

eBook Geotagging: Linking Literature and Location

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Abstract

Geotagging is a common practice used with photos, videos, and social media. Its use with text is less common, although some research has been performed with web pages, primarily news sources. It has also had limited use in online libraries and bibliographies. This project details the development of a tool for applying geotagging as annotations to electronic book (eBook) documents. The tool provides an easy way to highlight geographical references in an eBook text, map to visualize the geographical references in Google Maps, and save the geotag metadata as a special type of annotation in an eBook document. The tool uses annotations to generate Keyhole Markup Language (KML) files; which are shareable via Google My Places, email, or transfer to other sites such as social media. The geotag annotations provide a user with a toolset to explore geography, imagery and literature associated with geographical references included in eBooks in a seamless and user-friendly manner.

Introduction

Geotagging is the process of adding geographical identification metadata to various media. The metadata usually consists of latitude and longitude coordinates and other location – related information, such as the geocoded place name, data sources, etc. Geotagging is used primarily with photos; and has been applied to other media such as videos. Ways to extend geotagging to text documents have been researched, proposed and demonstrated; with little application development having occurred (Di Napoli, Gasparetti, Micarelli, and Sansonetti, 2010). This project demonstrates a method to apply geotagging and visualization of geotags to eBook documents.

Geotagging of text presents problems related to scanning for possible

geographical references (*placenames* or *toponyms*) located within a body of text, the disambiguation of the candidate placenames that were found, and the geocoding of the disambiguated placenames. Typically, annotations containing metadata resulting from the geotagging process are inserted into the text body, and appear as hyperlinks when the text is viewed. When a geotag is clicked, a web mapping or visualization service displays the geocoded location; along with the metadata that is included in the geotags (Lieberman, Samet, Sankaranarayanan, and Sperling, 2007).

This case study outlines the development of a geotagging tool that extends and enhances a free and open source (FOSS) eBook reader application called Calibre. The geotagger is an annotation tool that leverages the geocoding, mapping and file sharing

services offered by Google Maps and Google My Places. The geotagger eliminates some of the software automation normally involved in geotagging text. Instead of scanning the document for geographic references, the tool allows the user to decide which pieces of text are of geographic interest; and manually annotates them. In this way, the geotagger behaves in a fashion similar to the standard annotation tools in the eBook reader application.

Within the annotation process, the geotagger offers an automated and interactive method of visualizing the geographic references via Google Maps; and saving the metadata derived from the maps in the annotations. Geotag annotations are stored within KML files that can be shared and displayed on Google My Places, emailed or transferred to other sites such as Facebook (Ballard, 2009).

Geotagging a body of text adds spatial context to its narrative. With geotagging, places and geography can be visualized, adding spatial context to a novel or text book. It is a valuable research tool; and a way to explore the cultural history of a place through the linkage of literature and location.

Methods

Tools and Technologies

The geotagger was developed as an extension to the eBook reader that is included in the Calibre application. Calibre is a FOSS eBook software application that organizes, saves and manages eBooks, supporting a variety of formats (Figure 1). Other eBook readers, such as Amazon's Kindle and Barnes & Noble's Nook; were considered for this project; but their reader software is not

open source nor are their reader applications extendible in any way.

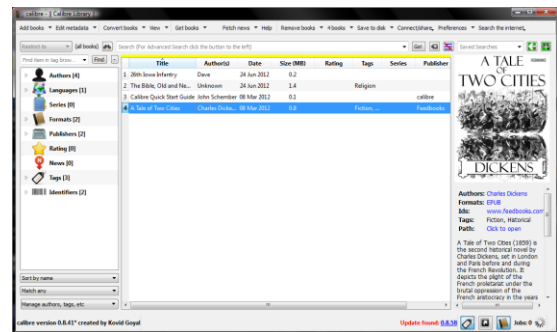


Figure 1. The Calibre application main window.

From the Calibre main window, a book that has been saved by the user can be selected and opened in the Calibre e-reader window (Figure 2). In the e-reader window, the eBook text can viewed, searched and annotated.

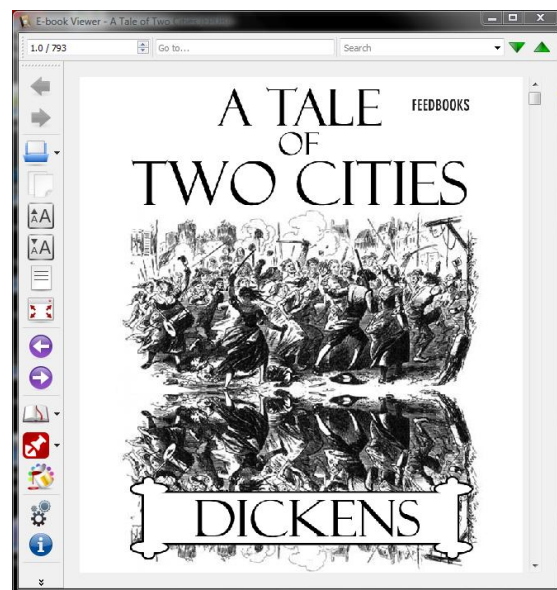


Figure 2. The Calibre e-reader window.

With the geotagging extension installed, users can add a new type of annotation to texts that includes geocoding, geotag metadata and user notes. The metadata is obtained by geocoding highlighted strings within the text; and displaying the geocoding results in a popup window. When a user selects

and saves a geocoding match from the list of candidate matches, the metadata is saved in a KML file that is associated with the eBook txt file. The highlighted text string is then given a red background; showing that it is a geotag annotation. Clicking on an existing geotag displays the saved location, eBook text and user notes in a popup window that is a Google Maps browser.

Sharing geotags for a specific eBook text is accomplished by copying its associated KML file to a Google My Places account. The KML files can also be emailed or added as links within other sites such as Facebook.

Development of the extension was achieved by modifying the source code of Calibre's eBook reader software. The primary development languages were Python and JavaScript. The integration of Calibre and Google Maps was accomplished via a web browser object included in the Python QT (PyQt) graphical user interface (GUI) toolkit; and the Google Maps JavaScript application programming interface (API).

The Google Maps API also provides a geocoding service; and this is used as a means to disambiguate the placenames selected within a text by the user. No additional data other than what is provided by Google Maps is required for the extension or by the end user of the geotagging tool.

Creating Geotags

The user initiates the geotagging process by highlighting a portion of text in an eBook document, and then right-clicking to display the reader application's context menu (Figure 3). From the context menu, the user selects *Geotag*; and the highlighted text is geocoded; with all candidate matches listed and displayed in

a popup window that includes Google Maps (Figure 4).

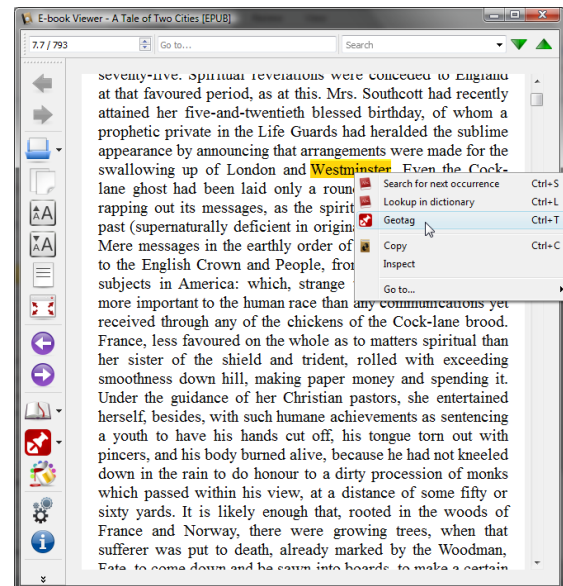


Figure 3. Create a geotag from the context menu.

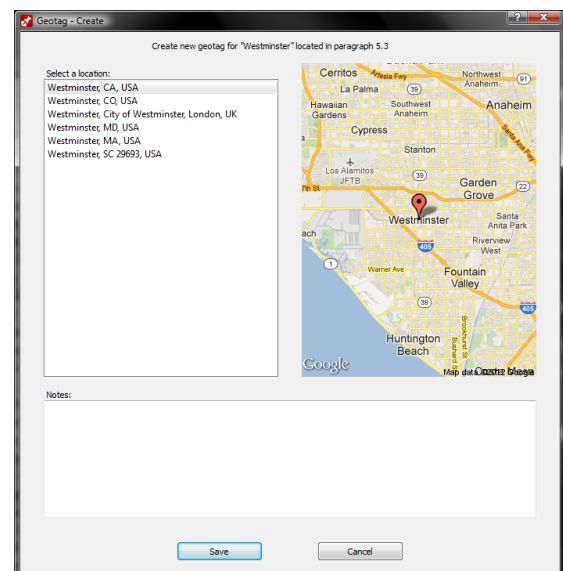


Figure 4. Geocoding results popup window.

Geotagging is a process of identifying and disambiguating references to geographic locations (Lieberman *et al.*, 2007). In this application, the Google Maps application programming interface (API) is used to perform the geocoding as well as producing maps for each candidate match in the geocoding results.

From the list of geocode matches, the user can select each match and view its corresponding map (Figure 5). If a satisfactory match is found, the user may enter any notes to save with the geotag (Figure 6), and click *Save* to add the geotag as a new annotation to the eBook text (Figure 7).

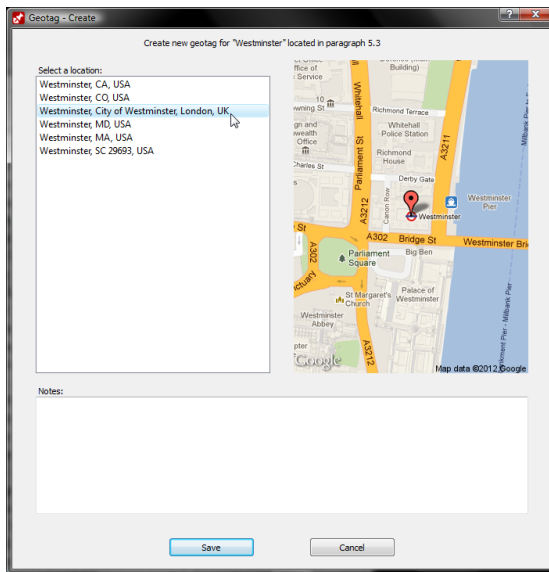


Figure 5. Selecting a geocoding match from the list of candidates.

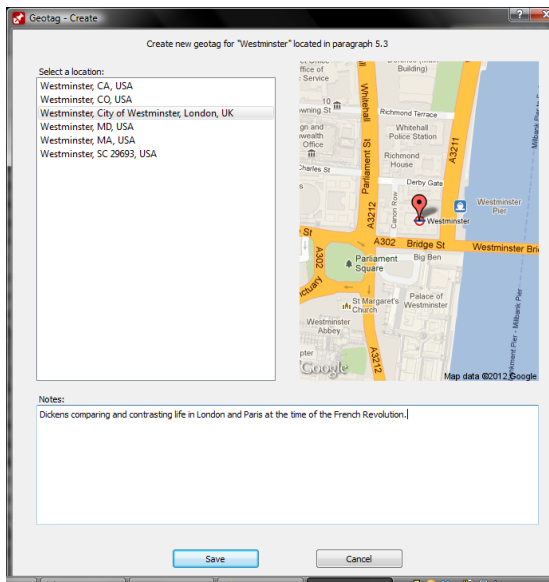


Figure 6. Adding user notes to a new geotag.

Geotags are saved as metadata within a KML file. Hyperlinks are added

to the eBook annotations that provide a connection between the eBook text and the entries in the KML file. When the user clicks on a geotag annotation, the hyperlink executes a JavaScript function that extracts the metadata from the KML file; and displays it in a popup window utilizing Google Maps (Figure 8).

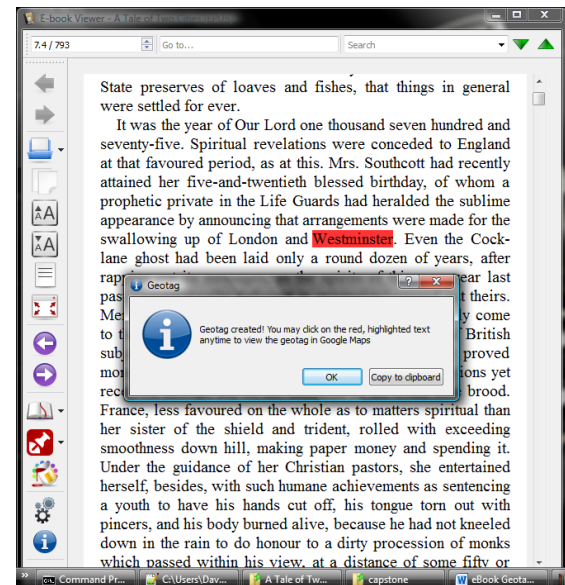


Figure 7. A new geotag added as an annotation in a text.

Viewing Geotags

The geotag annotations include metadata that stores the latitude and longitude coordinates, the geocoded place name and other map formatting information. The metadata also includes citation information that references the source document, its author, publisher and the position within the document, plus notes added by the user, which are displayed when the geotags are viewed.

An individual geotag can be viewed in an interactive map window by clicking on its red – highlighted hyperlink from within the eBook text. The geotag's location is marked with a push pin which displays the paragraph of text where the geotag was created (Figure 8).

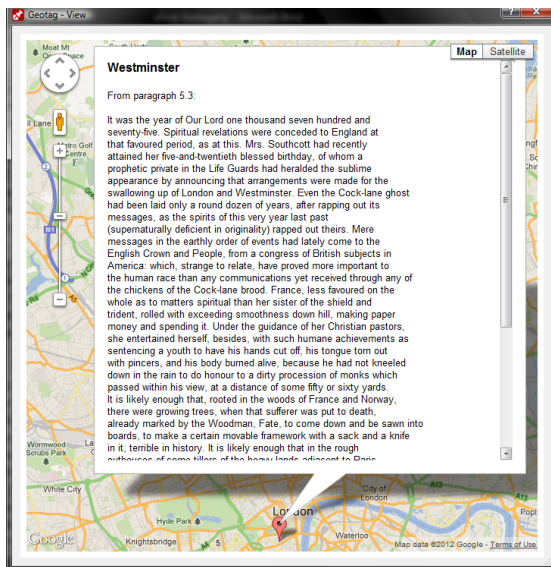


Figure 8. Viewing an individual geotag by clicking on the annotation's hyperlink within an eBook text.

All geotags that have been created in an eBook can be viewed at once in a single interactive map window by selecting *View Geotags* from the Geotag menu on the e-reader's toolbar (Figure 9).

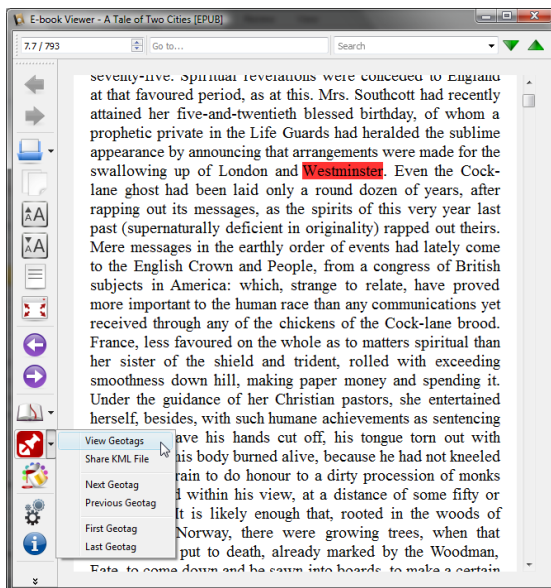


Figure 9. The *View Geotags* item from the Geotag menu that is included in the e-reader's toolbar.

When *View Geotags* is selected from the menu, a window is displayed that shows all the geotags in an interactive map (Figure 10).



Figure 10. Viewing all geotags from an eBook text within a single interactive map.

Clicking on any of the individual map markers in the map will display the geotag's metadata and source text (Figure 11).



Figure 11. Viewing a geotag's metadata in a map displayed via *View Geotags* from the Geotag toolbar menu.

Sharing Geotag KML Files

Geotag KML files can be viewed, edited, commented and collaborated on in Google My Places. The KML files, once they are uploaded to Google My Places, can be shared and linked to in Facebook and other social media sites.

To share a geotag KML file on Google My Places, it must first be uploaded to that site using a Google Mail (Gmail) user's login. The first step in this process is to select the *Share KML File* option from Geotag menu in the e-reader's toolbar (Figure 12).

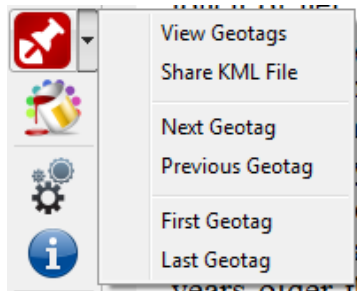


Figure 12. *Share KML File* option in the Geotag menu.

When this menu option is selected, a browser window pops up that displays the Google Maps main page, which includes a *Sign In* button in the upper-right corner (Figure 13).

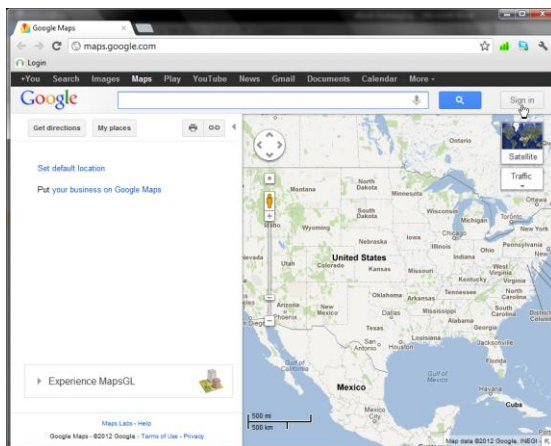


Figure 13. Google Maps with the *Sign In* button.

When the *Sign In* button is clicked, a login form is displayed, where the user enters an existing Gmail account login; or a new account can be created (Figure 14).

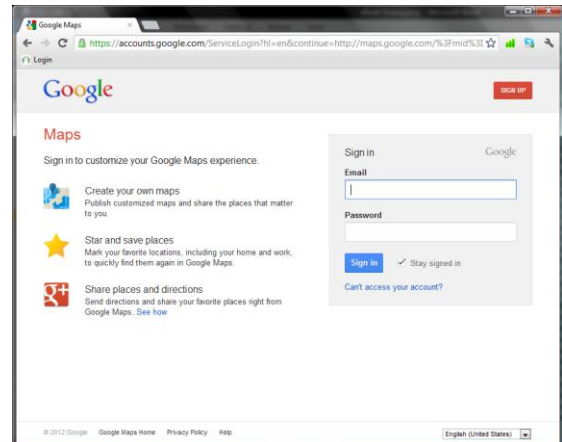


Figure 14. Google account login.

Note: If the user is already logged in to his Google account, the previous two steps are skipped; and the Google My Places page is displayed when the *Share KML File* option is selected from the Geotag menu on the e-reader's toolbar (Figure 15).

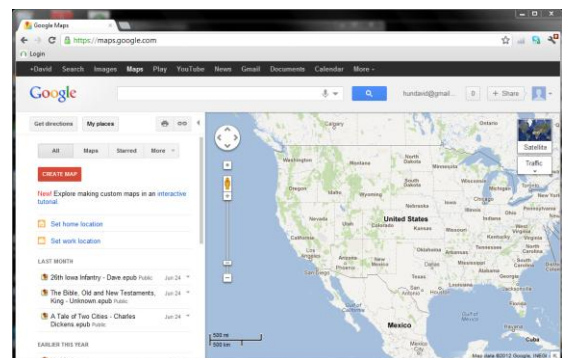


Figure 15. Google My Places main page.

Once the Google My Places page is displayed, the KML file upload can be initiated by clicking the *Create Map* button. This displays a web page that includes a form for adding a title and description of the new map; and an interactive mapper for creating new maps

in the user's personal maps space (Figure 16).

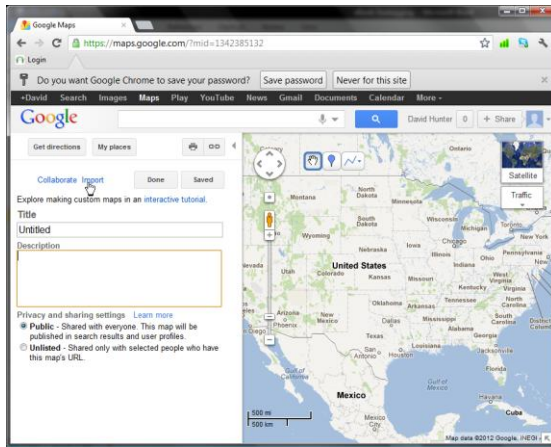


Figure 16. Create a new map in Google My Places.

Maps can be created using Google My Place's map building tools; or they can be created by uploading KML files that have been written using other tools; like the e-reader's geotag tool. Creating a new map in Google My Places from a KML file that was created elsewhere involves uploading the file to the user's personal space on Google My Places. Clicking the *Import* link on this page pops up a window with a form for uploading or linking to KML files (Figure 17).

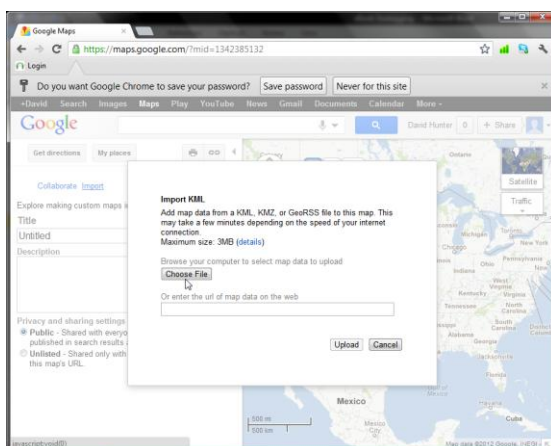


Figure 17. The *Import KML File* form.

Clicking the *Choose File* button opens a file selection dialog (Figure 18). In this dialog, the user navigates to the

directory where the eBook text file is stored; and selects the geotags KML file that is associated with the eBook; and clicks the *Open* button.

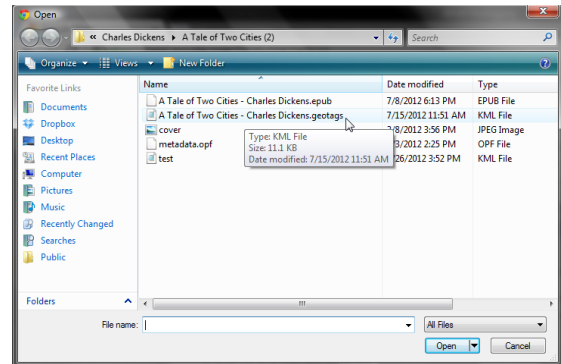


Figure 18. Import file selection dialog.

When The KML file is selected and opened in this dialog, it is uploaded and displayed in the Google My Places *Create Map* page (Figure 19).

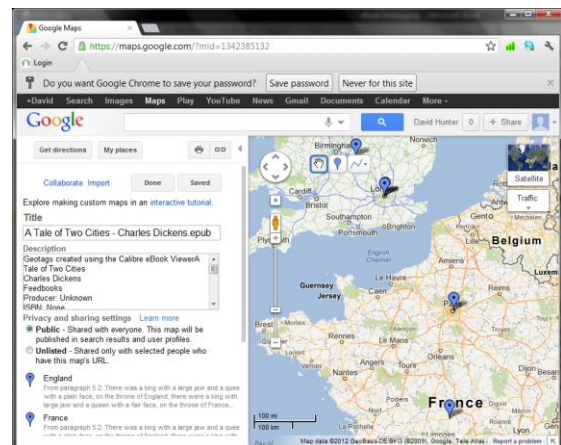


Figure 19. Geotag KML file uploaded and displayed in a new map in Google My Places.

Here, the map and its metadata can be further edited and formatted. Map markers can be added, removed and moved. Their texts can be edited and annotated; and the map can be zoomed and panned to provide an optimal view of the area of interest and the data that the user has added to it. When the map is ready to be saved, the *Done* button is clicked and the finished map is displayed (Figure 20).

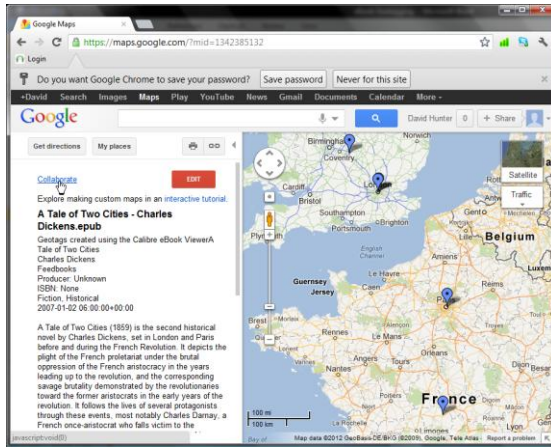


Figure 20. A new, finished map in *Google My Places*, created by uploading a geotag KML file.

Maps in a Google My Places account can be individually shared by its owner/creator by inviting other people to view, edit and collaborate on the map. Clicking the *Collaborate* button in a map page displays a window that enables others to be invited to collaborate on the map (Figure 21).

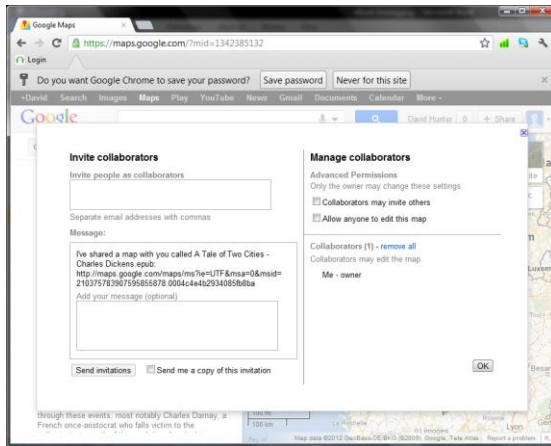


Figure 21. Invitation to Collaborate form in *Google My Places*.

In addition to sharing and collaborating, maps in a user's Google My Places account space can be linked to in Facebook and other social media sites. To create a link to a map, the *Link* button is clicked; which displays a form that allows the user to copy and paste the map's

Uniform Resource Locator (URL) string (Figure 22).

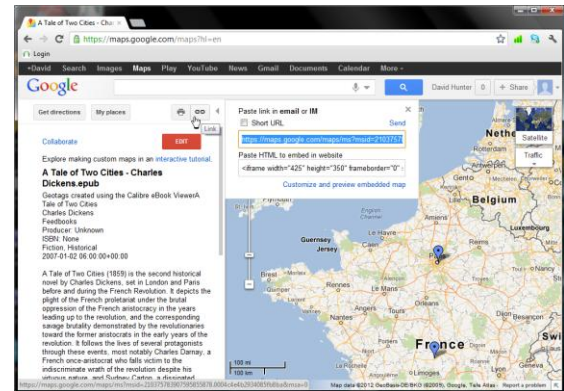


Figure 22. Displaying the *Link* dialog in *Google My Places*.

In this example, a new posting in Facebook was created that included a link to the map created in Google My Places. This provides another means to notify other people about the existence of the map; and to view and collaborate on it (Figure 23).



Figure 23. A Facebook posting that includes a link to a new map in Google My Places.

Project Evaluation Analysis

Software Demonstration and Survey Questionnaire

In order to gauge the usefulness of the eBook Geotagging concept and the way it was implemented in this project, a survey was conducted based on a demonstration of the software that was given to two small groups of people. The first group included ten graduate students from the Saint Mary's University Master of Science in Geographic Information Science degree

program; the second was a group of undergraduate students at the University of Wisconsin – River Falls. The first group was computer – savvy and sophisticated users of GIS technology. The second was just as computer – savvy; but they had no knowledge of GIS; outside of everyday use of online mapping services such as Google Maps.

Each survey respondent was informed of the purpose of the survey and were asked to make note of whether they used eBooks in any way on the following devices: on an eBook reader device, on a smartphone, tablet, or on a personal computer. Of the twenty total respondents, only three indicated they used eBooks, all of them from the non-GIS group of respondents. Of those, one owned a Nook, the other two read eBooks on their personal computers.

Each group was given a survey at the beginning of the demonstration; and after a short introduction and an explanation of the origins of the idea and some background information on the concept, the software demonstration took place. The demonstration lasted about half an hour. The *Calibre* application was introduced and described, and its e-reader launched with Charles Dickens' *A Tale of Cities* being displayed.

The groups of respondents were shown how to scroll and search through the book; and how to create a few new geotags on references to places such as “Bastille”, “Old Bailey”, “Paris” and “London.” They were then shown how to view the geotags that had been created in the book, in individual maps and as a set of points within a single map. The eBook’s KML file was uploaded to Google My Places and respondents were shown how to view, edit, and collaborate with the map using that service. They were also shown how to add a link to a map

within Facebook and were given a description of the potential for geotagged maps in social media.

After a question and answer period, respondents were thanked and their surveys were collected. The software demonstration survey questionnaire included seven questions. Each of these questions included four checkboxes. The checkboxes were labeled according to the following categories: “Very Good”, “Good”, “OK” and “Needs Improvement.” In addition, the survey included three qualitative questions (Figure 24; Appendix A).

E-BOOK GEOTAGGING DEMO SURVEY

Please help us evaluate the eBook Geotagging demo by completing this short questionnaire. Please answer each question to the best of your ability. We will use your feedback to determine how we can improve our software and demo.

	Very Good	Good	OK	Poor	Very Poor
Integration of Geotagging with the eBook reader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag creation feature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag toolbar menu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag text annotations and map viewer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Usefulness of sharing Geotagged maps in Google My Places	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Usefulness of sharing Geotagged maps in social media (Facebook, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall usefulness of eBook Geotagging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

What were the strengths of the geotagging extension? What did you find most useful or effective?

Which parts were the least useful or effective?

Comments and recommendations:

Figure 24. eBook Geotagging Demo Survey.

Results/Conclusions

For a quantitative analysis of the survey results, eight graphs were constructed displaying results of each survey question, plus the total response types for all seven questions. The first group of respondents, from the Saint Mary’s University Master of Science in Geographic Information

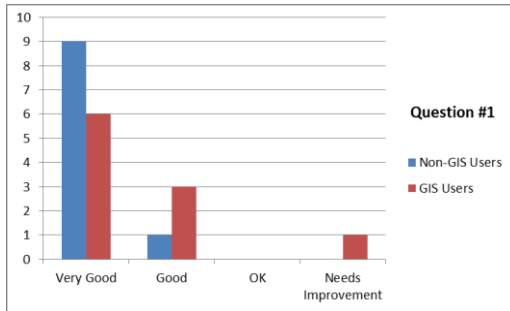


Figure 25. Survey results for question #1: “Integration of the Geotagging feature with the eBook reader.”

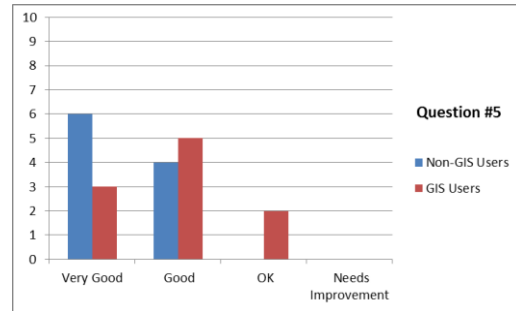


Figure 29. Survey results for question #5: “Ease of sharing Geotagged maps in Google My Places.”

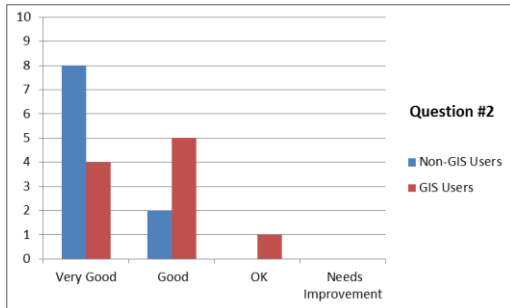


Figure 26. Survey results for question #2: “Intuitive design and ease of use of the Geotag creation feature.”

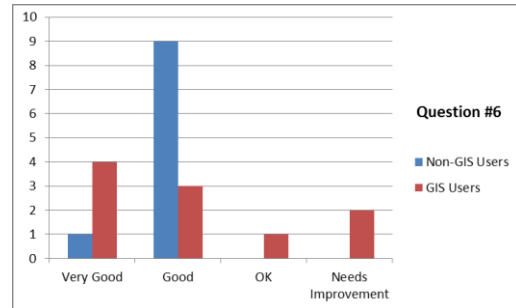


Figure 30. Survey results for question #6: “Ease of sharing Geotagged maps in social media (Facebook, etc.).”

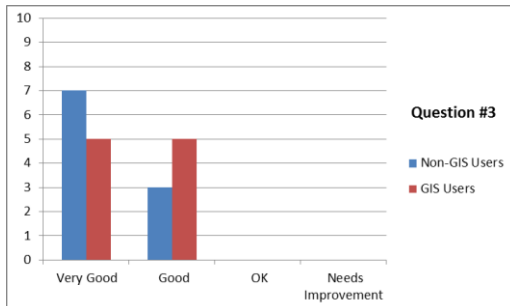


Figure 27. Survey results for question #3: “Intuitive design and ease of use of the Geotag toolbar menu.”

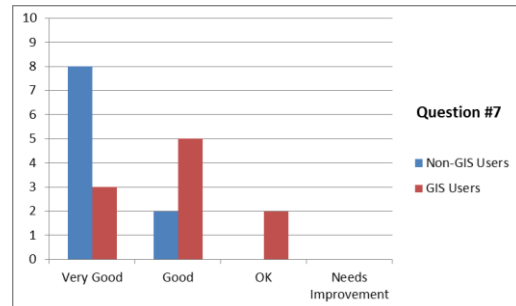


Figure 31. Survey results for question #7: “Overall usefulness of eBook Geotagging.”

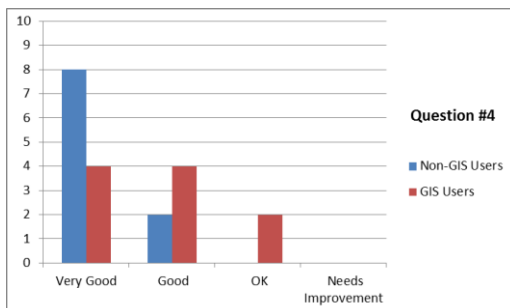


Figure 28. Survey results for question #4: “Intuitive design and ease of use of the Geotag text annotations and map viewer.”

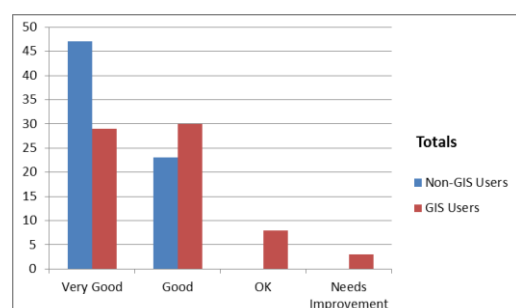


Figure 32. Total responses for all seven survey questions.

Science degree program is labeled “GIS Users”; the second group is labeled “Non-GIS Users” (Figures 25 – 32).

Overall, the responses given in the surveys were highly positive. As a group, the non-GIS users were significantly more positive than the GIS group; with the exception of one question, #6, which asked them to rate the ease of integrating the geotagged maps with social media (Figure 30). This was an interesting finding; since this group was the younger of the two; and presumably more attuned to the use of social media. This facet of the software (and the demo) is a weak point; there is no direct integration of Google My Places and Facebook; which means that this would probably be used very little.

The responses to the qualitative questions were almost universally positive from both groups. The first question, “What were the strengths of eBook Geotagging? What did you find most useful or effective?” – resulted in responses that included:

- “Ease of use/simple design”
- “The option to view locations via Geotagging to help illustrate the different locations in the text”
- “It is a great visual representation of places in books. Would be great for an English or history project.”
- “It’s quite useful for people who enjoy geography and love to get a visual location of the places the characters in a book are on the map.”
- “Being able to track all your saved places and seeing them all at once – tracking location progress is very helpful.”
- “A lot of people are visual learners so ebook geotagging would be very useful.”

- “I like the idea of being able to see the places I read about - especially in reference to each other. It helps to really picture the book.”
- “There is definitely value in the concept – especially with historical fiction.”
- “Cool application. Great idea.”

The second question, “Which parts of eBook Geotagging were the least useful or effective?” – resulted in responses that included:

- “Unsure – the program in its entirety is very effective.”
- “Some people would probably not have use for it.”
- “Nothing that was important.”
- “I would need to use it to see what its weaknesses are.”
- “I like being able to save maps, but I don’t know how many would share them.”
- “Might be nice to see integrated with Bing maps.”
- “Looks like social media part could use some work.”
- “Without the cooperation of B&N or Amazon, ...limited.”
- “Uploading file perhaps cumbersome.”
- “Lack of automation probably its biggest drawback.”

The third question, “Comments and recommendations:” – resulted in the following responses:

- “Instead of over-laying geotags for the same place, have them save each individual tag, like in a list form.”
- “I think this would be a great app to actually have and would work

- really well for teachers. History teachers would love this!”
- “I like the idea of using this while reading. Cannot wait till this software becomes available.”
 - “This would be appreciated by a lot of readers and students because it helps them pinpoint what they are looking for, especially when they have 500+ pages to read. It is a very helpful tool.”
 - “It would have been better if the application can scan through all the texts in the ebook and identify all the places.”
 - “Very interesting application. It feeds into a lot of readers perspectives who have historical geographical longings. A cool addition might be some kind of chronology component.”
 - “I like the idea!”

Evaluating the responses from a survey can be difficult; especially from such a small sample size. Surveys require clear goals, an appropriate target audience, and well – designed questions that support the reliability and validity of the survey (Thayer-Hart, Dykema, Elver, Schaeffer, and Stevenson, 2010).

In a general sense, validity of a survey is the extent to which it properly measures the properties it is supposed to measure. Response Process Validity is the extent to which the survey respondents demonstrate that they understand the software demonstration in the same way it as the presenter (Bernard, Killworth, Kronenfeld, and Saler, 1984). There is no statistical test for this type of validity, but rather it is observed through respondent observation and feedback. The open – ended, qualitative questions at the end of the survey served to gauge the response process validity. There were few non

responses to the questions, and the quality and length of the responses suggests respondents were engaged during the demonstration and understood the goals of the project and the survey itself.

Reliability is the degree to which the results can be repeated. Reliability of a survey requires that the questions mean the same thing to everyone; so that measurement error due to the respondent’s backgrounds, motivations, etc. can be minimized (Bernard *et al.*, 1984). There appeared to be some variability between the two groups of responses. Possible explanations for this could include the settings. The first demonstration group, the GIS users, participated in their classroom immediately after a midterm exam. The second group, the non-GIS users, participated in a dormitory commons room; and were given pizza and soda for their efforts. Another possible factor was the quality of the demonstration. The second demonstration went considerably smoother; due to the presenter’s added experience and comfort level with the demonstration.

Future Work

This project demonstrates an idea for a software tool that could be incorporated into eBook reader software on all platforms, especially devices such as the Kindle and Nook. This requires not only those devices to be open for third – party software development; but for their respective eBook reader applications to be available for modification as well. At the time this application was created, limited third party access was available for use.

Additional features that could be added to future versions of the geotag tool, as it now exists as an extension to the *Calibre* eBook reader application, include but are not limited to the following:

- Alternative geocoding sources, such as Geonames.org, to augment the results provided by Google Maps. This would be especially desirable when dealing with archaic and obscure placenames (such as in Biblical text).
- Utilize alternative mapping services, such as Bing Maps and Open Street Maps.
- Develop a tool that will enable an entire text to be automatically scanned for possible placenames, based on patterns such as comma pairs.
- Provide better integration with Google My Places, so that file uploads are more streamlined and automated.
- Provide better integration with Facebook and other social sites, so that geotagged maps can be directly embedded in a user's personal space.

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Appendix A. E-Book Geotagging Application Demonstration Survey.



E-Book Geotagging Application Demonstration Survey

Purpose: This short survey will gather user feedback for the eBook Geotagging application. Results will be used to critique and improve the application's performance and functionality.

Directions: Please provide a response to each statement that best corresponds to your experience after the demonstration of the application. For open-ended questions, please provide additional thoughts related to your experiences with using the application.



	Very Good	Good	OK	Needs Improvement
Integration of the Geotagging feature with the eBook reader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag creation feature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag toolbar menu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intuitive design and ease of use of the Geotag text annotations and map viewer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of sharing Geotagged maps in Google My Places	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of sharing Geotagged maps in social media (Facebook, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall usefulness of eBook Geotagging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

What were the strengths of eBook Geotagging? What did you find most useful or effective?

Which parts of eBook Geotagging were the least useful or effective?

Comments and recommendations:
