Ad Hoc Innovation by Users of Social Networks: The Case of Twitter

Axel Bruns
ARC Centre of Excellence for Creative Industries and Innovation
Queensland University of Technology
Brisbane, Australia
a.bruns@qut.edu.au – @snurb_dot_into – http://mappingonlinepublics.net/

Abstract

Generic, flexible social media spaces such as Facebook and Twitter constitute an increasingly important element in our overall media repertoires. They provide a technological basis for instant and world-wide, ad hoc, many-to-many communication, and their effect on global communication patterns has already been highlighted. The short-messaging platform Twitter, for example, caters for uses ranging from interpersonal and quasi-private phatic exchanges to 'ambient journalism': ad hoc new reporting and dissemination as major events break.

Many such uses have themselves emerged through user-driven processes: even standard Twitter conventions such as the @reply (to publicly address a fellow user) or the #hashtag (to collect related messages in an easily accessible space) are user inventions, in fact, and were incorporated into Twitter's own infrastructure only subsequently. This demonstrates the substantial potential of social, user-led innovation in social media spaces.

1. Introduction

Since its launch in 2006, the short-message social networking service *Twitter* has rapidly grown to become the second most important social networking platform, after *Facebook*. Its key features differ markedly from *Facebook* in a number of important aspects, which have also led to its widespread use especially for public discussion and in during acute events (BURGESS 2010). First, similar to short messages sent via mobile phones, *Twitter* messages are limited to 140 characters (and indeed, the company operates a number of SMS-to-*Twitter* message gateways); this necessarily requires users to be economic in their language and to develop appropriate short-hand expressions and discourse markers in their communicative exchanges.

Additionally, and perhaps more importantly, the *Twitter* network exhibits a flatter and more open structure than that of *Facebook* and other social networking platforms: contrary to the diverse categories of 'friendship' which users of *Facebook* or *Google*+ may define, for example, *Twitter* users can simply choose to 'follow' the updates sent by another user. To follow another *Twitter* user generally does not require permission from that user, nor does it imply reciprocity: *Twitter* follower/followee relationships resemble subscriptions to the RSS feeds of Websites more than friendship ties in *Facebook*. (One exception from this rule exists where *Twitter* users have set their accounts to 'private': here, new followers *do* have to be approved by the owner of the private account. However, a significant majority of *Twitter* accounts are publicly visible.) Overall, this simplistic implementation of social networking in *Twitter* results in a flat network, then, where any tie between two users is structurally equivalent to every other connection in the network, regardless of whether the tie connects

close friends, loose acquaintances, fans with their idols, workers with their employers, or enthusiasts with their areas of personal or professional interest.

Indeed, to follow updates from specific users, it is not even necessary to join the *Twitter* network at all: provided that users have not set their accounts to 'private', their latest messages (tweets) are publicly available at http://twitter.com/*username*, even for non-registered Internet users. The same is true also for messages found through the *Twitter* search interface, which enables users to follow the stream of tweets containing their chosen keywords (or hashtags, as we will discuss below); *Twitter*, therefore, constitutes a very open social network space, whose lack of barriers to access also further contributes to its utility during acute events, for example. Even non-registered users are able to use *Twitter* to track breaking news on their chosen topics, from 'Eurovision' to 'debt crisis'.

Arguably, it is this simplicity and openness which has contributed significantly to *Twitter*'s success as a social networking platform; as Benkler (2006) and Bruns (2008) have argued, user-led, collaborative spaces depend crucially on providing a low threshold and small, manageable steps to meaningful participation. Beyond its fundamental technological platform – and both *despite* the significant built-in limitations of *Twitter*'s 140-character messages and flat network structures, and *because* of them – *Twitter* is also a space for considerable user-led innovation: *Twitter* users, not its engineers, are ultimately responsible for a number of the core features which are now in use by the *Twitter* community.

2. Innovation on *Twitter*

2.1 Key User-Driven Features: @replies and #hashtags

While much early coverage of *Twitter* was focussed on its use for sending personal updates – as encouraged by its original question to users, "What Are You Doing?", and resulting in the characterisation of 40% of *Twitter* content as "pointless babble" in a widely reported market research report (PEAR ANALYTICS 2009) –, this underestimates the importance of phatic communication for maintaining social connections. Instead, as boyd (2009) notes, users *Twitter* who engage in such phatic communication are participating in

> a mix of social grooming and maintaining peripheral social awareness. They want to know what the people around them are thinking and doing and feeling, even when co-presence isn't viable. They want to share their state of mind and status so that others who care about them feel connected. It's a back-and-forth that makes sense if only we didn't look down at it from outer space

– that is, from the perspective of an outside researcher who is unable to understand the nuances of the social interactions which they are observing.

Such "peripheral social awareness", then, requires the use of mechanisms which sit between mere status updates to any and all followers, and the direct (private) messages between two users which the *Twitter* platform also supports; it requires mechanisms which allow a user to address one or more of their connections, in public, so that a public, communal conversation can ensue.

To enable such conversations, *Twitter* users quickly imported a communicative convention which had already existed for some time in other computer-mediated communication spaces: the @reply. Such @replies prefix an '@' symbol to the username of the participant who is to be addressed – for example, '@snurb_dot_info' to address the *Twitter* user *snurb_dot_info* – and had been in use, informally, in newsgroups, mailing-lists and blog comment threads for several years (HALAVAIS/MARTIN-ELMER 2009). Additionally, the *Twitter* platform itself provided functionality to track such @replies, as a means for users to see where and in what contexts they are mentioned (various *Twitter* clients for desktop and mobile platforms also incorporate such functions).

A further, special form of @reply is used where users wish to pass along messages which they have received from the *Twitter* accounts they follow. Such retweets amplify the visibility of the original message: not only is the original tweet visible to all followers of the sender, but also to the followers of those followers who have chosen to retweet it. *Twitter* users have developed a number of conventions for retweeting; of these, the most common is to prepend 'RT @*sender:*' to the original message – as, for example in this retweet of a message originally sent by *Twitter* user *GreenJ*:

> RT @GreenJ: Newspaper correction of the year. The Sun. Winning. http://bit.ly/SQ7Ms

Such additions to the original tweet necessarily cut further into the character count for the total message; where the original message plus new retweet prefix would extend beyond the available 140 characters, therefore, it is common to shorten the original tweet by abbreviating or removing less important elements. As boyd *et al.* (2010) note, this can also lead to significant misunderstandings, however.

Conversely, where sufficient space is available, such retweets can also be used to add further commentary, support, or disagreement to the original tweet – as in the following tweet commenting on a news update from the *Telegraph* newspaper:

> OK. This is getting silly. RT @Telegraph: Welsh harpist ready for Royal Wedding http://tgr.ph/fXw62f

Retweets, therefore, are not always made simply to pass along an existing message to a broader readership; nor do they inherently imply agreement and support for the original message. Rather, they may also constitute a discursive intervention in an ongoing conversation.

A number of alternative conventions for marking a message as a retweet also exist, and are generally used in comparable ways. Rather than prepending 'RT @*sender*' to the original message, some users prefer to append '(via @*sender*)' or '(HT @*sender*)' – for 'hat tip' – to the message; others now use 'MT' – for manual (re)tweet – rather that 'RT', to distinguish such retweets from retweets made using *Twitter*'s more recently introduced 'retweet button' (which we will discuss below). This range of user-generated solutions for passing along *Twitter* messages to one's followers further demonstrates the spirit of user innovation which the *Twitter* environment has engendered.

Finally, while multiple @replies may be used to address multiple users in the same message, the limitation of *Twitter* messages to 140 characters also means that there are natural limits to doing so – addressing multiple users through @replies in the same tweet leaves previous little space for the actual message:

> @jeanburgess @coffee001 @kwelle @snurb_dot_info Thanks for the discussion!

Another important user-generated tool for coordinating conversations on *Twitter*, therefore, is the hashtag: a brief keyword or abbreviation, prefixed with the hash symbol '#', which is included in relevant tweets. User innovation has taken place here on two levels: first, the idea of the hashtag is itself a user-generated invention, which builds on *Twitter*'s available functionality as well as working within the constraints of the system. Hashtags are simple to use and easy to follow; they are treated by *Twitter*'s search tools just like any other search term, and thereby enable both registered users and non-registered visitors to the *Twitter* site to follow the stream of hashtagged messages (but are less likely than mere keyword searches to generate a substantial number of false positives: a term like 'Australia' may be used in many possible contexts, but a hashtag like '#Australia' is likely to be used more deliberately). Additionally, hashtags may be kept short, maximising the number of characters available for the actual message – the key hashtag associated with the earthquakes in Christchurch in 2010 and 2011, for example, was '#eqnz' (for earthquake New Zealand), using up only five characters of the 140 available.

As this example demonstrates, however, innovation also takes place on the level of individual hashtags themselves: it is the users themselves who – *ad hoc* and without requiring approval from *Twitter* administrators or their fellow users – are able to create and use whatever hashtags they feel are appropriate. Whether such hashtags receive wider take-up then simply depends on the communicative choices of other users – an example of the principle of "open participation, communal evaluation" which Bruns (2008) has introduced as part of his produsage framework.

Such *ad hoc* creation of hashtags contributes considerably to *Twitter*'s ability to respond speedily and effectively to major breaking news and other acute events, of course: within minutes of major events (from the earthquake and tsunami in Japan to the extremist terror attacks in Oslo and Utøya), relevant hashtags had emerged and began to carry the latest mainstream news stories, first-hand updates from affected locals, and commentary from the wider *Twitter* user community. This emergency is by no means always linear and unproblematic, of course – competing hashtags including #Oslo, #Osloexpl, and #Oslobomb carried news of the bombing in downtown Oslo, for example –, but in most cases, a gradual convergence of conversations into no more than a small handful of hashtags can be observed; standard network effects (which mean that the hashtags with the largest number of participants also contain the greatest volume and best quality of information) tend to apply. Additionally, key messages are often made visible to all the followers of competing hashtags by including both those hashtags in the same tweet (or by users manually adding other hashtags as they retweet the original message).

Beyond such topical uses, it should be noted that hashtags are also used in other contexts: for example as an ironic marker of one's mood – for example, '#tired', '#win', or '#headdesk'. While such uses are unlikely to be made with a view towards enabling other users to more

easily track all tweets containing the hashtag, they nonetheless also constitute a form of user-led communicative innovation: they can be understood as a *Twitter*-native alternative to the use of standard emoticons, and similar to ';-)' or ':-O' convey through a short sequence of characters a range of complex, difficult-to-express extratextual information.

2.2 Helper Tools

User-led innovation building on the *Twitter* platform does not take place only *within* the spaces of *Twitter* itself; in addition to the communicative interventions made by users as part of their everyday activities, a number of external support structures have also been developed. These, too, address some of the fundamental features and limitations of *Twitter* as a technological platform for communication – in particular, its 140 character limit. The fact that any one message exchanged through *Twitter* is forced to stay within this limit introduces obvious problems especially for users wishing to exchange links to Websites and audiovisual information. While generic domain names may still be able to fit into the limit, any links to specific pages on a Website are likely to run well beyond 140 characters (in the process also removing any opportunity to include any explanatory text, relevant hashtags, or @replies directing the message to specific recipients, with the URL itself).

As a result, an ecosystem of third-party helper tools has developed around *Twitter*. Operating from minimal domain names such as *Bit.ly*, *T.co*, or *J.mp*, these tools provide (usually free) URL shortening services which convert lengthy Webpage addresses into much shorter links – such as 'http://bit.ly/SQ7Ms' – which, when included in a tweet, will leave ample room for additional text. (Several content Websites are now also automatically offering shortened URLs for their own content – the *New York Times* shortens its URLs to http://nyti.ms/, for example.) Similarly, some services expand the *Twitter* experience beyond its text-only origins, by providing hosting and URL shortening services for images, audio, and video. Users are able to upload their content directly to sites such as *Twitpic* or *yFrog*, resulting in a short URL which may then be embedded into their tweets.

Here, in particular, the ecosystem of third-party helper tools intersects with the available product range of *Twitter* client applications (for a variety of desktop or mobile platforms). Such tools build on *Twitter*'s public Application Programming Interface (API) to enable users to access their tweet streams through dedicated applications rather than through the *Twitter* Website itself; in doing so, they also provide a unified user interface for a range of the available helper applications, and enable users to follow, *inter alia*, the incoming stream of tweets from their network connections, the @replies and direct messages sent to their own account, and any hashtags or keyword searches they have selected. Further, some such clients also provide access to a range of alternative social networks (such as *Facebook* or *LinkedIn*), and enable the cross-posting of messages from one network to another.

Other *Twitter* tools and applications provide more specialist functionality – ranging, for example, from tools which enable individual users to graphically display their network of followers to systems which map the tweets made in specific hashtag conversations onto a geographic map, and from tools which generate simple word clouds of the tweets made by specific users to systems which enable researchers to effectively capture entire hashtag conversations for detailed study (see e.g. BRUNS/BURGESS 2011a). This active and diverse ecosystem of available tools stems from a decision by *Twitter*'s developers to

impose relatively few limitations on the content of tweets (beyond the 140 character limit itself), and to make available a relatively comprehensive Application Programming Interface which provided access to virtually all public *Twitter* content (excluding only messages by private accounts and direct – private – messages between users).

Given this relatively instrumental understanding of *Twitter* as a communications platform (rather than a content provider in its own right), especially early on, the service and its API can therefore be understood as a user toolkit, as Eric von Hippel describes it – a set of technological tools, and general rules for their use, which circumscribe an overall space within which users are able to freely innovate. As he writes, such

> toolkits for users … change the conditions potential innovators face. By making innovation cheaper and quicker for users, they can increase the volume of user innovation. They also can channel innovative effort into directions supported by toolkits. (VON HIPPEL 2005: 147)

Indeed, while their implementation and the range of functionality they support necessarily varies from case to case, APIs can generally be understood to act as user toolkits in this fashion; given that *Twitter* was introduced without much overall direction for how it should be used (as contrasted with *Facebook*'s considerably more overt aim to represent the world's 'social graph'), however, it can be considered to be a particularly open space for user-led innovation. To support such open-endedness, toolkit approaches are especially appropriate:

> the toolkit-for-user innovation approach to product design is likely to be most appealing to toolkit suppliers when the heterogeneous needs of many users can be addressed by a standard solution approach encoded in a toolkit. This is because it can be costly to encode all the solution and production information relevant to users' design decisions. (VON HIPPEL 2005: 162)

2.3 Twitter's Own Interventions

The move to extent an open invitation to everyday users and third-party developers to develop innovative approaches and solutions on top of the shared basis of the *Twitter* platform and API should not be misunderstood as a complete abdication of interests by *Twitter* itself, however; as von Hippel also notes,

> the primary function of toolkits for user design is to co-locate product-development and service-development tasks with the sticky information needed to execute them. Need-intensive tasks involved in developing a particular type of product or service are assigned to users, along with the tools needed to carry those tasks out. At the same time, solution-intensive tasks are assigned to manufacturers. (2005: 148)

Part of the appeal of sharing the load of innovation with users and external developers is also that it may uncover innovative approaches which can then be reincorporated into the main platform itself. So, for example, revisions to *Twitter*'s Website – as well as to third-party *Twitter* clients, whose developers are similarly tracking user-led innovation, of course – have made it possible to more easily find and follow @reply and hashtag conversations and to preview embedded links, images, and audiovisual materials. A click on an @reply on the

Twitter Website, for example, now automatically reveals any preceding or subsequent messages in the @reply conversation, while clicking on hashtags in many client applications will retrieve the latest tweets in these hashtag feeds.

Not all such developments drawing on user innovations have been equally successful, however. Most notably, *Twitter* reacted to the development of user conventions governing retweeting etiquette by introducing its own, alternative retweeting functionality, but this intervention served to confuse more than assist users. Importantly, *Twitter*'s own retweeting function, accessed through a 'retweet button' which is displayed with any tweet on its Website (and was subsequently also implemented by most *Twitter* client applications), provides *only* for verbatim retweeting. Tweets shared in this way appear in the retweeting user's *Twitter* feed as coming from the original sender, with the name of the retweeting user indicated in the associated metadata; this means that no shortening or other alteration of the original message needs to – or indeed *can* – occur.

While this preserves the integrity of the original tweet (ruling out any misunderstandings or misattribution caused by the shortening of messages which is otherwise required to include the 'RT @*sender*' statement at the start of manual retweets), it also prevents the common practice of using retweets as discursive statements, in the manner which we have encountered above. Perhaps most importantly, when using 'button' retweets it is no longer possible for retweeting users to indicate within the retweet whether they agree or disagree with the contents of the original message.

'Button' retweeting functionality as implemented by *Twitter* can be seen as based on an incomplete understanding of the practice of retweeting, then: it certainly provided an easier and more reliable mechanism for simply passing along other users' messages to one's own followers, but in doing so removed any direct opportunity for users to indicate the context in which they sought to make such retweets. The comparative failure of this top-down innovation to provide an equivalent 'official' implementation of the bottom-up, user-developed innovation of manual retweeting can be clearly seen in the fact that (at least after a brief phase of favouring 'button' retweets), most third-party *Twitter* clients now offer the functionality to make both manual and 'button' retweets; indeed, at the time of writing even the *Twitter* Website for mobile devices (http://mobile.twitter.com/) is itself now again offering a choice between *both* types of retweet (http://twitter.com/ itself continues to support only 'button' retweets, however).

Such failures to completely understand, and officially implement, user innovation – or indeed simply to understand how users do or wish to make use of the platform – may not create any significant problems for *Twitter* at least in the somewhat arcane case of retweeting mechanisms; however, in this context we may also consider the case of *Facebook*, which over the years has had to make a series of apologies to its users following a variety of bungled introductions of widely disliked new features (including, for example, the targetted advertising system Beacon, or an automatic face recognition system for photos uploaded to the site).

To some extent, these mistakes also betray the conflicting needs of userbase and platform operators, of course: *Facebook*'s interventions, in these and a number of other examples, are driven largely by the need to generate a continuous stream of revenue from the site (for

example by better profiling users in order to deliver more relevant advertisements to them), while even *Twitter*'s introduction of a more streamlined retweeting functionality may have been inspired at least in part by the desire to track retweeting activity more effectively (and thus to identify – and monetise? – those messages which are most widely shared). The dissemination pathways of manual retweets, by comparison, with their many idiosyncratic truncations, additions, and other motifications made by users, are considerably more difficult to track with any certainty.

Similar commercial objectives clearly also provide the background to another highly problematic – if much less widely publicised – course of action taken by *Twitter*: the gradual curbing of its API functionality. As noted above, the relative openness of the *Twitter* API should be seen as a major early strength of the platform; it has contributed significantly both to the establishment of a healthy ecosystem of third-party developers, and to significant efforts at researching *Twitter* as a social network (research activities which themselves also again feed into the development of additional third-party tools). Importantly, such research into the affordances and utility of *Twitter*, especially also in the context of breaking news stories and major crisis events (e.g. PALEN *et al.* 2010), has also contributed to the widespread take-up of *Twitter* as a key communications tool by government authorities, media organisations, and other official actors.

Twitter's powerful API, and the comparatively flat and open structure of its underlying network, combined to provide researchers with unprecedented access to a wealth of data on public communication using the platform; for the most part, they struggled not with gaining access to large datasets, but with developing the appropriate frameworks for storing and analysing data at such large scales. Comprehensive access enabled them to study not only isolated, largely unrepresentative communicative events taking place in niche spaces within the overall network, but to be able to develop a more reliable understanding of *Twitter* as such.

Such research and development, however, is increasingly threatened by a very heavy-handed push towards the commercialisation of access to *Twitter* data. Where earlier, *Twitter* was generally prepared to provide research access to comparatively vast datasets (enabling easy access to the combined public feeds of several hundred thousand users, or even to the overall 'firehose' of *all* tweets, on request), more recent changes have meant that any access to the streams of more than 5,000 users at one time must take place through *Twitter*'s commercialisation partner, Gnip, at considerable cost (cf. MELANSON 2011).

While perhaps commercially justified, such changes cannot but have a chilling effect on research and development in the *Twitter* ecosystem – especially where such research is conducted by publicly funded institutions. If, as a result, evidence of *Twitter*'s value in public communication becomes more scarce, leaving behind only the basic market research conducted by commercial research companies, *Twitter* will achieved little more than to silence some of its strongest advocates; alternatively, however, these new restrictions may also lead to a new burst of unforeseen – and from the company's perspective, unwanted – user innovation, as researchers explore semi-legitimate approaches to gathering data by using server farms or similar distributed mechanisms, for example.

3. Social Innovation: Future Challenges

Such examples highlight the conflicted nature of *Twitter* (and, by extension, of similar social networking platforms) as spaces for innovation. Given the generic nature of the platform, which may be used for anything from 'mere' phatic communication to life-saving updates on natural and human-made disasters, its operators are necessarily forced to pursue a 'toolkit' approach to innovation: to enable their users – both individuals and providers of third-party tools – an almost free rein in their exploration of innovative approaches to using the platform for their specific needs. The innovations which emerge from such activities may not align well with *Twitter*'s own commercial directives, however, nor may they be easily adopted and adapted into its core technological frameworks; indeed, those innovations which do have a chance of commercialisation (through advertising or by providing premium functionality) may be owned by third-party developers rather than by *Twitter* itself. *Twitter*'s recent acquisition of *Twitter* client application *TweetDeck* (EMPSON 2011), and its declared intention to introduce its own image sharing and URL shortening functionality, point to its desire to generate revenue in these areas.

While such conflicts over the future development direction of a communicative space whose ownership is (in practice, if not in law) shared between users and platform providers are concerning in any case, they are especially problematic for a social networking platform such as *Twitter*, which within its short lifespan to date has already proven itself to be an important, sometimes indispensible, tool for public communication. As noted above, such importance has been highlighted especially in the uses of social media during major natural disasters and other crisis events. Studies of *Twitter* (and general social media) usage during the 2010 earthquake in Chile (MENDOZA *et al.* 2010), the 2010 and 2011 earthquakes in Christchurch, New Zealand (BRUNS 2011a/b/c), the 2011 floods in southeast Queensland, Australia (BRUNS/BURGESS 2011b), and in a range of other acute events, point to the significant value of *Twitter* as an emergency communications channel, not least also in situations when failing electricity and landline communications networks mean that mobile access to social media spaces becomes the last remaining option for bidirectional public communication.

Building on such experiences, significant work is currently underway to develop additional means of harnessing user-generated information and communicating with affected local residents. Such work builds, for example, on the *Ushahidi* mapping platform, which combines official information from emergency authorities, mainstream news stories, and first-hand user-generated updates into a geographic visualisation of the current situation (GOOLSBY 2010). Harnessing the first-hand reports of users – as they may be shared on *Twitter* and in other social media spaces – for this purpose necessarily requires the collaboration of all parties in the processes of innovation: users themselves must develop and employ still more effective conventions for formatting and hashtagging their updates so that they may be more easily identified by the *Ushahidi* platform, and will generally need to develop more sophisticated ways of using social media platforms (the developers of software clients may also need to provide additional functionality to support these efforts); *Ushahidi* and other third-party developers must further develop their tools for capturing and evaluating these messages, focussing especially on verifying the accuracy of the information they provide; this, in turn, crucially depends also on gaining more comprehensive access through *Twitter* and Gnip to the full stream of updates from which relevant messages are to be selected.

Such efforts – *social* innovation in the true sense of the term, as it addresses a clear and present social need – are inherently threatened in a climate of innovation where the three parties are as likely to work at cross purposes as they are to cooperate. What is likely to be required in this context is a significant rethinking of the interrelationships between the parties: users must be (and to some extent already are) prepared to accept that platform and third-party tool providers have a need to generate revenue through advertising and other interventions; third-party developers must maintain good, cooperative relationships with *both* the wider userbase and the platform providers; and providers such as *Twitter* must understand that an overly heavy-handed, restrictive approach to how their platform may be accessed and used will ultimately prove to be counterproductive.

For most of the early history of *Twitter*, this balance has been maintained, and has contributed to the rapid rise to prominence of the platform. Recent events, however, point to a growing imbalance as *Twitter*, in its pursuit of sustainable revenue streams, has chosen to take decisions which harm the innovation ecosystem that has emerged around the platform. Should this imbalance not be able to be corrected, innovation (and social innovation in particular) on the *Twitter* platform may turn out to be increasingly less likely.

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