

Twittering for Earth: A Study on the Impact of Microblogging Activism on Earth Hour 2009 in Australia

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Abstract. The role of Twitter - a form of microblogging - as both influencer and reflector of real-world events is fast emerging in today's world of Web 2.0 and social media. In this investigation, we survey how the use of Twitter in Australia is linked to the real-world success of the Earth Hour 2009 campaign. The results of this research will give us an idea of the emergence of microblogging as a new medium of influencing human behavior and providing a source of collective intelligence in planning and decision making, specifically in the Australian context. We found that, from our observations, there is a correlation between the inter-state total energy reduction during this campaign with the amount of inter-state online Twitter discussion. We also identified a link between the Twitter discussion frequency and the total real-life population of the locale in which the chatter takes place, which could be used as a yardstick to analyze the reach of online technologies in the real world.

1 Introduction

Twitter [26], a microblogging site, has become one of the fastest growing trends on the Internet, with an exponentially-growing user base [19]. Users participate by expressing their thoughts or feelings within 140 characters, publishing their messages (or 'tweets') for friends, family, and the rest of the world to see. Of late, Twitter has been an effective method for information dissemination and interpersonal communication, and can be used as a gauge to measure the current *zeitgeist* on certain topics or issues. The shift from microblogging of daily trivialities to the usage of Twitter for dissemination of information can be seen in the transformation of the original Twitter motto – from the original “*what are you doing?*” to the current “*what's happening?*” [26].

In this research, our aim is to perform a case study to observe how online activity on Twitter which is part of the “social web” [6] can be reflected in a real-world social system. Such studies allow us to gain insight as to how social media in a virtual online setting can be linked to real-world human behavior, which

supplements existing studies on online memetics [1,27], information-sharing behavior [5], and social participation and dynamics.

Specifically, in this study we investigate how Twitter activity in a collective action campaign can be a reflective indicator of real-world sentiment on real-world events – in this case, the microblogging pattern of Australian Earth Hour 2009 participants on Twitter. We also intend to measure the success of the Australian Earth Hour campaign on a state-by-state basis in terms of energy savings recorded and attempt to determine a link, if any, between activism on Twitter and the efficacy of the Earth Hour campaign. This is interesting in the fact that Earth Hour 2009 not only focused on real-world campaigning and activism, but also had a strong online presence [29]. Finally, we determine any possible correlation between population levels and the level of participation in the Twitter microblogging platform, which allows us to see how adoption rates of online microblogging and social networking technologies can be linked to the size of the population.

The motivation behind our work is that no prior work has been done in this domain, and the potential results obtained from such a study could give us an insight into how an online microblogging platform (with elements of social networking and communication [6,9], collaborative applications [9], and information dissemination [5,12,16]) could effectively ‘mirror’ a real-world social system.

2 Background and Prior Work

2.1 An Overview of Twitter

There exists limited prior literature on Twitter and microblogging research. Java et al. [12] surveyed the topological, geographical and statistical properties of the Twitter social network. In their paper, they conducted an analysis on the taxonomy of “user intentions” of microblogging via Twitter, and found that users on Twitter not only answers the basic question of “what [they] are doing” at the moment. Users are inclined to share information, news, and sentiments [12] – this is also described by O’Reilly and Milstein [19] in their Twitter book. A high-level overview of the trending topics (top ten topics discussed on Twitter) by Cheong [6] came to a similar conclusion. From a social science and humanities perspective, Mischaud [16] stated that users on Twitter use it as an “expression of themselves” by using it as a medium for information and news sharing.

Krishnamurthy et al. [14] and Huberman et al. [10] studied the growth pattern of the existing Twitter network, user connections based on network theory, geographical presence based on time zone, and Twitter usage (‘tweeting’) habits versus geographic location. They found that Twitter updates roughly correlate to day-to-day activities of the user base, and that Twitter is predominantly used in the West but is quickly gaining popularity in other countries.

Honeycutt & Herring [9] studied the communication aspect of Twitter by studying the trends of Twitter replies, or “@ messages” and observed that Twitter messages also constitute a form of interpersonal communication amidst the flurry of chatter generated by users.

Cheong and Lee’s research on Twitter Trends and user demography [6] have found that such ‘Trends’ can be used as efficient indicators of the current sentiment of a section of Twitter users. This is corroborated by their findings that Twitter users contributing to a particular topic can be clustered according to their demographics and that such information can be used for policy-planning and decision making.

2.2 Social Information Spread

Social information spread is also relevant in discussing our case study. Arbesman [1] and Wasik [27] in their experiments with memetics and flash mobs respectively have shown that information dissemination via electronic media have been proven effective in triggering a ‘viral’ spread of information. This in turn translates in a real-world cultural phenomenon where people act upon the viral information that is spread online; an example would be people participating in real-world ‘flash mobs’ as a consequence of Wasik’s email experiment [27].

Relating to Twitter, Cheong’s work on surveying the commonly found text strings on Twitter Trends [5] found that ‘activism campaigns’ on Twitter are commonplace and can generate large amounts of discussion on Twitter due to increased “worldwide awareness and conversation”.

2.3 Twitter and OSNs as ‘Facilitators’

Relating to real world deployment issues, Hughes and Palen [11] have studied the usage patterns of Twitter in real-world scenarios of emergency response and mass convergence. Jungherr [13] and Goolsby [7] also discussed about how Twitter is being used as a facilitator to express political dissent.

Twitter has also been given much discussion in terms of it being a catalyst for activism and citizen journalism. Examples include an overview of the extensive role of Twitter in Barack Obama’s 2008 US presidential campaign [8], in political activism [13,17,21], and also reporting terrorist threats and disaster events as they unfold [3,4,25]. In the context of computer-based media art, Patel [20] explains that “context-specific [Twitter] feeds reveal a rich vein of social possibilities to mine . . . in activism”.

Studies in activism among users of *de facto* online social networks (OSNs) have also been given much attention, particularly in the domain of social sciences and the humanities. There is a study by Song [23] in feminist cyber-activism with Facebook, which showed how Facebook – an OSN – can be leveraged to enhance activism. Mankoff [15] has also performed a study of how such OSNs can be used in eco-activism by encouraging members on OSNs to reduce their ecological footprint in real life.

Relating to our case study, there was prior work done by Solomon [22] on analyzing the energy drop recorded during the 2007 Earth Hour conducted Sydney-wide from an economic perspective, which revealed findings that users “overstate their participation in the Earth Hour project”, as observed from the total energy drop registered during the 2007 Earth Hour. For the sake of comparison,

this case study will also address the issue of whether the energy drop registered during the 2009 edition of Earth Hour has actually become significant compared to past years due to the increasing popularity and media coverage given to it by the organizers [29].

3 Methodology

3.1 Analyzing Twitter Chatter during Earth Hour in Australia

For the Earth Hour 2009 campaign, users on Twitter are encouraged by the organizers to publish Twitter messages in such a format to express their support for the Earth Hour campaign:

...use the hashtags #earthhour or #voteearth along with your #location to get the word out. [28]

‘Hashtags’ are words preceded with a hash [#] symbol to tag Twitter messages, indicating a “use of social tagging to categorize posts to allow ease of communication and searching for related posts” [5].

Using this notation, we are able to create a search query to seek out Twitter messages from Australia in support of Earth Hour. The Twitter official API [26], however, is ill-suited for this purpose as it only allows the retrieval of the past 1500 messages, limited to a period of approximately one month (whichever limit is reached first) as discovered in prior research [6].

Therefore for the purposes of this project, we use the Hashtags.org website [2], a Twitter API-based website which automatically tracks users with hashtags and has a backdated, browsable archive for the hashtags ‘#earthhour’ or ‘#voteearth’.

For the location, the list of Earth Hour messages obtained are then scanned through to identify names of Australian state capitals, major cities, and their abbreviations. The messages are then collated according to state (with case-insensitive matching), as per the hashtag keywords in Table 1.

From the corpus of the filtered Twitter messages, Twitter activity will be expressed as total Twitter messages per each of the aforementioned states. A

Table 1. Hashtag keywords found in Earth Hour Twitter messages Australia-wide, grouped on a state-by-state basis

State	String describing state name, abbreviation, state capital, or major cities
NSW	Nsw, NewSouthWales, Sydney
QLD	Qld, Queensland, Brisbane
SA	SouthAustralia, Adelaide
TAS	Tasmania, Hobart
VIC	Victoria, Melbourne, Bendigo

scatter-plot of Twitter activity to percentage of power savings will be generated to identify if there is any link between the two variables. The R-squared coefficient of determination will be obtained from the graph to statistically validate our findings.

3.2 Measuring Power Consumption during Earth Hour 2009 in Australia

The Australian National Electricity Market Management Company Limited (NEMMCO) [18]¹ publishes electricity market (supply and demand) data, updated on a half-hourly basis, for five Australian states - New South Wales, Queensland, South Australia, Tasmania, and Victoria. By using the data for Earth Hour 2009, we are able to come up with an authoritative measure of how much energy is saved during the year's observance of Earth Hour (8.30pm to 9.30pm local time for each state, on the 28th of March 2009).

Power consumption data in megawatts (MW) for the Earth Hour time period (two half-hour periods, 8.30pm–9.00pm and 9.00pm–9.30pm) for a period of one week centered on the 28th of March 2009 (25th of March – 31st of March inclusive) is gathered for each of the states mentioned above.

The average non-Earth Hour power consumption (on a state-by-state basis) is calculated by averaging the wattage for the 3 days before and 3 days after the Earth Hour event. Hence, the energy reduction during Earth Hour could be expressed as a percentage of the average consumption.

To test the significance of the energy drop, a paired Student's *t*-Test for statistical significance is performed (using an α value of 0.05) with the aid of a spreadsheet package on the entire set of wattage data. This gives us an idea of whether the energy drop is statistically significant. For visualization and data tabulation, the energy consumption data will be formatted in bar graph and table form.

3.3 Investigating Twitter Activity versus State Population

As a secondary part of our investigation, we compare the Twitter usage rate as above to the population of each of the specified Australian states. This ratio provides us an insight into the adoption rate of microblogging (expressed by the proportion of people participating in the Earth Hour Twitter campaign) relative to the size of each state in terms of its population.

The latest population data on a state-by-state basis, dated December 2008, is obtained from the Australian Bureau of Statistics [24], as it is an authoritative source of population and demographical statistics. A scatterplot of the interstate Twitter usage rate versus state population will be generated and the R-squared value obtained to statistically validate our findings.

¹ As of July 2009, NEMMCO's operations have been taken over by the Australian Energy Market Operator (AEMO).

4 Results

By calculating the average state-by-state consumption of power for two half-hourly periods – Period 1: 8.30pm–9.00pm and Period 2: 9.00pm–9.30pm in each state’s respective time zone – three days before and after Earth Hour, and also the actual consumption recorded during the same half-hourly periods on Earth Hour day (28th March 2009), we obtain the following data in Table 2. The number following the state abbreviation represents the half-hourly period.

Table 2. State-by-state energy consumption for both half-hourly periods during Earth Hour and the corresponding average consumption during non-Earth Hour days (expressed in MW to 2 decimals)

State & period	Average consumption	Earth Hour consumption	Energy drop
NSW:1	8688.59	7729.56	959.03
NSW:2	8373.54	7607.68	765.86
QLD:1	6454.31	6001.81	452.50
QLD:2	6330.06	5789.71	540.35
SA:1	1496.56	1370.52	126.04
SA:2	1450.41	1372.22	78.19
TAS:1	1071.12	1031.49	39.63
TAS:2	1030.07	1008.60	21.47
VIC:1	5806.23	5317.49	488.74
VIC:2	5659.26	5323.03	336.23

Table 3. Percent reduction of energy use during Earth Hour, to 2 decimal places; and tabulation of Twitter messages observed

State	Percentage of energy reduction during Earth Hour	Number of Twitter messages observed
NSW	20.18%	48
QLD	15.55%	21
SA	13.81%	6
TAS	5.78%	3
VIC	14.36%	4

Using a spreadsheet package, we calculate the *t*-probability using Student’s two-tailed, paired *t*-Test for the sets of average consumption data and the Earth Hour consumption data. Using an α value of 0.05, and 18 degrees of freedom, we obtain a *t*-value of 3.24 (which is greater than the required *t*-value of 2.10 obtained from the given parameters). This indicates a statistically significant drop of energy consumption during Earth Hour.

We then obtain the net reduction of energy for each of the states expressed as a percentage value, and the aggregated Twitter usage count on a state-by-state basis in Table 3.

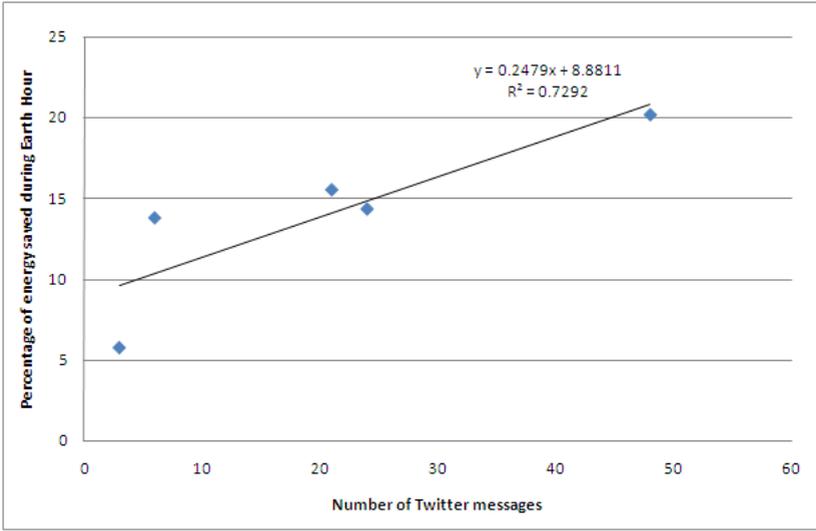


Fig. 1. Scatter-plot of energy savings (expressed as percentages) versus count of Twitter messages for the Australian states

Table 4. State-by-state Australian population data (in millions)

State	State population (millions)	Number of Twitter messages observed
NSW	7.0414	48
QLD	4.3495	21
SA	1.6120	6
TAS	0.5003	3
VIC	5.3648	4

A scatter-plot of the percentage of energy savings and Twitter usage count for the 5 states is then created (Figure 1).

Population data for each of the states is acquired from the website of the Australian Bureau of Statistics (ABS) as of the end of 2008 [24], and tabulated in Table 4. The scatter-plot for Twitter message activity versus population data is per Figure 2.

5 Discussion

Firstly, based on the analysis performed on total energy savings, the drop of energy consumption suggests that the Earth Hour campaign 2009 showed statistically significant results in promoting energy conservation. Although this study is confined to five major Australian states - NSW, QLD, SA, TAS and VIC; it does suggest an efficacy on the part of the organizers of such campaigns in promoting awareness on the need for energy conservation.

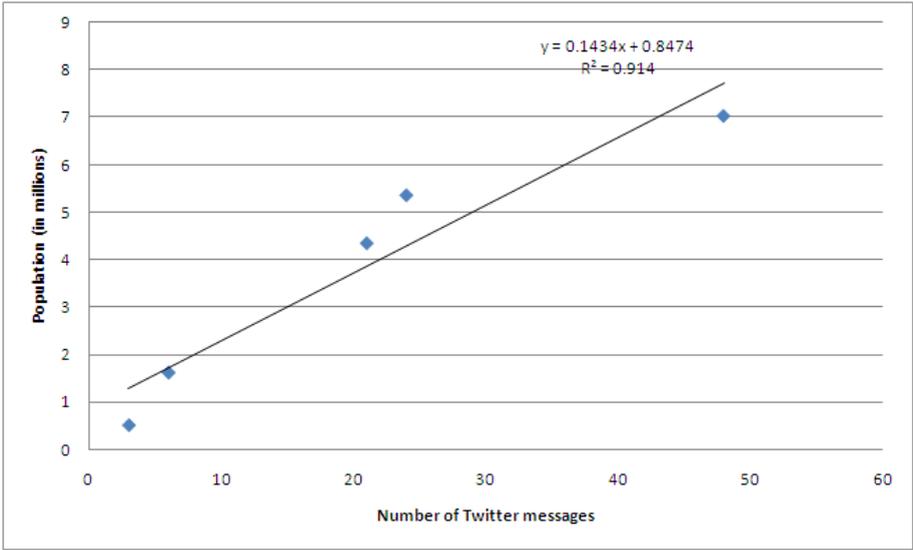


Fig. 2. Scatter-plot of state population (millions) and the Twitter messages for the Australian states

The results seen here are clearly better than the 2007 edition of the same campaign [22]. Among the chief reasons for this is the awareness generated among the populace by a successful marketing campaign which involves commitments from local governments worldwide; and also the engagement of the social media (namely blogs, social networks, and microblogging sites), corroborating research which illustrates the efficacy of social media in activism (aforementioned examples include [15,23]), and also the ‘viral’ spread of information online as discussed in [1,27].

Secondly, by analyzing the scatter-plot comparing Twitter message activity with the net energy reduction for the 5 states, we obtain a correlation coefficient (R-squared value) of 0.729. This suggests a relation between the two parameters mentioned, implying that the frequency of Twitter message activity might be influential to the percentage of energy savings in the Australian states.

On another note, comparing the Twitter message activity with state population gives us a high correlation coefficient of 0.9140. This suggests that there is a strong correlation between Twitter activity per state with the state’s total population in real life. An interpretation of this is that the usage rate of Twitter and such microblogging technologies depend on how populated a particular locale is. This has potential as a basis for future work to measure the penetration rate of social media and microblogging in Australia.

6 Conclusion

To conclude this study, we prove the existence of a link between Australian Twitter usage patterns and the efficacy of a Twitter-based (and social media-

based) global activism campaign that is Earth Hour. This suggests that Twitter can be effectively used as a “mirror” of real-world sentiment and knowledge. Online activity on Twitter can be translated into action in a real-world social system, as we have seen how an activism campaign on Twitter can influence people to act accordingly in a real-world setting.

Future work in this domain include studying how behavior of other online social systems can be mapped to the real world; how human interaction via microblogging can be an avenue for self-expression; measuring real-life sentiment and gauging response via microblog posts; and exploring other avenues of mass coordination via Twitter and OSNs.

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