



Analyzing Smartphone Usage Patterns at Colleges with Strong Gender Differences Using Social Media

Allen Finchum, Matthew Haffner, Adam Mathews, Emily Fekete
Department of Geography
Oklahoma State University



Introduction

In this project we are continuing our work to better understand if spatial similarities existed between the various demographic variables with which smartphones Operating System people tended to carry/use. Initially we looked for a mathematical relationship, but to date we have not found one that adequately describes our data. The data itself is culled from Twitter (Geo-Coded Tweets), which we accept are not representative of the entire population, but they can represent a portion of the population – one that marketing and advertising are keen to understand – 18-35 year old technically savvy individuals.

In our earlier poster (see attached small copies), we looked at OS percentage, minority percentage, and per capita income. Since that time we have considered other possible avenues of inquiry, and one that came to mind is whether there were variations around college campuses that demonstrate significant gender bias along with different academic environments (Liberal Arts vs Engineering, etc). We were curious if more technical campuses would tend to be more 'Android Oriented', as the OS is open source and allows for far greater customization than iOS. We were also interested if more Liberal Arts/General Studies campuses were more 'iOS oriented', for reasons paralleling those for technical campuses.

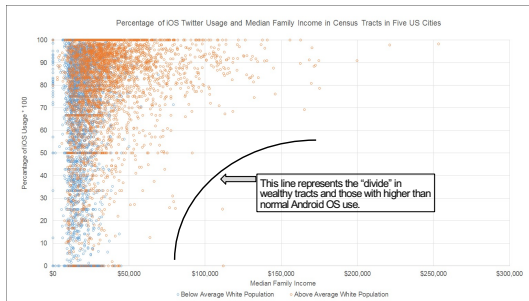
Since we no longer needed demographic information from the Census, we dropped our use of Census Blocks and Blockgroups, and created a one km hexagonal based "grid" to use as the geographic base for this study. The tweets were spatially joined and summed by OS type to these hexagons to develop the maps shown here.

We scraped the Twitter feed using Tweepy and other tools to cull out geo-coded tweets for three months (mid October 2015 until mid March 2016). These were then matched to census tracts to match with generalized demographic information. At this point we used a Getis-Ord G_i^* Hot Spot Analysis to determine generic patterns for all of the variables. We mapped each geotagged tweet location in ArcGIS by OS type. Using the G_i^* local spatial autocorrelation statistic with the default, fixed distance band method (which optimally selects an appropriate distance based on the size of the study area).

Despite the large number of observations, this dataset has several limitations. First, the percentage of geotagged tweets comprises a very small amount of the total number of tweets posted on Twitter (around 2 – 3%). Second, not being able to identify an individual's home census tract, we did not remove multiple tweets generated by an individual user. Also, this dataset is not a true representation of the entire US population, since the predominant users of Twitter are the young and tech-savvy. However, this group is heavily targeted for marketing purposes, and the interesting results of this study could provide a foundation for future research.

Overall our analysis of these maps shows that for some of the more technical oriented campuses with a higher percentage of male students and in smaller communities a tendency for higher Android use existed, although this pattern was not consistent. Also, in larger communities we began to see an imposition of the overall existing pattern impact the usage patterns for the campus community. So, while some weaker patterns are visible, the overall results of this mapping analysis is much weaker than what we found last year looking at usage patterns across entire cities.

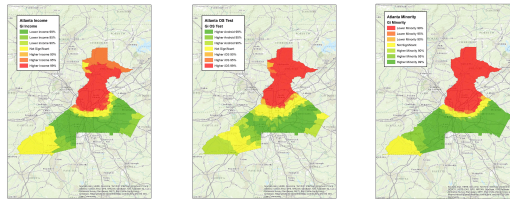
We have included the scatterplot shown below from our earlier work to demonstrate that certain patterns of Mobile OS usage are evident within the larger population. The plot shows a depiction of the data with income on the X-axis and percentage of iOS versus Android devices. As can be seen an interesting plot of the data exists. Very low iOS usage (<30-40%) is really only found in tracts with income less than \$50,000. Tracts over \$50,000 are strongly iOS, and over \$100,000 the tracts are almost exclusively high iOS users (over 70%). We found this very interesting – While all income groups use iOS, heavy Android users tend to be lower income, and higher income users are strongly oriented to iOS.



ACKNOWLEDGEMENT:
We wish to thank the following undergraduate student from Oklahoma State University for their assistance with the mapping efforts for this project: Rachel Destrman and Michael Larson.

Data Sources: American Community Survey, U.S. Census, 2013 and Twitter API/Tweepy.

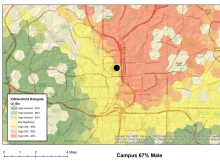
Mapping/Analysis



Atlanta

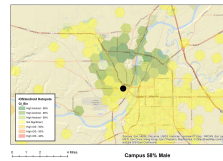
These maps from our previous work show how there are often strong patterns of Mobile OS Usage that parallel those of Income and Minority Population. Atlanta was our strongest example of the spatial patterns showing a consistent pattern.

Atlanta - Georgia Tech



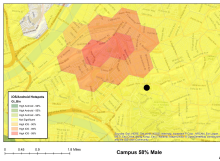
For Georgia Tech we would have expected a strong Android presence given the Universities heavy technology emphasis and male population. However, it would seem that the overarching patterns show in the maps of All of Atlanta are drowning our any impact from the campus community.

West Lafayette - Purdue University



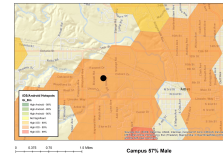
This map shows OS usage in the Lafayette/West Lafayette Indiana area, including the Purdue University Campus. Like Georgia Tech this campus shows a high percentage of male students and is a technically oriented university. However, the campus influence is more noticeable in this much smaller community, and the area immediately north of the campus does meet our expectations of higher Android device representation.

Pittsburgh - Carnegie-Mellon



Carnegie-Mellon University is a strong, tech oriented campus with a significant male presence, but in this situation there would seem to be a situation similar to that at Georgia Tech where the larger city strongly impacts any usage patterns. The University of Pittsburgh campus which is immediately next to CMU does show a strong iOS pattern. Given that Pitt is much larger than CMU this could impact visible patterns for the smaller campus as well.

Ames - Iowa State University



In the Ames, Iowa area and surrounding Iowa State, a community and campus not unlike the Purdue area, we found a what we found to be a surprising result. This campus area displayed a strong iOS usage pattern.

Mapping/Analysis

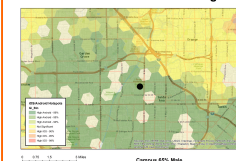
In addition to the mapping work shown here, we also completed a survey of students at Oklahoma State to see how these students use their smart phones for Twitter and Social Media. Our goal was to better understand what proportion of students use Twitter, geo-tag their tweets, and where they might do such posts. The survey was sent to 5,000 random students in late February 2016, and approximately 250 (5%) responded. While this is not a high response percentage, 250+ responses would provide some insights into how students use Twitter.

Item	Female	Male
Number of survey respondents	153	63
Percentage of those that use the iPhone	72.6%	63.2%
Percentage of those that have geotagged at least once (any platform)	76.5%	51.6%
Percentage of those that use Twitter	55.3%	54.8%
Percentage of those that post on Twitter	48.1%	48.8%
Percentage of those that use Twitter most frequently (out of all social media platforms)	10.0%	16.2%
Percentage of those using the iPhone that have geotagged	60.7%	51.9%
Percentage of those that prefer to post to social media via mobile device	66.0%	71.6%

Interesting observations in this table include the higher percentage of Female students using iOS (as expected), and that a higher percentage of Female users have geo-tagged tweets. Also notable is that female users of the iPhone are highly likely to geo-tag (vs male users), and while both male and female student prefer mobile platforms for Twitter, female users prefer the mobile platform at a higher rate. However, Twitter is the preferred social media platform to a lower percentage of female vs male users.

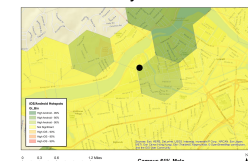
It is also interesting that virtually the same proportion of male and female users have used and posted on Twitter, making the other differences more notable.

Santa Ana - Santa Ana College



Santa Ana College is a tech oriented 2 year college in the LA area. While we are seeing an expected Android strength here, this matches the broader OS usage pattern in the entire LA Basin.

Lowell - University of Massachusetts



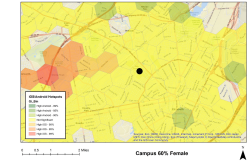
UMass Lowell is another tech oriented with a strong male student body. In this smaller community there is some evidence of a stronger than normal Android usage pattern in the entire LA Basin.

SUMMARY

During our review of campuses, we found little of real interest in areas surrounding Female dominated campuses. These campuses are either in larger urban regions where a prevailing pattern of use overpowers any impact from the campus itself, or are on the periphery of smaller cities where little can be discerned due to a lack of data across the broader area.

While our survey of students at Oklahoma State yielded some interesting results regarding variations and similarities in Mobile OS and Social Media usage, non-Tech oriented campuses and those with larger than average proportions of female student led to little discernible spatial patterns of mobile device usage.

Union NJ - Kean University



In this example we have Kean University in Northern New Jersey near NYC. This is a female dominated campus, and while there is a pattern of heavy iOS use nearby, this could be simply overflow from the broader NYC region.