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When are Tweets Better Valued? An Empirical Study

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Abstract: The increase in Twitter's popularity has been phenomenal over time. Tweets are now not only a means of status update and one-on-one communication, but they are also widely used for trend setting and marketing. The probability that the user will see a Tweet when he was offline at the time it was tweeted is very low. In order to increase the Tweet impact, it is important to determine the number of individuals online so that maximum number of users see the Tweets. This research focuses on identifying the individual users from Saudi Arabia based on the parameters already set for the conduct of this study. The time-stamped data for 1000 selected individuals is retrieved from Twitter and is analyzed accordingly. The number of online users is observed by recording the 'last seen' status. The retrieval of data is based on a number of experiments that was run at same time on all days of the week to reduce the inconsistent patterns. The data is then analyzed to see the time slots where the online user percentage is higher as compared to other time slots. The results of the study are focused to identify and recommend the timings when the Tweets are better valued and the impact is considerable.

Keywords: Best time to tweet, Twitter Saudi Arabia, Saudi social connectivity, Twitter connectivity, Saudi weekend twitter
Categories: E.2, M.1, M.6

1 Introduction

The usage of Twitter for the purpose of marketing is very common. Twitter is a medium of communication and sharing information for the diversified purposes including but not limiting to opinion making, advertising, counseling, and complaining. Twitter, in contrast with Facebook is considered more reliable and user friendly in terms of sending direct and comprehensive messages in a very short wordings. Twitter, in recent past has attained overwhelming popularity. A recent research [StatisticBrain, 13 and A.M. Kaplan, 10] shows that the number of active users has crossed 554 million with an addition of 0.14 million new users daily. According to Twitter's blog, It has been observed that more that 500 million tweets are sent daily while the number of twitter search engine quarries have bypassed 2.1 billion per day. The study also identified that 43% of the users use Twitter on their mobile phones. Having a Tweet rate of 9,100 per second, 1 billion tweets can be observed in 5 days. Twitter employs 2,500 employees currently and its expected revenue from advertising for 2013 is 339 million $.

In recent past, while the use of social media in general and the use of Twitter in particular has become common for the purpose of advertising, some extensive research studies have been conducted in identifying the effectiveness of the advertisement, readability, and social impact. John D. Fisher [John, 13 and Chris, 13] has performed several statistics in his research. He identified that Saturday and Sunday are the best days to tweet as 17% more engagement is observed on these days while 19% of all the brands tweet on these days to increase the probability of their increased viewership. Wednesday and Thursday are observed as the days having least Twitter activity. Fisher extended his study to identify the peak times for tweet [John, 13 and J. Hendler, 08]. The study proposed that 8 am to 7 pm is the high time for tweet activity and 30% more engagement is observed in these eleven hours. It was also reported that 64% of the brands advertise in these eleven hours of activity. Length of the tweet is also a major component is deciding the level of engagement. It has been observed in this study that tweets containing less than 100 characters gain 17% more engagement while tweets with hashtags get twice more coverage as compared to the tweets without hashtags.

The advertisement and marketing of specific brands and services requires the identification of target audience to address. The study done by Fisher [John, 13] provides a general overview of the trends in the facts that have been identified and lacks a specific consideration of a targeted audience. It also does not consider the impact of time zone differences which may have a different impact altogether. Canopymedia [Canopy, 13] has provided a guide that helps in identifying and maintaining the twitter following for the users and guides about the suitable tweet times to gain more engagement. Dan Zarella [Dan, 13] has identified that 5pm is the peak time when the retweets are done and this time slot observes 6% more retweets as compared to other peak hours. Zarella also identified that best tweet frequency is 1-4 tweets per hour, best time to tweet is noon, and 6 pm and best day to tweet is mid-week and the weekend days [Wasseman, 06 and C.Holotescu, 09].

Socialbro [Socialbro, 13] provides an automated way of generating the reports for the best time to tweet for the customized users. The online available tool, helps in identifying the best time to tweet for the given user. The Socialbro has prepared an online tool that costs hundreds of dollars to generate an online report about the targeted individuals by identifying their best and worst times to tweet (Alwagait, 14 and Basit, 13). An organization [ImageforSuccess, 13] "ImageForSuccess" has published its results about the best and worst time to tweet on different social networking sites including Facebook, Twitter, LinkedIn, and Google+. The organization has identified that for Facebook 1-4 pm is the best time to post anything while 8pm-8am is the worst time to post on Facebook. For Google+ the best time to post is 9am-11am while the worst time is 6pm-8am [Online Top Project, 13]. For Twitter, the best time to tweet is identified to be 1pm-3pm and the worst time as 5pm-6pm. The LinkedIn observes the best time to post as 7am-9am or 5pm-6pm while the best time as10pm-6am. Like Fisher's research [John, 13], the results of this study are also general and don't target individuals based on some time zone or some other collaborating parameter.

Considering the shortcomings in the existing literature, this research study is designed to meet the following objectives, i) To identify the participating individuals and determine the parameters for selection, ii) To retrieve and analyze the data for the

selected individuals, iii) To identify patterns in the retrieved data, iv) To determine the level of cohesiveness among the twitter users, and v) To suggest an ideal tweet time for commercial purposes. This research study addresses the following research questions, i) how the individual's "online" status can be identified? ii) How individuals are selected for analysis and what parameters are observed? iii) How the data is acquired and analyzed? And what specific patterns are identified? The goal of this research is to identify the peak hours of social activity on Twitter with respect to the individuals followers having the same time zone to identify their tweet pattern by finding the peaks and the low activity areas.

While existing literature focuses on the "engagement" of the users, this research study focuses on the probability of the users seeing the tweet. As in printed media and some online advertisement models, user engagement is not measured and/or not needed. We argue the same. This study comprises of five experiments that have been conducted on data sets and each of them is measuring the different number of records. The first data set consists of 1,000 records and the analysis is made to determine the pattern for the online availability of the followers of those 1,000 users and data of online users is recorded accordingly. In the second increment the study is extended to 100 users containing 10,000 followers on average. In the third and fourth increment we have 10 users with the average following of 50,000 and finally a single user having around 1 million followers is observed.

The experiments performed in the study, cover a broader spectrum of the data sets that guide through the process of consolidation of the results. As an argument, the experiments done on millions of data sets will possess higher trust level and lower errors while the experiments with thousands data set are expected to be less prominent as compared to millions of records. The reasons of considering and mentioning all these experiments in this study is to demonstrate the trend of the online followers for the given users and also that how the trend is governed. The intra dataset comparisons will guide to know that how the trends matures while the number of dataset increases. The increasing amount of data in the experiments will guide to establish trust on the results produced as an outcome of this study. Detailed analysis of experiments in shown in the section 3.

The rest of the paper is structured as follows: Section 2 discusses the selection process of the data and the parameters to collect the data. Section 3, details the experiments that have been conducted in this study. Section 4, identifies the findings that have been observed as an outcome of this study.

2 Data Acquisition

This section describes the parameters for the selection of the data to be addressed, section 2.2 describes that how the data is stored and managed.

2.1 The selection process

This study aims to measure the availability of Twitter users for each hour during the week. Time is a crucial factor in this study. Thus we target users within the same country or the same time zone. So that all twitter users have equal chances to be

online at any given time. This will increase the stability and reliability of our selected sample.

Our selection process starts from a predefined set of well-known users from different countries such as Saudi Arabia, Qatar, and Kuwait. Those countries have the same time zone. The data set contains the Twitter id, Twitter username, number of followers, and the country of all the users. The set is sorted by the number of followers. In order to cope with Twitter API limitation per hour, we have to choose a smaller random sample of the larger set of Twitter users without affecting the accuracy of the study. We believe that the usage patterns among different countries/time zones is consistent.

As mentioned earlier, five different experiments are performed on the increasing number of followers. In the first experiment we randomly choose 1000 users with a certain number of followers. We try to assure that the total number of followers lies within our capacity to collect the whole Twitter users' data each hour. We randomly picked 1000 users whose followers range from 300 followers to 1600 followers. In the second experiment we have chosen 55 users at random having an average following of 10,000. In the third experiment we have chosen 11 users at random having an average following of 50,000. In the fourth experiment we have chosen 5 users at random having an average following of 100,000 while in the last experiment we have chosen 1 users at random having an approximately 1,000,000 followers.

2.2 The collection process

Twitter has a rich Application Programming Interface (API) for third party applications. Third party applications can fetch different type of information from Twitter such as messages, tweets, and users. They can also query Twitter data by keywords, hashtags, and user names. To retrieve a user follower's information, there is a sequence of steps that must be followed:

Retrieve followers IDs: This step can be achieved by using the API followers/ids. In this step we retrieve all the followers IDs of a certain users. We store those IDs for later in the next step. Retrieve followers Information: This step can be achieved by using the API Users/lookup. In this step we iterate all the IDs, which were retrieved before, divide them into multiple requests and send those request to twitter to get followers' information (i.e. their "lastseen" status).

In this study, we retrieved all the followers IDs for all users at the beginning. We stored them in a Database in order to use them later. We scheduled a process to retrieve users' information every hour. Each time we retrieve user information; we extract the timestamp property of the last status and check it with the current time. Technically, a user is online for the last hour if he/she made any activity such as posting a tweet, replaying to other users, or retweeting other tweets. Nonetheless, Twitter gives you this information through a "lastseen" field which we use to determine the online status of the user.

3 Experiment

The experiments are classified in 5 different cases based on the datasets that we address in this study. In each case we analyses data based on percentage of online followers per-day and then, by average online followers per hour.

3.1 Experiment # 1

In this section, a two-fold analysis is presented, i.e. with respect to the percentage of online users per day and the trends about the hours when the users are online.In this experiment a group of 1000 Twitter users were selected based on the methodology described previously. The total number of followers for these 1000 users is 665,335. Making an average of 665 followers per user. The data has been gathered over a period of one week to observe the number of online followers and the timing patterns of the online patterns. Table 1, demonstrates the summary of the online followers for the 1000 selected Twitter users.

Day	Date	Followers	Online	Average %
Saturday	4-May-2013	665,335	81,161	12.20
Sunday	5-May-2013	665,335	81,976	12.32
Monday	29-Apr-2013	665,335	83,046	12.48
Tuesday	30-Apr	665,335	82,264	12.36
Wednesday	1-May	665,335	80,800	12.14
Thursday	2-May	665,335	77,006	11.57
Friday	3-May	665,335	84,069	12.64

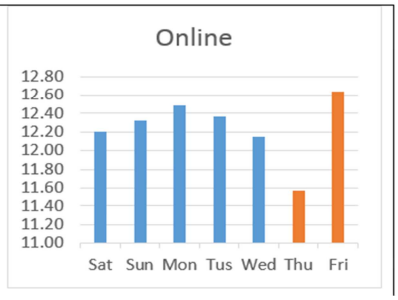


Table 1: No of online followers for experiment 1. Figure 1: Percentage of online followers

It is observed that on Thursday, least followers come online compared to other days of the week. One possible reason for this is that Thursday is the first weekly holiday every week. The decreasing online trends are also observed on the Wednesday evening and night. This also helps in concluding that on weekend evening the individual's better like to spend time in social gathering and travel rather than social networking. Figure 1 describes the percentage of online followers during different days of the week. Figure 2 demonstrates the percentage of the online followers during different hours of the day. One can determine the patterns of activity by observing the change in the percentage of online followers.

Figure 2 shows hours at x-axis and online followers at y-axis and days of the week at z-axis. The average presented in the Figure 1 demonstrates that the average for the whole day is approaching 12%. However, the per-hour average provides a more in-depth view of the online followers. As we are interested to identify the peaks in the graph, i.e. the time slots when maximum followers are online. It can be observed that sometime the number of online users falls as low as 5% or lower and sometimes it touches 20% which is maximum. As a matter of fact, it is evident that the number of online users is never more than 20%.

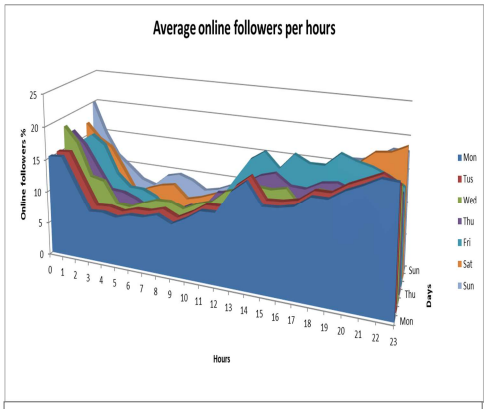


Figure 2: Average online followers per hour

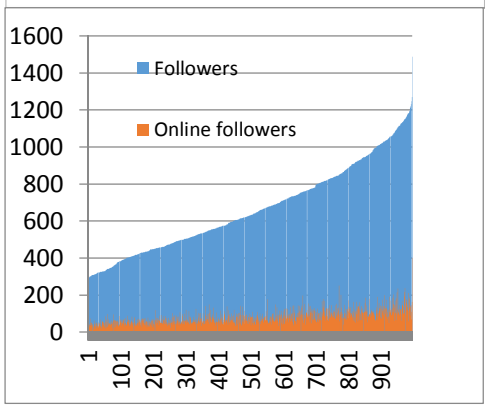


Figure 3: Online followers per user

Figure 3, shows the number of online followers for the selected Twitter users. The user have been sorted in ascending order with respect to the number of followers. This graph of the online is taken on static data that represents the number of online followers for the selected users.

3.2 Experiment 2

In this experiment a group of 55 Twitter users was selected based on the methodology described previously. The total number of followers for these users is 527474. Making an average of 9590 followers per user. The data has been gathered over a period of one week to observe the number of online followers and the timing patterns of the online patterns. Table 2, demonstrates the summary of the online followers for the 55 selected Twitter users.

Day	Date	Followers	Online	Average %
Saturday	11 May-2013	527,474	33,168	6.29
Sunday	12 May-2013	527,474	32,604	6.18
Monday	13 May-2013	527,474	31,858	6.04
Tuesday	14 May-2013	527,474	31,824	6.03
Wednesday	15 May-2013	527,474	31,921	6.05
Thursday	16 May-2013	527,474	31,478	5.97
Friday	17 May-2013	527,474	33,606	6.37

Table 2:

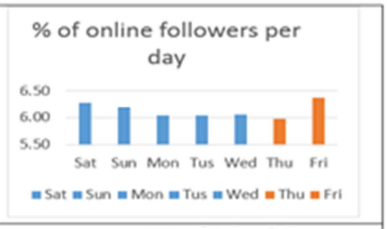
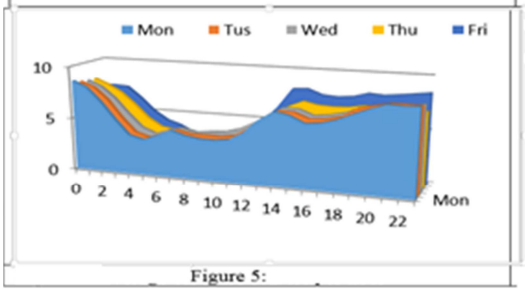


Figure 4



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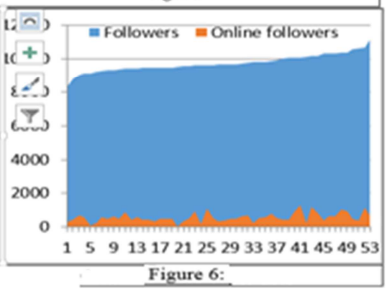


Figure 6:

Table 2: Online users for experiment 2, Figure 4: Percentage of online followers, Figure 5: Average online followers per hour, Figure 6: Online followers per hour

The trends demonstrate that the most number of online followers is on Friday followed by Saturday. While the least number of followers can be observed on Thursday followed by Tuesday. In contrast to experiment 1, the percentage of the online followers is almost half, on average, while the number of followers grows to 10,000 on average. This experiment demonstrates almost the same trends as in experiment 1 with the only difference of the decreasing number of online followers. In order to consolidate the trends in the time and percentage further experiments are conducted with more followers.

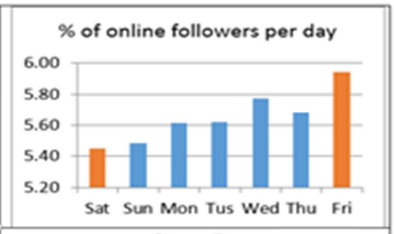
3.3 Experiment 3

In this experiment a group of 11 Twitter users are selected. The total number of followers for these users is 575146. Making an average of 52286 followers per user. In contrast to the experiment 1 and 2 the average number of followers has been increased in this experiment. The data has been gathered over a period of one week to observe the number of online followers and the timing patterns of the online patterns. Table 1, demonstrates the summary of the online followers for the 11 selected Twitter users.

It can be identified that the highest average for online followers is 5.94 while the lowest is 5.45, which is even less as compared to the experiment 2. The trends about the time to become online are almost same as in experiment 1 and 2.

Day	Date	Followers	Online	Average %
Saturday	19 May-2013	575,146	31,344	5.45
Sunday	20 May-2013	575,146	31,525	5.48
Monday	21 May-2013	575,146	32,262	5.61
Tuesday	22 May-2013	575,146	32,293	5.61
Wednesday	23 May-2013	575,146	33,196	5.77
Thursday	24 May-2013	575,146	32,661	5.68
Friday	25 May-2013	575,146	34,166	5.94

Table 3:



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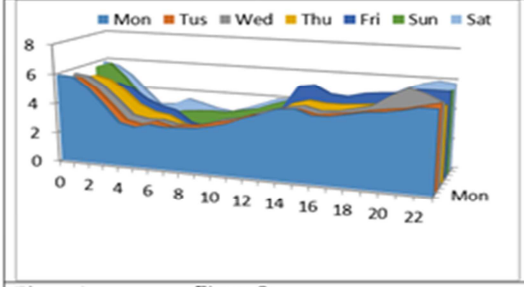

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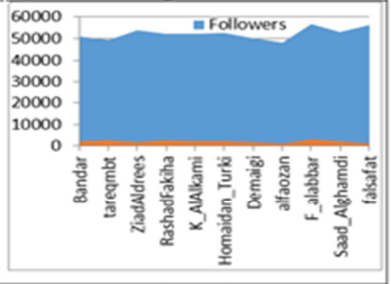


Figure 9:

Table 3: Online users for experiment 3, Figure 7: Percentage of online followers, Figure 8: Average online followers per hour, Figure 9: Online followers per hour

3.4 Experiment 4

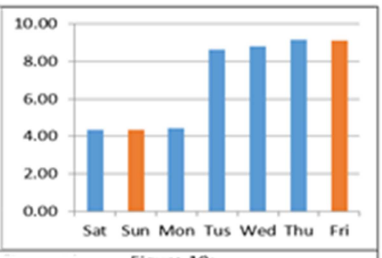
In this experiment a group of five Twitter users are selected at random. In contrast to the experiment 2 and 3 the average number of followers has been increased in this experiment. The data has been gathered over a period of one week to observe the number of online followers and the timing patterns of the online patterns. Table 4, demonstrates the summary of the online followers for the five selected Twitter users.

3.5 Experiment 5

A single Twitter user is selected for this experiment containing more than a million followers. The data has been gathered over a period of one week to observe the number of online followers and the timing patterns of the online patterns. Table 1, demonstrates the summary of the online followers for the selected Twitter user.

Day	Date	Followers	Online	Average %
Saturday	1-June-2013	556,028	24,221	4.36
Sunday	2-June-2013	556,028	24,045	4.32
Monday	3-June-2013	556,028	24,654	4.43
Tuesday	28-May-2013	556,028	48,007	8.63
Wednesday	29-May-2013	556,028	49,047	8.82
Thursday	30-May-2013	556,028	50,945	9.16
Friday	31-May-2013	556,028	50,589	9.10

Table 4:



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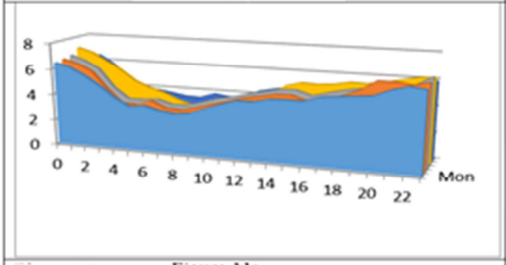

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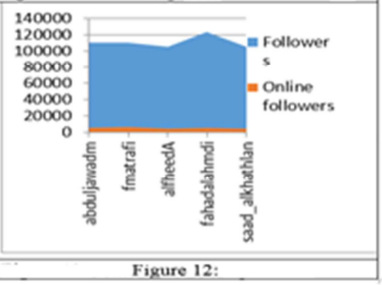
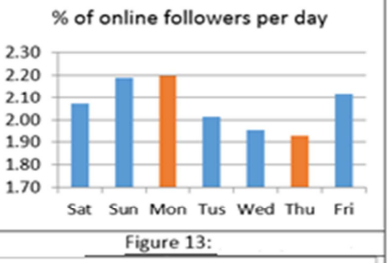


Figure 12:

Table 4: Online users for experiment 4, Figure 10: Percentage of online followers, Figure 11: Average online followers per hour, Figure 12: Online followers per hour

Day	Date	Followers	Online	Average %
Saturday	22-June-2013	1,263,173	26,176	2.07
Sunday	23-June-2013	1,263,173	27,680	2.19
Monday	24-June-2013	1,263,173	27,750	2.20
Tuesday	18-June-2013	1,263,173	25,419	2.01
Wednesday	19-June-2013	1,263,173	24,672	1.95
Thursday	20-June-2013	1,263,173	24,356	1.93
Friday	21-June-2013	1,263,173	26,770	2.12

Table 5:



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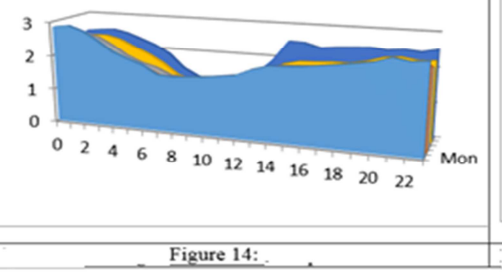

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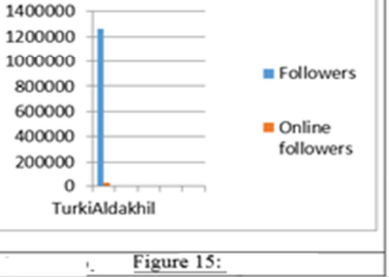

Figure 15:

Table 5: Online users for experiment 5, Figure 13: Percentage of online followers, Figure 14: Average online followers per hour, Figure 15: Online followers per hour

4 Findings

Following findings have emerged from the study

a. Most Followers are online on Friday followed by Monday in most cases
b. Least number of followers becomes online on Thursday followed by Wednesday.
c. Major part of social activity is done after the office hours.
d. The peak of social activity is gained between 10 p.m. to 2 a.m. while the slope is observed from 4 am to 2 pm, giving an impression that most of the social networking is done late at night.

It is observed that on Thursday, least followers come online compared to other days of the week, the decreasing online trends are also observed on the Wednesday evening and night. It can be concluded that on weekend evenings the individual like to spend time in social gathering and travel rather than social networking. We observed that as the number of followers for a user increases the percentage for online follower's decreases.

5 Conclusion

The papers discusses the experiments that have been undertaken to conclude the findings in section 4. It has been observed that the large amount of Twitter data requires the effective handling for extraction of meaningful information. Five different experiment have been conducted by using the millions of Twitter followers and generally they are observed to follow the same trends that have been mentioned in Section 4. If the experiments are considered sequential, every later experiments confirms the results (trends) of the former experiments. It can be concluded that Twitter is a major source of social networking and most of the social networking is done around the midnight.

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