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RESEARCHING NEWS DISCUSSION ON TWITTER

New methodologies

Axel Bruns and **Jean Burgess**

Twitter has become a major instrument for the rapid dissemination and subsequent debate of news stories, and comprehensive methodologies for systematic research into news discussion on Twitter are beginning to emerge. This paper outlines innovative approaches for large-scale quantitative research into how Twitter is used to discuss and cover the news, focusing especially on #hashtags: brief identifiers which mark a tweet as taking part in an established discussion.

KEYWORDS news; social networking; *Twitter*; #hashtags

Introduction

Twitter has become an important addition to the toolboxes of journalists and journalism researchers (Ahmad, 2010). Its trajectory has mirrored that of previous social media platforms: just as blogs became established as tools both for occasional first-hand reporting and for extensive follow-on curation, commentary, and discussion of news stories (cf. Bruns, 2006), so Twitter's uses have been extended beyond everyday "lifesharing" and interpersonal communication to similar journalistic, para-journalistic, and quasi-journalistic activities (Kwak et al., 2010; Subasic and Berendt, 2011). Even accompanying claims of "over-hype" or concerns about Twitter's possible adverse affects on journalism practice (Farhi, 2009) signal widespread awareness and take-up, and indicate that for journalists and journalism researchers, when it comes to Twitter, there is something at stake. This paper addresses the challenges and opportunities for researchers as they study how Twitter is used in the context of specific journalistic activities. First, however, we sketch the possible uses of Twitter in relation to news events.

First and most obviously, Twitter is used for first-hand reporting of events as they occur; the simple format of Twitter messages and the near-ubiquitous accessibility of the network (with tweet-via-SMS functionality as ultimate fallback) combine to make live tweeting a more important practice on Twitter than comparable live activities have been for previous platforms. Such activities now include not only the reporting of events by actual eyewitnesses on the ground, from live coverage of the emergency water landing of a plane on New York's Hudson River (Subasic and Berendt, 2011) to the inadvertent (and only retrospectively discovered) live account of the raid on Osama bin Laden's compound by an Abbottabad local (Hill, 2011), but also second-hand live discussion of unfolding events as they are covered by other media—such as the worldwide public sharing of news on the Japanese earthquake and tsunami in March 2011, which generated some 140,000 tweets per hour containing the word "tsunami" in the hours immediately following the

earthquake (see Bruns, 2011a) or the appearance of Rupert and James Murdoch before the British Parliament's Culture, Media and Sports Committee in July 2011 (Richards et al., 2011).

A key driver here is the ease with which additional materials (links, photos, video, audio) can also be shared. This aids both the dissemination of first-hand, user-generated material documenting unfolding events as directly experienced by the user, and the sharing of secondary material in the form of links, screen captures, or even photos of TV screens. These additions extend Twitter's affordances far beyond the 140 character limit, adding a rich media layer to the tweets themselves—and these multimedia materials often also make their way into mainstream media coverage.

Second, and consequently, Twitter is also used widely for ongoing discussion—and instant evaluation—of newsworthy events. This is triggered by mainstream media reporting, first-hand coverage by Twitter users themselves, or established interests of specific communities of Twitter users; it employs processes similar to what Bruns (2005) has described as "gatewatching": highlighting, sharing, and evaluating relevant material released by other sources, in order to develop a more comprehensive understanding. What is shared, and how it is framed in discussion, provides an interesting alternative to conventional "vox pops"; "what Twitter thinks" about an issue has become a staple feature of mainstream media coverage. One important aspect of news discussion practices on Twitter is the *curating* of information related to specific stories: the more active Twitter users frequently engage in gathering and sharing what they perceive to be relevant materials, for example tweeting links to further information (or retweeting relevant posts of other users) to their own followers or to Twitter communities formed around topical hashtags.

Finally, Twitter's news coverage also consists of significant amounts of broader commentary on current events, reflecting mainly the senders' own perspectives and intended more as markers of those perspectives than as formal contributions to debate. Here, perhaps, the "ambient" function of Twitter, highlighted by both Hermida (2010) and Burns (2010), emerges most clearly: for the average user, the majority of their Twitter use on any day may be taken up with non-news-related communication—much of it mundane and phatic—with Twitter as an ambient, always-on, always-in-the-background medium akin to ambient background music (Crawford, 2009). However, when important news breaks and spreads across the Twittersphere, shifts in tone and topical focus of incoming tweets may cause that user to pay attention to the story (again, much as a sudden shift in musical style may cause background music no longer to appear merely ambient).

Shifts from ambient to central are measured, simplistically, by Twitter's own "trending topics", and used by some newsrooms as additional measures of the newsworthiness of specific stories; more detailed analysis not only of such trends, but also of the relative attention paid to particular sources, political and other actors, or to the information shared by different Twitter users, is also possible. A recurring feature of the *Guardian's* coverage of the *News of the World* voicemail hacking scandal, for example, have been visualisations of how Twitter users' mentions of key figures and organisations in the scandal unfolded over time (see e.g. Richards et al., 2011). Here, especially, journalism practitioners and researchers share a common interest: the development of more sophisticated methods and metrics for describing, analysing and representing Twitter's response to news events.

Twitter as Social Networking Site and Information Stream: Followers and Hashtags

Twitter is the most prominent example of a recent shift in social media, which has seen the convergence of explicit networking practices (“friending”, “following”, interpersonal communication) with original content (“broadcasting” of updates), and large-scale information sharing and propagation. It is *through* the social network that news and information spread: Twitter is both a social networking site and an ambient information stream. This convergence (cf. Kwak et al., 2010) underpins Twitter’s significance for journalism; any evaluation of user activities on Twitter must reflect on the structural aspects of this convergence. Explicit networking structures among users determine—to an important extent, though not exclusively—which tweets are visible to what subset of the total userbase (now over 200 million worldwide; cf. White, 2011).

Overall, Twitter’s communicative structure is determined by two overlapping and interdependent networks—one long-term and relatively stable, based on follower–followee relationships; one relatively short-term and emergent, based on shared interest in a topic and coordinated by a common hashtag. First, Twitter users are able to “follow” one another: all tweets originating from the followee will automatically be visible to the follower, in an update feed combining tweets from all followed users.¹ Such relationships are usually based on a longer-term interest in updates from the followee; the overall network structure shows unsurprising tendencies to cluster around key interests or attributes shared by communities of followers (Java et al., 2007), much as in other social networks (e.g. Adamic and Glance, 2005; Kelly and Etling, 2008). Our own investigation shows that even an as yet incompletely mapped network of some 440,000 Australian Twitter users already tends towards clustering around shared professional and cultural interests (Bruns, 2011c).

To the extent that Twitter users consciously understand this network structure, their responses to newsworthy events address and interact with their own immediate community of followers, and may also attempt to overcome the barriers dividing specific clusters in the network. The imagined immediate audience for any one tweet is likely to be the user’s network of followers; receiving responses from, or being retweeted by, these followers is seen as possible and perhaps even desired. Indeed, some tweets carry explicit encouragements to “pls RT”, asking for messages to be spread well beyond the user’s own follower network.

Similarly, while retweeting practices vary widely in meaning and intention (boyd et al., 2010), they reflect implicit understandings of Twitter’s network structure, recognising that unaided, original messages will reach only a limited number of users, and that further passing-along amplifies their visibility. Retweeting users may even see themselves as information brokers, bridging distinct communities of interest by passing on tweets from one network cluster to another. Retweeting can also be interpreted as an implicit endorsement for message and sender, unless additional commentary is added by the retweeter during retweeting; especially where original messages stem from Twitter users who are already widely visible, the primary intention may well be commentary rather than dissemination, however.

Twitter follower/followee structures are far from static: following another user only takes a few clicks. Nonetheless, such structures are unlikely to fluctuate wildly for any one user: substantial changes to one’s list of followees also significantly change the focus of

one's incoming update stream. Analogous to blogrolls, Twitter follower/followee networks represent the long-term interests, rather than the short-term foci, of individual Twitter users.

Follower/followee networks, however, are also overlaid by another mechanism for coordinating Twitter communication: hashtags. These brief keywords or abbreviations, prefixed by the hash symbol, are included in tweets—for example, #auspol for discussing of Australian politics, or #NotW to track the *News of the World* scandal. Hashtags are simply entered manually by users as they tweet; they can be created *ad hoc*, and emerge almost instantaneously as news breaks. Hashtags make topical tweets more visible: drawing on Twitter's search functionality, users can find (and subscribe to) all tweets marked with the same hashtag, regardless of whether these tweets originate from established followees or previously unknown users.²

Hashtags enable users to communicate with an *ad hoc* community around the hashtag topic without needing to establish mutual follower/followee relationships with any of the other participants. It is this flexibility and ability to rapidly form discursive communities around breaking news which underlies Twitter's recognition as a platform for news dissemination and discussion. A drawback of the *ad hoc* and non-supervised emergence of hashtags, however, is that competing hashtags may emerge (for example, #eqnz and #nzeq for coverage of the Christchurch earthquakes in 2010/2011), or that the same hashtag may be used for vastly different events simultaneously (for instance, #spill for the 2010 BP oil spill in the Gulf of Mexico, and for the leadership change in the Australian Labor Party on 23 June 2010). Twitter users themselves will often work to resolve such conflicts as soon as they are identified.

Using a hashtag can be seen as an explicit attempt to address an imagined community of users—and the network of Twitter users formed this way is separate from follower/followee networks. However, the two network layers overlap: hashtagged tweets are visible *both* to the sender's established followers, *and* to anyone else following the hashtag conversation. Each user participating in a hashtag conversation acts potentially as a bridge between the hashtag community and members of their own follower network, therefore. But not all users posting to a hashtag conversation also *follow* that conversation: they may use a hashtag to make their tweets visible to others, but may themselves focus only on tweets coming from their established followers. Conversely, not all relevant conversations following on from hashtagged tweets will themselves carry the hashtag: explicitly hashtagging a response to a previous hashtagged tweet may be understood as performing the conversation in front of a wider audience, by comparison with the more limited visibility of non-hashtagged responses.³

Finally, we note a unique communicative feature of the Twitter platform: excepting "private" accounts, tweets are generally visible also to non-members. Such users may visit the Twitter website to view tweets from specific accounts, or use Twitter's search functionality to find all tweets containing particular keywords or hashtags. This adds further to the value of hashtags as a mechanism for coordinating news discussion and information curation.

Methods for Researching Twitter

For journalism scholars and practitioners, there is a clear need to develop further methods for researching Twitter's response to news and current events. Twitter provides

significant levels of access to data on user activities through its Application Programming Interface (API): an interface which is designed predominantly for use by Twitter clients, but can also be used for tracking current activity by users, or on specific keywords and hashtags. However, there are substantial limitations to what is available directly through the API, and these limitations have been gradually tightened as Twitter seeks further revenue. Changes made late in 2010 (Melanson, 2011) mean that even for the purposes of publicly funded, non-commercial research, it is no longer possible to gain access to the full “firehose” of *all* tweets, or to substantial subsets of this full feed; tracking the ongoing public activities of more than 5000 Twitter users at a time is now only possible by working with Twitter’s licenced third-party API provider Gnip, at a cost well beyond the funding available to most research projects. This effectively rules out academic studies that track the current activities and thematic interests of large, representative samples of Twitter users.⁴

A more immediately achievable direction for research into news and current events is to track keywords and/or hashtags. The Twitter API enables users to automatically capture any tweets containing given keywords (including hashtags), with comparatively few limitations, and tools for doing so are readily available to researchers; of these, the leading open-source solution to date is yourTwrapperkeeper (yTK).⁵ With minor modifications to improve data export (see Bruns, 2011b), yTK can be used to track a substantial number of keywords simultaneously; further processing and evaluation of these datasets reveals many important patterns.

Such research draws on various additional tools: the data-processing tool Gawk, statistics packages such as Excel, textual processing software like Leximancer or WordStat, and the open-source package Gephi for network analysis and visualisation. This paper provides an overview of approaches to analysing these datasets; it does not intend to act as a hands-on methodological guide. However, our project website at <http://mappingonlinepublics.net/> offers substantial practical advice on processing yTK data, and access to the custom-made open-source software tools we have developed.

Here, we outline the insights that this data-driven approach provides. We acknowledge that a keyword- or hashtag-based study of Twitter activity is necessarily limited, and will not capture tweets of the discussion which do not explicitly include the chosen terms. Therefore, the data must be understood as a reasonably representative sample rather than a comprehensive dataset of activities around an event—hashtag datasets in particular are weighted considerably towards the most engaged subset of Twitter users (those engaged enough to include the hashtag in their tweets), and thus towards a comparatively élite group. This does not invalidate such studies any more than studies of the tenor of letters to the editor in a leading newspaper would be invalidated by that newspaper’s specific audience composition. Additionally, the overall make-up of the Twitter userbase, and its lack of correlation with overall demographic patterns, also means that views of Twitter users can never simply be regarded as representative for the general population.

Development Over Time

The simplest form of analysis is the study of activity patterns over time. This charts the number of tweets made during any one period, possibly breaking them down into a

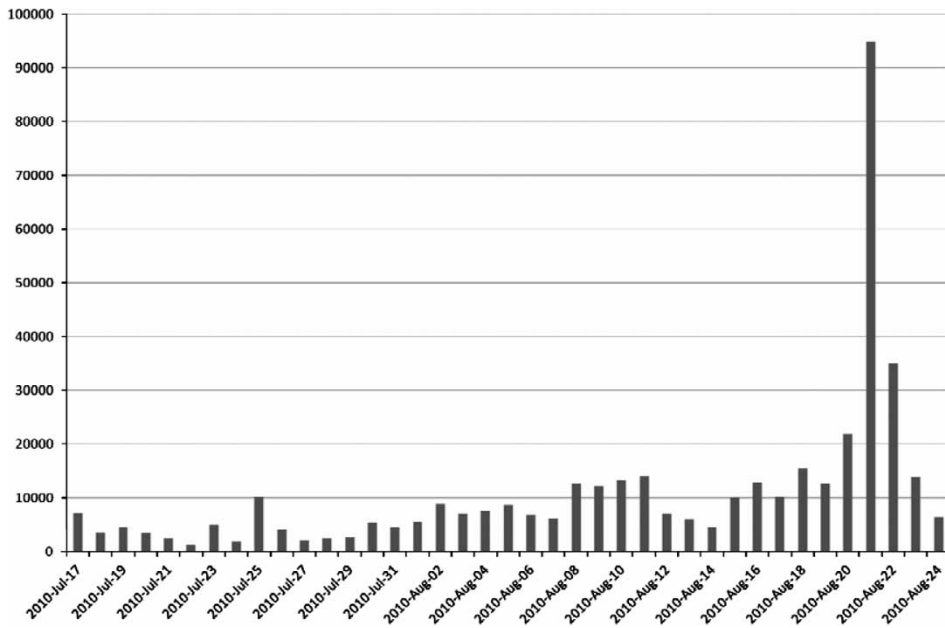


FIGURE 1

#ausvotes tweets, 17 July to 24 August 2010

number of categories. Figure 1, for example, depicts the daily number of tweets made to the #ausvotes hashtag in the lead-up to and immediate aftermath of the 2010 Australian federal election, showing a gradual ramping-up of activity and a major spike on election day; another minor early spike occurs on 25 July, during the televised debate between the party leaders.⁶

By contrast, Figure 2 shows minute-by-minute activity under the #royalwedding hashtag, following the wedding of Prince William and Kate Middleton on 29 April 2011; here, activity is broken down into the overall number of tweets (in black), retweets, @replies, and tweets containing URLs (various shades of grey). This graph points to the importance of television, with significant increases in volume at 7:00 and 8:15 GMT, as major networks switched to their live coverage; it also highlights key moments of the day: activity spikes around 12:25, for example, during the newlyweds' first kiss.

These simple metrics provide clear insights into what moments had particular resonance; they may be correlated with key developments in a story. Inferences about users' media practices may also be drawn: both Figures 1 and 2 point to the use of Twitter as a backchannel for television, for example, and to the continuing resonance of mainstream media tropes in the coverage of these events (debates and election night broadcasts, vows and kisses) even in social media environments.

Key Users

Further, it is useful to identify key participants in the discussion. Given obvious ethical concerns with highlighting activities of individual users, the goal here is not to engage in detailed profiling of individuals, but to establish the overall community

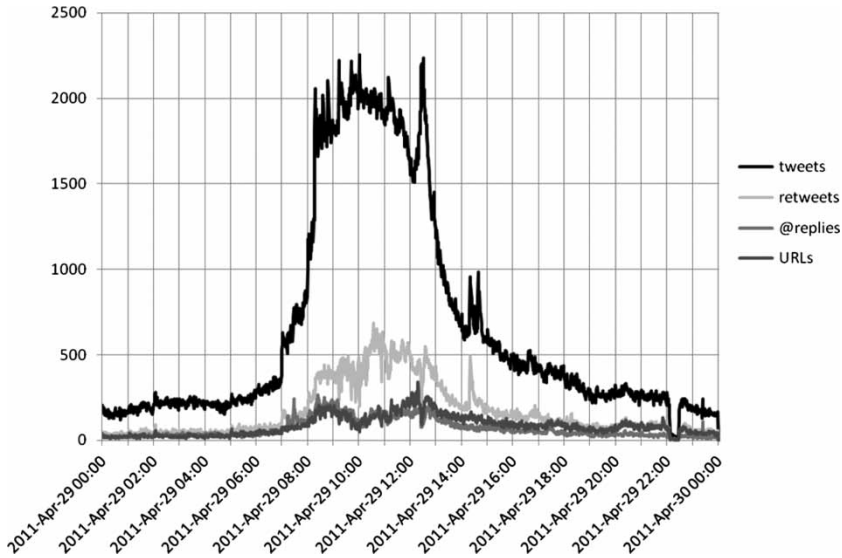


FIGURE 2
#royalwedding tweets, 29 April 2011

structure. In doing so, it is usually less important to examine the total number of tweets *sent* by each user (the volume of contributions made does not provide a reliable approximation of the impact of those tweets), but rather to focus on the number of responses (that is, public @replies) and retweets *received*.⁷

It should also be expected that most messages received by an account in a hashtag conversation are retweets rather than @replies: as noted, @reply responses to hashtagged tweets will not usually include the hashtag, unless respondents deliberately choose to make their response visible to the wider hashtag community. Much of the follow-on conversation around the hashtagged topic will therefore be absent from the dataset.

An analysis of responses and retweets provides a useful indication of the overall visibility of each account: as discussed, retweets are a means of amplifying the reach of a tweet, and thus of increasing the visibility of a tweet and its sender, while the @replies received by a user can be seen as a direct result of the visibility of their tweets, and thus of the user themselves. Figure 3, for example, shows the most visible users participating in #eqnz in the immediate aftermath of the second Christchurch earthquake on 22 February 2011. The field is led by the Twitter account of newspaper *NZ Herald*, which received over 9000 retweets and @replies, while key emergency authorities (including the Canterbury Earthquake Authority and Christchurch City Council) also feature prominently. This indicates that “official” accounts are able to establish themselves as authoritative sources of information, even in the open environments of social media.

For such official accounts, more in-depth further analysis is also ethically acceptable. Figure 4, for example, examines the performance of the Queensland Police Service Media Unit Twitter account (@QPSmedia) during the southeast Queensland flood crisis on 10–16 January 2011. Similar to the Christchurch experience, a handful of official accounts emerged as the most visible, led here by @QPSmedia; as Figure 4 indicates, the relatively limited number of @QPSmedia tweets to #qldfloods (dashed line, peaking at 17 on 11

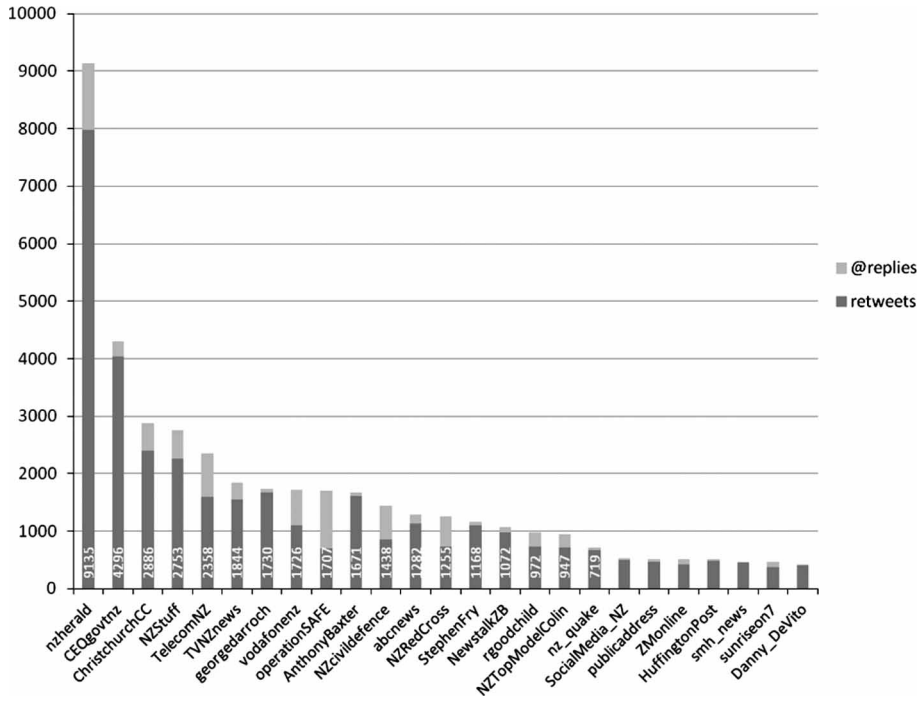


FIGURE 3
Key users in #eqnz, 22 February to 7 March 2011

January) were amplified very significantly through retweets (resulting in 601 manual retweets that same day). This clearly indicates the impact of retweeting on the visibility of messages from official accounts.

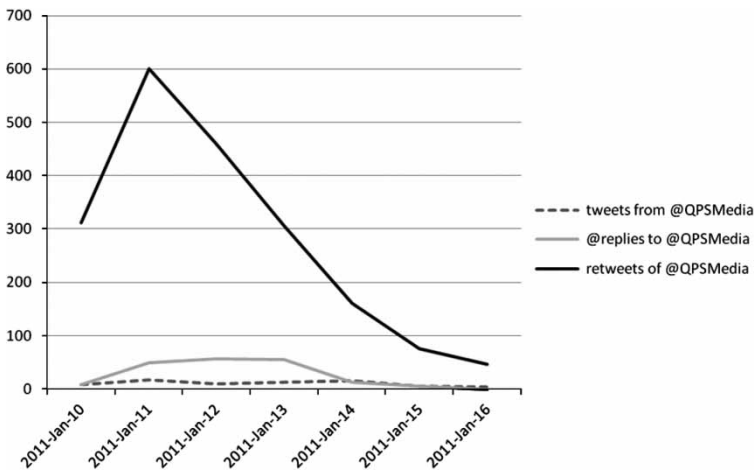


FIGURE 4
@QPSmedia during #qldfloods, 10–16 January 2011

Mentions of Key Concepts and Key Actors

Much like tweets and retweets can be tracked over time, it is also possible to examine the presence of names and themes. This requires preparatory work to identify the key terms or named actors occurring across the entire corpus; researchers can then define bundles of terms to be tracked. Figure 5, for example, shows a cumulative count of #ausvotes mentions of the two main candidates for Australian Prime Ministership during the 2010 campaign, and indicates that their numbers are virtually equal until 10 August; from that day, following a controversial television appearance, Opposition Leader Tony Abbott (in black) takes a clear lead.

Similarly, Figure 6 tracks five bundles of keywords related to the key themes of the campaign, normalising mentions to 100 per cent for each day. What emerges here is both an overall bias in the Twitter conversation on #ausvotes, in comparison with mainstream media coverage, towards ICT themes, and a shift in discursive focus after 10 August: from the mandatory Internet filter proposed by the Labor government to the National Broadband Network project opposed by its conservative challengers, and criticised by Abbott in his television interview.

Advanced Network Analysis

Finally, network analysis provides further possibilities. One approach here is the analysis of the (temporary) social networks evident in response and retweeting patterns; such analysis supports the statistical identification of leading accounts, discussed above. Social network analysis adds various other metrics: it points to participants, for example, with high “betweenness”—that is, importance as connectors of otherwise distant parts of the network; such users may not be major net sources or recipients of information,

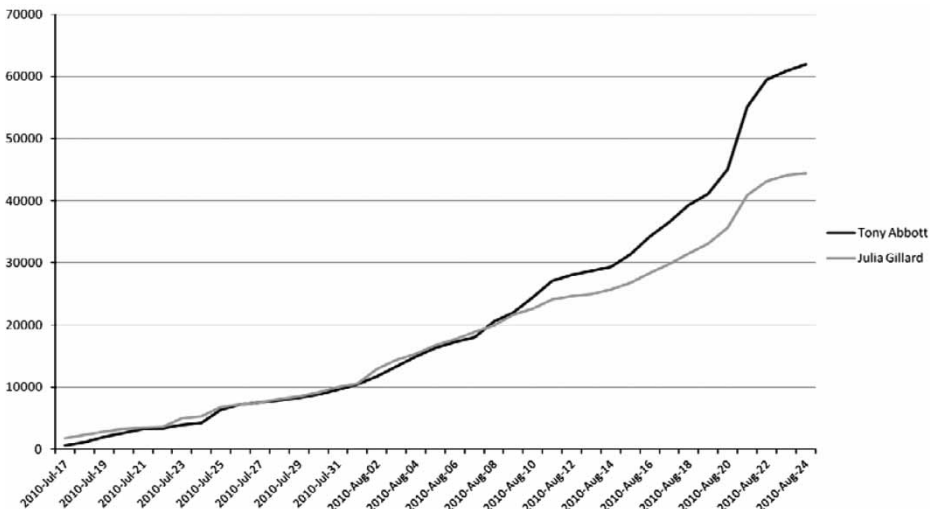


FIGURE 5

Leader names on #ausvotes, 17 July to 24 August 2010

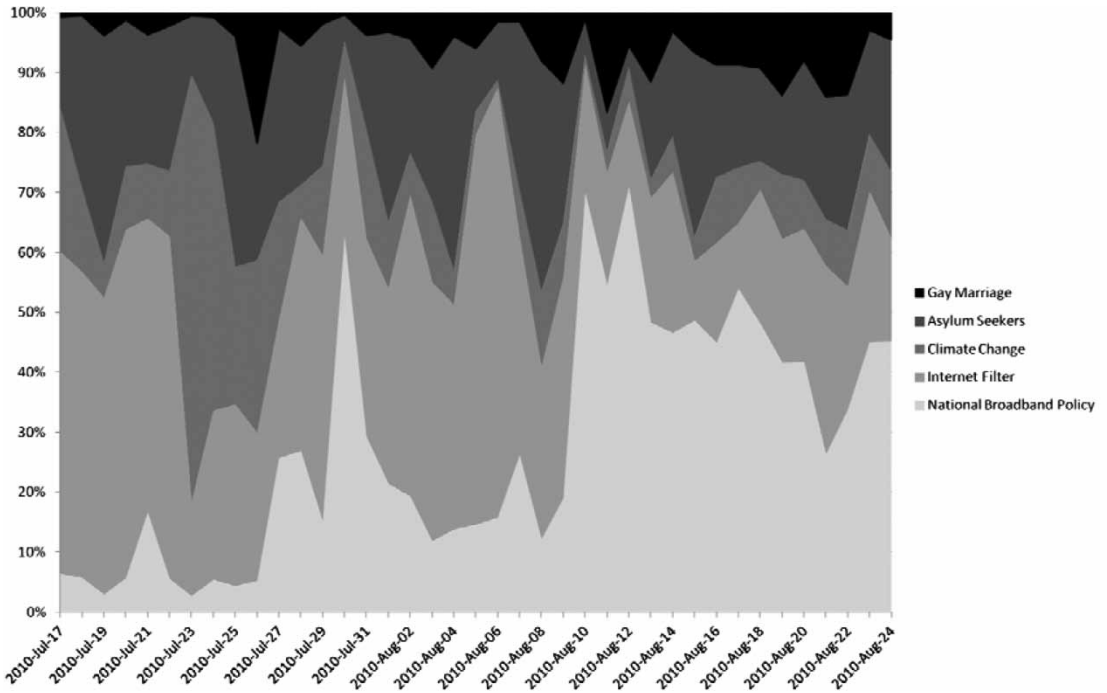


FIGURE 6
Key #ausvotes themes, 17 July to 24 August 2010

but are highly instrumental in ensuring the movement of information *across* the network.

Figure 7, for example, shows the network of retweets and @replies in the #spill hashtag, discussing rumours of a leadership challenge in the Australian Labor Party during 23 June 2010. While not actively participating, the account of then Prime Minister @KevinRuddPM is featured prominently as an addressee of @replies, while some journalists are prominent as senders and receivers of @replies and retweets. It is even possible to visualise developments over time in a series of snapshots or as a dynamic animation of the available social network data (see Bruns, 2011d).

Further opportunities exist for the visualisation of hybrid networks, linking participating users to the key concepts they reference, or showing relationships between different terms and actors in the textual corpus. As one example, Figure 8 depicts a network extracted from tweets discussing the SBS television mini-series *Go Back to Where You Came From*, which sent six Australians with outspoken views about “illegal” immigration on a reverse voyage from Australia to the main countries of origin of asylum seekers and generated substantial discussion on Twitter under the #GoBackSBS hashtag. It identifies mentions of the six participants, and connects Twitter users to those participants whom they mention most often. Users mentioning only one of the participants are shown in medium grey, on the periphery, while users discussing multiple participants are shown in dark grey at the centre. Two participants, Raquel and Adam, receive particularly many one-off comments, highlighting them as especially fascinating or polarising personalities.

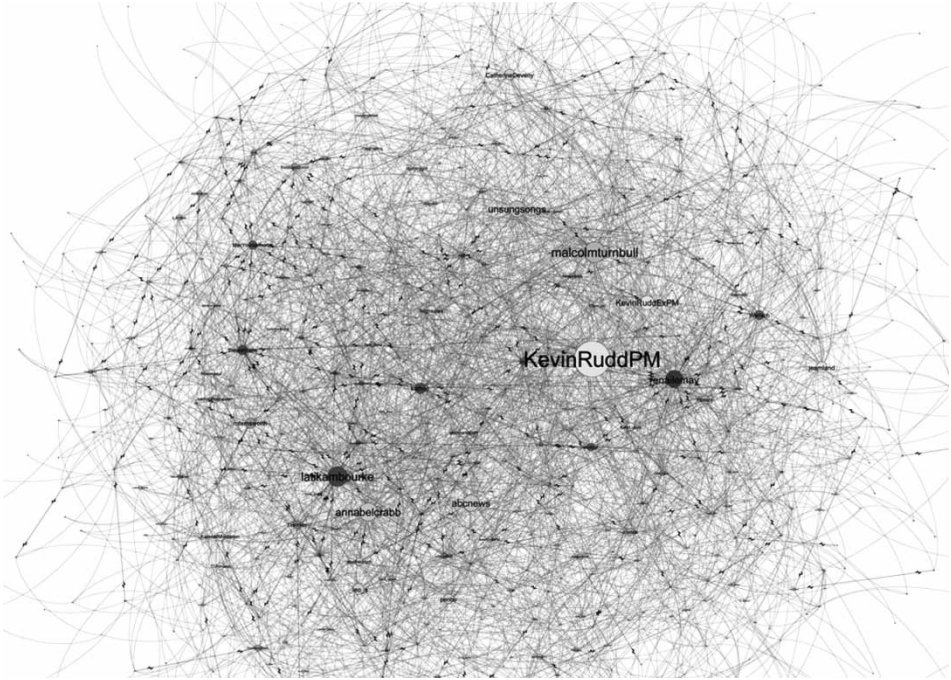


FIGURE 7
#spill @reply network, 23 June 2010 (node size = indegree; node darkness = outdegree)

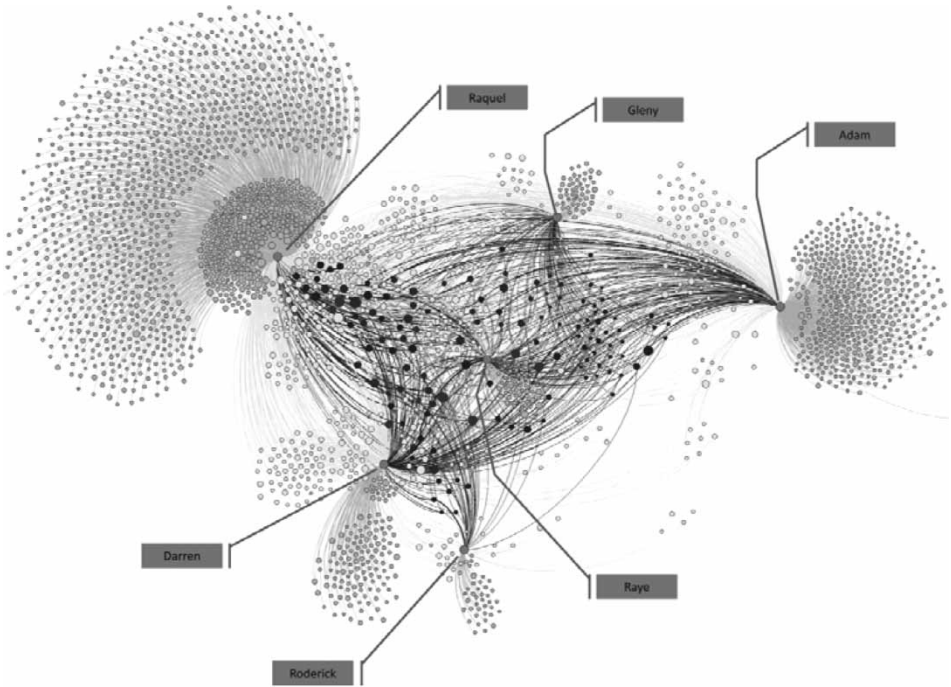


FIGURE 8
Mentions of #GoBackSBS participants

Conclusion

The approaches outlined here are readily available to researchers, and provide detailed insights into how Twitter users engage in newsworthy events. Such observations should not be seen as representative for society at large, any more than letters to the editor are representative, but how the Twitter userbase reacts to events is relevant in its own right. Especially where our methods can be used to examine the interrelation between Twitter use and other forms of (mainstream) media participation, there are significant further benefits for scholars: compared to studies which build on such relatively artificial devices as media usage surveys or diaries, tracking Twitter activities provides a more *in situ* picture of media engagement, comparatively unaffected by the act of observation. Additionally, many of these analyses can be performed virtually in real time; this enables researchers to respond very quickly to current events, and to examine popular responses on Twitter even while events are still unfolding.

This research does rely on the continued availability of data through the Twitter API—and researchers are treated as no more than uninvited guests by Twitter at this point, with no guarantees of continued access and a push by Twitter towards the commercialisation of large-scale data access (Steele, 2011). It would be most unfortunate for this trend to continue: commercialisation would effectively rule out much publicly funded research into Twitter use, but it is precisely these scholarly studies which clearly document the important role which Twitter now plays in public communication.

Even if Twitter were to become an increasingly hostile environment for researchers, however, the time spent developing Twitter research methods remains time well spent. It is inconceivable for any future social media platform not to offer an API comparable to that of Twitter, and while technologies may change, the methods which we have outlined here will be transferable—*mutatis mutandis*—to the study of other online social networks as well.

NOTES

1. Generally, it is possible for a user to follow any other Twitter user; however, users may set their accounts to “private”, in which case they will have to approve any follow requests.
2. One remaining limitation is that hashtagged tweets from accounts marked as “private” will not be included in the search results.
3. Hashtags are also used in other contexts—for example as ironic markers of one’s mood (#tired) or to highlight key terms (#Australia)—but our focus in the following discussion is purely on *topical* hashtags.
4. Twitter has entered into an agreement with the US Library of Congress to make its full “firehose” feed available to the Library, for access by researchers after a six-month embargo (Raymond, 2010); however, the embargo means that research into *current* coverage and news discussion remains impossible, and modalities of access to the dataset at the Library are as yet unknown.
5. See <http://your.twapperkeeper.com/>.
6. Higher-resolution, colour versions of all figures presented in this paper are available online: Figure 1: <http://www.mappingonlinepublics.net/2010/11/24/election-2010-the-view-from-twitter/>; Figure 2: <http://www.mappingonlinepublics.net/2011/08/12/twitter-and-the-royal-wedding-pt-1-something-processed/>; Figure 3: <http://www.mappingonlinepublics.net/2011/07/12/emergency-management-conference/>; Figure 4: <http://www.mappingonlinepublics.net/2011/07/12/emergency-management-conference/>.

mappingonlinepublics.net/2011/07/12/emergency-management-conference/; Figure 5: <http://www.mappingonlinepublics.net/2010/11/24/election-2010-the-view-from-twitter/>; Figure 6: <http://www.mappingonlinepublics.net/2010/11/24/election-2010-the-view-from-twitter/>; Figure 7: <http://www.mappingonlinepublics.net/2010/11/24/election-2010-the-view-from-twitter/>; Figure 8: <http://www.mappingonlinepublics.net/2011/07/07/tweeting-at-the-tv-some-observations-on-gobacksbs>.

7. We note that yourTwrapperkeeper only captures *manual* retweets (“RT @user ...”), not retweets made using Twitter’s more recent “retweet button” functionality. This is not necessarily a drawback: because they can be edited before sending, manual retweets serve significantly more conversational functions than “button” retweets; for example, users will often retweet part of an earlier message in order to add their own, original commentary. “Button” retweets, on the other hand, constitute merely a verbatim passing-along of the original message, with retweeting users unable to include any additional comments with the retweeted message. While tracking the amount of button retweets for each message might provide an interesting additional dimension to the analysis, it does not have significant relevance to the analysis of actively *discursive* interaction.

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