single hashtag by a single user, which are likely to indicate bots, as a human would struggle to tweet such volumes.[20]

Crucially, however, many of the top bots on the list are not so easy to dismiss *as* irrelevant to the controversy about the NSA leak. @KRfront (Keyword Resistance Front) represents a website that automatically generates blog posts composed of a mix of trending social media words and "red flag" keywords on government anti-terrorism lists ("bomb, jihad, shoe, etc."), with the stated purpose of confounding or jamming surveillance systems like those of the NSA.[21] *This account is clearly a bot, but one whose purposes are explicitly political and specific to the issue. In practice, then, it turns out to be quite difficult to operationalize the distinction between an issue campaign and a promotional bot*, between an issue-specific intervention and platform-specific behaviors. Our data cleaning exercise may have allowed us to clarify somewhat the composition of the issue space, but it also problematized the distinction between a platform effect and a substantive contribution to issue formation.

In Affirmative Mode

Rather than approaching platform-specific activity like that of bots as external to the dynamics of issue formation, we may also adopt the opposite approach, and consider how platform-specific dynamics may be an indicator of issue activity (Marres & Rogers, 2008; Rogers, 2013). In the wake of the NSA leak, a variety of more or less "media-specific" tactics were pursued on Twitter: circulating news through retweets, wry commentary including tags and mentions, links to online how-to-guides for anonymous browsing. This is to say that issue engagement on a platform like Twitter does not just involve "substantive position taking," a primary focus on controversy analysis in STS, but relies on a wide variety of information formats, something that invites a

Figure 4. https://www.privacyinternational.org/blog/un-report-the-link-between-state-surveillance-and-freedom-of-expression, URL trajectory on Twitter, URL Sequencer.

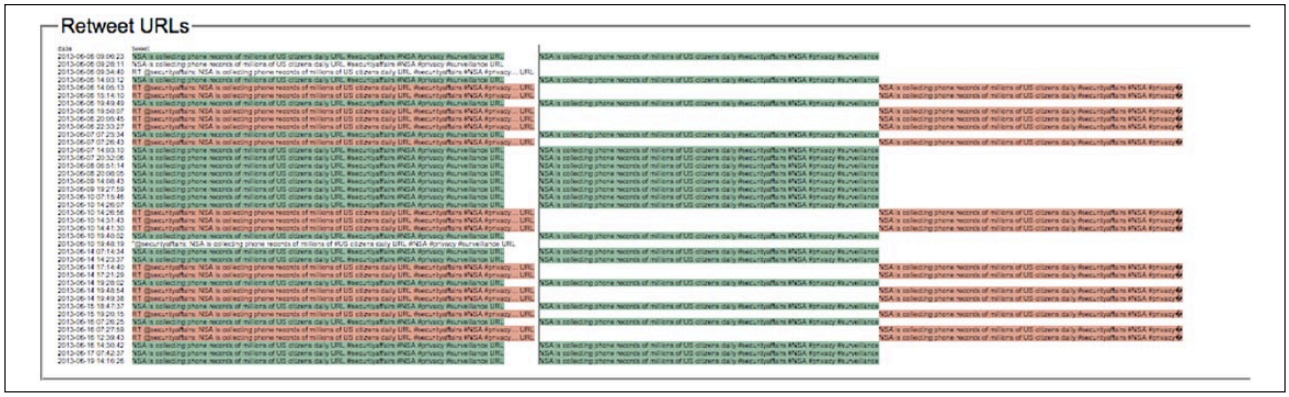

Figure 5. http://securityaffairs.co/wordpress/14947/intelligence/nsa-is-collecting-phone-records-of-millions-of-americans-daily.html, URL trajectory on Twitter, URL Sequencer.

broader focus on issue analysis rather than only controversy analysis (Marres, 2015; Rogers et al., 2015).[22] Here, the object of research is to analyze the articulation of "topics of concern" in different registers (humor, advocacy, knowledge) rather than to trace focused disagreement about specific knowledge claims.

One example of an affirmative approach in digital issue analysis is the practice of tracing the circulation of URLs in social media. Using a prototype tool called the "URL sequencer" currently being developed between the University of Amsterdam and Goldsmiths, we can visualize the trajectories of a URL being spread on Twitter.[23] The URL is a somewhat under-studied data object on Twitter (Bruns & Burgess, 2012; Lerman & Ghosh, 2010), despite the fact that it may provide important insights about cross-platform dynamics. Especially interesting are the modifications of a tweet containing the URL (retweet, @reply, comment, and so on), which may re-direct the reference to a slightly different potential audience (Murthy, 2013). We speculate that retweets of URLs here become technical tools for struggles over issue definition. Plotting URL trajectories in our Twitter data set then brings into view different social media tactics pursued by different actors in disseminating references and/or thematizing issues.

Analyzing the trajectories of top URLs in our data set, we identified three relatively distinct tactics of URL sharing. A first mode of link sharing that we dub "grassroots," as information sharing here takes the form of a distributed process.

Take as an example the URL of the advocacy organization Privacy International (Figure 4), which was retweeted among users who generally took care to attribute the tweet to the user they copied it from, allowing a user network to potentially grow as these users attract followers. The graph above collects all tweets containing a particular URL (after tiny URLs and similar formats have been expanded) arranged in time order and separates them into colour-coded columns, each representing a sequence of mostly identical retweets (disregarding different attributions - @user and automatic truncations "..."). A second type of circulation we refer to as the "broadcast" mode, as it involves the use of semi-automated bots and services to disseminate information widely. In the case of the article by Security Affairs (Figure 5),

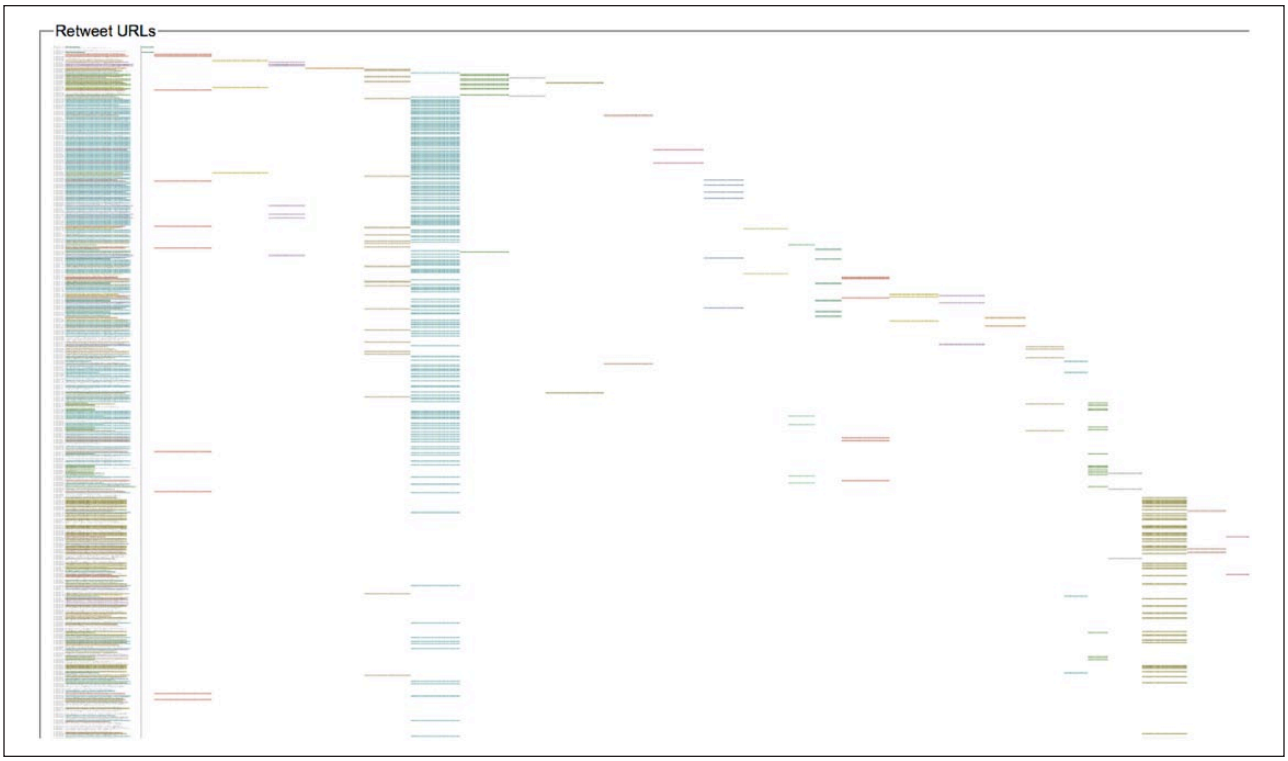

Figure 6. Guardian Article: http://www.theguardian.com/world/2013/jun/06/nsa-phone-records-verizon-court-order, URL trajectory on Twitter, URL Sequencer.

two columns correspond to several identical messages sent by the publisher of the story through their Linked-In account (the green column), which then elicits retweets from other users.[24] A third and final mode of circulation we call "spin," which involves the proliferating of unique tweets in which individual users overtly modulate the link by commenting on it as they forward it (Rieder, 2012). Thus, in the original Guardian exposé by Glen Greenwald (Figure 6) in which the NSA's domestic surveillance program was first announced, one can see quickly accumulating unique phrasings rather than blocks of identical ones. There is evidence of Really Simple Syndication (RSS)[25] bots such as Tweet Deck sharing the article, but the URL's trajectory shifts when the "hacktivist" collective Anonymous represented by @YourAnonNews (blue) takes up the URL and user @attackerman reacts to former Vice President Al Gore's denouncement of the NSA program: "So this happened. MT @algore Is it just me, or is secret blanket surveillance obscenely outrageous? URL" (the beige strip in the visualization).

Focusing on a platform-specific feature, URL sharing, we thus get to view different tactics pursued to public-ize the NSA leak. Distinguishing modes of circulation is useful for controversy analysis, as it brings into view "issuefying" operations *across content and format*, which are of special importance to the thematization of issues as public affairs (Latour & Weibel, 2005; Marres, 2005). However, the above visualizations of circulating references also bring into view what we have identified as a tension in social media research: To what extent are these trajectories expressive of Twitter dynamics, and to what extent can they tell us about broader "issue careers" in the wake of the NSA leak? Insofar as the URL trajectories above include a lot of repetition, the suspicion may arise that Twitter represents little more than an "amplification device," which merely facilitates the spread of propositions articulated elsewhere. This would undermine the assumption that we later realized had informed our pilot study, that Twitter enables idiosyncratic substantive issue articulations that perhaps are not viable elsewhere.

In Empiricist Mode

To address this creeping concern, we adopted an experimental research design in which we sought to determine to what extent Twitter activity in relation to the NSA leak followed issue activity in the news media, or whether it also displayed issue dynamics that were to an extent irreducible to the "news cycle." There are many assumptions and further questions packed into this question, concerning the supposed autonomy of social media platforms in relation to media organizations as well as the relations between news cycles and wider issue cycles (Coleman, 2011). We certainly cannot unpack these assumptions here: in analyzing privacy and surveillance issues with Twitter after the Snowden leaks, our aim is to evaluate whether we can map issues in a way that

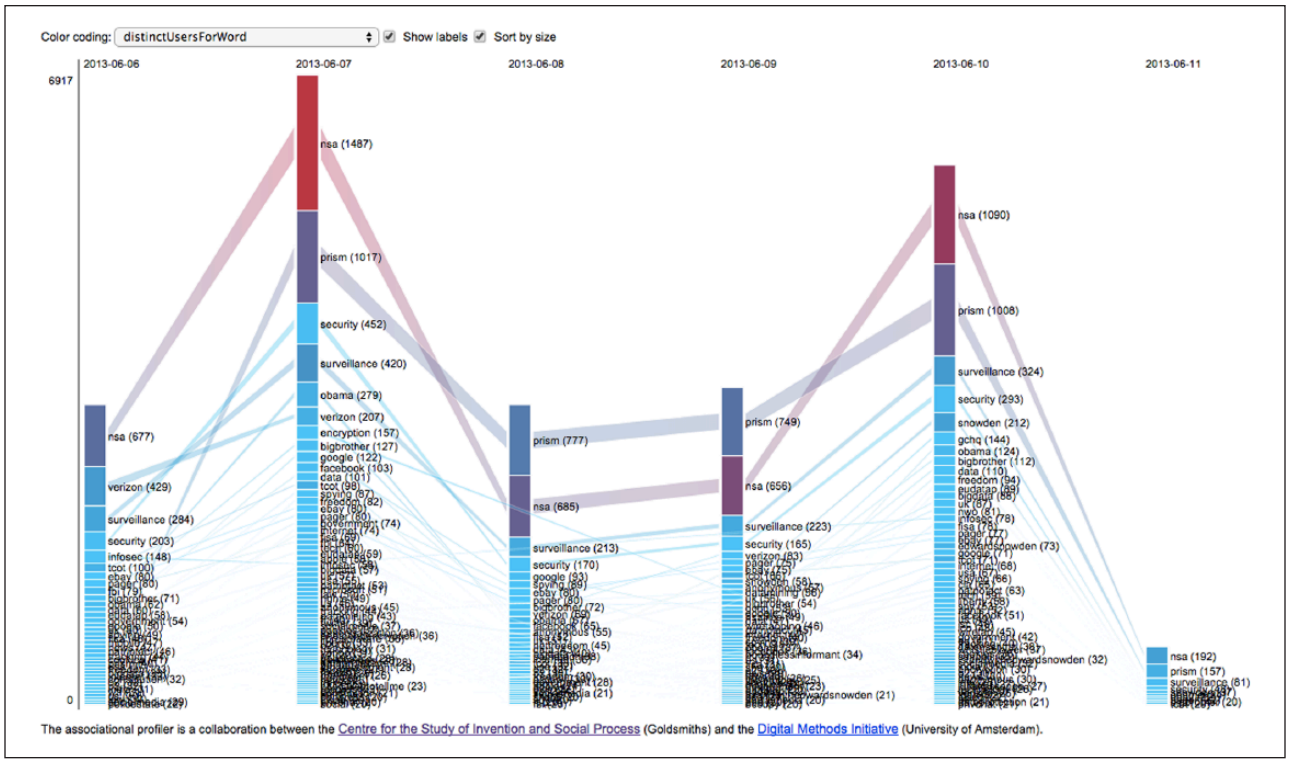

Figure 7. Hashtag profile of privacy in the "privacy" and "surveillance" Twitter data set, the Associational Profiler.

does not negate platform-specificity, but at the same time remains focused on tracing substantive issue formations. To this end, we use a Twitter tool designed to analyze content dynamics over time, the Associational Profiler. We plot which prominent hashtags are associated with "#privacy" and how this changes over time.[26] Figure 7 suggests that the top hashtags associated with privacy in the selected period are closely related to the staggered release of the Snowden files over the week. The hashtags closely follow the news media keywords and so we ask "what happens if we (temporarily) remove the news-centric hashtags?"

We then decide to strip away overtly "newsy" hashtags and their associated activity from our data set, in order to find out whether any issue formations remain. To determine the set of "newsy" hashtags, we use a timeline of the Snowden scandal usefully presented by the BBC,[27] which summarizes the sequence of events: from June 6, when the Guardian revealed government phone tapping by the company Verizon, to the revelation of the government program known as PRISM that collected online records with the complicity of Google and Facebook (but notably not Twitter) on June 7, then Obama's statement on the June 8, and the revelation of Snowden's name on June 9. We then (temporarily) blacklist all hashtags referring to the news events listed on the BBC timeline (nsa, prism, snowden, google, verizon, facebook).

Without the newsy hashtags (Figure 8), the profile for "privacy" becomes more issue-specific, insofar as it now primarily contains substantive issue terms (surveillance, security, data tap). Profiling these focus words in turn, we find that they contain terms one would not expect to find in the news media, including hashtags like "policestate," "nwo" (for new world order), and "bigbrother." As such, we hypothesize that Twitter does not just further spread news articles, but may indeed be participating in the substantive specification of the NSA leak as a matter of concern.

Conclusion

What are we mapping when mapping issues with social media? When we take up tools of online data analysis in order to map controversies with social media, we are confronted by this methodological issue, and we have proposed that STS approaches to controversy analysis may help us to address it. While methods of controversy analysis are used to analyze social media content across fields, STS methods are useful insofar as they explicitly recognize the "heterogeneous" constitution of the object of analysis. In turn, social media research provides important opportunities for further developing this methodology. In analyzing controversies, or mapping issues, with a platform like Twitter, we have the opportunity to elaborate a *symmetrical* approach to the study of controversy between science, technology, and society. We can extend this symmetrical approach from a focus on the relation between knowledge content and political interests in controversy, as was the aim in early STS, to include the relation between medium and content.

While controversy analysts in STS have in the last decade or so stepped up efforts to account for the role of public

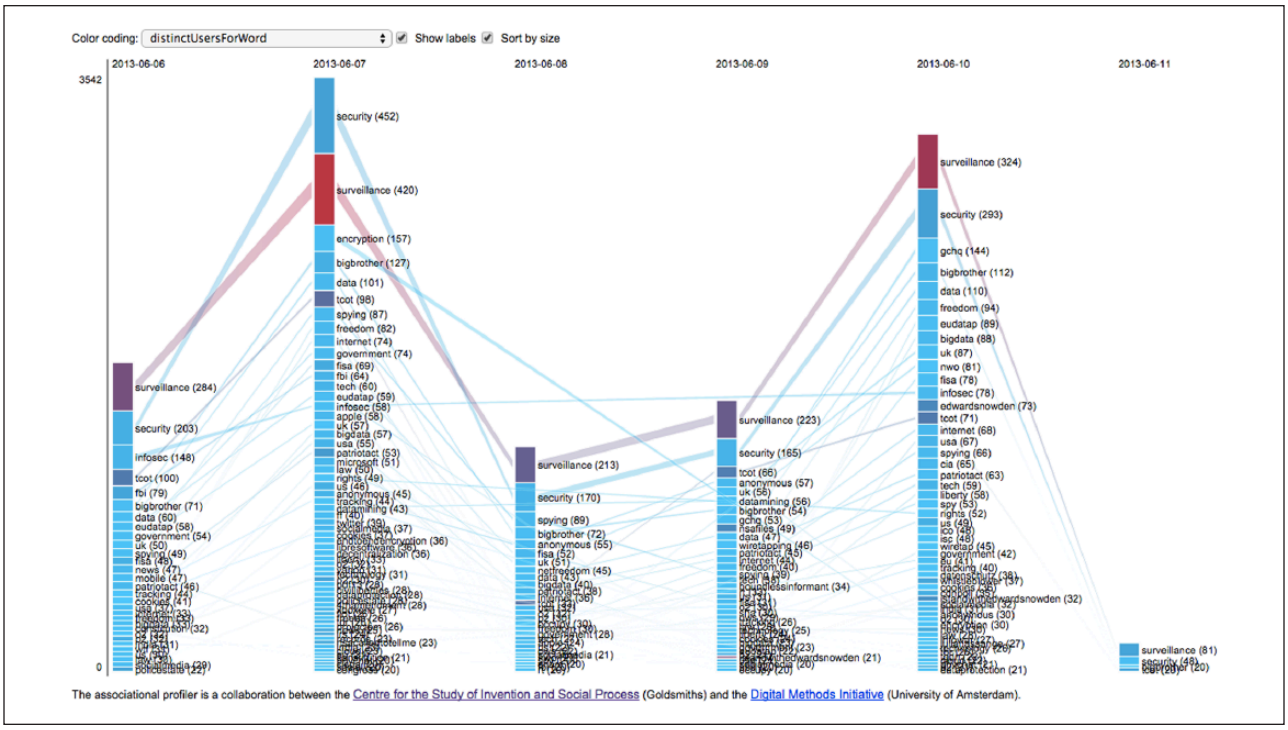

Figure 8. Hashtag profile of privacy "without the news" in the "privacy" and "surveillance" Twitter data set, the Associational Profiler.

media in controversies, social media research allows us to further operationalize the twin concern with both substantive and media-logical dynamics of controversy. This also means that in implementing controversy analysis as a social media method, media studies and STS can be brought into a wider and more intimate dialogue. Insofar as social media research occasions such an encounter between inter-disciplinary fields, some difficult and unsettling questions arise, not least the questions addressed here. However, rather than treating these questions as "distractions" from empirical and technical engagement with social media, or as primarily requiring definitional work (what is your domain of study?), we have suggested they may be productively approached as praxiological questions: as methodological issues that can be addressed in and as social media research practice.

This has the advantage of bringing into view the complementarity of different methodological approaches. An instrumental or "precautionary" approach, which is interested in deploying social media analysis for social research, may be especially suited to the early phases of research, when the aim is to craft an "interpretable" empirical object. An affirmative approach may better grasp dynamics that operate across content and medium, analyzing platform-specific dynamics in order to detect issue activity. An empiricist approach, finally, allows us to approach the qualification of the empirical object—are we studying media-technological dynamics or issue dynamics?—as an objective of social media research.

We have only been able to show snippets of the empirical tactics involved, but by discussing how we might move across different modes of inquiry in practice, we have tried to show that social media research offers opportunities for a *symmetrical treatment* of the relations between media-technological and issue dynamics in the study of public controversy. While this approach is in many ways still to be developed—and while existing contributions to this project are still to be more fully recognized and appreciated—it is clear that by elaborating symmetry in this way, we are not just implementing STS methods in social media research. Rather, social media research invites us to re-negotiate the relations between STS and media studies, and our practice-based account above suggests that practical collaboration is key to this process. It is critical that we do not withdraw into theoretical debates about what constitutes the "proper object" of controversy studies and social media research, but rather look to take advantage of productive confusions between the two.

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Notes

1. Julia turner: "Everything you were angry about on social media" Slate, 17 December 2014 http://www.slate.com/articles/life/culturebox/2014/12/the_year_of_outrage_2014_everything_you_were_angry_about_on_social_media.html
2. We thank an anonymous reviewer for *Social Media and Society* (SMS) for suggesting this particular example.
3. We discuss the relation between controversy analysis and issue mapping in more detail below.
4. Controversy analysis can be traced back further to the study of priority disputes in science (Merton, 1957), but it assumed much more central importance in the sociology of science with the Strong Program, which deployed the approach to make the *content* of scientific knowledge production available for sociological analysis (Barnes, 1977; Bloor, 1976) In their historical studies of controversies in and about science, they aimed to demonstrate that even the most esoteric and abstract knowledge, such as particle theory in physics, is marked by social and political interests.
5. We speak of a "radically empiricist" approach insofar as Actor–Network Theory (ANT), like other some strands of work in Science and Technology Studies (STS), insists on treating theoretical issues as empirical questions: it wishes to treat "ontology" as an accomplishment of the setting—and thus, as topics for research rather than something to be assumed a priori.
6. These studies, in other words, offer good examples of work situated at the different ends of the spectrum of digital research on controversy: work that is mainly focused on media dynamics on the one hand and on issue dynamics on the other.
7. We say "formative ambiguity" because the ambiguity is not just something operating below the radar of the empirical (i.e. it is not a "theoretical problem," concerned with conditions of possibility)—but affects the shape controversies and issues take in digital settings.
8. A range of authors have studies how informational devices organize action, including Cochoy's (2008) insightful analysis of the info-material devices that make supermarkets tick (carts, product placement).
9. The full quote reads "Current work on Twitter will be able to be combined with studies of other (social) media platforms in order to develop a more comprehensive and detailed picture of information and communication flows in society" (Bruns & Stieglitz, 2012). However, such delineations of the empirical object of social media analysis tend to contain ambiguity by definitional means and do not engage with it as a constructive empirical question (what are we mapping?). In his article on Facebook research, Rieder (2013) adopts a similar solution.
10. If we rely on content-based demarcations of publicly available social media data—such as hashtags—there is perhaps less of a risk that we end up investigating personal topics and/or attributes. However, we must not only ask what is public but also what is public "for whom" (Zimmer, 2010).
11. Building on praxio-logical approaches developed in STS and cultural economy, Marres and Weltevrede (2013) argue that social media *research practices* provide a productive site for exploring more fundamental normative and methodological issues.
12. Marres et al. (2013) Detecting the Socials, https://wiki.digitalmethods.net/Dmi/DetectingTheSocials. With thanks to Johannes Passmann and Colleen Reilly for earlier helpful suggestions. It is common practice for spam peddlers, commercial entities, or even activist groups to hi-jack trending hashtags to promote their (unrelated) messages. See Christensen (2013) on "hashtag jumping."
13. See Niederer, S. et al., "Issue Resonance," Issue Mapping Online Workshop, 22 May, 2012, Goldsmiths, http://issuemapping.net/Main/IssueRessonance
14. Of course, one important way to enable a more symmetrical treatment of media and controversy is to conduct multi-sited research. However, in this article, we want to deliberately stick with methods of social media analysis. A good understanding of the methodological issues this raises is critical, we think, to appreciating the strength of mixed methods in this area.
15. If we had chosen a classic public science controversy which was largely confined to technical matters debated in public institutional settings, then the issues of platform bias might be more minimal and/or easier to adjust for. If on the other hand we would have chosen a controversy focused on digital culture such as #gamergate, it would be very pertinent and also more straightforward to do a media-specific analysis—taking in not only the medium-specific features but also the very particular affective culture of social media scandals. Our case is more ambiguous because it operates across these various dimensions. Thanks go to one of the anonymous reviewers for suggesting the example of gamergate.
16. For a different (frequency-based) study of these events, see http://blog.trendsmap.com/2014/06/snowden
17. Our initial data set contains 511,332 tweets by 257,683 unique users. The TCAT platform has also captured tweets related to Snowden, National Security Agency (NSA) and PRISM but only after the controversy had started. As will become clear, these terms are more indicative of news coverage of the Snowden affair and do not cover the wider range of issues and actors affected by the scandal as well.
18. Several network analysis measures—including centrality and clustering—can be used to sift through the mass of data, but we opted for simpler techniques. Our aim was not to do a formal analysis of network structure, but to get to know (and see) the substantive issues at stake in the controversy.
19. One website (http://web.archive.org/web/20130430025727/http://botornot.net/project) speculates that anywhere from 30% to 50% of Twitter is made up of bots. This is phrased as a sliding scale because it is difficult to distinguish between very clever bots pretending to be humans, human users acting in very repetitive bot-like ways (using pre-set messages from the tweet button), and accounts which are a mix of human-composed and bot-created messages (Wilkie, Michael, & Plummer-Fernandez, 2014). Detecting not bots but spam is also a project being undertaken by Twitter itself (Lardinois, 2010) with the spammers constantly updating their methods to evade filters.
20. @oursurveilance is likely a bot (selling home surveillance equipment) because a human would struggle to tweet upward of 2000 tweets in 7 days. @eudytw80uz similarly sells home security on eBay.com through automatically generated tweets. Of the hashtags with a high degree, we surmise that a majority of the top 20 represent generic bots.
21. Further down the list, @liberationtech which should be comfortably above the "definitely-a-bot" threshold is actually an RSS driven account from Cal Tech which is set up as a feed

of privacy and surveillance news (like a kind of curated magazine). Again this is a high volume account, but one which is perfectly relevant and issue specific.

22. In our data set, "NSA" and "PRISM" are themselves relatively uncontroversial—nearly everyone on Twitter thinks that surveillance is bad. Only a few users defend the NSA programs as a necessary cost of security. Insofar as there is focused disagreement on Twitter around Snowden, it concerns questions such as whether or not NSA and PRISM should be blamed on the Obama or George W. Bush administration's policies. But this is not so much expressed in propositional claims (with some exceptions: http://michellemalkin.com/2013/06/06/history-lesson-the-crucial-differences-between-bush-and-obamas-nsa-phone-surveillance-programs/) but by tying tweets to the #Obama, or alternately the #patriot act tag.
23. The tool first expands all tiny URLs, including those that were truncations of already shortened URLs, and resolves them back to their original sources (t.co/XFDFS—>tiny.url/SFDSFS—→BBC.co.uk/FDSFSDS). It then arranges every tweet in which a URL is shared in a given data set in time order. To analyze these URL shares qualitatively would be a challenge because of the amount of repetition due to the presence of RSS bots and retweets. The URL sequencer first identifies similar deployments of a URL by stripping away particular @ mentions and URL truncation to compare the core text and separates the types into columns (in the order of the first appearance of a typology). This allows the researcher to identify variations and modifications which may be consequential for how the URL is shared.
24. The repeated tweet in question reads: NSA is collecting phone records of millions of US citizens daily URL #securityaffairs #NSA #privacy #surveillance URL.
25. RSS (Really Simple Syndication) is a protocol which allows for automatic notifications when pages are updated. Some Twitter services and bots are set up to automatically Tweet when new content is published, often containing the title and short description as specified in the RSS feed.
26. This tool was developed between Goldsmiths and the University of Amsterdam and is built into TCAT. In its current implementation, the associational profiler uses co-word analysis to detect relations among words or hashtags in Twitter data. The profiler visualizes these networks as stacked bar graphs showing the associated hashtags ranked by quantity of co-occurrence over time. The graph can also be color coded by specificity (which measures the relative strength of the hashtag association in comparison to the strength of relations with other hashtags in the population) or user diversity which, in a similar way to the edge weights above, highlights hashtags which are pushed by single users as opposed to multiple users (Marres, 2015).
27. http://www.bbc.co.uk/news/world-us-canada-23768248

References

Anderson, C. W., & Kreiss, D. (2013). Black boxes as capacities for and constraints on action: Electoral politics, journalism, and devices of representation. *Qualitative Sociology*, *36*, 365–382.

Barnes, B. (1977). *Interests and the growth of knowledge*. Milton Park, UK: Routledge.

Barry, A. (2001). *Political machines: Governing a technological society*. London, England: Continuum.

Beck, G., & Kropp, C. (2011). Infrastructures of risk: A mapping approach towards controversies on risks. *Journal of Risk Research*, *14*, 1–16.

Birkbak, A. (2013, May 2-4). From networked publics to issue publics: Reconsidering the public/private distinction in web science. In H. Davis, H. Halpin, & A. Pentlandt (Eds.), *Proceedings of the 5th Annual ACM Web Science Conference, WebSci '13* (pp. 24–32). New York, NY: Association for Computing Machinery.

Bloor, D. (1976). *Knowledge and social imagery*. Chicago, IL: University of Chicago Press.

Bloor, D. (1982). Durkheim and Mauss revisited: Classification and the sociology of knowledge [Special issue: The Sociology of Knowledge: Cases and Debates]. *Studies in History and Philosophy of Science*, *13*, 267–297.

Bolter, J. D., & Grusin, R. (2000). *Remediation: Understanding new media*. Cambridge, MA: MIT Press.

Borra, E., & Rieder, B. (2014). Programmed method: Developing a toolset for capturing and analyzing tweets. *Aslib Journal of Information Management*, *66*, 262–278.

Borra, E., Weltevrede, E., Ciuccarelli, P., Kaltenbrunner, A., Laniado, D., Magni, G., . . .Venturini, T. (2014). Contropedia—The analysis and visualization of controversies in Wikipedia articles. In *Proceedings of the 10th Symposium on Open Collaboration* (p. 34). New York, NY: Association for Computing Machinery.

boyd, D., & Crawford, K. (2011, September 21-24). *Six provocations for big data*. A decade in internet time: Symposium on the dynamics of the internet and society, Oxford, UK.

Bruns, A., & Burgess, J. (2012). Researching news discussion on Twitter. *Journalism Studies*, *13*, 801–814.

Bruns, A., & Burgess, J. E. (2011, August 25-27). *The use of twitter hashtags in the formation of ad hoc publics*. Paper presented at the 6th European Consortium for Political Research General Conference, University of Iceland, Reykjavik.

Bruns, A., & Stieglitz, S. (2012). Quantitative approaches to comparing communication patterns on Twitter. *Journal of Technology in Human Services*, *30*, 160–185.

Burgess, J., Galloway, A., & Sauter, T. (2015, forthcoming). Hashtag as hybrid forum: The case of #agchatoz. In N. Rambukkana (Ed.), *Hashtag publics*. New York, NY: Peter Lang.

Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen. In J. Law (Ed.), *Power, action and belief: A new sociology of knowledge* (pp. 196–233). London, England: Routledge & Kegan.

Callon, M., Lascoumes, P., & Barthe, Y. (2001). *Acting in an uncertain world: An essay on technical democracy*. Cambridge, MA: MIT Press.

Christensen, C. (2013). Wave-riding and hashtag-jumping. *Information, Communication & Society*, *16*, 646–666.

Cicourel, A. V. (1964). *Method and measurement in sociology*. Oxford, UK: Free Press of Glencoe.

Cochoy, F. (2008). Calculation, qualculation, calqulation: Shopping cart arithmetic, equipped cognition and the clustered consumer. *Marketing Theory*, *8*, 15–44.

Coleman, G. (2011). Hacker politics and publics. *Public Culture*, *23*, 511–516.

Corner, J., Richardson, K., & Fenton, N. (1990). *Nuclear reactions: Form and response in "public issue" television*. New Barnet, UK: John Libbey.

Crawford, K. (2013, May 16-17). Can an algorithm be agonistic? Ten scenes about living in calculated publics, a response to Tarleton Gillespie's essay "the relevance of algorithms." In: *Governing Algorithms Conference*. New York: New York University. Retrieved from http://governingalgorithms.org/wp-content/uploads/2013/05/1-response-crawford.pdf

Driscoll, K., & Walker, S. (2014). Big data, big questions | working within a black box: Transparency in the collection and production of big twitter data. *International Journal of Communication*, *8*, 1745–1764. Retrieved from http://ijoc.org/index.php/ijoc/article/view/2171/1159.

Foot, K. A., & Schneider, S. M. (2004). Online structure for civic engagement in the September 11 web sphere. *Electronic Journal of Communication*, *14*, 3–4.

Gerlitz, C., & Helmond, A. (2013). The like economy: Social buttons and the data-intensive web. *New Media & Society*, *15*(8), 1348–1365.

Gerlitz, C., & Lury, C. (2014). Social media and self-evaluating assemblages: On numbers, orderings and values. *Distinktion: Scandinavian Journal of Social Theory*, *15*, 174–188.

Gieryn, T. F. (1999). *Cultural boundaries of science: Credibility on the line*. Chicago, IL: University of Chicago Press.

Gillespie, T. (2014). The relevance of algorithms. In T. Gillespie, P. J. Bockzkowski, & K. A. Foot (Eds.), *Media technologies: Essays on communication, materiality, and society* (pp. 167–194). Cambridge, MA: MIT Press.

Gillespie, T., Boczkowski, P. J., & Foot, K. A. (Eds.). (2014). *Media technologies: Essays on communication, materiality, and society*. Cambridge, MA: MIT Press.

Gregory, J., & Miller, S. (1998). *Science in public*. New York, NY: Basic Books.

Hilgartner, S. (1990). The dominant view of popularization: Conceptual problems, political uses. *Social Studies of Science*, *20*(3), 519–539.

Hilgartner, S. (2000). *Science on stage: Expert advice as public drama*. Stanford, CA: Stanford University Press.

Jasanoff, S. (2005). *Designs on nature: Science and democracy in Europe and the United States*. Princeton, NJ: Princeton University Press.

Kelty, C. (2005). Geeks, social imaginaries, and recursive publics. *Cultural Anthropology*, *20*(2), 185–214.

Koed Madsen, A. (2012). Web-visions as controversy-lenses. *Interdisciplinary Science Reviews*, *37*(1), 51–68.

Lardinois, F. (2010, March 23). Twitter is winning its fight against spammers. *readwrite*. Retrieved from http://readwrite.com/2010/03/23/twitter_is_winning_its_fight_against_spammers

Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge, MA: Harvard University Press.

Latour, B. (1992). Where are the missing masses? The sociology of a few mundane artifacts. In W. E. Bijker & J. Law (Eds.), *Shaping technology/building society: Studies in sociotechnical change* (pp. 225–258). Cambridge, MA: MIT Press.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network theory*. Oxford: Oxford University Press.

Latour, B., & Weibel, P. (Eds.). (2005). *Making things public: Atmospheres of democracy*. Cambridge, MA: MIT Press.

Lerman, K., & Ghosh, R. (2010, May 23-26). Information contagion: An empirical study of the spread of news on Digg and Twitter social networks. In *Proceedings of 4th International Conference on Weblogs and Social Media (ICWSM)* (pp. 90–97). Menlo Park, CA: AAAI Press.

Lewenstein, B. V. (1995). From fax to facts: Communication in the cold fusion saga. *Social Studies of Science*, *25*, 403–436.

Leydesdroff, L. (1989). Words and co-words as indicators of intellectual organization. *Research Policy*, *18*, 209–223.

Lievrouw, L. A. (2009). New media, mediation and communication study. *Information, Communication & Society*, *12*, 303–325.

Lievrouw, L. A., & Livingstone, S. (2002). *Handbook of new media: Social shaping and consequences of ICTs*. London, England: SAGE.

Marres, N. (2005). *No issue, no public: Democratic deficits after the displacement of politics*. (Doctoral thesis). Amsterdam School for Cultural Analysis (ASCA), Amsterdam, Netherlands.

Marres, N. (2015). Why map issues? On controversy analysis as a digital method. *Science, Technology & Human Values*, *40*(5), 655–686. doi:10.1177/0162243915574602

Marres, N., & Rogers, R. (2008). Subsuming the ground: How local realities of the Fergana Valley, the Narmada Dams and the BTC Pipeline are put to use on the Web. *Economy and Society*, *37*, 251–281.

Marres, N., & Weltevrede, E. (2013). Scraping the social? Issues in real-time social research. *Journal of Cultural Economy*, *6*(3), 1–52.

Merton, R. (1957). Priorities in scientific discovery: A chapter in the sociology of science. *American Sociological Review*, *22*, 635–659.

Meyrowitz, J. (1997). Shifting worlds of strangers: Medium theory and changes in "them" versus "us." *Sociological Inquiry*, *67*, 59–71.

Morley, D. (2006). *Media, modernity and technology: The geography of the new*. London, England: Routledge.

Murthy, D. (2013). *Twitter: Social communication in the Twitter age*. Cambridge, UK: Polity.

Nelkin, D. (1971). *Nuclear power and its critics: The Cayuga Lake controversy*. Ithaca, NY: Cornell University Press.

Nelkin, D. (1987). *Selling science: How the press covers science and technology*. New York, NY: Freeman.

Papacharissi, Z., & de Fatima Oliveira, M. (2012). Affective news and networked publics: The rhythms of news storytelling on# Egypt. *Journal of Communication*, *62*, 266–282.

Pinch, T. (1994). Cold fusion and the sociology of scientific knowledge. *Technical Communication Quarterly*, *3*, 85–100.

Plantin, J.-C. (2011, September 21-24). *"The map is the debate": Radiation webmapping and public involvement during the Fukushima issue*. Paper presented at a Decade in Internet Time: Symposium on the Dynamics of the Internet and Society, Oxford Internet Institute, Oxford, UK.

Prabowo, R., Thelwall, M., Hellsten, I., & Scharnhorst, A. (2008). Evolving debates in online communication: A graph analytical approach. *Internet Research*, *18*, 520–540.

Procter, R., Vis, F., & Voss, A. (2013). Reading the riots on Twitter: Methodological innovation for the analysis of big data. *International Journal of Social Research Methodology*, *16*(3), 197–214.

Rieder, B. (2012). The refraction chamber: Twitter as sphere and network. *First Monday*, *17*, 11–15.

Rieder, B. (2013). Studying Facebook via data extraction: The Netvizz application. In H. Davis, H. Halpin, & A. Pentlandt (Eds.), *Proceedings of the 5th Annual ACM Web Science Conference, ACM* (pp. 346–355). New York, NY: Association for Computing Machinery.

Rogers, R. (2009). *The googlization question, and the inculpable engine.* Retrieved from http://govcom.org/publications/full_list/rogers_inculpable_engine_2009.pdf

Rogers, R. (2013). *Digital methods*. Cambridge, MA: MIT Press.

Rogers, R., & Marres, N. (2000). Landscaping climate change: A mapping technique for understanding science and technology debates on the World Wide Web. *Public Understanding of Science*, *9*, 141–163.

Rogers, R., Sánchez-Querubín, N., & Kil, A. (2015). *Issue mapping for an aging Europe*. Amsterdam, The Netherlands: University of Amsterdam Press.

Scharnhorst, A., & Wouters, P. (2006). Webindicators: A new generation of S&T indicators. *Cybermetrics*, *10*. Retrieved from http://depot.knaw.nl/3752/

Smith, M. A., Rainie, L., Shneiderman, B., & Himelboim, I. (2014). *Mapping twitter topic networks: From polarized crowds to community clusters*. Pew Research Internet Project. Retrieved from: http://www.pewinternet.org/2014/02/20/part-2-conversational-archetypes-six-conversation-and-group-network-structures-in-twitter/

Stilgoe, J. (2012). Experiments in science policy: An autobiographical note. *Minerva*, *50*, 197–204.

Thelwall, M., Sud, P., & Vis, F. (2012). Commenting on YouTube videos: From Guatemalan rock to el big bang. *Journal of the American Society for Information Science and Technology*, *63*, 616–629.

Thielmann, T. (2012). Taking into account: Harold Garfinkels beitrag fur eine theorie sozialer medien. *Zeitschrift für Medienwissenschaft*, *6*(1), 85–102.

Tufekci, Z. (2014 June 2–4). *Big questions for social media big data: Representativeness, validity and other methodological pitfalls*. ICWSM '14: Proceedings of the 8th International AAAI Conference on Weblogs and Social Media. Ann Arbor, MI: AAAI.

Van Loon, J. (2011, May 26-30). *How to be mediatizated? An invitation to metaphysics in defense of actor network theory*. Paper presented at the International Communication Association's 2011 Virtual Conference, Boston, MA.

Venturini, T. (2010). Building on faults: How to represent controversies with digital methods. *Public Understanding of Science*, *21*, 796–812.

Wajcman, J., & Jones, P. K. (2012). Border communication: Media sociology and STS. *Media, Culture & Society*, *34*, 673–690.

Weber, I., Garimella, V. R. K., & Teka, A. (2013, March 24-27). Political hashtag trends. In Serdyukov, P., Braslavski, P., Kuznetsov, S. O., Kamps, J., Rüger, S., Agichtein, E., . . . Yilmaz, E. (Eds.), *Advances in Information Retrieval 35th European Conference on IR Research (ECIR 2013)* (pp. 857–860). Heidelberg, Germany: Springer.

Wilkie, A., Michael, M., & Plummer-Fernandez, M. (2014). Speculative method and twitter: Bots, energy and three conceptual characters. *The Sociological Review*, *63*, 79–101.

Yasseri, T., Sumi, R., & Rung, A. (2012). Dynamics of conflicts in Wikipedia. *PLoS ONE*, *7*(6), e38869.

Zimmer, M. (2010). "But the data is already public": On the ethics of research in Facebook. *Ethics and Information Technology*, *12*, 313–325.

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