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The Arab Spring and Social Media Audiences: English and Arabic Twitter Users and Their Networks

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Introduction

The ‘Arab Spring’ uprisings in 2011 saw widespread anti-government protests, and some régime changes, in many Middle Eastern and North African (MENA) countries, from Libya and Tunisia to Bahrain and Syria. Social media were among the tools used by protesters to organise themselves and to disseminate footage from rallies. These were not only used by local activists, but also attracted comments from a worldwide media audience, for example in Twitter hashtag conversations such as #egypt and #libya. These hashtags were used to mediate a wide range of practices of political participation among a diverse group of social media users – from distanced observation and information-sharing in a globalised ‘ambient journalism’ (Hermida, 2010) environment through to narration of direct experience and even coordination of on-the-ground activities. However, there is no reason to assume that these diverse activities were really ‘connected’ via the hashtag, or that one geographically or culturally distinct group of users ever encountered another, hence highlighting the question of whether social media, in such contexts, facilitates the flow of information across social boundaries. This paper addresses these questions via an analysis of language differences in social media communication focused on the Arab Spring, in doing so describing new methods for the analysis of large-scale *Twitter* data.

We focus on discussions on *Twitter* concerning the uprisings in Egypt and Libya, tracked between January and November 2011. These two cases, showing citizen opposition to long-serving leaders, ultimately took different forms in their pursuit of revolution. The Egyptian uprising initially saw a short series of large protests in January and February 2011, resulting in the ouster of President Hosni Mubarak. In Libya, anti-government protests quickly transformed into a civil war, resulting in months of bloodshed before the capture

and death of Libyan leader Colonel Gaddafi. In both cases, developments were accompanied by widespread discussion on *Twitter*, in both Arabic and English. Our focus in this article is on the relative levels of activity in Arabic, English, and mixed-language tweets featuring the #egypt and #libya hashtags, and on the interactions between these different linguistic groups. This enables us to track the changing circumstances of these revolutionary conflicts, and to examine the relative contributions of different language groups to their discussion.

Context, background and approach

The organisation and coverage of public protests is one of many purposes for which *Twitter* has been used; many other social, political, and educational functions have also been identified (Crawford, 2009). However, the specific contribution made by the platform remains debatable. In June 2009, *Twitter* was viewed as the medium of choice for activists, both local and international, to dispute the Iranian election result using the #iranelection hashtag (Burns & Eltham, 2009; Gaffney, 2010), to the point that the Iranian protests were dubbed an (ultimately unsuccessful) '*Twitter* revolution'. At the same time, opinions remain divided about the extent to which these and other protests were in a narrower sense *led* by activists using social media to express their views and orchestrate resistance (Axford, 2011; El Hamamsy, 2011; Gladwell, 2011; Morozov, 2011). On the evidence available, it appears that social media were *additional* communication tools for activists, rather than drivers of the demonstrations themselves (Gladwell, 2010). The Arab Spring uprisings have attracted similar descriptions, as social media are used to share details about protests and generate support for movements, in a highly hybridized media environment (Chadwick, 2011) in which *Twitter* has achieved increased uptake both in the population at large and among news organizations and journalists themselves. Although the Egyptian and Libyan governments attempted to block domestic Internet access during the uprisings, protestors used workarounds to post to *Twitter* (York, 2011). Once the Egyptian blackout was lifted, mobile phone videos were uploaded directly from the demonstrations to *YouTube* (El Hamamsy, 2011), and shared through social media. The volume of tweets hashtagged #egypt or #libya highlights the attention which the uprisings received from *Twitter* users both domestic and further afield; however, there are questions about whether *Twitter* was a stable means of coordinating demonstrations on the ground, or primarily a channel for international observers to discuss the uprisings (Barrons, 2012).

Either way, coverage of the Arab Spring on *Twitter* provides important examples for the formation of issue publics through shared hashtags. By including '#egypt' or '#libya' in their tweets, *Twitter* users are connecting their comments to a wider discussion. Bruns and Burgess (2011) argue that these conversations on common topics can create *ad hoc* issue publics, which can 'respond with great speed to emerging issues and acute events'. Such events include crises and emergencies, including civil unrest and natural disasters (Starbird & Stamberger, 2010); hashtags have been used to concentrate the flow of information from emergency authorities in such cases as the earthquakes in Christchurch, New Zealand (#eqnz), and the floods in Queensland, Australia (#qldfloods), both in 2011 (Bruns & Burgess, 2012; Bruns *et al.*, 2012). Indeed, the convention of using hashtags to mark topical tweets first spread (before becoming fully integrated into *Twitter* architecture) following their use in the coverage of wildfires in San Diego in 2007 (Messina, 2007; Starbird & Stamberger, 2010).

Hashtagged discussions emerge without being controlled by any one organisation or user. Politicians, journalists, and emergency authorities may all be contributing to the ongoing coverage, and may indeed be central figures to these discussions, but any account is able to use, or ignore, hashtags in their own tweets. Any *Twitter* user could include #egypt or #libya in their tweets, regardless of their proximity to the uprisings or involvement in the protests (the range of participants discussing #egypt is studied by Lotan *et al.*, 2011). Discussion of events in Egypt, for example, also used the #jan25 hashtag, signifying the 'Day of Revolt' against President Hosni Mubarak. While this hashtag was widely used, it was not studied here (tweets containing #jan25 as well as #egypt are present within the dataset, however). In the present context it should be especially noted that the use of these hashtags was not limited to English speakers, in spite of the use of the English names of these countries as hashtags. At the time of the uprisings, Arabic speakers were forced to use hashtags in Latin characters: although *Twitter* supports the use of non-Latin characters in tweets themselves, as of January 2012 it was still testing its official support for right-to-left languages, especially regarding hashtags (*Twitter*, 2012). A key reason that many Arab Spring tweets combined Arabic text with an English hashtag was that the platform could not yet support right-to-left hashtags; left-to-right hashtags, by contrast, are automatically converted on publication to links to *Twitter* searches for those tags, providing easy access to the wider discussion on the topic. Therefore, a substantial volume of tweets mainly in English (as the international *lingua franca*), using Latin characters, were united with an at times equally significant volume of

tweets in Arabic (as the common language of the MENA region), using Arabic characters, under the #egypt and #libya hashtags.

An additional technological innovation, in response to local Internet restrictions, can also explain some of the crossover between Arabic tweets and the English hashtag #egypt; the *Speak2Tweet* tool provided by *Google* and *Twitter* enabled users to tweet by calling an international telephone number and leaving a voice message, which was subsequently turned into a tweet and automatically accompanied by the #egypt hashtag (Singh, 2011). Here, too, comments in various languages were combined with an English hashtag, thus aggregating multilingual tweets about the Egyptian revolution, although this does not necessarily translate to greater links between linguistic groups.

The resulting heterogeneous, bi- or multilingual nature of these hashtags immediately raises questions about the structure of their participant communities. Were there two or more separate groups of commenters, writing in Arabic and English but using the same hashtag? To what extent were bilingual users acting as boundary riders, connecting different language communities and facilitating an information flow between them? Previous studies of blogging within the MENA region have noted the presence of blogs written in English alongside sites in Arabic, leading Zuckerman (2008) to suggest that some of these sites may act as 'bridgeblogs', intended to inform readers 'from a different nation, religion, or culture' (p. 48). Similarly, a study of Arabic language blogs found a group of sites from across the Levant acting as an 'English bridge', writing in both English and Arabic (Etling *et al.*, 2010). While Egyptian bloggers did not necessarily act in this way, they played 'key roles in movement politics' (p. 1240), using the Internet to circumvent the regulation of political organisation offline.

Indeed, prior to the uprisings, Egyptian blogging was credited as having 'intensified current trends in politics and media', following media outlets' increasingly critical coverage of the Mubarak régime (Isherwood, 2008, p. 13). Blogs became publishers of commentary or reports that could not be featured in the traditional media, even those opposed to Mubarak. As an active Egyptian blogosphere developed, the bloggers involved formed activist networks, in Egypt and abroad, and with international journalists and other foreign bloggers. These links enable the wider spread of information, sharing reports in Egypt and with a more distributed worldwide audience (p. 9).

But writing in different languages does not automatically mean that an individual is acting as a bridge between different groups of users. Herring *et al.*'s (2007) study of language networks on *LiveJournal* found that

English, and other languages, would be featured within journal entries "in formulaic or emblematic uses", connecting users of different linguistic backgrounds even without a thorough understanding of the languages concerned (p. 9). The intent – or result – of using another language on *LiveJournal* is not to reach a new international audience, like Zuckerman's bridge bloggers, but to participate extensively within *LiveJournal*'s "cosmopolitan environment". Within the MENA region, bloggers will use both Arabic and English, or Arabic and French, in their posts, so that these languages are strongly interconnected, rather than used by distinct groups of bloggers (Etling *et al.*, 2010, p. 1229).

Use of English or Arabic may also be affected by the topics discussed in posts, and by the intended audience. Jansen's (2010) study of digital activism in the Middle East found that in Syria, Arabic was employed for discussion of 'more general issues like government, unemployment, and poverty', while English was used for comments on specific activist issues, including individual cases of arrest or harassment (p. 48). Jansen argues that blogging in English may be aimed at drawing more, global attention to particular issues. In their analysis of #sidibouid tweets around the Tunisian revolution, Poell and Darmoni (2012) found that the most active users would post in multiple languages, tailoring their content for different audiences and acting to connect groups of users commenting on the uprising in Arabic, English, and French. Although determining the subjects of tweets written in Arabic and English during the Arab Spring is beyond the scope of this article, the two languages (and others) may have been employed in different tweets by individual users for similar purposes (for a content analysis of #egypt tweets written in English, see Papacharissi & de Fatima Oliveira, 2012).

Although the different languages represented in the datasets used here do not map onto distinct geographic regions, it is important to distinguish the patterns of social media use around the Arab Spring originating from local and international users. Howard *et al.* (2011), examining tweets containing geolocation data as well as the #egypt hashtag, found that the early discussions were led by users found outside Egypt and its neighbours. In the weeks leading up to Mubarak's resignation, a greater proportion of tweets came from local users (and from users who did not provide location information) (pp. 16-17). In addition, Freelon's (2011) analysis of several Arab Spring hashtag datasets found that spikes in *Twitter* activity in most discussions were led by international users, rather than those within the MENA region. While language is not in itself an accurate means of determining location, comparing the use of English and Arabic tweets over the same period allows us to examine whether spikes in activity are led by particular linguistic groups.

In this study, we investigated the following questions through our comparison of Latin and non-Latin tweets:

1. Do tweets containing Latin and non-Latin characters follow similar patterns in responding to the events of the Arab Spring?

Based on previous research into online communication in the region, it would be expected that the use of English (and other Latin languages) would be prominent within the #egypt and #libya hashtags, however:

2. Is this use consistent throughout the uprisings, or does the volume of tweets from different language groups follow more varied patterns of troughs and spikes in response to specific events?

And finally:

3. Are the different language groups (Latin and non-Latin) interconnected; and is there evidence of bridging between these groups of *Twitter* users?

The presence of bridges in other online contexts suggests that an examination of user interactions in the #egypt and #libya hashtags would find some users acting as bridges between Arabic and English speakers. These hashtags also provide an automatic tie between the groups, through *Twitter's* conversion of hashtags into hyperlinks. However, this does not necessarily mean that bridging is taking place; we examine the networks of @replies and retweets within the datasets to identify connections between users tweeting in Latin and non-Latin languages. As part of this examination, this study also establishes methods for identifying, and comparing, the languages used within large datasets of tweets, which have applications for further research into multilingual social media discussions.

Methods

Our datasets were collected through the *Twitter* API. Using a modified version of the open source tool *yourTwapperkeeper* (see Bruns, 2011), we tracked #egypt and #libya from early 2011 (23 Jan. 2011 for #egypt, 16 Feb. 2011 for #libya); for the purposes of our analysis, our data collection period terminates on 30 November 2011. Due to the vagaries of collecting data from the *Twitter* API, we cannot expect to have gathered a fully comprehensive dataset for either hashtag: given the long timeframe of data collection,

unavoidable outages both on *Twitter's* and on our side will have combined to create several brief gaps in the archives. Further, as the API is the only sanctioned access point to *Twitter* data at scale, it is impossible to independently verify exactly how much data may have been excluded from collection: short of comparing datasets with other researchers tracking these hashtags over the same period, there is no reliable method for finding gaps in the data (see also Freelon, 2011, on similar limits to his study). This is a fundamental problem of all research drawing on third-party APIs; it is an unavoidable aspect of doing 'big data' research (boyd & Crawford, 2012).

At the same time, the overall volume of tweets which we did capture is immense, and sufficient as a basis for the examination of broad patterns in *Twitter* activity. A chronological overview of the data points to obvious gaps: for #egypt, we received no tweets at all on 31 Jan., 5-7 Feb., 31 Mar., 1 and 2 Apr., 2-4 Aug., 15 Sep., 16 Oct., and 23, 26, 27, and 29 Nov. 2011; for #libya, we are missing data for 31 Mar., 1 Apr., 15 Apr., 2-4 Aug., 15 Sep., 16 and 21 Oct., and 26 and 29 Nov. 2011.¹ This means that for #egypt, we missed 16 days in over ten months of data collection; for #libya, we missed 11 days in nine and a half months.

yourTwapperkeeper datasets are available in simple comma- or tab-separated value formats, containing the tweets themselves and a range of additional metadata; most importantly, these metadata include the numerical *Twitter* ID and username of the sender, as well as the exact timestamp of the tweet. Further metadata can be extracted from the tweets: chiefly, this includes the usernames of any *Twitter* users mentioned (through @replies or retweets), and the – usually shortened – URLs of any links included with the tweet. Further processing also reveals the specific type of tweet: by parsing its syntax, it is possible to distinguish between simple @replies and retweets (in the form "RT @user ...", "MT @user ...", "via @user ..." or ""@user ... "" – that is, enclosing the original tweet in quotation marks), or to identify tweets as *original* tweets that neither @reply to nor retweet another user.

In the present context, it is especially important to distinguish between tweets in different languages. The *Twitter* API itself does not provide sufficient information to make immediate distinctions: while amongst the metadata returned by the API is a language code for each tweet, that code is simply inherited from the language setting made globally by the tweet sender, and does not reflect the specific language of the tweet itself. Tweets by an Egyptian user, tweeting in Arabic, who left their global *Twitter* profile setting at the English default would be marked as 'English'; tweets by a French user who set their profile to French but converses in

¹ All dates and times here are in Cairo time.

English and Arabic would be marked as French. The specific language of tweets can only be ascertained by individually analysing each tweet itself, then.

For the purposes of the present analysis, working with datasets that largely contain tweets in English and other European languages on the one hand, and in Arabic on the other, this analysis can be considerably simplified: a useful approach to distinguishing these two groups is to examine whether tweets are written in Latin or non-Latin characters. While the non-Latin group will also contain tweets in various other scripts (Chinese, Japanese, Korean, etc.), the presence of such languages in our present datasets is negligible in comparison to Arabic script; additionally, in an analysis of conversational networks between *Twitter* users, such third language groups should form distinct conversational networks at a distance from the dominant Arabic and English groups. Similarly, any major distinctions in the Latin group should indicate the presence of various European languages.

Since all standard Latin characters and punctuation marks have been assigned ASCII character codes below 128, a simple method for coding tweets as ‘Latin’ or ‘non-Latin’ is to count the number of characters with a code above 127 in a tweet. Should that number pass a certain threshold, the tweet is coded as ‘non-Latin’. Through a trial and tuning process², we determined that a threshold of 10 non-Latin characters results in a reliable distinction between Latin and non-Latin tweets. This threshold value is preferable to a strict zero as it allows for the presence of several accented characters as they are common in various European languages (äöüß, áéíóú, etc.) as well as for ‘fancy’ punctuation marks (“ instead of ", etc.), all of which have also been assigned character codes above 127.

Such automated coding of tweets was implemented using *Gawk*, a programmable command-line tool for processing CSV/TSV data files (Bruns, 2012e). In addition to coding the tweets themselves, we can also calculate a cumulative language score for each *Twitter* user participating in these datasets, indicating what percentage of their tweets was in non-Latin scripts. This can be used to distinguish different *Twitter* user groups: those posting mainly in Latin characters (in the present context, mainly in English); those posting mainly in non-Latin characters (mainly in Arabic), and those using a mixture of scripts (and thus perhaps acting as information brokers between different language communities). Similarly, we can calculate the ratio of Latin and non-Latin tweets across all users per timeframe (e.g. per day or hour), to show when different language communities were especially active.

² See <http://mappingonlinepublics.net/2012/01/28/creating-basic-twitter-language-metrics/> for details.

Beyond this coding of language, we also extracted a range of other metrics from the *Twitter* datasets (see Bruns, 2012a/b/c/d for an extended discussion of these metrics and the methods used to obtain them): we track the number of tweets made (also broken down into tweet categories including original tweets, @replies, retweets, and tweets containing URLs) as well as the number of active users per timeframe; further, for each user we determine the number of hashtagged tweets sent and received (again also broken down into the different tweet categories).

Finally, following the 1/9/90 rule which has become an unofficial standard for analyses of user communities where activity broadly follows a 'long tail' distribution (Anderson, 2004, 2006; Tedjamulia *et al.*, 2005), we divide the userbase of active contributors into three groups: one group of lead users which contains the most active one percent of participants; a second group of highly engaged users which contains the next nine percent of active participants; and a third group comprising the remaining 90% of least active users. These divisions are determined by ranking users on the basis of the number of tweets they have contributed to the hashtag: the top one percent of users on this ranked list are included in the first group, the next nine percent in the second group, and the remaining userbase in the third group. Finally, a fourth group contains all those whose usernames are mentioned in @replies and retweets, but who did not themselves post to the hashtag. For each of the first three groups, we again become track their contribution to the hashtag over time, and determine overall patterns of activity such as their relative use of original tweets, @replies, retweets, or tweets containing URLs.

Overall Patterns

Based on this methodology, we are able to determine overall patterns for both #egypt and #libya, over the total period covered by each dataset – 23 Jan. to 30 Nov. 2011 for #egypt, 16 Feb. to 30 Nov. 2011 for #libya.

#egypt

In total, we captured some 7.48 million #egypt tweets from over 445,000 unique users between 23 Jan. and 30 Nov. 2011. *Twitter* activity for #egypt peaks at a significantly higher level during the early stages of the revolution than at any other subsequent point (fig. 1). While unfortunately, data for several days in this early period (31 Jan., 5-7 Feb.) are missing from our overall dataset (visible as gaps in the graphs which follow), the

resignation of President Mubarak on 11 Feb. has the greatest resonance in the available data: we recorded more than 205,000 #egypt tweets from over 82,000 unique users during this day. During this early stage the composition of the *Twitter* community is also markedly different from that recorded during the majority of the overall period: throughout almost all of February, tweets using Latin characters retain the majority; it is only on 26 Feb. that the balance first swings towards non-Latin tweets. From then on, the situation is markedly different: from 1 Mar. to 30 Nov., an average of more than 75% of the #egypt tweets sent each day are composed in non-Latin characters.

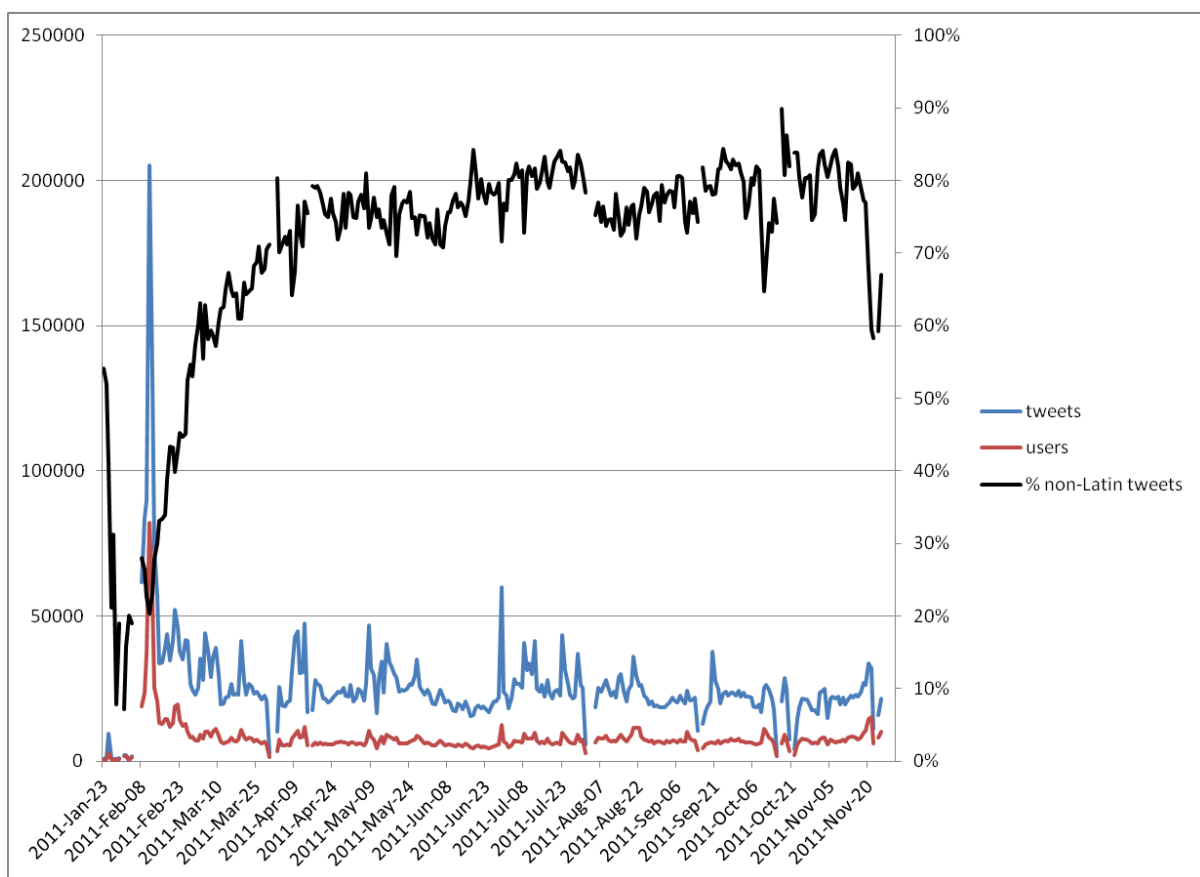


Fig. 1: #egypt tweets and unique users per day, compared with daily percentage of non-Latin tweets

This demonstrates a substantial shift in attention: while during the first month, and especially around the key days of régime change, a significant number of non-Arabic-speaking users participate, their interest dissipates as the situation moves from outright revolution to a more long-term reshaping of the political system; the remaining #egypt userbase (an average of over 7,000 unique users per day, posting nearly 24,000

tweets per day during the 1 Mar. to 30 Nov. period) is likely to be composed largely of Egyptian locals and expatriates with a more direct interest in the continuing process of change.

One additional possible explanation for these changes is also the existence of the alternative hashtags #Jan25, referring to the so-called “Day of Revolt” which ignited the protest movement against the Mubarak régime. Notably, our data record only a relatively minor spike of less than 9,500 #egypt tweets on 25 Jan., substantially less than the over 205,000 tweets on 11 Feb.; it is conceivable that the majority of early *Twitter* activity around the Egyptian protests took place under the #Jan25 hashtag, shifting to #egypt only once the initial aim of the protests (Mubarak’s resignation) was achieved, and as the further passage of time made the #Jan25 tag seem anachronistic. The #Jan25 tag may also have had substantially greater resonance with directly involved local users, participating in or closely following the 25 Jan. protests, than with onlookers further afield; it is possible, therefore, that #25Jan hashtag activities attracted a proportionally larger number of Egyptian (and generally Arabic-speaking) *Twitter* users, in turn leaving #egypt to be dominated by English speakers, and that this imbalance only changed once a greater number of Arabic speakers transitioned to #egypt.

Such shifts in the userbase can also be traced by examining the relative contributions made by each of the three user groups outlined above. Fig. 2 indicates the percentage of all daily tweets contributed by the three groups, and shows significant activity by the normally less active groups especially during the first stage: until the end of February, the lead users contributed only an average of 36% of all tweets per day; from March onwards, the same group accounts for an average of 60% of all tweets each day. In other words, this early stage saw a substantially larger presence of – in the long term – less engaged users; when these users exit the hashtag conversation as the ‘hot’ phase of the revolution comes to an end, the two user groups who have a more long-term commitment to discussing political change in Egypt increasingly come to dominate the conversation. But it should also be noted that from July onwards, lead users are again pushed back, in favour of a greater contribution especially from the second group of users: this may point both to the growing frustration with the slow pace of changeover from the Supreme Council of the Armed Forces to a civilian administration, which began to be voiced at this time, and to the building anticipation of popular elections, which began on 28 Nov. 2011. It is interesting to note that while the balance of contributions by the three groups gradually shifts from mid-year, the total volume of #egypt tweets remains relatively stable.

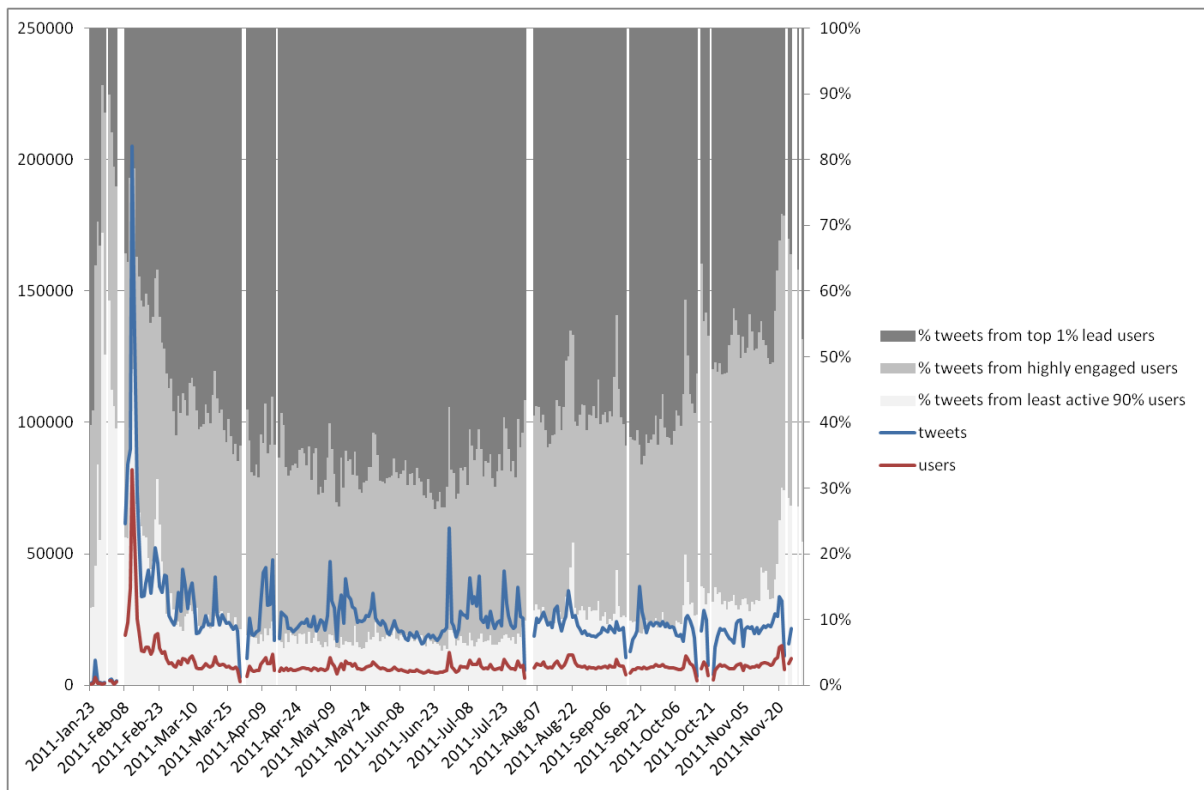


Fig. 2: #egypt tweets and unique users per day, compared with daily contributions by different user groups

For further illustration, fig. 3 specifically compares the daily contributions made by the least active group with the daily percentage of tweets in a Latin character set, and points to a strong correlation between these metrics. Especially during the early stage of the revolution, the presence of a large number of normally relatively inactive users also coincides with a large number of Latin (i.e. mainly English) tweets; this implies that Arabic-language users are especially well represented in the leading groups of most active contributors to #egypt, while less active contributors are more likely to be from non-Arabic backgrounds, and may have been attracted to the #egypt discussion largely because of the widespread media coverage of the revolution, but have limited interest in the longer-term process of political change.

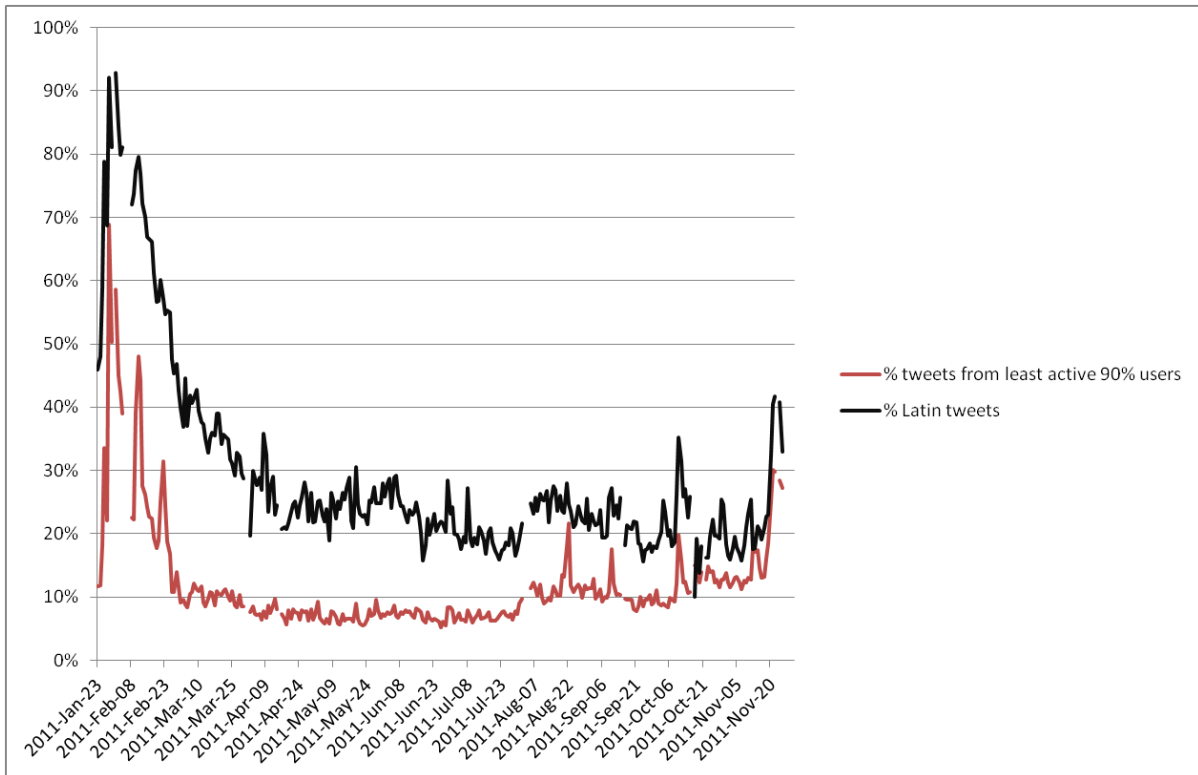


Fig. 3: daily percentage of Latin tweets, compared with percentage of tweets from least active users

These differences also become apparent from a further examination of the activity patterns for each of the three groups (fig. 4). As is to be expected, the lead users are responsible for a disproportionate percentage of all #egypt tweets; this one percent of most active users contributed nearly 56% of all tweets. Their tweets are also substantially more likely to be what original tweets (that is, neither @replies nor retweets – 64% of their tweets fall into this category); by contrast, the majority of the tweets contributed by the least active user group – 65% – are retweets. The leading user group are also most likely to share URLs: some 56% of their tweets contain hyperlinks to external resources, compared with under 40% for each of the other two groups.

A further striking difference between these three groups is evident from their language preferences. For the lead group, an average of nearly 75% of their tweets use non-Latin characters; this reduces to 63% for the highly engaged users, and drops to 43% for the large group of least engaged users. This means that Arabic speakers are relatively overrepresented amongst the most engaged groups, while the least engaged group of users contains a substantially larger number of non-Arabic speakers.

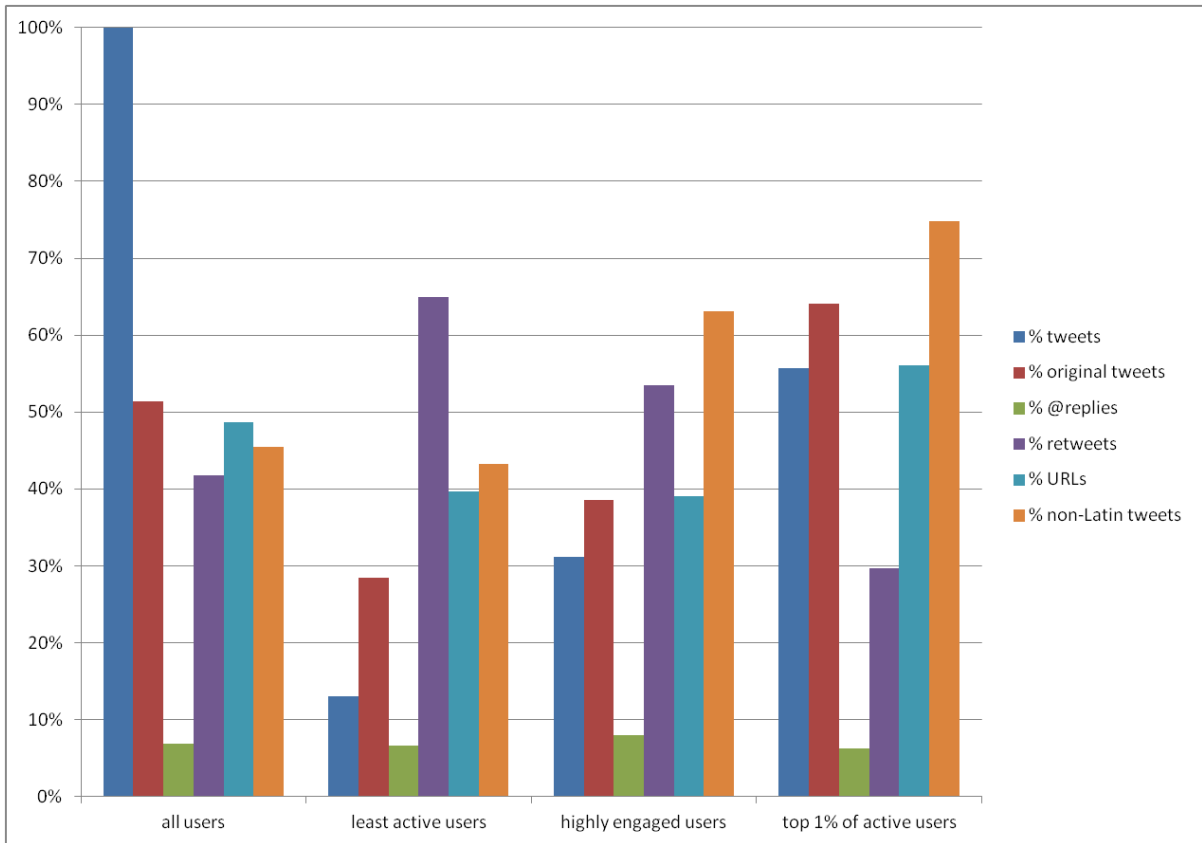


Fig. 4: #egypt contribution patterns across the different user groups

#libya

Patterns in the #libya dataset are somewhat different from those for #egypt, as fig. 5 indicates. Over the course of the data collection period, we captured over 5.27 million tweets originating from more than 476,000 users. Total usage of the hashtag spikes early on at over 320,000 tweets per day on 21 Feb. 2011, as first reports of unrest are covered by world media, but after this relatively brief moment of heightened activity the #libya hashtag continues to operate at a much lower volume: from the start of April, the daily average remains at a comparatively low 10,500 tweets. As in #egypt, the number of unique users contributing to the hashtag each day generally correlates with the number of tweets; it peaks at over 80,000 on 22 Feb., but reaches only an average of 3,600 for the period after 1 April.

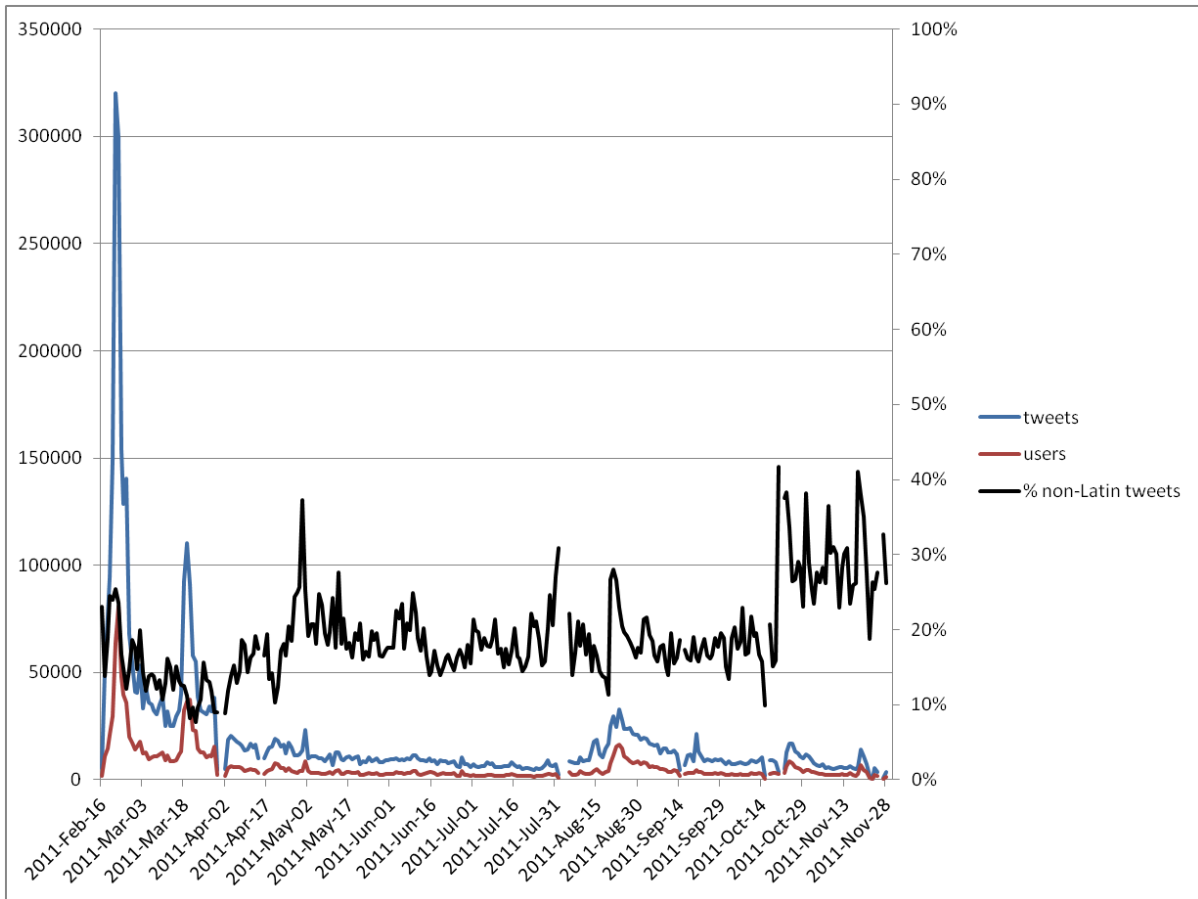


Fig. 5: #libya tweets and unique users per day, compared with daily percentage of non-Latin tweets

A notable difference from #egypt emerges with the percentage of Arabic (i.e. non-Latin) tweets per day: here, #libya shows a surprisingly limited number of tweets using non-Latin characters. From 16 Feb. to 15 Oct., the average percentage of non-Latin tweets remains at a lowly 18%; it rises to 29% only during the last one and a half months. Contrary to #egypt, fluctuations in language use cannot be traced back to the relative contributions made by the different user groups: at 23%, the percentage of non-Latin tweets posted by the top 1% group of lead users over the entire period differs little from that of the least active group, at 27%.

Rather, an explanation for the generally comparatively low number of Arabic tweets in the #libya dataset must be sought in the user demographics, and in the nature of the conflict. In Egypt, where protests were centred on demonstrations in the urban setting of Cairo, significant use of *Twitter* in covering the crisis may well have been considerably more likely than in Libya, where régime change was achieved only after a long military campaign unfolding across the country; additionally, differing Internet and social media take-up, and subsequent blocking of access to such communication tools, is likely to have influenced the respective

level of domestic *Twitter* use in these countries. Media reports during the Libyan civil war, suggesting that the Gaddafi régime attempted to block Libya’s access to the global Internet, would explain the low number of Arabic tweets in the #libya dataset; further, the substantial rise in Arabic tweets from 20 Oct. 2011 may indicate that such restrictions were lifted as the régime fell (Gaddafi himself was killed on that day).

Fig. 6 again compares overall daily activity with the respective contributions made by the three user groups. As before, the top 1% of most active users is generally responsible for the vast majority of all tweets; over the entire period, they contribute some 57% of all tweets, while the least active group only contribute 16% of all tweets. Again, however, the contribution of the less active user groups also rises considerably when the overall number of tweets peaks; on 23 Aug., for example, the lead user group accounts for less than 27% of all tweets, with the other two groups driving overall hashtag activity on that day (the day rebels overran Gaddafi’s Bab al-Azizia compound in central Tripoli).

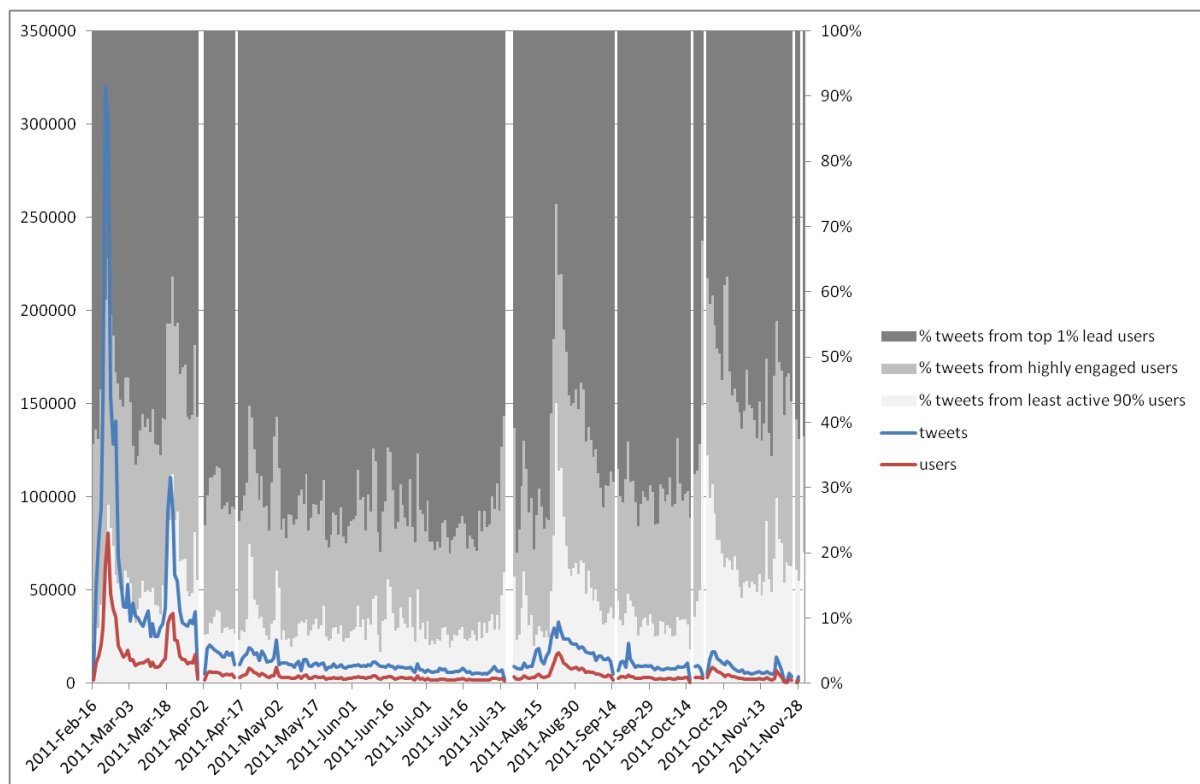


Fig. 6: #libya tweets and unique users per day, compared with daily contributions by different user groups

Compared #egypt, the activity patterns for these different user groups in #libya (fig. 7) show few notable trends. There is, as expected, a marked difference in the overall level of contributions made by the

three groups; the lead users are also somewhat less likely to send retweets (56% of their tweets were retweets, compared to 66% of the tweets made by the least active group), and more likely to post original tweets (36% compared to 27%). There also is no clear pattern in the relative use of Latin or non-Latin scripts; differences between the groups are relatively minor.

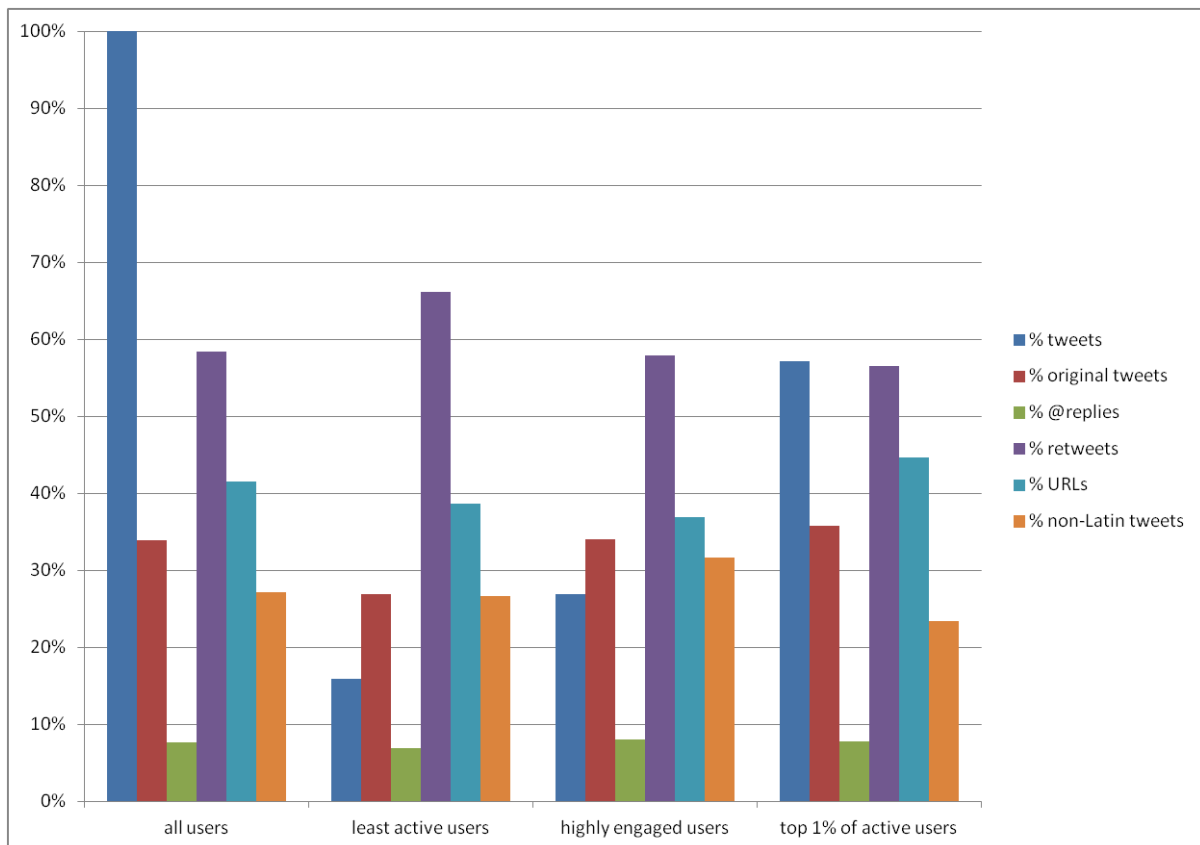


Fig. 7: #libya contribution patterns across the different user groups

This is remarkably different from #egypt, where lead users were substantially more likely to post original tweets (65% of their messages were neither @replies nor retweets), and to do so in Arabic (nearly 75% of their tweets used non-Latin script). What these observations strongly suggest is the relative absence – because of Internet blockages or a more limited take-up of *Twitter* – of a domestic *élite* of Libyan *Twitter* users reporting on the latest developments, as well as of an active ex-pat community to take up and disseminate their messages further. *Twitter* as a communications tool *was* used to document and discuss the unfolding events of the Libyan civil war – but more so by interested onlookers outside of the country, mainly using English to communicate, than by Libyan locals and their compatriots abroad.

Interactions between Language Groups

There are clear differences in the *Twitter* audiences for the #egypt and #libya streams, and the make-up of these groups changes substantially over the course of 2011. Of particular interest is the presence of different language groups, and the potential for interactions between them: our interest is in determining to what extent information originating from predominantly Arabic-speaking *Twitter* participants is able to reach English-speaking users, and vice versa. Such interactions can be traced by examining the flow of @replies and retweets (collectively, @mentions) between participating accounts; for both #egypt and #libya they consist largely of retweets, since (as figs. 4 and 7 have demonstrated) less than ten percent of all tweets are genuine @replies. For our analysis, this is useful: retweets are generally used by *Twitter* contributors to pass along incoming information to their own networks of followers; where we find evidence of significant connection between Arabic- and English-language users, we may assume that information is transmitted across language boundaries.

To examine these questions, we focus on four distinct periods selected from the overall *Twitter* feeds for #egypt and #libya. For #egypt, we examine the period of 1-28 Feb., which sees the major spike in *Twitter* activity, and is characterised by a relatively high number of users (many from the less engaged groups) tweeting in Latin characters, and the period of 15 June to 15 Sep., marked by a steady but less spectacular daily volume of tweets and a predominance of non-Latin tweets. For #libya, we examine 16 Feb. to 15 Mar., a comparable one-month period during the early stages of the uprising, reaching daily volumes surpassing even those seen in #egypt but notable for the comparative absence of non-Latin tweets, and 1 Aug. to 30 Sep., with steady levels of activity and a slightly higher incidence of non-Latin tweets. For each of these periods, we again divide participating users into the three groups of lead users, highly engaged users, and least active users, as well as a final group of passive *Twitter* accounts whose usernames are mentioned in hashtagged tweets, but who do not themselves post hashtagged tweets during the period.

We also calculate for each user the percentage of their tweets which use more than our threshold value of ten non-Latin characters. On this basis, we divide the overall userbase along new lines: into groups using predominantly Latin characters (less than 33% of their tweets pass the non-Latin threshold); predominantly non-Latin characters (more than 66% of their tweets are non-Latin); and mixing both Latin and non-Latin tweets (between 33% and 66% of their tweets are using non-Latin characters). Such distinctions can

only be made for active contributors to the hashtags, of course; for the group of passive accounts which are merely mentioned, we are unable to determine their position across the language divide. In the network graphs which follow, accounts with predominantly Latin (i.e. mostly English-language) tweets will be shown in blue; those with mainly non-Latin (i.e. Arabic) tweets in green; users posting a mixture of Latin and non-Latin tweets are marked in an intermediate colour that reflects that mix; passive accounts, finally, are shown in grey. Connections between users are shown in the colour of the originating user.

#egypt

The two periods in the overall #egypt dataset which we examine here are marked by a substantial shift in the language mix, from a substantial majority of Latin tweets to an even more significant predominance of non-Latin tweets. Fig. 8a/b shows the relative presence of the three different language groups within the total community of users, as well as within the groups of more and less active users.

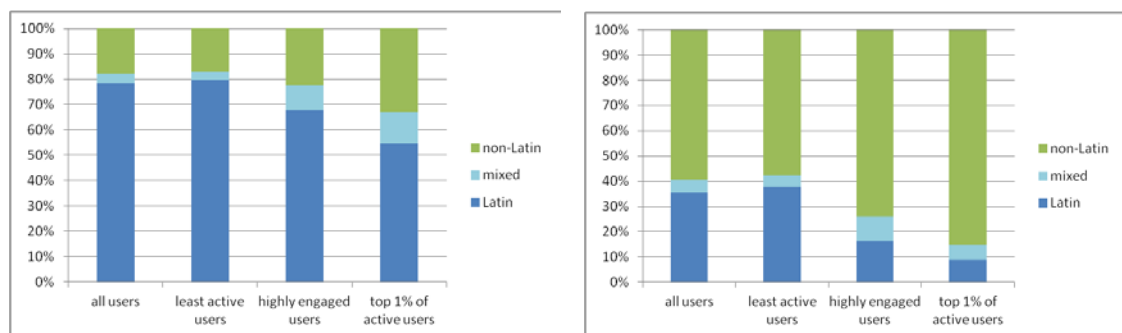


Fig. 8a/b: #egypt language groups as percentage of total userbase, 1-28 Feb. and 15 June to 15 Sep.

During the 1-28 Feb. period, users tweeting predominantly in Latin characters clearly dominate: more than 78% of all users fall into that category, while only 4% and 18%, respectively, belong to the 'mixed' and 'non-Latin' groups. The distribution within the least active user group largely matches this distribution. Towards the more active end, however, the distribution changes considerably: only 67% of the highly active group, and only 55% of the lead users, tweet predominantly in Latin characters, while the presence of 'non-Latin' users grows to 22% and 33%. The most remarkable difference is for the mixed-language group, however: constituting only 3% of the least active group, they account for 10% of the highly active group, and make up nearly 13% of the lead user group. This indicates a considerable difference in commitment to the #egypt

discussion: while larger numbers of English speakers may be interested enough to tweet or retweet the occasional message relating to the situation in Egypt, even at this early stage Arabic-speaking *Twitter* users are prepared to participate in significantly more depth.

Several months later, similar patterns persist, but the balance has shifted much further towards the ‘non-Latin’ group. They now constitute nearly 60% of the total userbase, and are again considerably overrepresented amongst the more engaged groups; over 85% of all lead users tweet predominantly in non-Latin characters. Similar to the earlier period, too, mixed-language contributors are disproportionately represented amongst the more active groups; here, however, they constitute a larger proportion of the second, highly engaged group (at nearly 10%), but only 6% of the lead user group. One explanation for this shift may be that the ‘mixed’ group is more likely to include native Arabic speakers who use English as a second language than native English speakers with some knowledge of Arabic; as the overall stream of the #egypt discussion shifts more towards the use of Arabic in these later months, users who were in the ‘mixed’ group during the earlier phase of the uprising may now be posting Arabic-language tweets so frequently that they have moved into the ‘non-Latin’ group as we have defined it.

Fig. 9a/b compares the total network of *Twitter* exchanges between users through @replies and retweets during these periods. Connections are depicted in the colour of the originating user: @replies and retweets by ‘Latin’ users are shown in blue; those by ‘non-Latin’ users in green; and those by users tweeting in a mixture of character sets in the corresponding mixed colour. The balance between predominantly blue (Latin) and green (non-Latin) regions in the network shifts substantially from the 1-28 Feb. to the 15 June to 15 Sep. period. During the former period, in fact, some 68% of all connections through @replies and retweets originate from the ‘Latin’ user group, 10% from the ‘mixed’ group, and 22% from the ‘non-Latin’ group³; during the latter, the situation is reversed, and even more one-sided: only 18% of all @mentions originate from ‘Latin’ users, 9% from ‘mixed’ users, and 73% from ‘non-Latin’ participants. If the least active group of contributors is excluded from this calculation, the situation changes slightly: for the earlier period, the ‘Latin’ group now accounts for a slightly lower 64% of all @mentions; for the later period, however, the contribution of ‘non-Latin’ users rises yet further, to over 78% of all @mentions. Several outliers may be detected in these network graphs (especially amongst ‘non-Latin’ users in the June-September period); it is likely that ideological,

³ Here and throughout, these percentages refer to the relative *number* of connections (network edges) between users from these different language groups; we do not take into account the *frequency* with which such connections between any pair of participants may have been repeated during each timeframe (i.e. the specific *weight* of each network edge).

geographic, or other sociodemographic factors are responsible for their separation from the core of the network.

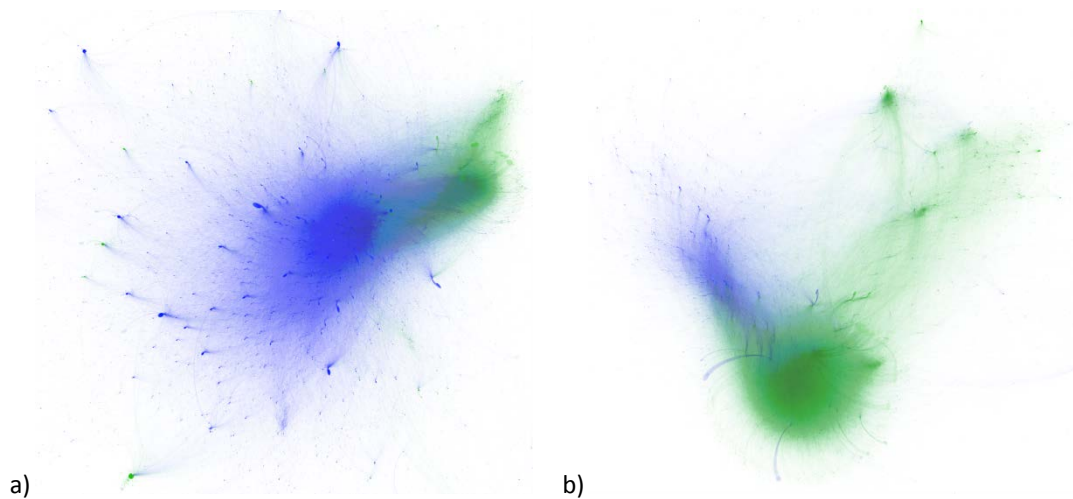


Fig. 9a/b: #egypt @reply/retweet networks, 1-28 Feb. and 15 June to 15 Sep.

The overall flows of information across the network, for which @replies and retweets provide a proxy measure, can be examined further by visualising aggregate flows (fig. 10a/b). These graphs show that interaction by 'Latin' and 'non-Latin' groups during both periods is largely amongst themselves: the indicators of self-linking are considerably more prominent in fig. 10a/b than any connections across language boundaries. During February, some 80% of all @replies and retweets by 'Latin' users reference others in the same group; 65% of the @mentions by 'non-Latin' users mention other 'non-Latin' participants. For 'Latin' users, in fact, the second most prominent source of information are 'passive' accounts: 10% of their tweets reference those accounts (amongst which news organisations and other sources will play an important role), often likely retweeting information while adding the '#egypt' hashtag to the original messages. Where they look beyond their own group, by contrast, 'non-Latin' users divide their attention almost equally between 'mixed' (14%) and 'Latin' (16%) sources; they draw on passive accounts only for 5% of their @mentions. The 'mixed' group, finally, act considerably differently: only 15% of their @replies and retweets are directed at other mixed-language users, but 42% reference 'Latin' accounts and 37% connect to 'non-Latin' accounts. While the overall contribution of the 'mixed' group to #egypt is relatively minor, therefore, their main role appears to be an attempt to bridge the major language groups.

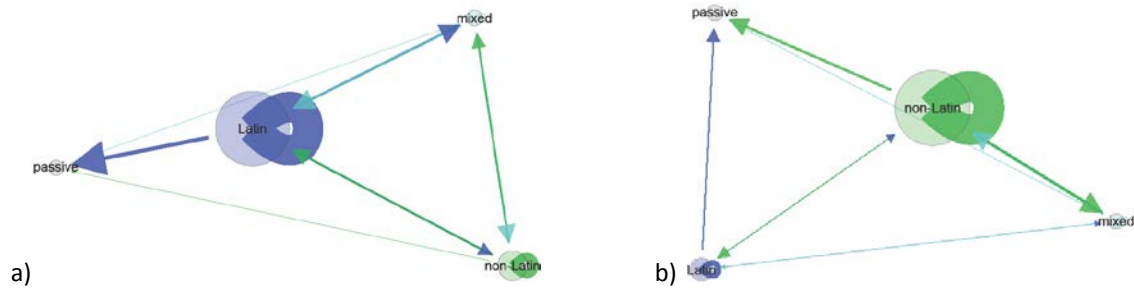


Fig. 10a/b: aggregate #egypt @reply/retweet networks, 1-28 Feb. and 15 June to 15 Sep.

During the period of 15 June to 15 Sep., the situation is reversed, and more: as originators of only 18% of all @mentions, ‘Latin’ users now play an even lesser role than ‘non-Latin’ users did during February. Due in part to their overall dominance, the ‘non-Latin’ group is similarly self-focussed: over 82% of their tweets mention other ‘non-Latin’ users, with between four and 7 percent mentioning each of the other three groups. Conversely, as #egypt is now predominantly a non-Latin *Twitter* stream, the remaining ‘Latin’ users are also forced to look beyond their own group for more information: while 56% of their tweets continue to reference other ‘Latin’ participants, 11% draw on the ‘mixed’ group, and 14% contain @mentions of ‘non-Latin’ users. Indeed, if the 90% least active users are excluded from the analysis, the cross-language links from ‘Latin’ to ‘non-Latin’ users increase from 14% to over 19% (and from 11% to 12% for links to the ‘mixed’ group): those ‘Latin’ users who are amongst the most active overall contributors to #egypt are also significantly more likely to seek information beyond their own group. The ‘Latin’ group also remains especially focussed on ‘passive’ accounts, however: some 19% of their tweets continue to inject information from such non-participating accounts into the #egypt discussion, through retweeting. Finally, more so than during the earlier period, the ‘mixed’ accounts have also accepted the dominance of ‘non-Latin’ accounts: 53% of their @mentions reference those accounts, compared to only 21% referring to ‘Latin’ users. Intra-group @mentions remain characteristically low for this group: only 14% of their @mentions refer to fellow mixed-language accounts.

#libya

Dominated throughout by ‘Latin’ users, the situation in the #libya hashtag differs considerably from that in #egypt. During the early phase of the revolution, the overall #libya userbase presents what is nearly a mirror image of the situation in #egypt: some 82% of all participating users during this time fall into the ‘Latin’ category (fig. 11a/b). However, when broken down into the groups of more or less engaged users, the

distribution of language groups becomes more complicated: while the second most active group again includes a larger number of ‘non-Latin’ and mixed-language users, that trend is reversed again for the leading user group. ‘Non-Latin’ users constitute 14% of the least active group, 20% of the second group of highly engaged users, but again only 14% of the lead group; by contrast, the mixed-language group accounts for only 3% of the least active group, 8% of the highly engaged group, and nearly 9% of the leading group. It appears that similar to #egypt, during this early phase the #libya hashtag attracted a substantial number of relatively random English-language commenters, a comparatively large number of fairly active Arabic-speaking users, but also a substantial number of very highly active English-language participants.

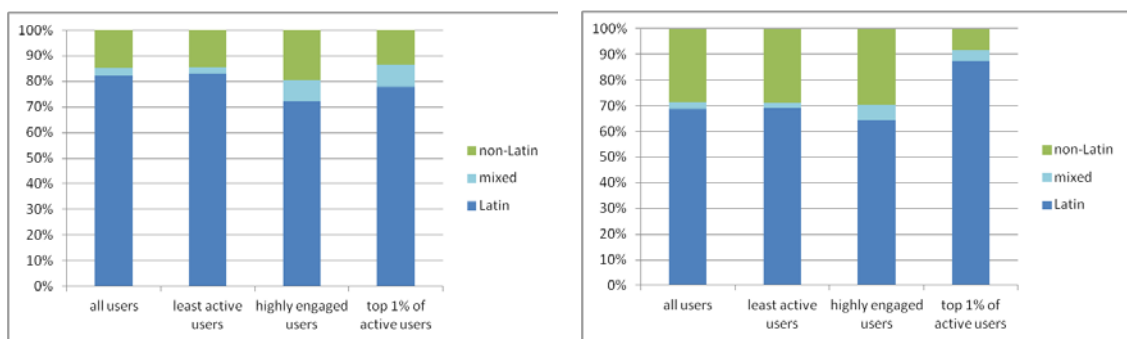


Fig. 11a/b: #libya language groups as percentage of total userbase, 16 Feb. to 15 Mar. and 1 Aug. to 30 Sep.

This pattern is even more pronounced for the August/September period. By this time, users tweeting mainly in non-Latin characters have become substantially more active in the #libya community; they now account for 29% of the total userbase, and constitute 30% of the highly engaged user group. Surprisingly, however, they have not only failed to make any inroads into the lead user group, but have indeed been pushed out of this group by an even more active English-language elite, to the point where they now constitute only 8% of that lead group. Further, the mixed-language group also appear to have been squeezed out of the overall hashtag community by this increasing language polarisation: now accounting for only 2% of the total #libya userbase, they also constitute only 6% of the highly engaged group, and 4% of the lead user group.

Fig. 12a/b again compares the overall network of @replies and retweets across the two periods we have chosen (16 Feb. to 15 Mar. and 1 Aug. to 30 Sep., respectively), and shows a gradual thinning of and cluster formation in the network: not only do connections between the predominantly ‘Latin’ and ‘non-Latin’ sections of the network weaken from the earlier to the latter period, but even within these sections

themselves distinct, loosely connected clusters emerge (available space in this article does not permit us to examine the unifying traits of these distinct clusters). During the earlier period, nearly 80% of all connections through @mentions originated from the 'Latin' group of users, while the 'non-Latin' group accounted for just over 13%; the 'mixed' group contributed only 7% to the total number of @mentions. This distribution remains steady once the least active 90% of users are removed from the network, too. In August and September, during the final battle for control of Tripoli, the situation becomes more polarised: while at 79%, the 'Latin' dominance remains steady, the contribution of the 'mixed' group drops to only 4%, and that of 'non-Latin' users increases to nearly 17%; if only the top 10% of most active users are considered, however, the 'Latin' group now accounts for over 85% of all @mentions, and the 'non-Latin' group drops back to just over 10%.

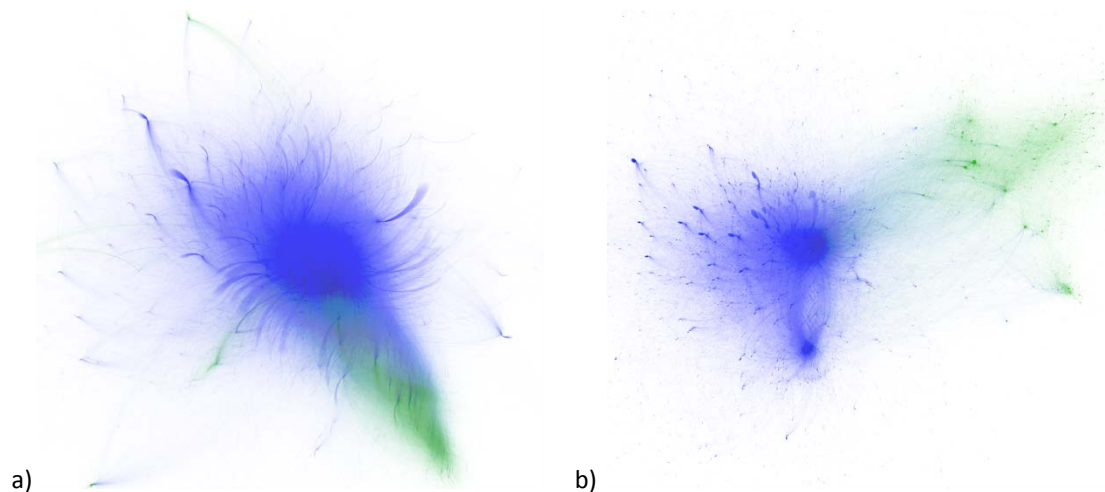


Fig. 12a/b: #libya @reply/retweet networks, 16 Feb. to 15 Mar. and 1 Aug. to 30 Sep.

An analysis of the aggregate flow of information further supports these observations. Fig. 13a/b is clearly dominated by the presence of 'Latin' users, who largely make intra-group @mentions (more than 85% of their @mentions are directed to other 'Latin' participants, in both periods); where they connect outside their own group at all, they do so mainly to 'passive' *Twitter* accounts (8% and 11% of their @mentions, respectively, are pointing to that group during the two periods, while @mentions of any of the other groups fail to account even for as little as 4% of the total @replies and retweets sent by 'Latin' users.

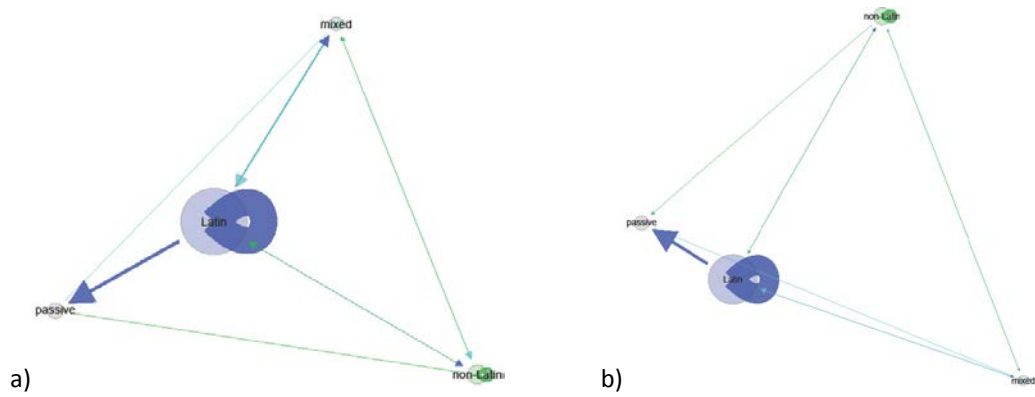


Fig. 13a/b: aggregate #libya @reply/retweet networks, 16 Feb. to 15 Mar. and 1 Aug. to 30 Sep.

Nonetheless, a small but internally active group of ‘non-Latin’ users does remain: respectively, during the two periods, 66% and 76% of the @mentions originating from ‘non-Latin’ users are directed at other members of that group. During February/March, ‘Latin’ users are the next most important information source for ‘non-Latin’ users, at 16%, followed by mixed-language users at 11% and ‘passive’ accounts at 6%; in August and September, however, external, ‘passive’ sources become more important (at 9%), while @mentions of the ‘Latin’ and ‘mixed’ groups drop to 8% and 6%, respectively. Finally, while in #libya the efforts of the ‘mixed’ group of users do not amount to a substantial level of activity, it is nonetheless notable that their information-sourcing processes do not reflect the balance of power which prevails within the #libya community: while during both periods, over 50% of their @mentions refer to ‘Latin’ users, a similarly considerable over 30% of their mentions are directed to the significantly smaller group of ‘non-Latin’ users. This intermediary group of mixed-language users do continue to play a role in enabling an information flow across language boundaries, therefore, even if their more limited presence in the #libya hashtag means that direct connections between ‘Latin’ and ‘non-Latin’ users must play a greater role here, compared to #egypt.

Conclusion

Space available in this article has only allowed us to examine the broad patterns of *Twitter* usage by Arabic and English speakers in the Egyptian and Libyan uprisings, and to point to the relative presence of highly active élite users in each case; even this already highlights significant differences between the two cases. These differences are clearly aligned with sociodemographic and technological distinctions between the countries, as well as with the different course of events followed by each revolution.

We found that there is a substantially larger group of Arabic-speaking users participating in the #egypt discussion than in #libya; this observation supports research which found – albeit on the basis of geolocated tweets, which account for only a minute percentage of all messages on *Twitter* – that the Egyptian *Twitter* population is larger by an order of magnitudes than the Libyan (Karanja, 2012). As a consequence, discussion under the #libya hashtag is likely to consist largely of outsiders looking in, rather than – as in #egypt – of locals and expatriates discussing the unfolding political crisis in their country.

Even in #egypt, however, we found a substantial shift over time, from a comparative dominance of users tweeting in Latin characters to an overwhelmingly Arabic-speaking userbase. This shift may be driven in part by the early prominence of alternative hashtags – chiefly, the #Jan25 hashtag which referenced to the date of the first major demonstrations, and which subsided thereafter. But our analysis has also shown the already considerable presence of an Arabic-speaking élite amongst the top one percent of most active contributors to #egypt even at this early stage; as other users shifted from #Jan25 to #egypt proper, and as long-term interest by international participants waned, this established élite became the nucleus around which a largely Arabic-language discussion unfolded.

Our analysis of activity patterns in #egypt and #libya provides a complement especially to Lotan *et al.*'s (2011) analysis of the activities of a small group of highly active *Twitter* users who commented on the uprisings in Tunisia and Egypt. Where that study traced patterns of dissemination for a limited number of high-profile examples, our research points to the degree to which information exchanges are able to bridge existing language divides. Though outside the scope of the present article, further work will be able to examine the relative prominence of specific news sources (as URLs cited in tweets, and/or as major *Twitter* contributors themselves) in the English- and Arabic-language networks, and the extent to which such resources are shared across the language divide, or specific to one or the other of these language communities; this will shed further light onto the relative uses of *Twitter* for disseminating both mainstream and eyewitness accounts of the uprisings to local and international followers of these hashtags.

Such analyses also enable us to move beyond simplistic arguments about whether or not the events of the Arab Spring constituted '*Twitter* revolutions' (see e.g. Sullivan, 2011, and Morozov, 2011, for examples of the opposing perspectives in this argument). The differences we have found between the Egyptian and Libyan uprisings already point to the fact that the real situation is far more complex, and not only highly dependent on national and regional specificities, but also considerably changeable over time. The substantial

level of Arabic tweets in the case of #egypt certainly points to the fact that *Twitter* – and, by extension, other online media – did play a role in informing, organising, and reporting protest activities in the country (and most likely continue to do so now, as post-election unrest persists), but this does not necessarily translate into support for the popular narrative of Egypt as a social media revolution. In Libya, the situation is notably different – here, the consistent lack of local *Twitter* activity makes it difficult to escape the conclusion that other, more conventional forms of communication were significantly more important to the successful pursuit of régime change, and that *Twitter* interest in the uprising was driven largely by onlookers from further afield. Future research will show whether – in the wake of these political transformations – *Twitter* and other online and social media will become established for the long term as tools for political communication in both countries.

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