GEOSOCIALFOOTPRINT(2013): SOCIAL MEDIA LOCATION PRIVACY WEB MAP

by

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A Thesis Presented to the
FACULTY OF THE USC GRADUATE SCHOOL
UNIVERSITY OF SOUTHERN CALIFORNIA
In Partial Fulfillment of the
Requirements for the Degree
MASTER OF SCIENCE
(GEOGRAPHIC INFORMATION SCIENCE AND TECHNOLOGY)

March 2014

ACKNOWLEDGEMENTS

First and foremost I offer my sincerest gratitude to my committee Chair, Dr. Jennifer Swift. I will always be grateful for the continued encouragement and support she offered during this overwhelming process. I would like to thank my committee as a whole, Dr. Jennifer Swift, Dr. Edward Pultar, and Dr. Craig Knoblock for their time, resources, insight, and guidance.

I would also like to thank my family for their constant support and inspiration throughout this process. I thank my parents for always giving me freedom in my endeavors yet consistently pushing for success. Not only does my wife deserve the credit for introducing me to Geographic Information Systems (GIS) but now she also deserves the credit in helping me complete my thesis in GIS. Without her, not only would this thesis be much worse off, but I as an individual would not have the confidence in myself or the dedication to complete this work.

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List of Abbreviations

Abbreviation	Meaning
API	Application Programming Interface
AWS	Amazon Web Service
CDN	Content Delivery Network
CSS	Cascading Style Sheets
CSV	Comma-separated values
DOM	Document Object Management
FEMA	Federal Emergency Management Agency
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
JSON	JavaScript Object Notation
OOD	Object-oriented Design
PAAS	Platform as a service
REST	Representational state transfer
S3	Simple Storage Service
SDLC	Software Development Lifecycle
UML	Uniformed Model Language
UX	User experience
VGI	Volunteer Geographic Information

ABSTRACT

Spatial thinking is an abstract term and process in regards to what most of the general population understand. Many people are not well versed in geospatial terminology, options of use, and the location intelligence they unconsciously disclose when using social media outlets. This thesis integrates a unique technical web application with GIScience intended to illuminate the subsequent effect location-based data can have on one's personal privacy, security, and web-presence. An innovative new web mapping application was built for general public consumption that aggregates location data from Twitter, harvests ambient location information, analyzes the captured data to provide personal location intelligence, and visualizes possible areas of interest. In addition, the research examines the results of an online voluntary survey collected from the users of the application. Finally, this thesis discusses how these same techniques can be applied to other social media outlets along with potential opportunities to educate and inform the general public more about their social media location privacy.

CHAPTER 1: TOPIC DEFINITION AND BACKGROUND

Social media entities like Facebook, Google+, and MySpace store large data sets of personal information about their users. Not only do they store the information provided to them through registration and status updates, but users also grant them access to personal data through other means, such as internet browser cookies, search history, and even e-mail conversations. Social media entities store this data with trust from the user that it will only be used to customize a user's experience.

Social media users should be concerned with much more than the data they give to their social media providers. Lini (2012) found that 35 percent of hiring managers, across a wide array of disciplines, have rejected an applicant based purely on information they found online. They also found that Human Resource departments now screening new hires through social media searches has risen 38.4 percent since 2008.

The screening doesn't end with employers. Thieves use social media as a tool for gathering intelligence and for picking their victims. Police in Brazil are very familiar with kidnapping and ransoms, but in 2010 they arrested a gang that used social media to stalk, kidnap, and maximize their ransom (Fox News, 2010). The gang, who has been attributed with kidnapping up to 19 individuals, first finds their victims online through extravagant social media posts. They then stalk the user physically

by visiting the locations the user geo tags or references in text. Finally the gang kidnaps the user and evaluates their worth through their tweets and their social connections.

Theft through social media isn't restricted to Brazil. In 2008 United States vice presidential candidate Sarah Palin had her e-mail account stolen after a thief was able to gather intelligence from her social media outlets and web searches. The National Foundation for Credit Counseling has found that these types of social media tactics and online identity thefts are ground zero for credit card identity thieves (Benda 2010). Loeffler (2012) argues that privacy laws need to be updated to reflect evolving social media trends.

These thefts are made possible through the seemingly innocent sharing of information on social media websites. For example, most Internet users don't stop to think that a mother's maiden name, which is a common secondary security question online, can be gathered from social media relationships. It is also common for users to share, seemingly harmless photographs of their families or homes. More interesting to this thesis, it is very common for social media users to disclose their real-time location to what they assume are their family and friends. To the ill intentioned, this is all yet more information that could be used against the social media user.

1.1 Review of relevant research

1.1.1 Relevant literature

Between 2005 and 2012 extensive research was been done on the need for privacy constraints within social networking (Stefanidis et al. 2011, Friedland and Sommer, 2010). However, to date very limited research has been accomplished related to the subcategory of location privacy within social networks. Recent research is currently being done on spatial data collection from social media and alterative research about location based cyber stalking, but no recent article was found that specifically focused on social media location privacy concerns or methods for systematically mining potential location privacy threats.

In regards to research similar to this thesis work, the George Mason University Geosocial research team has proposed a system architecture for capturing geospatial information from social media as volunteer geographic information (VGI), and presents methods for analyzing social media streams for event "Hot Spots" (Goodchild 2007; Stefanidis et al. 2011). The results of that study validate the use of social media analysis as a data mining opportunity for different types of alerts, as well as a means to monitor real world events. In addition, this study revealed the potential for the harmful use of social media data and suggested that social media streams be considered "pseudo" volunteer geographic information even through it is defined as "ambient" geospatial information. This ambient data is

defined as any data that references a location yet isn't spatially located. In the terms of relevance to this thesis work, the ambient geospatial data described in Humphreys, L., et al. (2010) builds on the idea of ambient data, but is not described in terms of spatial location. Humphreys et al. (2010) instead introduces the idea of "coded phrases," or in other terms, using phrases in the text of the tweet to classify tweets. In the research of Humphreys et al. (2010) coding tweets was classified in a broad sense as activities, locations, proper names, times of day, and information about the author themselves. This thesis and web application, GeosocialFootprint (2013) (geosocialfootprint.com, 2013), merges this train of thought with the Stefanidis (et al. 2011) definition of ambient location data to classify locations as homes, places of employment, or places of education.

In another study attempting to raise awareness about cybercasing, Friedland and Sommer (2010) scrutinize the activity of using publically available geo-information in conjunction with geo-tagged pictures and videos to infer real world situational awareness for questionable purposes. The authors focus on geo-tagged pictures and video for the source of geospatial information instead of social media outlets. They argue that most submitters of the geo-tagged media are unaware of the location information they're publishing as metadata and suggest steps need to be taken on mobile devices to decrease privacy concerns and increase awareness.

Additionally, there has also been significant research accomplished concerning opportunities to increase location privacy through computational awareness. For example Krumm (2009) discusses opportunities for situational based restrictions on location data. The author argues that while most people do not seem to comprehend the potential negative consequences of sharing location data, system designers should be responsible and instinctively protect users' privacy through location anonymizing algorithms.

Another article by Barkhuus L. (2004) attempts to research, through human subjects, a user's level of concern with sharing location based data. In their human subject research they performed two tests. In the first test they had subjects carry a pseudo location-tracking unit and then record their location concerns at the end of each day in a journal. The second experiment was designed as a real world example of sharing. It involved supplying another set of students with location tracking devices and asking them to share their location as they saw fit. The students were not required to journal about their experience. Therefore they were not required to reflect on their concerns. Barkhuus found that while their research subjects initially showed concern for sharing their location in the first experiment, the concern was drastically decreased in the second experiment when reflection was not forced upon the subject. Their study is limited due to the fact that nearly all their subjects fall within one demographic, college students, but, nonetheless, it proves that at least one subset of people do not seem to care about their location privacy.

This thesis argues that while the relationships and photographs shared through social media should be of concern to the user, they should be equally aware of location privacy and the potential risk they place themselves in due to their location sharing. This thesis advances this concern by building upon recent research and arguments made by several authors discussed in the background review on this topic, including Stefanidis et al.(2011), Friedland and Sommer, 2010, Barkhuus L. (2004), Krumm (2009), and Humphreys, L., et al. (2010).

The application developed and reported in this thesis is unique as it attempts to shed light on the ease with which personal location data can be extracted and analyzed for privacy concerns. It provides the user with a dynamic experience that not only informs them of such privacy concerns, but also provides feedback for decreasing such risks. While the application focuses on Twitter, these same techniques can be adapted to collect and analyze other social media data. In turn such value-added information can raise awareness to both social media users and providers regarding weaknesses as well as strengths in the privacy options offered to consumers.

1.1.2 Relevant web applications

In recent years there have only been a few web applications that approximated the functionality of the web application, GeosocialFootprint (2013), developed as part of this thesis work. WeKnowYourHouse.com (2011) and PleaseRobMe.com (2012) both highlight known possible unintended side effects of sharing your location on social media. There are also other tools, like Tweography (2012), that let users map their own twitter stream. Finally, there are also web applications that allow users to map and monitor the entire Twitter Stream as a whole, such as Tweetping.net (2012).

WeKnowYourHouse.com (2011), which was taken offline in 2011 due to legal action from Twitter, actively scanned Twitter for geo-enabled tweets that made a textual reference to a user's home. From there, the web application mapped the location using Google Streetview and automatically responded to the user on Twitter. While all the information the web application used was public, in late 2011 the application owners received a takedown request from Twitter.com due to privacy concerns over the automated tweets providing estimated address locations for selected users. WeKnowYourHouse received a wide array of media coverage due to its extreme stance and proactive nature in exposing location privacy concerns on Twitter. GeosocialFootprint (2013) employees similar ambient location context matching, but then builds upon the existing work by providing additional analysis and visualization.

A second application that has received significant media coverage due to social media over-sharing is PleaseRobMe.com (2012). Instead of searching for people's homes, it does the near opposite and allows a user to enter their twitter screen name and see their foursquare check-in activity, and therefore shows when a user is not at home. It expands the definition of personal privacy web tools and has received significant media coverage because of it. While the application is simple and provides no location context, it serves as a reminder to all users that the twitter data, and any location data associated with it, is public. Regardless of what the name implies, the site actively helped Twitter users from disclosing personal information by alerting potential targets of their over-sharing habits. Unfortunately due to changes in Twitter's application programming interface (API), PleaseRobMe (2012) no longer works.

While Tweography.com (2011) has also failed to evolve with the recent Twitter API changes, it still provides a solid example of the value of geographic visualization. Tweography simply displayed all of a user's geo-enabled tweets on a map. Unlike GeosocialFootprint (2013), Tweography does not provide analysis, risk accounting, text geocoding, or educational features. However, they received constant media coverage due to the simple approach of helping users visualize their tweets on a map. GeosocialFootprint (2013) does build upon the concept of simple tweet visualization and reaped the benefits of extensive media coverage as well.

While each of the sites listed previously in this section were unique in their application, there is another series of twitter applications that focus on the macro visualization of tweets. Instead of focusing on one user's tweets, Tweetping.net (2012) visualizes all live tweets on a map. What it lacks in micro and privacy focus, it makes up for in analysis. Tweetping expands on the simple geographic visualization of Tweography and adds an analysis overlay, which provides some simple metrics for and key indicators. These allow the user to correlate the visual representation on the map with the actual data found in the tweets. Tweetping provides an example that validates ways to provide meta data and simple statistics on the web application to greatly increase its functionality.

Weknowwhatyouredoing.com (2011) is an educational web site listed as a social networking privacy experiment. The application focuses on the entire Twitter stream, not just individual users. It sorts and filters tweets based of key phrases that are expected to divulge some type of personal or identifiable information. Their main page provides a stream of current Twitter users who, based off the context of their tweets, are either hung over, taking drugs, speaking poorly about their boss, or have recently published a new phone number on Twitter. They also provide secondary searches for users that have used Four Square, a check in service, to inadvertently provide coordinates for their "home." This web site tries to shed light

on the privacy risks assumed through over-sharing but does not provide any type of location analysis or advanced web mapping tools such as heat mapping.

Since the release of GeosocialFootprint, UC Berkley's Teaching Privacy group has released an application that allows users to visualize their twitter footprint named Ready or Not. It also performs a temporal analysis of the user's tweets which can show patterns in weekly tweeting habits. The group's application provides no additional analysis or visualization.

While each of these relevant web applications serves a solid purpose in their own right, none of them explicitly allow a Twitter user to visualize their geo-enabled activity, view possible risks, highlight areas of concern, and provide dynamic instructions on how to reduce their over-sharing habits. This thesis and application merge many aspects and ideas found in these previously referenced web applications into a new tool that fills the gaps left behind in serving this projects' desired purpose.

1.2 Motivation

The research completed by Stefanidis (et al. 2011) on ambient location information was inspiring in that it provided a methodological foundation for developing a systematic approach to ambient location mining. While the data in that study was

used to extract macro level information on world events, the same theory can be applied to the individual user and therefore their personal privacy concerns. Other researchers have inadvertently used some of this information to define location, but Stefanidis (et al. 2011) used it as an exclusive data source. This thesis and GeosoicalFootprint (2013) have been adopted from the same train of thought; ambient data should be considered, at the very least, valid metadata worthy of analysis.

While Friedland and Sommer (2010) may argue that software developers should instinctively anonymize the geo-tagged data, this thesis work takes an entirely unique and courteous approach of intending to inform only the individual end user instead. With that being said, this previous work illuminating the twitter general user population's lack of awareness of the dangers of geosocial over-sharing truly validated the need for this thesis work and thus development of this web application.

Barkhuus' (2004) work again validates the need for an application that educates the end user on the risks of location over sharing. This thesis and web application serves to fill the need of location privacy education through data visualization for Twitter users. Additionally it will provide opportunities for users to reflect on location privacy risks by offering basic alerts, highlighting areas of concern, and customized educational opportunities through third party resources on over-

sharing. Their human subject research, along with the conclusion they have drawn was a solid foundation for building my own human subject research.

A strong motivation for this research is the fact that no web application currently exists that allows a user to view and manage their social media location privacy concerns. The other projects mentioned above outline specific privacy concerns divulged through social media, but are not full monitoring solutions.

One of the first applications that sparked my interest for this topic was WeKnowYourHouse.com (2011). The strong media coverage it received seemed to be thought provoking for its readers. In fact, it was so impactful that Twitter had to step in and request that the service be taken down. It serves as a good example for this thesis in that it takes an extreme stance and innovation to gain media attention, yet a strict adherence to all rules and policies to maintain an extended impact.

PleaseRobMe (2012) shows again that a unique and bold application is required to catch the attention of users and the media. Through the media attention a large impact can be made on over sharing. In addition it can be noted from the experiences of PleaseRobMe (2012) that API evolution must be considered and accounted for when designing a web application. The web application in this thesis was designed with such API changes in mind and will easily accommodate future changes in Twitter's API endpoints.

The simple design of Tweography (2011) provided a great example to base the design of this thesis and project after. With the understanding that many users were educated through the simple visualization of tweets, during the development of GeosocialFootprint (2013), it was important that Tweography's(2011) idea mirrored and then built upon.

The idea of classifying a tweet based off the text, which is also referenced in Humphreys, L., et al. (2010), is a strong feature of GeosocialFootprint (2013) (2013) and was built off the ideas found in both Weknowwhatyouredoing (2012). While Weknowwhatyouredoing (2012) focuses on the macro level of Twitter, the same principles of classifying text based on phrases can be applied to the individual user. Instead of being interested in what users are using drugs, this thesis focuses on classifying users locations.

Tweetping (2012) is an example and validation for how providing metadata and simple statistics on the web application can greatly increase it's functionality. The application developed for this thesis does not provide analysis on the macro level or even access to the live tweet stream, however it does mirror some of metadata functionality in its risk calculation and areas of concern.

1.3 General Objective

GeosocialFootprint (2013) aims to help inform social media users of their personal social media location footprint and the potential risks they are susceptible to through social media over sharing. This is done through merging successful aspects of the pertinent applications listed above and implementing the research found in the relevant literature.

The application was built with a simple user interface and experience in mind. It was assumed that advanced technical users would be more aware of the risks of over sharing, therefore the interface needed to accommodate for novice and intermediate users. This is accomplished through simple, intuitive design and clearly defined instructions.

Based on the experience of similar projects, specificallyWeKnowYourHouse.com (2011), precautions were taken to minimize the risk of legal action from entities like Twitter. GeosocialFootprint (2013) complies with all known understandings of the Twitter.com and Twitter API terms of use and such terms of use were implicitly followed during the design and development phase of the application.

1.4 Software and Platforms

JavaScript was selected as the software development language of choice for this project. JavaScript allows for cross platform use and availability, including desktop

and mobile computing(Microsoft MSDN 2013). JavaScript also allows for the use of client side application logic, which enables the analysis to be performed on the user's computer instead of a central server. This in turn reduces hardware needs.

Due to the use of client side logic, the web application is hosted on Amazon's S3 cloud services. A proxy has also been built on top of Heroku's (2013) service oriented infrastructure that allows for user interaction with Twitter's API. Both of these services allow for elastic use, meaning the hosting environments react to client requests. Therefore, hosting costs are reduced as site usage is reduced.

Other software development languages and hardware hosting options are available for use, but these selections represent emerging computational trends barely used in the previous studies cited above. Consequently GeosocialFootprint (2013) is not only innovative in its analysis, but also its technologic use.

CHAPTHER 2: TECHNOLOGY AND APPLICATION DEVELOPMENT

2.1 Technology

Technology is always evolving. As technology evolves, so do the uses of the data collected and stored by these new technologies. Both the geospatial and social networking industries have capitalized on the evolution of technology. The geospatial industry has continued to expand its analytical capabilities to reach new mediums, such as the web, and improved its data collection proficiencies. Social media, among other things, has begun to augment its data collection habits with spatial information. As such, there are opportunities for these technologies to overlap. GeosocialFoorprint.com serves to be a melding of both industries' technologies as it extends the location based information collected by social networks to a web based geospatial application.

While the main objective of GeosocialFootprint (2013) is to educate and inform social media users of potential location over sharing, a subset of technical design objects were put in place to focus and formalize the application development efforts. The subset of objectives includes: simple user interface, client side application processing, open source technologies, and web application event tracking.

As the previous research depicts, a simple user interface can provide an improved user experience for the untrained. Client side logic reduces the overall hosting costs

and improves the applications response time by allowing the user's Internet browser to handle the data storage and processing. Building upon and further developing open source technologies not only expands the body of knowledge but also reduces to cost of entry for this applications and others like it. Selective web application event tracking will allow for thesis validation.

This thesis project relies heavily on the use of third party API's to access data along with third party libraries to analyze and display results. Google Maps API version 3.3 is used as the web-mapping base. Twitter's API is used to access the tweets. Bootstrap.js and jQuery.js libraries were both implemented to efficiently develop the web application.

2.1.1 Software Development Language

Since client side application processing is a fundamental goal of the application, the large majority of Geosocialfootprint.com was developed using HyperText Markup Language(HTML), Cascading Style Sheets (CSS), and JavaScript. Just like this thesis builds upon much of the research that has come before it, the web application is also built upon existing open source projects that utilize such coding languages.

In the setting of GeosocialFootprint.com, JavaScript is used not only to collect, process, analyze and visualize the tweets, but it's also used as a mechanism to manage the dynamically changing HTML code within the application. This is also

referred to as Document Object Model (DOM) manipulation. Bootstrap.js (2013) andjQuery (2013) both provide for an agile web application platform while using JavaScript and DOM manipulation. They are preconfigured templates of HTML, CSS, and JavaScript code that can be combined with custom web applications to improve functionality and visualization. Bootstrap.js controls much of the layout and design of the application: headings, buttons, input boxes, and etc. Among other things, jQuery provides a visual enhancement for elements such as feedback popups, transitions, and etc.

Not only do these frameworks allow for efficient development but they also mimic accepted industry standards for user interface design and user experience expectations (Paddock and Peterson 2012). Additionally, both implement elements of responsive design, which allows the application to detect the user's computing environment and adjust to fit user hardware restraints. This allows the application to be used on all platforms, including mobile.

While jQuery is very efficient at DOM manipulation and provides many visually appealing enhancements, its most utilized tool in GeosocialFootprint (2013) is JavaScript Object Notation (JSON) management. jQuery has a series of built in JSON centered functions that allow for easy access and retrieval of Twitter's API data. Due to the efficiency of jQuery's JSON handling, not only is the Twitter API data received

as JSON, but the application developed for this thesis is programmed to use JSON as a local storage container for all analytical data and results.

2.1.2 Platform As A Service (PAAS)

Foundationally, the platform used to host a web application is just as important as the code that is executed for the user. Without a reactive and efficient platform, even the best of code can seem slow and unresponsive. With that understanding, GeosocialFootprint (2013) employs Platforms As A Service (PAAS) in an effort to maintain an efficient hosting environment. Amazon's AWS services were selected for this project due to their service record, flexibility, and relatively low operating costs. In addition to Amazon's offered platforms, two additional services are operated: Heroku (2013) and Qbaka (2013).

Amazon's Simple Storage Service (S3) acts as the physical web host for the application (Barr, J., Tetlaw, A., & Simoneau, L. 2010). As a result, Amazon's AWS environment manages the domain and Domain Name System (DNS) handling. Due to the S3's safe storage redundancy practices and their Content Delivery Network (CDN), users of GeosocialFootprint (2013)receive low latency and fast response times. Amazon's S3 platform was selected due to the dynamic scalability of their platform and service(Wang et al. 2010). Amazon S3 can support the hosting of static files across Amazon's content delivery network which enables dynamic scaling using Amazon's existing infrastructure. This came in particularly handy when news

media outlets published stories on GeosocialFootprint (2013) and traffic increased to thousands of users per day.

Heroku (2013) is a small PAAS that itself is built on top of Amazon's AWS. Through extending and simplifying the AWS functionality, Heroku (2013) makes it possible to quickly deploy server resources through a template system. Heroku (2013) Developer's write templates that can be shared on popular coding repositories, like GitHub, and then directly deployed to a Heroku environment. GeosocialFootprint (2013) utilizes such a template to handle the authentication and interaction between Twitter Developer's API and the users web browser.

While Qbaka's (2013) service was originally designed to help developers of client side applications monitor errors received by users, in GeosocialFootprint it is being used to monitor and manage user events. After the application performs the analysis on the tweets, data is sent to Qbaka (2013) that contains the anonymous event information. That information has been used in this thesis to validate the applications effectiveness.

2.1.3 Application Programming Interface (API)

API's specify a defined protocol for interacting with data or processes stored by differing computer systems. In the context of this thesis, API's provide access to

social media data from Twitter, mapping base layers from Google Maps, and event error management from Qbaka.

Google Maps API provides a very nimble and responsive JavaScript API. When used in conjunction with bootstrap.js and jQuery, it provides a very suitable foundation and viewing platform for the spatial analysis results. ESRI's JavaScript API (ESRI, 2013) and Leaflet (Leaflet, 2013) were also considered as options for use, at the time Google Maps API provided the most support for the Heatmap functionality in the form of both official Google documentation and user feedback through blogs and forums. Google's Map API establishes the user with a connection for base layer map tiles and data heat map visualization.

Twitter's API allows for the access of data from user profiles, tweets, and queries. For the context of this thesis, Twitter's API is used to aggregate a user's most recent 200 tweets for processing by GeosocialFootprint (2013). An alternative to Twitter's API is GNIP's API (Gnip 2013), however the latter is a paid redistributor of social media and would have provided no true value added to this thesis.

2.2 Application Development

In total, 10 modules were created to move the data from Twitter, parse, convert, store, geoprocess, analyze, and display results. The code is executed through a web

application that inputs the user's Twitter ID. This project flows through the common stages of analysis; data collection, data preparation, data analysis, and displaying results. This is depicted in the flow chart provided in Figure 1 (see below):

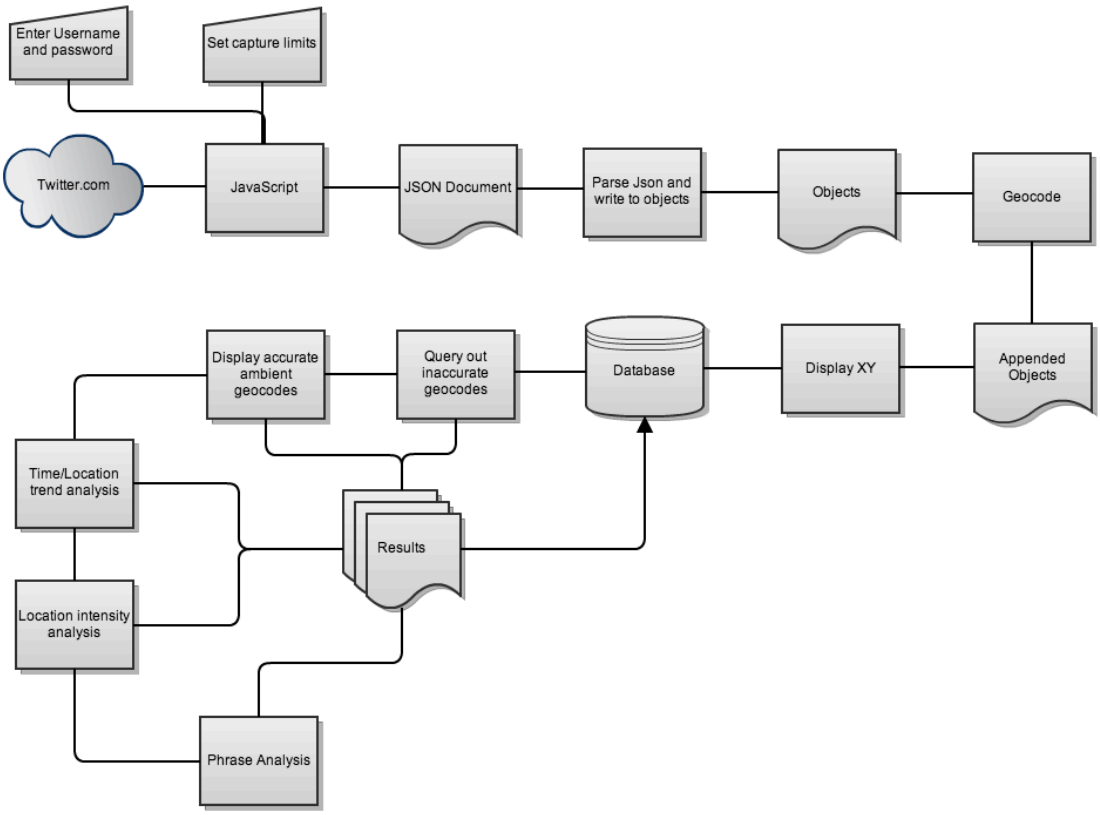


Figure 1 - Application Flow diagram

CHAPTHER 3: METHODS

GeosocialFootprint (2013) was created using an iterative Software Design Life Cycle (SDLC, University of California, San Francisco, 2013). Based on the findings of the technology research described in Chapter Two, requirements for developing this application were documented. Following the requirements analysis phase, a visual wireframe of the application along with object-oriented designs(OOD) documents were drafted. A visual wireframe is essentially a visual design guide that outlines the general layout, design, and functionality of a web page. The OOD patterns were used to begin application development. The development process occurred in small iterations with phases of testing completed at each milestone, the details of which are provide in the proceeding sections.

3.1 Requirements Analysis

During the requirements analysis phase of the SDLC two areas of focus were selected for the GeosocialFootprint (2013) project: functional requirements and architectural requirements. In the first phase, functional requirements gathering, necessary user experience (UX) tasks, actions, and activities were documented. In the second phase, architectural requirements gathering, key system architectures were identified.

Functional requirements gathering for GeosocialFootprint (2013) focused on the desired UX. During this sub-phase the emphasis was placed on defining a simple user interface, outlining industry standard expected user experiences, and any additional functionality required outside of visualization of tweets.

Fully defining system architecture is important with any technical development project. With GeosocialFootprint (2013), key architectures were outlined that allowed for client-side computing logic as originally intended. By identifying key system components early, technical hurdles were efficiently addressed during the second phase of SDLC, application design.

Trello(2013), a collaborative Kanban style project management tool was used to manage all GeosocialFootprint (2013) requirements. It was selected due to its simple user interface at no cost. It provided a hierarchal view of project tasks through all phases, from design to final testing. Within Trello (2013), tasks were grouped together to create coding iterations and milestones were defined for each group.

3.2 Application Design

GeosocialFootprint (2013) was designed using web application mockup templates in Adobe Photoshop, and also OOD design templates in UMLet (2013). Due to the utilization of the popular Bootstrap framework and JQuery library, it was most

convenient for visual wire framing to be completed using open source Adobe Photoshop templates(Bent Design Studios, 2012). These templates allow for rapid visual prototyping. During the visual design phase of GeosocialFootprint (2013), focus was placed on a simple user interface.

OOD documents were created using Unified Modeling Language (UML) in the UMLet application. UML diagrams provided awell-organized approach to the modeling the objects, methods, and attributes of GeosocialFootprint (2013).

3.2 Software Development

As referenced in Chapter two, a variety of software development languages were utilized in Geospatial Footprint. Sublime Text 2, an advanced code editor, effectively manages cross-coding environments and therefore was utilized for GeosocialFootprint (2013) software development (Sublime Text 2, 2012). While the four main industry leading Internet browsers, Microsoft Internet Explorer, Mozilla Firefox, Google Chrome and Apple Safari were used in testing, Google Chrome's Developer Tools were used exclusively during the creation of the application to monitor error reporting in an Internet browser setting.

3.3 Application Evaluation Method

GeosocialFootprint (2013) was evaluated for both its efficacy in educating a user on the potential risks of over-sharing and also for software bugs. Bug testing measured

the success of the software development. User feedback was collected through a user survey and provided metrics to gauge the educational value and effectiveness of the application.

3.3.1 Bug Testing

Application bug testing for GeosocialFootprint (2013) was accomplished in two different phases: unit testing and system testing. Unit refers to a processes of testing individual sections of code, while system refers to entire application testing. Due to the iterative application development cycle, unit testing occurred at the conclusion of each development milestone. Once each unit had been developed and tested individually an entire system test was completed.

Due to the varying structures and objectives of each development milestone, each unit test phase was implemented uniquely. In general sample data was stored and manually run through the code segments to ensure that calculations and logic were operating as intended. Bugs were documented in the project management tool and new tasks were created and prioritized. Once each unit was tested, the bugs were addressed and resolved. A second phase of testing was then completed on the same unit and the cycle was repeated until all bugs were corrected.

System testing began after each unit had been individually developed and tested. Two groups of beta testers were used to perform system testing in phases. Non

geospatial professional peers were selected to participate as beta testers. Group one was provided with in depth instructions and sample data for use. The testing focus of group one was data analysis accuracy. After group one completed their testing they were asked to provide descriptions of any bugs they encountered.

The bugs documented during phase one testing were corrected prior to initiating phase two testing. Phase two system testing focused on the UX. Group two was provided with minimal instructions and no sample data. Testers were provided with an unstructured feedback request in an effort to capture all UX inefficiencies. These bugs and inefficiencies were corrected prior to final release of the application.

3.3.2 User Survey

While the completeness and accuracy of GeosocialFootprint's (2013) application code was important, the true measure for success was its ability to educate and inform the users of over-sharing risks. To evaluate this success a user survey was offered to the public online users on a volunteer basis.

After two minutes of use, the web application triggered a pop-up window that prompted the user to participate in a user survey. The user survey provided an opportunity for feedback in 5 areas that measure educational value and one additional field for general comments. For the purposes of this thesis work, a total of

352 surveys were collected over a three-month period, from September 2013 to January 2014.

3.4Key Programming Challenge

GeosocialFootprint (2013) encountered two development challenges: changes to the Twitter API, and capturing meaningful user analytics. Both obstacles were overcome by using third party platforms to accommodate the design requirements of client-side computing logic, detailed in the following discussions.

3.3.1 Twitter API Changes

An early proof of concept for GeosocialFootprint (2013) was created using the Twitter API version 1.0 and Google Maps API version 2. Between the proof of concept and the beginning of application development, Twitter depreciated version 1.0 of their API and enforced the use of version 1.1 and Google depreciated version 2 and enforced the use of version 3. While the numerical change in API versions may seem minimal, the technical ramifications were significant.

The Google Map's API version 2 depreciation made it difficult to adopt the techniques of Weidemann and Swift 2013 in regards to geocoding tweets. Version 2 of Google's goecoding API performed entity extract, natural language processing,

and an accuracy assessment for the API user. When these functionalities were depreciated, geocoding tweets directly through Google's API became impractical.

The three largest modifications to the Twitter API were: required authentication on every API transaction, a change to the rate-limiting methodology, and an adaption of developer rules with regards to third party Twitter applications. Each modification impacted GeosocialFootprint (2013) differently. Currently, the change in rate-limiting actually improves the usability of GeosocialFootprint (2013) by expanding the simultaneous user limit from 350 to 720 (Sippey 2013). Although the adaptation of developer rules has limited impact on the current use of GeosocialFootprint (2013), it does limit the ability to further expand the application to a native mobile or desktop application. This is accomplished by requiring preauthorization from Twitter before distributing installable Twitter application clients. Lastly, requiring authentication to access an API endpoint had the largest impact on GeosocialFootprint (2013).

While using Twitter's API version 1.0, the proof of concept application accessed the Twitter API through a simple representational state transfer (REST) request using an unsecured HyperText Transfer Protocol (HTTP). With version 1.1, each REST request requires the inclusion of an authentication token and key. These tokens and keys are unique to each Twitter user and therefore must be secured and protected.

In the context of developing GeosocialFootprint (2013), the Twitter API version 1.1 presented the challenge of protecting the authentication token and key while simultaneously providing a user-friendly experience. Two options to overcome this challenge were evaluated: 1) require each user to login using Twitter's "OAuth" protocol and 2) utilize an API proxy.

Evaluating the first challenge of implementing Twitter's "OAuth" protocol required minimal application development time. However, it resulted in substantial complications for the user's experience. Requiring each user to login using their personal Twitter user account not only increased the number of steps for access, but, more importantly, potentially falsified the user's perception of safety. An important feature of the originally designed GeosocialFootprint (2013) was to showcase the public nature of Twitter data. If a user was required to login prior to viewing their footprint, they could perceive that their footprint was private.

The use of a Twitter API proxy was deemed the more suitable solution for GeosocialFootprint (2013). While its implementation required greater development time, it provided for the user-friendly experience that was originally intended. Instead of requiring the user to login, the proxy received a request from the GeosocialFootprint (2013) user and subsequently sent the same request on behalf of the user to the official Twitter API. The proxy to authenticate the account with Twitter then used a Twitter developer's token and key. The response was then

returned to the original user. As a result, the token and key were registered to GeosocialFootprint (2013) and stored securely by the proxy.

In building the Twitter API proxy, a platform as a service (PAAS) was used to minimize system costs and administration requirements. Heroku (2013) was selected as the PAAS provider due to services provided at no cost and its large user community.

3.3.2 User Analytics

One drawback to an application that is built on client-side computing logic is the inability to store user metrics. User metrics are imperative to evaluate and validate the efficacy of an application. In a traditional web application, the same database that stores user data could also be used to store and track user activity. By design, GeosocialFootprint (2013) does not have a hosted database to store user information and therefore cannot include user metrics.

Qbaka (2013) offered an adequate solution through an adaption of their error reporting service (2013). GeosocialFootprint (2013) alters the standard use case of Qbaka (2013) by reporting client actions back to Qbaka's API, instead of the traditional error reports. The user metrics were then monitored and analyzed using Qbaka's (2013) web application.

Based on the work described above, the next chapter discussed the finished application and the results of the user survey.

CHAPTHER 4: RESULTS

4.1 Application Function

By design, GeosocialFootprint (2013) provides a very simple user interface. The home page of GeosocialFootprint (2013) includes a summary of the web application, instructions for use, and links to recent news coverage this web application has received. As shown in Figure 2 the instructions are in bold to draw attention.

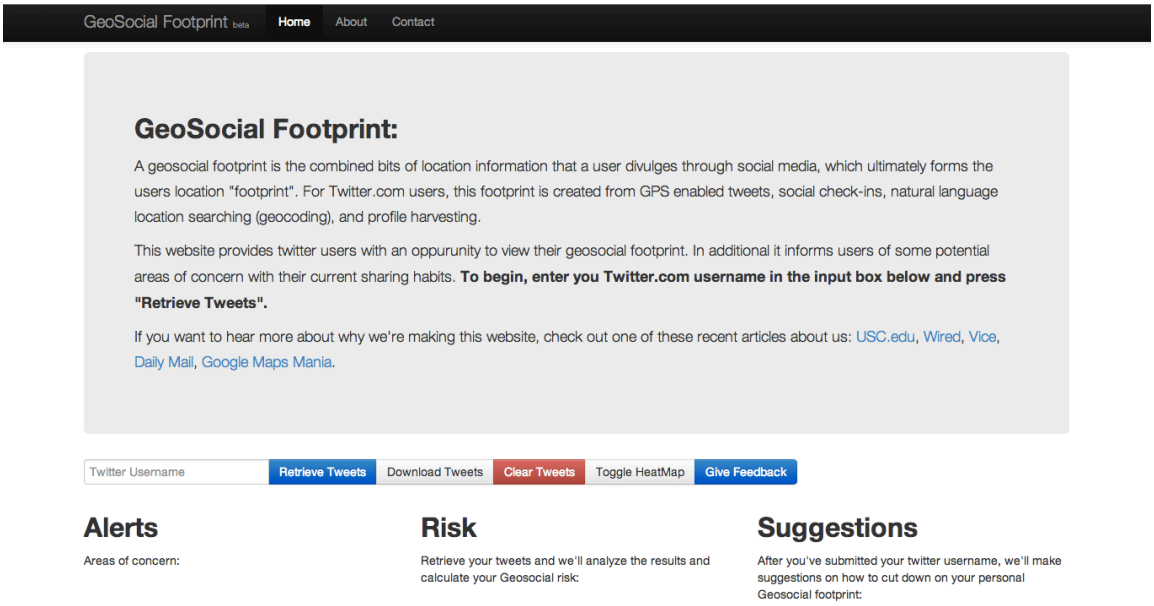


Figure 2 - GeosocialFootprint (2013) Landing Page

A user views a GeosocialFootprint (2013) by entering the desired Twitter username in the input box and clicking the button titled “Retrieve Tweets”. After a user attempts to retrieve tweets, the application checks the validity of the Twitter username. As seen in figure 3, if the username is valid the main user interface box updates and informs the user that the application is retrieving the first 200 tweets. If the Twitter username is invalid or private the user is alerted through a popup window, as shown in Figures 4 and 5.

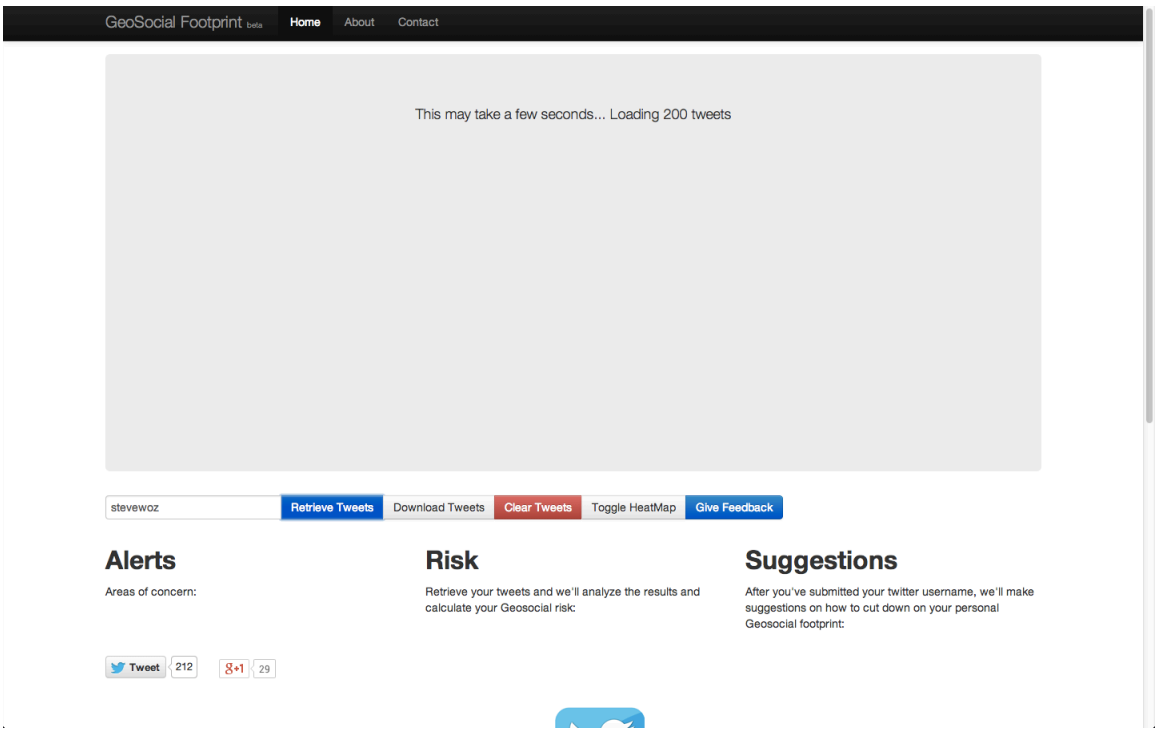


Figure 3 - View of intermediate web page after a valid Twitter username has been entered

Figure 4 - Popup alerting user of an invalid Twitter username

After a valid Twitter username has been entered and tweets have been retrieved, the web application updates the main user interface box with a map. Figure 4 represents the results of a user that has a high-risk rating where an obvious "footprint" is visible. In the event that the web application cannot geo-locate any tweets for the specified user, an in text alert is added between the input box and the map, as seen in Figure 6.

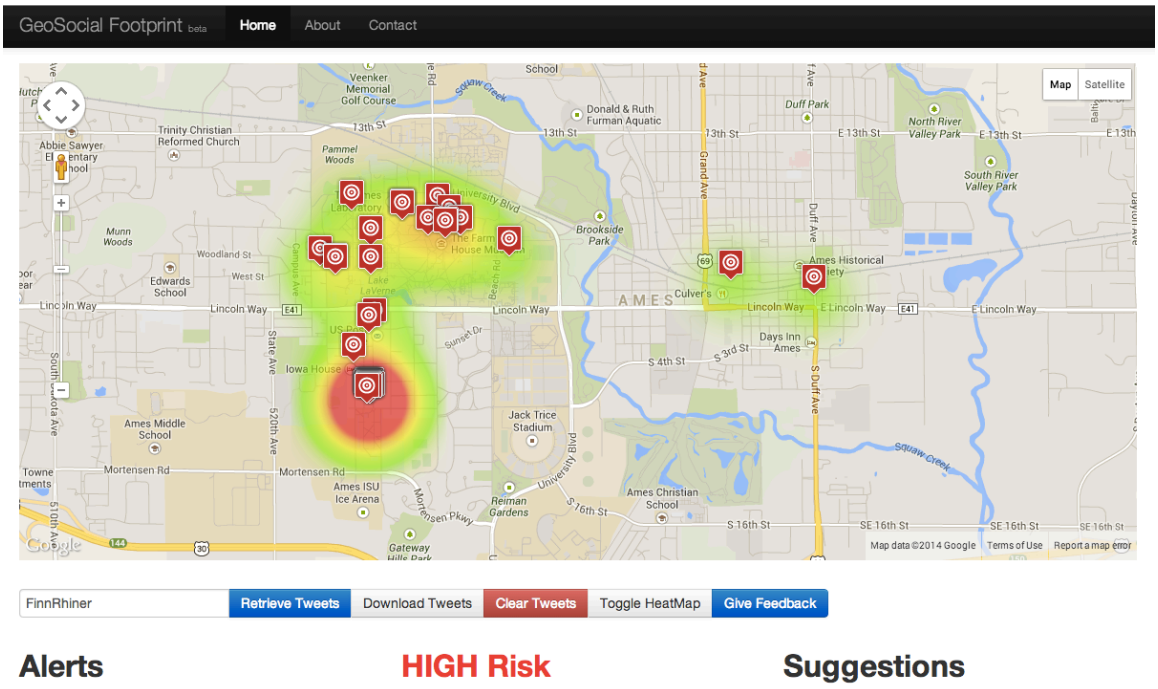


Figure 5 - Map results of a high risk Twitter user

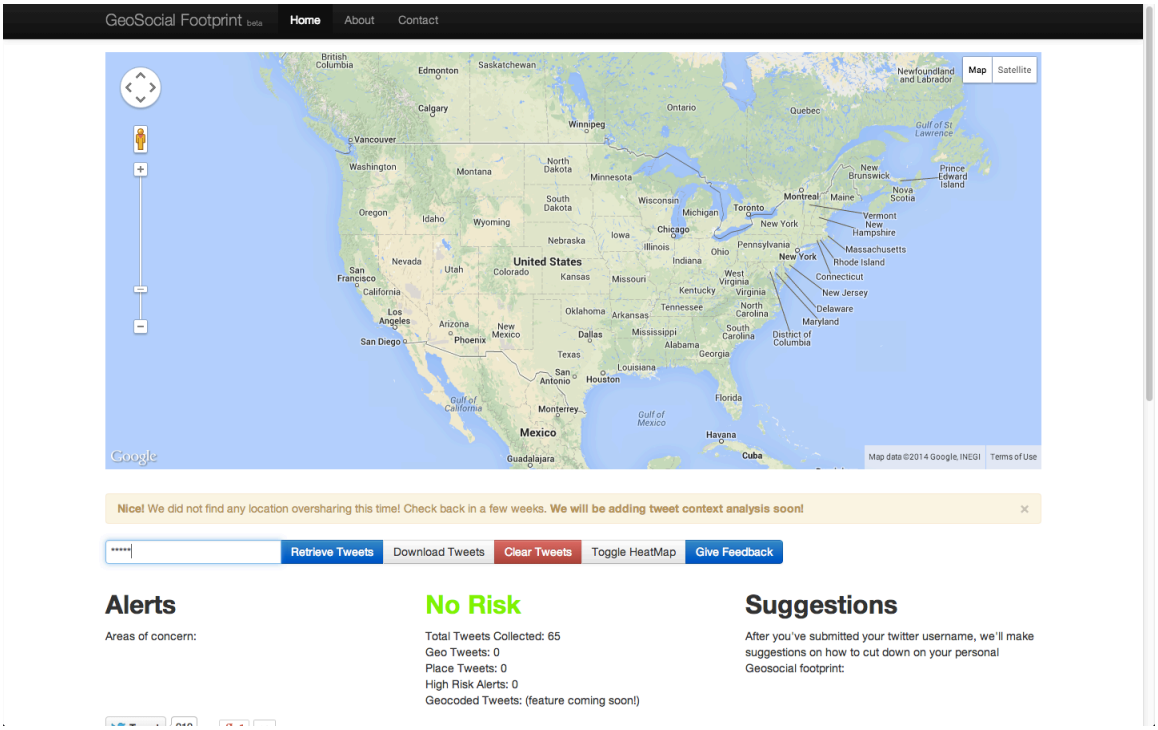


Figure 6 - Map results when no tweets are geo-located

4.1.1 User risk, alters, and suggestions

After a Twitter username has been validated, tweets have been retrieved, and a map has been generated the user is provided with dynamic alerts, a location over-sharing risk assessment, and suggestions on decreasing said risks. Figure7 shows the three columns of information that are produced for the user after a successful mapping of tweets.

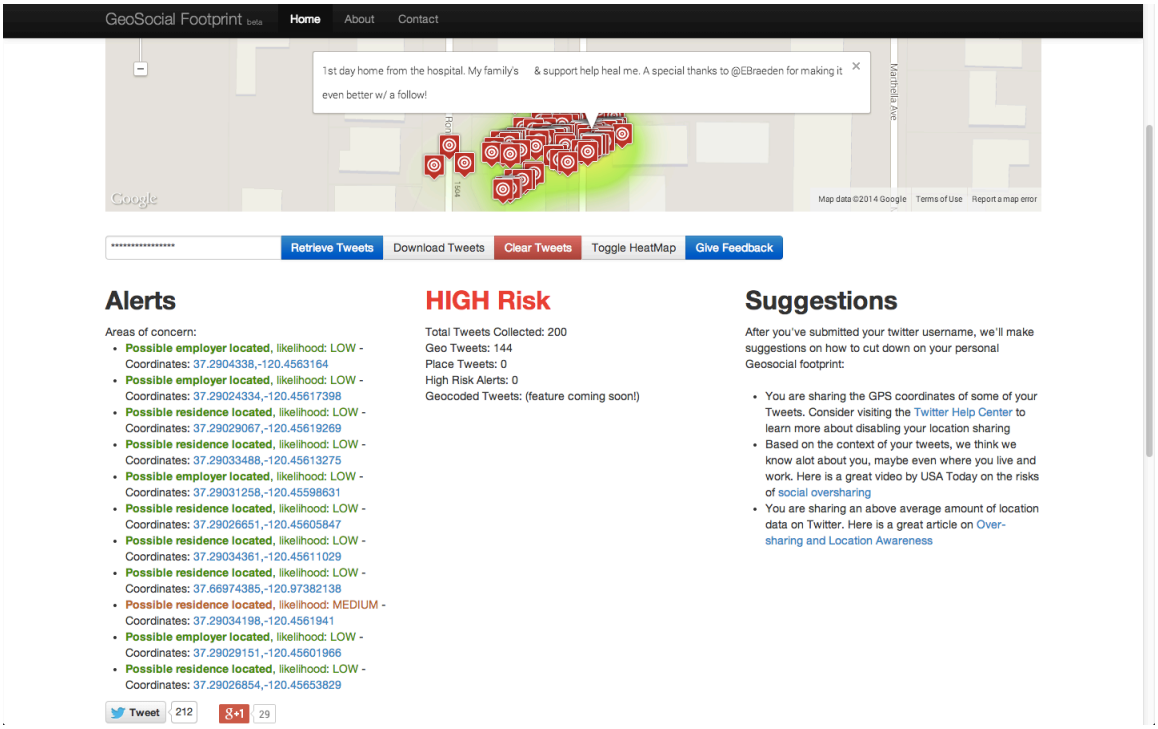


Figure 7 - Results of a high-risk user, including context alerts and suggestions to reduce risk

The alerts section displays the results of the context filtering analysis. These alerts are separated into three categories that represent the likelihood of alert accuracy: low, medium, and high. This accuracy is based on word context matching. Key phrases were built off of previous research by Humphreys (2010) and were designed to expose locations relating to a users home, place of work, and educational facility. Key phases include for example, "am at home" which is generally used in the context of a user mentioning they are at their place of residence. When the occurrence of these known words or phrases that divulge additional location information increases within a tweet, so does the accuracy rating. The likelihood category is not only displayed as text, but the color of the text for each alert changes based on the alert level. To increase the usability of the alerts section, when the user clicks on an alert, the map centers and zooms to the selected alert.

The risk of over-sharing is displayed in the center column. The risk is calculated based on the percentage of located tweets for each user. As the percentage of located tweets increases, so does the risk. The risk calculation was derived from findings of Weidemann and Swift (2013) which breaks down the observed use of location based tweets over the course of a 7 day sampling period. Using those results as a baseline, the following risk levels were created: 0% is no risk, between 3-6% is low risk, between 6-9% is average risk, between 9-12% is medium risk,

between 12-24 percent is medium-high risk, and above 24% is high risk. The heading of the risk column changes according to the resulting risk level. This text also changes color based on the risk level. Below the risk rating, the user is also provided with a summary of what was collected for the specified Twitter user.

The suggestions column dynamically provides the user with suggestions on how to decrease their personal over-sharing risk. This suggestion column is compiled from a list of resources, links, and videos on social media over-sharing(Twitter.com 2013, Shelly 2013, Groeneveld et. al. 2010). The web application analyzes the users Twitter trends and dynamically selects items from the list that could be beneficial to the specified Twitter username.

It should be noted that no guarantee of privacy can be made, even after following the steps provided in suggestions. Other techniques can be used to locate tweets. For example the work by Weidemann and Swift (2013) examines the use of geocoding to locate tweets based on the text and context of the tweet. While turning off GPS enabled tweets will decrease the risk of location profiling, it cannot be completely negated without making all tweets private.

Next, the user is automatically given the opportunity to participate in a user feedback survey, as described in the following section.

4.1.2 Anonymous Survey

GeosocialFootprint (2013) has an internal timer that asks the user to volunteer for an anonymous survey two minutes after tweets are retrieved for a Twitter username. The request is displayed as a popup on the main page, as depicted in figure 8. If a user agrees to participate in the survey, they are forwarded to a Google Forms page where they are asked to respond to the questions found in Figure 9. A summary of the anonymous survey results can be found below in subsection titled "Summary of Survey Results", while all results collected as of January 2014 can be found in Appendix A.

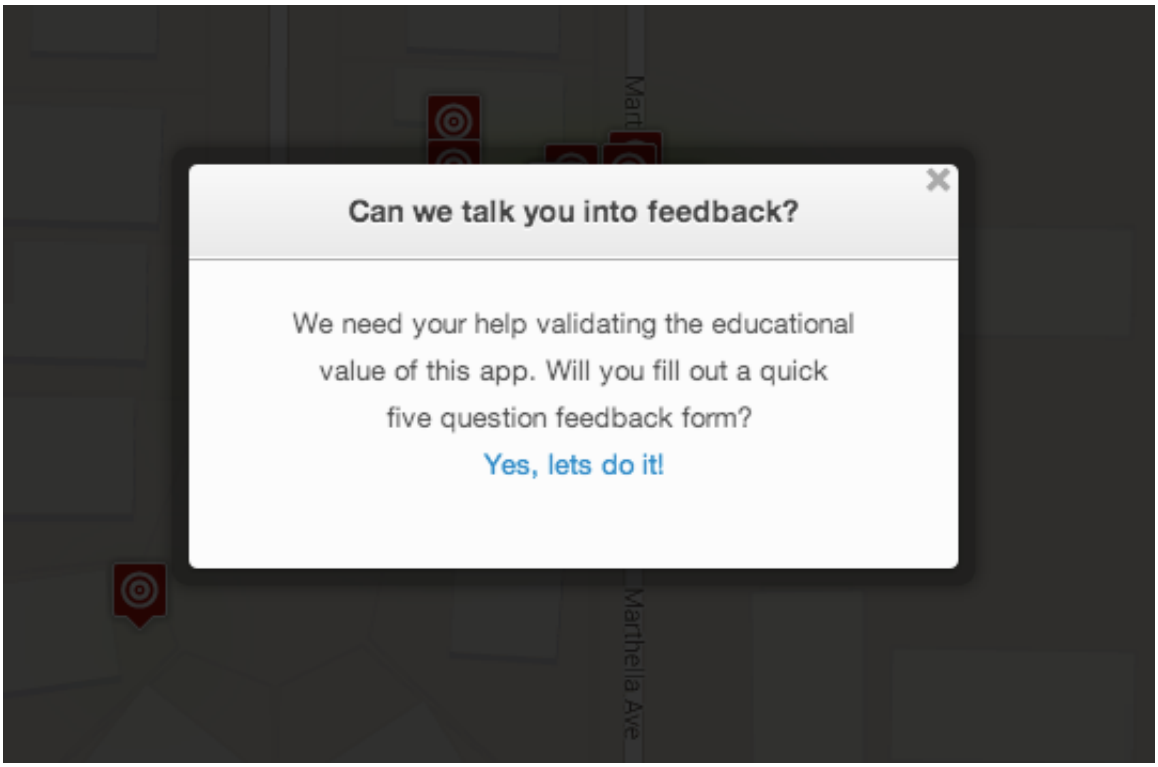
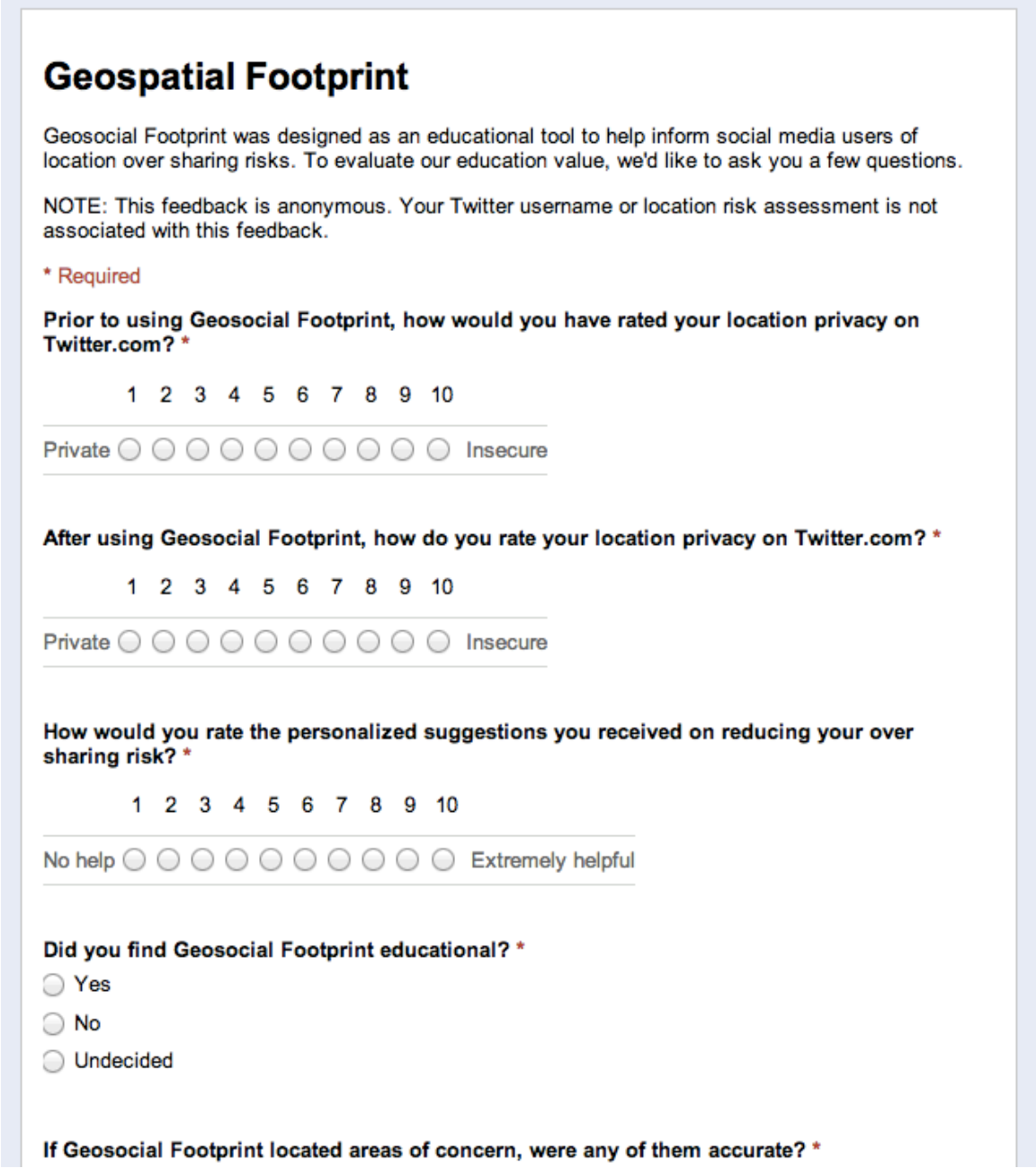


Figure 8 - Feedback request popup



Geospatial Footprint

Geosocial Footprint was designed as an educational tool to help inform social media users of location over sharing risks. To evaluate our education value, we'd like to ask you a few questions.

NOTE: This feedback is anonymous. Your Twitter username or location risk assessment is not associated with this feedback.

* Required

Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com? *

1 2 3 4 5 6 7 8 9 10

Private ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Insecure

After using Geosocial Footprint, how do you rate your location privacy on Twitter.com? *

1 2 3 4 5 6 7 8 9 10

Private ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Insecure

How would you rate the personalized suggestions you received on reducing your over sharing risk? *

1 2 3 4 5 6 7 8 9 10

No help ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Extremely helpful

Did you find Geosocial Footprint educational? *

○ Yes
○ No
○ Undecided

If Geosocial Footprint located areas of concern, were any of them accurate? *

Figure 9 - Feedback page

4.1.3 Data Download

Upon user request, data download functionality was added to GeosocialFootprint (2013). After tweets have successfully been retrieved, all geo-located tweets are available for download as a comma-separated values (CSV) file. To download the CSV file, a user must successfully plot tweets on the map and then simply click the "Download Tweets" button, as shown in Figure 10. The CSV file can be opened in most modern spreadsheet applications, along with numerous GIS software suites. The CSV file provided by GeosocialFootprint (2013) contains the tweet time, latitude, longitude, and text. Example contents of a CSV download are shown in Figure 11.

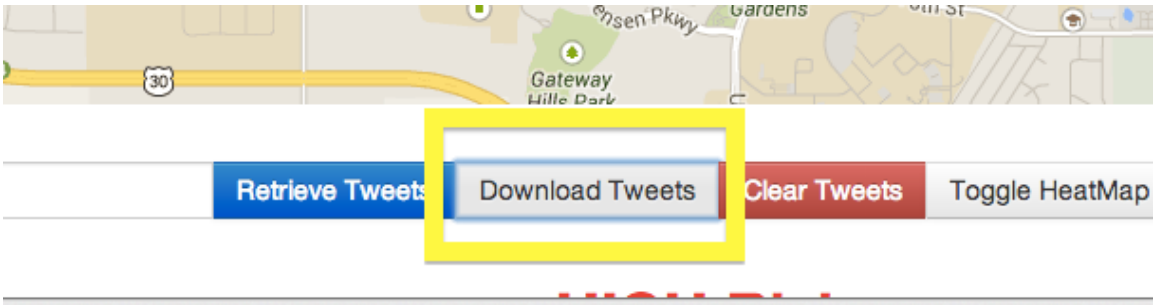
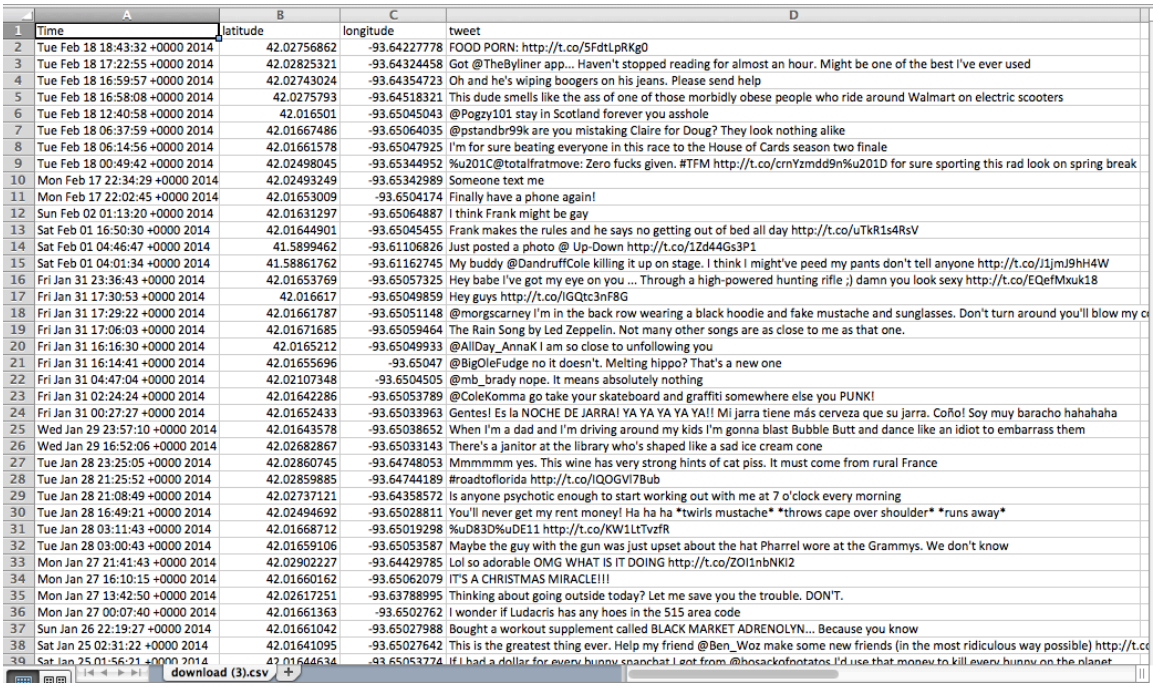


Figure 10 - Data download feature button



	A	B	C	D
1	Time	latitude	longitude	tweet
2	Tue Feb 18 18:43:32 +0000 2014	42.02756862	-93.64227778	FOOD PORN: http://t.co/5FdtLpRKg0
3	Tue Feb 18 17:22:55 +0000 2014	42.02825321	-93.64324458	Got @TheByliner app... Haven't stopped reading for almost an hour. Might be one of the best I've ever used
4	Tue Feb 18 16:59:57 +0000 2014	42.02743024	-93.64354723	Oh and he's wiping boogers on his jeans. Please send help
5	Tue Feb 18 16:58:08 +0000 2014	42.0275793	-93.64518321	This dude smells like the ass of one of those morbidly obese people who ride around Walmart on electric scooters
6	Tue Feb 18 12:40:58 +0000 2014	42.016501	-93.65045043	@Pogzy101 stay in Scotland forever you asshole
7	Tue Feb 18 06:37:59 +0000 2014	42.01667486	-93.65064035	@pstandbr99k are you mistaking Claire for Doug? They look nothing alike
8	Tue Feb 18 06:14:56 +0000 2014	42.01661578	-93.65047925	I'm for sure beating everyone in this race to the House of Cards season two finale
9	Tue Feb 18 00:49:42 +0000 2014	42.02498045	-93.65344952	%u201C@totalfratmove: Zero fucks given. #TFM http://t.co/crnYzmdd9n%u201D for sure sporting this rad look on spring break
10	Mon Feb 17 22:34:29 +0000 2014	42.02493249	-93.65342989	Someone text me
11	Mon Feb 17 22:02:45 +0000 2014	42.01653009	-93.6504174	Finally have a phone again!
12	Sun Feb 02 01:13:20 +0000 2014	42.01631297	-93.65064887	I think Frank might be gay
13	Sat Feb 01 16:50:30 +0000 2014	42.01644901	-93.65045455	Frank makes the rules and he says no getting out of bed all day http://t.co/uTkR1s4RsV
14	Sat Feb 01 04:46:47 +0000 2014	41.5899462	-93.61106826	Just posted a photo @ Up-Down http://t.co/1Zd44Gs3P1
15	Sat Feb 01 04:01:34 +0000 2014	41.58861762	-93.61162745	My buddy @DandruffCole killing it up on stage. I think I might've peed my pants don't tell anyone http://t.co/J1jmJ9hH4W
16	Fri Jan 31 23:36:43 +0000 2014	42.01653769	-93.65057325	Hey babe I've got my eye on you ... Through a high-powered hunting rifle ;) damn you look sexy http://t.co/EQefMxuk18
17	Fri Jan 31 17:30:53 +0000 2014	42.016617	-93.65049859	Hey guys http://t.co/IGQtc3nF8G
18	Fri Jan 31 17:29:22 +0000 2014	42.01661787	-93.65051148	@morgscarney I'm in the back row wearing a black hoodie and fake mustache and sunglasses. Don't turn around you'll blow my c
19	Fri Jan 31 17:06:03 +0000 2014	42.01671685	-93.65059464	The Rain Song by Led Zeppelin. Not many other songs are as close to me as that one.
20	Fri Jan 31 16:16:30 +0000 2014	42.0165212	-93.65049933	@AllDay_AnnaK I am so close to unfollowing you
21	Fri Jan 31 16:14:41 +0000 2014	42.01655696	-93.65047	@BigOleFudge no it doesn't. Melting hippo? That's a new one
22	Fri Jan 31 04:47:04 +0000 2014	42.02107348	-93.6504505	@mb_brady nope. It means absolutely nothing
23	Fri Jan 31 02:24:24 +0000 2014	42.01642286	-93.65053789	@ColeKomma go take your skateboard and graffiti somewhere else you PUNK!
24	Fri Jan 31 00:27:27 +0000 2014	42.01652433	-93.65033963	Gentes! Es la NOCHE DE JARRA! YA YA YA YA YA!! Mi jarra tiene más cerveza que su jarra. Coño! Soy muy baracho hahahaha
25	Wed Jan 29 23:57:10 +0000 2014	42.01643578	-93.65038652	When I'm a dad and I'm driving around my kids I'm gonna blast Bubble Butt and dance like an idiot to embarrass them
26	Wed Jan 29 16:52:06 +0000 2014	42.02682867	-93.65033143	There's a janitor at the library who's shaped like a sad ice cream cone
27	Tue Jan 28 23:25:05 +0000 2014	42.02860745	-93.64748053	Mmmmmm yes. This wine has very strong hints of cat piss. It must come from rural France
28	Tue Jan 28 21:25:52 +0000 2014	42.02859885	-93.64744189	#roadtoflorida http://t.co/IQOGVl7Bub
29	Tue Jan 28 21:08:49 +0000 2014	42.02737121	-93.64358572	Is anyone psychotic enough to start working out with me at 7 o'clock every morning
30	Tue Jan 28 16:49:21 +0000 2014	42.02494692	-93.65028811	You'll never get my rent money! Ha ha ha *twirls mustache* *throws cape over shoulder* *runs away*
31	Tue Jan 28 03:11:43 +0000 2014	42.01668712	-93.65019298	%uD83D%uDE11 http://t.co/KW1LtTvzfR
32	Tue Jan 28 03:00:43 +0000 2014	42.01659106	-93.65053587	Maybe the guy with the gun was just upset about the hat Pharrel wore at the Grammys. We don't know
33	Mon Jan 27 21:41:43 +0000 2014	42.02902227	-93.64429785	Lol so adorable OMG WHAT IS IT DOING http://t.co/ZOI1nbNKI2
34	Mon Jan 27 16:10:15 +0000 2014	42.01660162	-93.65062079	IT'S A CHRISTMAS MIRACLE!!!
35	Mon Jan 27 13:42:50 +0000 2014	42.02617251	-93.63788995	Thinking about going outside today? Let me save you the trouble. DON'T.
36	Mon Jan 27 00:07:40 +0000 2014	42.01661363	-93.6502762	I wonder if Ludacris has any hoes in the 515 area code
37	Sun Jan 26 22:19:27 +0000 2014	42.01661042	-93.65027988	Bought a workout supplement called BLACK MARKET ADRENOLYN... Because you know
38	Sat Jan 25 02:31:22 +0000 2014	42.01641095	-93.65027642	This is the greatest thing ever. Help my friend @Ben_Woz make some new friends (in the most ridiculous way possible) http://t.c
39	Sat Jan 25 01:56:21 +0000 2014	42.01644634	-93.65053774	If I had a dollar for every bunny snapchat I got from @hosackfootatos I'd use that money to kill every bunny on the planet

download (3).csv

Figure 11 - Contents of a CSV download opened in Microsoft Excel

While the data download may have many uses, it was specifically designed to help GIScience users more fully analyze Twitter.com data. Due to the limitations in the Twitter API, the Twitter API response cannot be redistributed in its original form, which makes sample Twitter data hard to source and locate. GeosocialFootprint (2013) removes all user data, as required by the Twitter API Terms of Service, and repackages the data in a usable format. This sample data can then be used by GIScience users to perform more advanced analysis, for example temporal or habitat analysis.

4.2 Summary of Survey Results

The anonymous user survey acts as tool to judge the efficacy of GeosocialFootprint (2013). The participants are asked to rate their perceived privacy on Twitter prior to using the web application, then again after. They are also asked to rate the educational value of the suggestions and the tool as a whole. Lastly, users are provided with an opportunity to provide general feedback and comments through manual typing into a form field.

The questions asked and the available answers are as follows:

1. *Question*: Prior to using GeosocialFootprint (2013), how would you have rated your location privacy on Twitter.com?

   Possible Answer: A scale from one to ten with one representing “private” and ten representing “insecure”.
2. *Question*: After using GeosocialFootprint (2013), how do you rate your location privacy on Twitter.com?

   Possible Answer: A scale from one to ten with one representing “private” and ten representing “insecure”.
3. *Question*: How would you rate the personalized suggestions you received on reducing your over sharing risk?

Possible Answer: A scale from one to ten with one representing “No Help” and ten representing “Extremely Helpful”.

4. *Question*: Did you find GeosocialFootprint (2013) educational?

   Possible Answer: “Yes”, “No”, and “Undecided”.

5. *Question*: If GeosocialFootprint (2013) located areas of concern, were any of them accurate?

   Possible Answer: “Yes”, “No”, “Undecided”, and “GeosocialFootprint (2013) did not locate areas of concern for my account”.

6. *General Comments section*: “We're interested to hear what you have to say. Please share any general comments, concerns, or feature requests.”

   Possible Answer: Blank text box.

Figure 12 shows the summarized results of question one. Only 16% of the anonymous users reported an insecurity rating of 8 or higher with respect to their feelings about using Twitter, with 10 being the most insecure, while 50 percent felt very confident in their privacy with a rating of 3 or less.

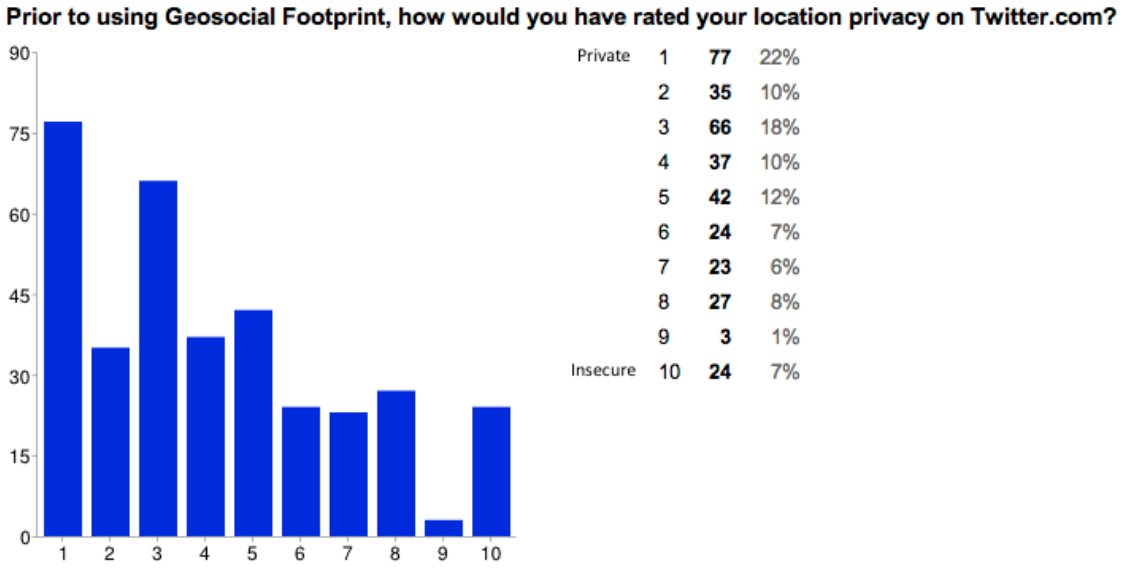


Figure 12 - Summarized responses to question one on the user survey

Figure 13 represents the summarized results of anonymous user's perceived privacy after using GeosocialFootprint (2013). The results from question 2. show that roughly half (49%) of users who responded to the survey indicate that they have strong confidence in their privacy after using the application. However users that recorded an insecure rating of 8, 9, or 10 double compared to question 1. accounting for 30% of the users. The results from question 2.show that GeosocialFootprint (2013) helped increase awareness of social media over-sharing insecurities. In addition, the number of users that rated their location privacy a 1, meaning most private, increased from 22% for question 1.to 30% for question 2. This shows that the tool not only highlights insecurities but it was also able to instill confidence in some users about their privacy.

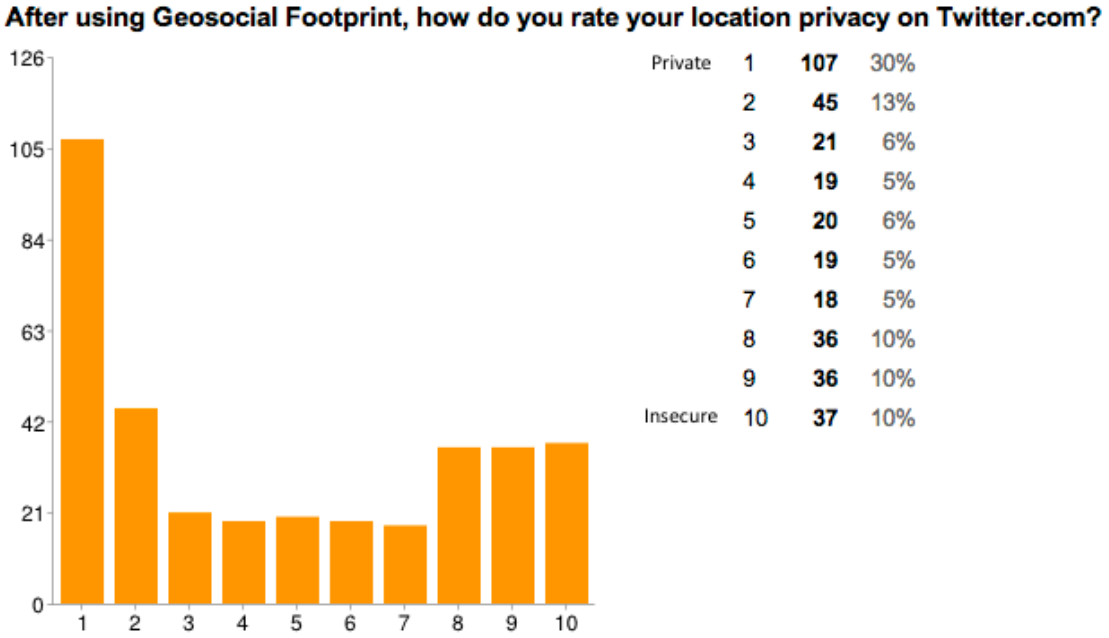


Figure 13 - Summarized responses to question two on the user survey

Figure 14 summarizes the results from question three. The bimodal distribution of the graph shows that users either found the personalized suggestions extremely helpful or no help at all. Many users that reported “no help” also left comments suggesting their Twitter username didn’t produce any geo-located Tweets, therefore no personalized suggestions were provided.

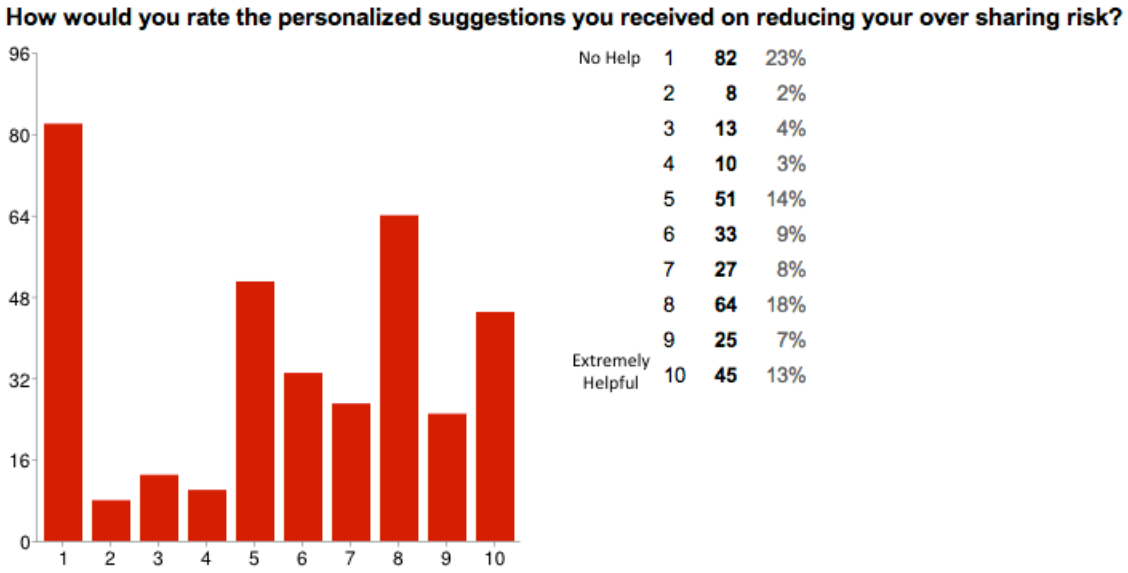


Figure 14 - Summarized responses to question three on the user survey

Figure 15 summarizes the results from questions four and five. Question 4. responses provide the most convincing results in favor of GeosocialFootprint (2013)s effectiveness in educating social media users of location privacy. An overwhelming 82% found GeosocialFootprint (2013) to be educational, with only 8% not finding it educational, while an additional 10% of users remained undecided.

Results for question five, summarized as well in figure 15, show that 54% of the users did not have areas of concern highlighted for their retrieved tweets. Of the remaining users, over half found that the areas of concern that were highlighted

were accurate. This is strong evidence that word context matching is indeed a viable solution for collected meta data about location enabled tweets.

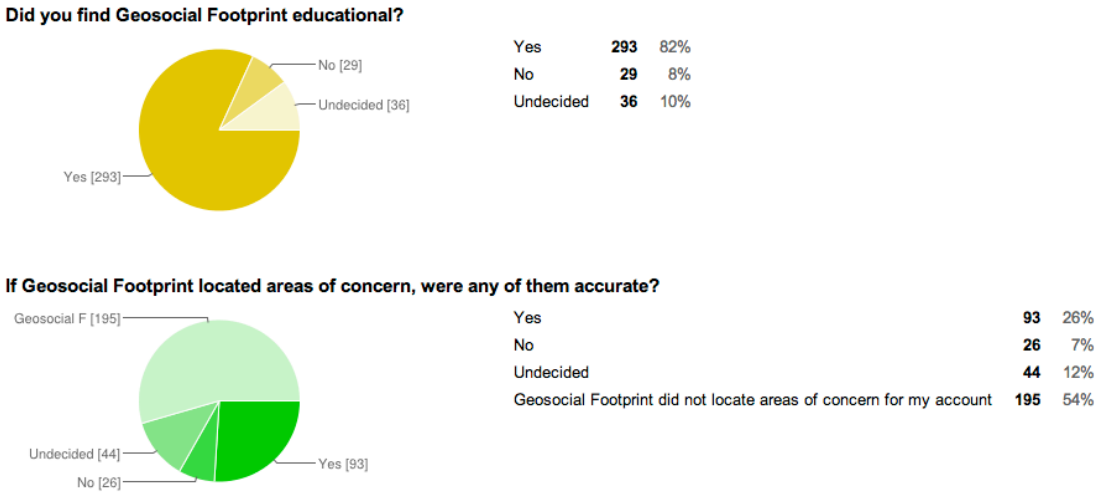


Figure 15 - Summarized responses to questions four and five on the user survey

Question 6 asks the user for generic feedback on the application through a text box. The responses provided in Question 6 personally validate the efficacy of the web application. One user commented that they made their "tweets private after" viewing GeosocialFootprint (2013). They continue by saying "I was high risk with 148 out of 199" being located "and you knew where I worked and lived". This user's comment shows that at least in one case GeosocialFootprint (2013) was able to educate and inform a user not only about their personal location privacy but also how to proceed with reducing their over-sharing risks. Another user had similar results and stated: " Nice article. This is kind of scary. While I personally don't have

any locations on the map, my kids each have our home and their local hangouts visible. Thanks for helping me be a better parent." This comment is another testament to the efficacy of GeosocialFootprint (2013) as it empowered a parent to help product their children.

Of course not all the comments were positive. GeosocialFootprint (2013) was met with criticism as well. One user stated: "I consider it important, useful, and good etiquette to share my location in my tweets". This comment reaffirms the notion that the concept over-sharing is still personally subjective.

These combined results provide evidence that GeosocialFootprint (2013) was successful in completing its main goal: educating and informing social media users of the privacy risks of location over-sharing. In addition the results conclude that word context matching can be implemented in social media feeds to gleam additional location information from geo-enabled tweets. Finally the personalized suggestions on how to increase social media privacy were successful when users have geo-enabled tweets.

CHAPTER 5: Conclusion

5.1 Main Advances

GeosocialFootprint (2013) is unique, unlike any other web application. No other online mapping application publically available allows Twitter user to visualize their tweets as an area of interest, provides ambient location data alerts, performs over-sharing risk assessments, or educates the user through dynamic and customized reporting.

GeosocialFootprint (2013) is like all other innovations in that it builds upon the successes of others. By combining historically successful geosocial tools into one geosocial web application, GeosocialFootprint (2013) is able to push the boundaries of geosocial location privacy and user education.

Beyond the principles of educating and informing social media users of the risks of overs-haring, GeosocialFootprint (2013) also expands upon the body of knowledge by advancing the capabilities of client side web application processing for geospatial tools. Traditionally users equate geospatial web tools with expensive and dedicated enterprise servers. Technology today allows for the large majority of geospatial processing to occur in the web browser on the client's (user's) machine. As a proof of concept, GeosocialFootprint (2013) greatly reduces the entry-level barrier for future geospatial tools.

5.2 Next Steps

Advances in machine learning, data analytics, temporal analysis, and entity recognition provide for further research in the area of geosocial location privacy. Research by Weidemann and Swift (2013) shows that geocoding entire tweets through entity recognition and accuracy assessments can increase the breadth of geo data from 3% of the Twitter API fire hose stream to nearly 30%. GeosocialFootprint (2013) proves this by providing simple metrics on user twitter habits that helps to inform the user. Delivering further data analytics could improve the efficacy of the user's education. The addition of temporal analysis may also increase the accuracy of the area of concern alerts. While the risk assessments and alert levels were deemed informative through the anonymous survey, using basic machine learning could expand upon this.

Geocoding of tweets is not a new subject. It has been researched by Huck et al. (2012), who found that while limitations still exist in current methodologies, viable location data can be processed using a multiple pass geocoding technique. Weidemann and Swift (2013) also found that it is not only plausible but it is also being used as a intelligence gathering tool by governments, criminals, and even commercial entities. Unfortunately the general public still does not have access to a tool that can help them visualize the ambient geosocial data they also disclose in their tweets.

A new geocoding tool is planned for a second version of GeosocialFootprint (2013), based off the research by Weidemann and Swift (2013). It will further develop this open source application to allow for geographic entity recognition and geocoding. Entity recognition extracts usable information from strings of text. That usable information can then be compared against a gazetteer and geographic coordinates can be assigned to the string of text as a whole. Geocoding would increase the number of geographic coordinates visualized on the map and ultimately help better shape a user's GeosocialFootprint (2013). Geocoding functionality was not included in the scope of this project due to depreciated functionality of the Google Maps API, as used in Weidemann and Swift (2013). Alternatives to entity recognition and natural language processing have been investigated and will be built into the application for a future release.

Beyond geocoding, GeosocialFootprint (2013) could be improved by increasing the analytics performed on the users tweets. The results of the survey, as discussed in chapter 4, show that users found the simple data analytics informative. It can also be derived from user survey responses that increasing the data metrics and analytics would also increase users'a bility to become more educated about their privacy through the web application.

Not only would general data analytics improve the efficacy of the web application but temporal analysis of the tweets may also improve the accuracy of alerts and suggestions. Nagarajan et al. (2009) points out that the time of the day a tweet is published can be a strong indicator for assumed location of the user. In the context of GeosocialFootprint (2013) this can be used to more accurately define areas of concern for the user. With the current alerts, word context matching is singularly used to perform analytics. Including temporal analysis may improve such findings by detecting patterns in temporal fluctuations and correlating those to anticipate or predict location.

Machine learning could improve upon the analytics even further by refining the data processing and analytical methods based on the continued use of the application and the results found therein. For example, the risk assessment method could dynamically respond to the continued use of the web application and adjust the risk classifications based on statistical findings such as a decrease in the mean percentage of geo enabled tweets. Alternatively entity recognition and gazetteers could be modified in the geocoding process as users verify the accuracy of such findings through a user survey.

5.3 The Future of GIS and social media

Technology changes faster than most users can keep up. In the context of social media the change has brought on many privacy concerns, a small part of which of which GeosocialFootprint (2013)successfully addresses. While sometimes this rapid change brings on negative consequences, many times technology evolves to improve society. Social media has seen negative change in the past yet is now entering a new era of improvement.

Social media providers, including Twitter, have made initiatives to limit accessibility to user data through the use of authenticated APIs. Other social media providers have tried to better manage data sharing options and security. Through trial and error, social media providers will find a solution that enables rich immersive social media content without sparing the user's privacy.

Applications that expand new technology and highlight weakness are necessary in the overall balance of social media privacy. Location privacy specifically will see a slew of applications that either harnesses the locational power of social media to provide innovative uses, or on the flip side, applications that exploit the weaknesses of such network.

Of particular emphasis will be direct and indirect VGI. With indirect VGI the user anonymously and autonomously contributes to a geographic information collection through active application and sensors. An example of this is WAZE, a traffic application that becomes more powerful as more users contribute to the geospatial system(Smith 2011). OpenStreetMap is another example of direct VGI [ref]. Users directly contribute to an obvious geospatial system. While neither of these VGI examples use Twitter as their communication network, the same information can be transferred through social media protocols. Using 3rd party API's, such as Twitter, to communicate VGI can greatly decrease the development time and effort required to generate new similar applications and thus enable more successful implementations.

Indirect VGI's that use social media as a sensor are already in use today. The Federal Emergency Management Agency (FEMA) uses social media event tracking as an indirect VGI to inform decision makers in the event of an emergency(Fugate 2011). Twitter users do no actively communicate on Twitter for the purpose of informing FEMA's VGI, but instead the FEMA VGI actively listens for geospatial content related to their interests. This same concept will probably be applied to different mediums in the future. Effective privacy constraints need to be in place to reduce the risk of nefarious VGI's while still empowering well-meaning entities like FEMA to save lives.

The future not only holds a lot of potential opportunities to advance the use of geosocial data but to also educate and inform the general public more about their social media location privacy. As the results of this thesis suggest, simple visualization is an effective tool to educate users. It is the opinion of the author that social media outlets should perform user outreach and allow users to proactively monitor their social media footprint within their existing web application frameworks. This is the responsible path forward, for all concerned.

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Appendix A: Survey Results

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
8/27/2013 16:07:31	1	1	6	Yes	Undecided	
8/28/2013 10:18:51	7	6	6	Yes	Geosocial Footprint did not locate areas of concern for my account	interesting app will be watching to see how it develops
8/28/2013 13:18:00	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
8/28/2013 14:18:20	1	1	8	Yes	Geosocial Footprint did not locate areas of concern for my account	Great app for quickly showing people how much information they may be strewing around the Internet without even knowing. Keep up the good work.
8/28/2013 17:01:52	3	8	8	Yes	Yes	I will stop sharing my location so often. It knew where I work.
8/29/2013 5:56:26	10	9	7	Yes	No	Nothing new under the sun here. Everyone and their mother know (or should know) that the core business of social based media-companies is logging/tracking/directing of content/places, with the intent of selling this information to 3rd party. Whether that be for advertising or other.
8/29/2013	4	8	7	Yes	Yes	I will check back for the new features. You should have an opt-in e-

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
12:02:24						mail list to keep people up to date.
8/30/2013 10:02:25	6	9	8	Yes	Undecided	
8/30/2013 10:02:25	6	9	8	Yes	Undecided	
8/30/2013 16:26:18	3	2	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/1/2013 17:41:06	3	8	10	Yes	Yes	
9/1/2013 20:43:56	3	7	9	Yes	No	
9/2/2013 5:27:47	5	1	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/2/2013 13:35:24	7	7	4	Yes	No	As a Geography student I found this tool very interesting. Nice work!
9/3/2013 14:32:29	7	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Fortunately, I'm very conscious of the geolocation information I share. (I have given talks in this area to teens before.) I was actually surprised that only 1/200 was flagged. But because I tweet so much, the last 200 tweets may not be a good sampling of "activity" tweets. Thus, my location privacy rating was (pleasantly) much lower than I expected, and I did not receive personalized suggestions on reducing oversharing risk. I would love to see Instagram, Foursquare and the like eventually incorporated into this app. Great tool!

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/3/2013 18:30:17	3	1	6	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/3/2013 21:54:49	6	9	8	Yes	Yes	
9/3/2013 21:58:08	4	2	7	Yes	Yes	
9/3/2013 21:59:17	3	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/3/2013 22:00:17	1	1	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/3/2013 22:01:09	4	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Very interesting! And useful. Re: "How would you rate the personalized suggestions you received on reducing your over sharing risk? ": There were no suggestions because I showed no risk.
9/3/2013 22:06:57	7	10	6	Undecided	No	
9/3/2013 22:07:10	1	1	10	Yes	Geosocial Footprint did not locate areas of	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/3/2013 22:15:20	5	5	1	No	Geosocial Footprint did not locate areas of concern for my account	This website does not work. I enabled all scripts and nothing happened when I pushed the various buttons
9/3/2013 22:27:21	5	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/3/2013 22:59:45	7	6	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 0:37:13	3	2	1	Yes	Geosocial Footprint did not locate areas of concern for my account	No risk in my case may be due to language not being english
9/4/2013 1:12:59	3	2	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 2:59:56	5	2	10	Yes	Geosocial Footprint did not locate areas of	I am strongly interested in Internet privacy and appreciate anything that helps me manage my online presence, particularly location data so I hope you get this up and running. Good luck.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 4:52:38	8	9	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 5:30:58	8	9	10	Yes	Yes	Scary, but informative!
9/4/2013 5:59:06	3	1	5	Yes	Geosocial Footprint did not	Great service, keep up the good work
9/4/2013 7:08:57	1	1	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	Interesting. I came out clean but when I looked at my tweets they do have locational references, fireflies, bluebirds, bears, forsythia, snow storm, visiting NYC... vague but locational
9/4/2013 7:19:22	1	1	9	Yes	Geosocial Footprint did not locate areas of concern for my account	Great idea - finally a website that seeks to educate about geotagging rather than use the info for other means. Nice work.
9/4/2013 7:26:23	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 7:26:36	2	2	3	Yes	Geosocial Footprint did not locate areas of concern for	Great idea, well implemented.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 7:38:43	1	1	7	Yes	Geosocial Footprint did not locate areas of concern for my account	My account was just fine but I checked some friends and Geosocial Footprint successfully told me where my friend lived (I knew anyway). Scary accurate!
9/4/2013 7:49:17	1	1	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 8:14:32	3	3	7	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 8:33:46	1	10	8	Yes	Yes	
9/4/2013 8:36:59	3	7	10	Yes	Yes	
9/4/2013 8:37:55	3	3	5	Yes	Geosocial Footprint did not locate areas of concern for my account	I don't have any of the location features turned on. What would be interesting is trying to determine my location based on people I follow and who I interact with. Really interesting project. Nice work
9/4/2013 8:38:06	2	2	6	Yes	Geosocial Footprint did not locate areas of concern for my account	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 8:48:00	3	1	5	Yes	No	
9/4/2013 8:48:07	8	8	10	Yes	Geosocial Footprint did not locate areas of concern for my account	Great work. Extremely useful for people who arent asare of the danger of geotags
9/4/2013 9:05:39	1	9	8	Yes	Yes	
9/4/2013 9:57:13	2	3	2	Yes	No	Geosocial confirmed that I was being safe with my geolocation and not revealing my home or work areas.
9/4/2013 9:59:25	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	None of the accounts I tested showed any location concerns at all, which makes me wonder if it's really working.
9/4/2013 10:27:40	3	2	6	Yes	Geosocial Footprint did not locate areas of concern for	
9/4/2013 11:06:21	9	7	1	No	Yes	I only geotag tweets from places I don't care about people knowing I am. You didn't pick up any private places
9/4/2013 11:25:21	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	You should be clear about your privacy policy and user agreement. Also- if this is meant to be educational, in the sense that it helps users become more aware of risks associated with tweets/locations- you should consider getting a subject matter expert on personal protection to provide guidance and advice- thereby helping give perspective.
9/4/2013 11:31:31	7	10	5	Yes	Yes	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 11:35:20	4	8	9	Yes	Yes	
9/4/2013 12:10:44	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Going 200 tweets is not enough
9/4/2013 12:22:27	6	7	8	Yes	Yes	
9/4/2013 12:42:36	8	2	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 13:12:33	3	4	6	Undecided	No	
9/4/2013 13:15:35	2	2	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 13:39:02	6	8	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 13:53:15	1	1	4	Yes	Geosocial Footprint did not locate areas of	Just started exploring the website, but I love the idea. keep up the good work!

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 13:55:08	7	2	8	Yes	Yes	
9/4/2013 14:06:45	1	1	5	Undecided	No	It gave my location as somewhere in the US, wheras I am in the UK
9/4/2013 14:32:09	3	2	7	Yes	Geosocial Footprint did not locate areas of concern for my account	Very neat tool. Thank you very much.
9/4/2013 14:42:28	4	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	Good Luck with the research. It did not find any location identifiers for my account. I have a twitter acct but rarely tweet. I mainly lurk in background to gather info, insigtht, and ideas in my own PLN. Overall for all social media, I try to be careful regarding security threats, identity, and location.
9/4/2013 15:19:08	3	3	3	Yes	No	
9/4/2013 15:43:18	4	5	10	Yes	Undecided	
9/4/2013 15:44:32	2	1	8	Yes	Geosocial Footprint did not locate areas of concern for	
9/4/2013 16:10:45	8	7	6	Yes	Geosocial Footprint did not locate areas of concern for my account	Great idea, great program!

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 17:15:31	8	8	8	Yes	Yes	
9/4/2013 17:19:38	2	2	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 17:31:12	1	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 17:38:27	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	Ui isn't intuitive controls are where the footer normally resides. Most of the page is taken up telling you how twitter works nothing about how to make it work. It told me it was loading 200 tweets eventually after i'd finally figured it out then showed at map of America somewhere I've never been. It didn't say it had found tweets or not. So maybe i haven't figured out how it works. The colour of the buttons appears to be significant but its not clear why or how. If I clear tweets am I removing them from the analysis or from twitter? Fairly poor user experience
9/4/2013 17:57:20	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	There are a couple of typos in the intro text on the home page: This website provides twitter users with an oppurunity to view their geosocial footprint. In additional it informs users of some potential areas of concern with their current sharing habits. To begin, enter you oppurunity -> opportunity additional -> addition, enter you -> enter your
9/4/2013 19:25:59	8	8	8	Yes	Yes	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 19:29:56	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 19:45:11	2	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	GQ through Reddit brought me here
9/4/2013 19:48:50	4	3	10	Yes	Geosocial Footprint did not locate areas of concern for my account	This is an excellent educational tool!
9/4/2013 20:15:49	3	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 20:21:19	3	1	2	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 20:26:43	3	2	1	Yes	Geosocial Footprint did not	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 20:56:34	3	3	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 20:59:29	3	2	10	Yes	Yes	Great program - congrats!
9/4/2013 21:05:16	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 21:27:48	1	9	10	Yes	Geosocial Footprint did not locate areas of concern for my account	I was reading The Hill Newspapers signed in to Twitter using Google. Newsmax asked to vote in a poll. I did complete the poll than Newsmax pulled up a map and asked me is this where you live. I was my home. I have never had this happen to me before it frightened me. How do I get off of Google information what-ever. Google shares too much personal information. I recently signed up to sign in with Google, I was with Yahoo, no problem with Yahoo. I didn't use my name with yahoo, but Google used my name. I will delete the account.
9/4/2013 22:21:22	1	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 22:33:32	2	1	10	Yes	Geosocial Footprint did not locate areas of	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/4/2013 22:43:06	3	1	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/4/2013 23:07:06	1	1	2	Yes	Yes	
9/4/2013 23:13:55	4	7	7	Yes	Yes	
9/5/2013 0:29:01	2	1	3	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 1:00:42	10	1	10	Yes	Yes	
9/5/2013 1:42:20	5	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	I appreciate the thought and effort that went into producing this site. In general, I want to be more informed about my privacy in relation to my web use.
9/5/2013 2:18:31	8	8	6	Yes	Yes	
9/5/2013 3:43:00	1	1	8	Yes	Geosocial Footprint did not locate areas of concern for my account	Great idea! Very useful and important work. Thank you :)
9/5/2013 5:03:06	3	4	1	Yes	Geosocial Footprint did	So far it seems to be stymied by private accounts, which is good. But this raises the question, if a profile isn't public, who could do this sort

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/5/2013 6:10:58	7	4	6	Yes	Yes	
9/5/2013 6:15:18	10	10	5	No	No	
9/5/2013 6:26:22	3	1	3	Yes	Geosocial Footprint did not locate areas of concern for my account	Great idea, I'm sure a lot of work went into it. Thanks
9/5/2013 6:28:56	8	5	6	Yes	Yes	Very interesting project, thanks.
9/5/2013 6:32:04	3	3	5	Yes	Yes	
9/5/2013 6:33:01	4	6	7	No	Geosocial Footprint did not locate areas of concern for my account	Why the fuck would anybody wsnt to know where I am? I'm no crook, or runaway or anything that someone needed to know my location. I live a quiet life and just want to be left alone. My life is mediocre and I have no idea why someone would think my activities are even worth tracking.
9/5/2013 6:43:12	7	4	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 7:40:53	3	10	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 7:48:40	3	8	5	Yes	Geosocial Footprint did	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/5/2013 8:09:52	5	5	9	Yes	Yes	
9/5/2013 8:36:21	1	1	10	Yes	Yes	This is awesome! I teach kids about social media and the data they leave on the internet, this is going to be a great tool!
9/5/2013 10:12:50	6	9	10	Yes	Yes	
9/5/2013 10:14:54	1	1	10	Yes	Geosocial Footprint did not locate areas of concern for my account	This is bloody brilliant. I'm always concerned about making sure my geocoding isn't activated on my profiles for just about everything. And I'm glad to see that twitter or my phone haven't accidentally slipped that into my tweets.
9/5/2013 10:27:39	1	1	9	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 10:49:40	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Great tool!
9/5/2013 11:07:45	2	2	3	Yes	Geosocial Footprint did not locate areas of concern for my account	thanks for putting the app up
9/5/2013 11:10:56	1	1	1	Yes	Geosocial Footprint did not locate areas of	Really interesting project, I want to know a lot more.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/5/2013 11:26:00	1	6	8	Yes	Yes	Nice job. Will raise awareness about oversharing.
9/5/2013 11:29:20	5	7	8	Yes	Yes	
9/5/2013 11:30:48	4	1	10	Yes	Geosocial Footprint did not locate areas of concern for my account	This is a great tool. Immediately I did realize the power for it to be used to find info on others. I suggest an OAuth to use it. But more people are starting to question Internet safety. The hidden geolocate information concerned me most. Also what if followers/following also help pinpoint? Scan
9/5/2013 11:32:50	8	9	6	Yes	Yes	I knew it but it's good to be reminded!
9/5/2013 11:40:01	3	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 12:13:39	7	7	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 13:10:56	2	9	8	Yes	Undecided	
9/5/2013 13:11:57	3	8	8	Yes	Undecided	
9/5/2013 13:22:30	7	10	10	Yes	Geosocial Footprint did not locate areas of concern for my account	It's a good eyeopener.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/5/2013 13:53:39	5	5	3	Yes	Geosocial Footprint did not locate areas of concern for my account	The suggestions should be a bit more specific. Perhaps detailing what apps that are posting the geolocations would be best. in my case, my geotagged tweets are postings from foursquare which i intentionally shared on Twitter.
9/5/2013 14:51:35	10	1	4	Yes	Yes	
9/5/2013 15:59:57	4	3	9	Yes	Geosocial Footprint did not locate areas of concern for my account	Surprised, but I don't tweet from a mobile phone. :) I think that makes a difference? No Risk Total Tweets Collected: 200 Geo Tweets: 0 Place Tweets: 0 High Risk Alerts: 0 Geocoded Tweets: (feature coming soon!)
9/5/2013 16:10:13	1	1	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 17:27:39	8	9	7	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/5/2013 19:14:28	5	8	6	Yes	Yes	
9/5/2013 20:12:06	2	8	8	Yes	Undecided	
9/5/2013 20:12:32	3	8	7	Yes	Undecided	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/5/2013 21:03:57	3	10	7	Yes	Undecided	
9/5/2013 23:03:47	10	1	1	No	No	As someone who's a frequent user of location based services (Foursqare) and one who enables geo location on my phone (and various apps!) - you got me SOOOOO wrong!! maybe if you increase your Twitter API limits (beyond 200 tweets), you'll have a much better outcome. Cheers @razchorev
9/6/2013 2:33:19	3	7	3	Yes	Undecided	
9/6/2013 3:48:49	7	9	1	Yes	Yes	
9/6/2013 7:51:44	7	8	8	Yes	Yes	
9/6/2013 9:15:23	3	9	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/6/2013 9:26:19	2	9	10	Yes	Yes	I guess I forget to turn off my gps a lot. From this map it's pretty obvious where my work and apartment is. Damnit... You should put a direct link to deleting the tweets.
9/6/2013 9:57:45	5	10	7	Yes	Yes	
9/6/2013 10:57:26	3	10	10	Yes	Yes	I'm not too worried about sharing my location, even after seeing my house lite up like a Christmas tree
9/6/2013 12:21:16	7	3	5	No	Geosocial Footprint did not locate areas of concern for	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/6/2013 12:48:55	4	10	10	Yes	Yes	I didn't realize I was tweeting my location on most of these. To the untrained eye these just look like places I like to hang out. Strangers wouldn't know they're my house or work. My friends and family would, but they already know this data anyways. I guess I'm confused at the risk here?
9/6/2013 13:30:32	5	2	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/6/2013 13:47:09	5	10	9	Yes	Geosocial Footprint did not locate areas of concern for my account	Didn't find my house, but the footprint is scary. I don't venture out of that boundary often.
9/6/2013 17:41:15	8	8	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/6/2013 21:19:39	4	9	9	Yes	Undecided	
9/6/2013 21:51:40	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	While I was already aware of location privacy risks, I am interested in this tool as a way of illustrating data privacy issues and think it has potential for that purpose.
9/7/2013 1:49:13	2	8	10	Yes	Yes	Mostly was foursquare check-ins.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/7/2013 10:21:17	5	10	10	Yes	Yes	Just made my tweets private after seeing this. I was high risk with 148 out of 199 and you knew where I worked and lived.
9/7/2013 16:52:04	10	10	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/7/2013 19:28:25	8	9	8	Yes	No	
9/7/2013 20:04:49	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	It showed nothing for my own account which I'm glad about as I do like to keep my privacy :) But I do volunteer work for a page and it showed a pretty precise location for it etc Interesting stuff...keep up the good work :)
9/7/2013 20:55:34	5	10	10	Yes	Yes	I share my location openly but I don't like seeing my house on here.
9/7/2013 23:20:02	1	1	1	No	Geosocial Footprint did not	I do not think the website worked. I looked up a few different accounts and none had any data
9/7/2013 23:50:09	7	9	5	Yes	Yes	As a quantitative geographer I'd like to see more people providing anonymous coordinate information. There is a lack of information on different types of movements and the processes that underlying movement patterns.
9/8/2013 1:01:26	3	8	8	Yes	Undecided	I think a KML would be more user friendly as a download. What do I do with a csv?
9/8/2013 1:43:59	3	9	9	Yes	Undecided	
9/8/2013 15:14:46	10	1	10	Yes	Geosocial Footprint did not locate areas of concern for	Within the first 45 mins of the Fed's becoming aware of a Yes Men/San Diego Museum of Art hoax, they proved that they have instant access to Twitter user accounts - by shutting down the hoaxster's account - without warning or notification from Twitter.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/8/2013 16:13:19	10	10	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/8/2013 19:15:59	3	9	8	Yes	Undecided	Can I put myself on a do not search list for your service? I don't want other seeing my footprint.
9/9/2013 1:33:42	1	1	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	almost everyone i tried doesnt share GPS data so i actually havent seen a result. everyone cant be found. Q3 is therefore a middle of the road answer because it's not applicable.
9/9/2013 3:34:52	1	2	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/9/2013 10:32:19	3	8	8	Yes	Undecided	
9/9/2013 10:50:39	6	6	6	Yes	Yes	Nice service!
9/9/2013 10:55:49	4	4	8	Yes	Yes	
9/9/2013 12:56:33	8	7	5	Yes	Undecided	
9/9/2013 13:21:50	3	2	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Really great idea! Thanks! Though this time nothing concerning was found for my account, I´m really looking forward to some of the new features. I think being aware of how many informations someone can get out of your tweets, even though you think you might be a "private" person on Twitter, might help people understand how important privacy and always being careful with what you share is!

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/9/2013 13:50:32	4	2	4	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/9/2013 17:10:22	2	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/9/2013 15:52:48	3	6	5	Yes	Yes	
9/9/2013 17:11:35	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for	
9/9/2013 18:53:57	2	2	2	Yes	Geosocial Footprint did not locate areas of concern for my account	Not sure if this is possible, but provide examples of accounts that are crazy. Took me a while to find an account that actually did something on the map. Was beginning to wonder if it worked.
9/9/2013 22:14:14	6	2	9	Yes	Geosocial Footprint did not locate areas of concern for my account	you can request the footprint/privacy risk of any twitter account, even you are not the owner of the account - is this intended? kind regards
9/10/2013 2:03:53	5	2	1	Undecided	Geosocial Footprint did not locate	Interesting, but not very far developed yet

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/10/2013 4:40:58	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/10/2013 6:15:34	2	2	1	Yes	Geosocial Footprint did not locate areas of concern for my account	I noticed one mistake: Despite me saying in my profile "glad to be in Germany" (virtually only location I share), your algorithm apparently didn't notice that but showed the map of the US! No big deal, but should be improved in future versions, imho. Otherwise great idea, thx for the hard work you invested!
9/10/2013 6:43:03	10	10	1	Yes	No	I consider it important, useful, and good etiquette to share my location in my tweets.
9/10/2013 6:51:45	5	3	1	Yes	No	
9/10/2013 7:08:59	7	7	1	Yes	Geosocial Footprint did not locate areas of concern for my account	I guess you just used the "coordinates" and "place" keys in your analysis. Therefore showing me a big green "NO RISK" is somehow misleading. It might be a good idea to let the users know more clearly, that much more geoinformation can be extracted by semantic and context analysis of their tweets. Looking forward to use your app again, when further analysis is available.
9/10/2013 7:34:15	2	2	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/10/2013 8:18:07	1	1	6	Yes	Geosocial Footprint did not locate areas of concern for	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/10/2013 10:39:04	2	2	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	As a Europe based user, I had to zoom out from North America to use. Might be better to start less geographically specific and zoom in!
9/10/2013 10:59:49	4	3	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	I was delighted to find that my social media paranoia has paid off and I am (so far) not locatable via Twitter.
9/10/2013 12:23:50	6	6	6	Yes	Yes	
9/10/2013 16:22:13	3	9	8	Yes	Undecided	
9/10/2013 16:49:07	3	9	8	Yes	No	The areas of concern seem to be triggered by text. It would make more sense to go off time and clustering. If you look at where I post at night, you can see my house, yet it guesses my house is near my office because I said I was on my way home?
9/10/2013 16:52:30	5	3	1	Undecided	Geosocial Footprint did not	Regarding Q "How would you rate the personalized suggestions you received on reducing your "
9/10/2013 19:38:04	4	3	1	No	Geosocial Footprint did not locate areas of concern for my account	I thought the app would be able to detect my location based on some other factor, aside from my already allowing location sharing on my account. What this app actually helped reinforce was that I'm satisfied with the amount of location sharing I do (which isn't much, about 10% of tweets and when I do it's intentional and for promo or business). It's plain dumb to broadcast personal stuff like home or where I'm eating at the moment I'm eating there. When I broadcast location it's usually when I'm about to leave. Safety first.
9/10/2013 23:39:02	3	3	10	Yes	Geosocial Footprint did not locate	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/11/2013 0:02:08	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	This is more of interest (to me) as an open-source intelligence gathering tool.
9/11/2013 10:54:53	6	1	10	Yes	Yes	
9/11/2013 12:02:35	8	4	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/11/2013 15:07:58	7	7	8	Yes	Yes	
9/11/2013 20:09:20	3	9	8	Yes	Undecided	
9/12/2013 4:41:55	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/12/2013 4:42:21	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/12/2013 8:30:22	3	3	3	Yes	Geosocial Footprint did not locate areas of	I don't use geoinformation myself but i;\'ve looked at a few friends and i'm amazed about what i can fnd. Some of them were lying about there whereabouts in tweets. So the tool has a lot of effect. I'll never never use geoinformation in twitter myself.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/12/2013 9:16:33	10	10	1	Undecided	No	Sorry man, but it doesn´t works.
9/12/2013 17:48:26	7	4	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 0:55:30	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Extremely fascinating and useful piece of programming: This could be used by individuals and/or organizations to check the Geossocial Footprint of members or friends and give them helpful warnings.
9/13/2013 2:09:07	2	8	8	Yes	Geosocial Footprint did not locate areas of concern for my account	I'm waiting for the tweet context analysis, geocoded tweets, hoped GF would be able to see through for used IP addresses for example to locate tweeps. Tried a few other tweeps like @4positiviteit who has Nijmegen in the bio and no report at all for that and @jacquessmits who got :ow Risk 4 location ratings - twitters complete addresses zipcode and numbers, @BCoachOpleiding who twitters cities, @cpap73 city in bio, @Beddoloog complete address in bio, @chgroenusa city in bio, none of them reported. @w8eens who tweets with GPS location was reported adequately high risk. So it seems to work fine!
9/13/2013 7:54:43	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Only No Help as I had no items of concern to advise me on
9/13/2013 11:32:29	1	1	3	Yes	Geosocial Footprint did not locate	I have mentioned some names of towns and villages I visited and near my home.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/13/2013 11:40:09	1	1	8	Yes	Yes	I just gave feedback that the single Geotag I've made was not shown. It worked the second time.
9/13/2013 11:51:28	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 11:55:07	1	1	1	No	Yes	
9/13/2013 12:09:24	4	4	7	Yes	No	Well, I am well aware when I share location information, so the tool did not change my location privacy assessment. As I do not tweet often, the "above average" message is no concern to me. When zooming in, I noticed that the four located areas of concern in London were neither the place where I live, nor the place where I work. I think it's a great tool, especially perhaps for people who do not notice when they share their locations!
9/13/2013 12:33:12	10	10	1	No	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 12:41:46	1	1	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 12:44:41	10	10	1	No	No	
9/13/2013 12:48:24	2	2	1	Yes	Yes	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/13/2013 13:48:48	3	3	4	Yes	Geosocial Footprint did not locate areas of concern for my account	Since I only had 2 locations, I had no tips.. Nice app!
9/13/2013 13:20:39	7	7	1	Undecided	Undecided	i wasnt able to get any information on the twitter usernames I entered
9/13/2013 13:48:57	3	7	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 14:09:28	5	5	2	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 15:05:51	1	1	4	Yes	Geosocial Footprint did not locate areas of concern for my account	I use location terms like city or venue names in my tweets, but they wasn't detected by geosocial footprint. But with this website I'm now more aware about privacy issues even though I thought Im careful. Thx
9/13/2013 15:41:53	5	10	6	Undecided	Yes	Good approach, but missing hashtag search (twitter is famous for this). Greetz from Austria.
9/13/2013 16:04:32	2	2	1	Yes	Geosocial Footprint did not locate areas of	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/13/2013 17:40:31	1	1	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 18:01:22	3	2	2	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 19:28:19	8	4	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/13/2013 21:51:45	6	1	5	Yes	Undecided	
9/14/2013 1:37:47	3	4	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	tried 6 accounts, non got results
9/14/2013 2:16:13	3	2	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/14/2013 4:46:09	1	1	10	Yes	Geosocial Footprint did	Good work! Best regards from Germany

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/14/2013 5:03:24	5	5	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/14/2013 5:19:47	6	4	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/14/2013 5:23:37	8	8	1	No	No	unfortunately it did not work
9/14/2013 11:45:23	1	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/14/2013 12:31:45	2	2	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/14/2013 14:39:11	5	1	1	Undecided	Geosocial Footprint did not	
9/15/2013 4:59:54	2	6	10	Yes	Yes	I was surprised by the results... I will get my family to check it out too.
9/15/2013 5:56:16	3	2	1	Yes	Geosocial Footprint did not locate	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/15/2013 6:23:06	3	1	8	Yes	Geosocial Footprint did not locate areas of concern for my account	Great product!
9/15/2013 8:48:36	6	10	8	Yes	Undecided	
9/15/2013 9:13:12	6	6	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/15/2013 9:32:04	6	4	9	Yes	Yes	
9/15/2013 9:58:45	10	10	5	Undecided	Undecided	
9/15/2013 10:00:59	3	8	8	Yes	Yes	looks like it only uses english. plus add others -Germany
9/15/2013 10:28:56	6	4	9	Yes	Yes	
9/15/2013 10:42:33	5	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/15/2013 12:39:11	2	5	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/15/2013 13:55:58	2	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/16/2013 3:09:11	10	5	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/16/2013 8:06:42	4	4	1	No	Geosocial Footprint did not locate areas of concern for my account	I had no results
9/16/2013 14:44:05	5	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/16/2013 17:32:28	8	3	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Didn't have any personalised suggestions as it said account was ok. However, I'd spent last week at a conference, using a # tag a lot. It might be useful in future iterations to see if it's possible to link tags & locations, for, while not as definite as a location set by the phone etc., lots of tags from a particular location could indicate possible locations, tho guess you'd need access to multiple Tweeters. Hope that makes sense - writing on tablet :-)

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/18/2013 11:17:12	1	1	7	Yes	Geosocial Footprint did not locate areas of concern for my account	Maybe try to include Facebook check ins etc? Although I would be inclined not to use it if j had to log into Facebook, so actually no, don't do this
9/18/2013 12:28:30	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Interesting.
9/19/2013 3:17:01	7	10	1	Yes	Geosocial Footprint did not locate areas of concern for my account	tryed with @u14183 and nothing was happen.
9/19/2013 6:57:37	5	5	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/19/2013 7:56:20	10	6	1	Yes	Geosocial Footprint did not locate areas of concern for my account	A fascinating tool
9/19/2013 16:16:25	3	3	5	Undecided	Geosocial Footprint did not locate areas of	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/20/2013 6:40:04	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/20/2013 8:23:38	3	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Potentially useful tool - without some feedback on sharing risk (just because I had no sharing information to provide feedback on) it's hard to assess the value.
9/23/2013 15:42:46	6	8	8	Yes	Yes	
9/23/2013 22:37:14	5	5	8	Yes	No	Very good tool
9/24/2013 2:30:41	4	4	10	Yes	Yes	Heatmap is good GUI
9/24/2013 17:01:29	5	5	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/24/2013 17:01:32	5	5	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
9/26/2013 10:40:13	8	10	8	Yes	Yes	
9/26/2013 14:47:19	1	1	10	Undecided	No	I wasn't able to locate anybody even open accounts

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
9/27/2013 14:07:37	5	4	1	Undecided	Undecided	My location is clear from some of my geographically-referenced tweets whether or not the tweet is geo-tagged.
9/27/2013 14:16:20	10	10	1	No	Yes	of the two major geolocations shown, one was wildly inaccurate.
9/28/2013 17:39:42	8	8	1	No	No	
9/30/2013 15:53:05	6	5	10	Yes	Yes	bu harika bir şey
10/2/2013 3:25:40	2	2	1	Yes	Geosocial Footprint did not locate areas of concern for my account	I'm very selective about turning location on. The only tweets were purposely geolocated for the USC Spatial Science Catalina Field trip to show places of interest. So while they show I was spending time at locations on Catalina Island, they show no patterns of tweeting or reveal workplace or home. That being said, I was pleased to see that nothing else showed up on the map.
10/2/2013 11:27:52	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
10/4/2013 11:10:09	6	6	7	Undecided	Geosocial Footprint did not locate areas of concern for my account	
10/6/2013 8:00:13	3	8	8	Yes	Undecided	I saw areas of concern but not sure how to check if they were accurate because I don't know the GPS location of my house. Maybe give a street address?
10/6/2013 8:01:35	4	9	9	Yes	Yes	Nice article. This is kind of scary. While I personally don't have any locations on the map, my kids each have our home and their local hangouts visible. Thanks for helping me be a better parent.
10/7/2013 3:37:36	3	2	5	Undecided	Undecided	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
10/7/2013 4:05:24	8	8	9	Yes	Geosocial Footprint did not locate areas of concern for my account	Develop its feature further to also check for hashtags
10/7/2013 8:59:48	3	9	10	Yes	Undecided	I didn't realize I was sharing my location so often. Does it collect location automatically on some tweets?
10/7/2013 9:37:16	6	6	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	No info or tweets showed on map? Windows phone incompatible? Interested in trying this out. Cindy Forbes @getmeoutnews
10/7/2013 11:28:06	4	10	8	Yes	Yes	Who knew that saying Fuck School would be enough for someone to figure out where I go to school.
10/7/2013 15:57:20	5	4	7	Yes	Geosocial Footprint did not locate areas of concern for my account	
10/7/2013 16:50:45	4	9	7	Yes	Undecided	I'm not sure what to think. It showed a few areas of concern. Most of them were wrong but one was marked as my home, but instead it was my university. I assume this means I'm spending too much time there or something?
10/7/2013 19:11:01	1	1	8	Yes	Geosocial Footprint did not locate areas of concern for my account	
10/8/2013 9:44:34	4	9	9	Yes	Geosocial Footprint did	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
10/8/2013 9:45:07	4	8	9	Yes	Undecided	
10/8/2013 10:04:49	4	8	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
10/8/2013 12:52:21	4	8	8	Yes	Undecided	
10/8/2013 16:00:03	4	8	8	Yes	Undecided	
10/9/2013 13:13:19	3	8	9	Yes	Undecided	Some of the areas of concern were remotely accurate but most were wildly incorrect. I don't live on the freeway.
10/9/2013 20:29:04	4	9	8	Yes	No	
10/10/2013 8:03:19	5	9	9	Yes	Undecided	
10/10/2013 10:36:41	1	5	5	Yes	Yes	
10/10/2013 15:20:31	2	2	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Thanks!
10/11/2013 13:53:25	6	6	8	Yes	No	I appreciate the educational component, but you could easily demonstrate this using a hypothetical person. Your application seems unethical from an educational standpoint because it provides an easily available tool to gain public, yet hard to find, information to a broad audience.
10/11/2013 15:36:03	5	6	7	Yes	Yes	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
10/11/2013 16:34:47	4	9	8	Yes	Undecided	
10/13/2013 20:55:17	3	8	8	Yes	Yes	1 of the 10 or 11 areas of concern were accurate. I am not sure if that is a good thing or a bad thing.
10/14/2013 15:40:44	5	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
10/15/2013 11:54:31	5	9	8	Yes	Undecided	
10/15/2013 16:18:10	5	10	8	Yes	No	
10/17/2013 10:06:15	1	1	1	No	Geosocial Footprint did not locate areas of concern for my account	
10/20/2013 9:07:28	10	10	10	Yes	Yes	son derece yararlı bir uygulama bence
10/22/2013 15:39:16	1	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
10/23/2013 21:53:38	4	9	4	Yes	Geosocial Footprint did not locate areas of concern for my account	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
10/24/2013 9:33:39	1	1	9	Yes	Geosocial Footprint did not locate areas of concern for my account	
10/24/2013 9:55:14	7	7	6	Yes	Yes	
10/27/2013 12:53:47	10	10	5	Yes	Undecided	
10/27/2013 16:10:45	10	5	7	Yes	Undecided	I'm happy to provide my location in tweets... helps people in the same area connect. I can see however how it could be a privacy concern when you tweet most of your tweets from home or office... there's crazies out there who might just use that info..
10/27/2013 16:15:28	10	10	3	Yes	Yes	Mhmm,... thinking about it again. This is very very helpful is showing the risk... but not helpful at all
10/28/2013 13:32:47	1	1	1	Yes	Undecided	
10/30/2013 4:28:32	5	2	6	Yes	Geosocial Footprint did not locate areas of concern for my account	would be good to develop features that alert users when location information has been identified.
10/30/2013 19:28:30	1	1	1	Undecided	Undecided	
10/31/2013 2:46:28	9	9	5	Yes	Geosocial Footprint did not locate areas of concern for my account	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
11/6/2013 20:36:47	10	10	10	Yes	Yes	
11/7/2013 0:55:20	2	4	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Good idea, thanks for making this!
11/9/2013 7:01:48	4	2	4	Yes	Geosocial Footprint did not locate areas of concern for my account	too soon. I was requested for this questionaire before I even had a chance to play with the website!
11/9/2013 8:26:04	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
11/9/2013 16:50:38	6	9	5	Yes	Geosocial Footprint did not locate areas of concern for my account	
11/11/2013 3:31:08	6	8	8	Yes	Undecided	
11/13/2013 16:12:47	1	1	1	Yes	Undecided	
11/14/2013 16:34:11	8	8	3	Yes	Yes	
11/14/2013 17:13:55	5	6	6	Yes	Yes	

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
11/15/2013 16:52:31	2	3	4	Yes	Undecided	
11/16/2013 7:44:30	7	7	7	Yes	Geosocial Footprint did not locate areas of concern for my account	looking forward to more options
11/21/2013 12:30:42	4	2	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	
11/22/2013 6:36:33	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	
11/24/2013 22:39:31	1	1	5	Undecided	Geosocial Footprint did not locate areas of concern for my account	
11/27/2013 5:01:49	2	7	8	Yes	Yes	
11/28/2013 9:30:55	2	2	10	Yes	Geosocial Footprint did not locate areas of concern for	I did tweet about you to teachers and mediacoaches.

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
11/29/2013 13:56:41	8	6	4	No	Yes	
12/2/2013 15:18:26	4	1	6	Yes	Geosocial Footprint did not locate areas of concern for my account	
12/9/2013 9:50:11	1	1	10	Yes	Geosocial Footprint did not locate areas of concern for my account	
12/9/2013 16:03:16	1	1	1	Yes	Geosocial Footprint did not locate areas of concern for my account	Great app, think that IOS users have a higher level of security by default and android more open. I rated the personalised suggestions as no help as I already had my account locked down
12/11/2013 8:22:53	8	6	3	Yes	Yes	
12/13/2013 10:12:27	5	5	5	Yes	Yes	
12/14/2013 3:03:17	1	1	5	Yes	Geosocial Footprint did not locate areas of concern for my account	Cool app
12/17/2013 6:14:52	3	2	8	Yes	Geosocial Footprint did not locate areas of	useful tool. Thankyou

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
12/22/2013 7:42:56	4	4	1	No	Undecided	For 5 twitteraccounts i found no risks at all
12/28/2013 8:06:33	8	10	9	Yes	Yes	
1/6/2014 11:30:50	8	9	7	Yes	Yes	
1/7/2014 19:09:17	4	1	5	Yes	Yes	
1/12/2014 21:59:57	8	8	7	Yes	Yes	
1/9/2014 16:15:57	10	10	8	Yes	Yes	
1/13/2014 5:46:53	10	3	10	Yes	Yes	
1/14/2014 6:10:59	5	10	7	Yes	Yes	
1/14/2014 14:02:55	1	1	6	Yes	Yes	
1/16/2014 0:07:08	5	5	7	Yes	Yes	
1/17/2014 12:31:40	1	1	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	
1/20/2014 2:23:26	9	10	10	Yes	Yes	
1/20/2014 12:47:01	5	5	5	Yes	Undecided	
1/22/2014 14:05:51	3	6	8	Yes	Yes	Great tool! I am a geographer and will be using this in a course where students map their movements over the course of the semester using anonymous twitter accounts to explore how they interact with the

Timestamp	Prior to using Geosocial Footprint, how would you have rated your location privacy on Twitter.com?	After using Geosocial Footprint, how do you rate your location privacy on Twitter.com?	How would you rate the personalized suggestions you received on reducing your over sharing risk?	Did you find Geosocial Footprint educational?	If Geosocial Footprint located areas of concern, were any of them accurate?	General comments?
1/22/2014 22:58:37	3	1	1	Undecided	Geosocial Footprint did not locate areas of concern for my account	I don't think it is entirely accurate. I tweeted about being at the Detroit Auto Show, as well as being at home or going to a hockey game, all things which could tell people where I am.
1/23/2014 14:40:22	7	3	8	Undecided	Geosocial Footprint did not locate areas of concern for my account	
1/23/2014 15:57:48	6	6	5	Yes	Undecided	
1/24/2014 11:30:27	1	10	2	No	Undecided	
1/25/2014 21:51:53	4	2	7	Undecided	Yes	
1/29/2014 11:46:05	3	2	3	Yes	Yes	