Crowd Sourcing a Story Map for Study Abroad Students

0. Background

The key concept behind the story map project was the student use of digital media to co-construct knowledge in a foreign language program. An initial inspiration was the work by SDSU Geography professor Ming-Hsiang Tsou involving crowd sourcing in research and project proposals. The project could enable the documentation of cross-cultural experiences embedded in a geographical setting.

Our first pilot in the summer of 2013 involved linking a Google form to an ArcGIS map. (SDSU is an ESRI center.) The students collectively submitted data, including URL's of uploaded pictures, descriptions and the latitude and longitude of the picture locus. When the form was submitted, the map was instantly updated with the new pushpin or data point.   As all students were adding links to the same map, we had a collective representation of the study abroad experience.   There were almost 250 postings for the study abroad in Florence, Italy: http://arcg.is/1nJzvg6

The project was marginally successful. In a very small survey distributed to four of the returning students, in two crucial questions, results were disappointing: for whether the project helped improve communication among the group one strongly agreed, but two were indifferent and one disagreed. Secondly three somewhat agreed that they would recommend using a mapping project for other classes at SDSU and one would probably not recommend. These responses were despite very favorable responses to the question of whether instructions were easy to follow. Some of the problems that impeded the success of the project had to do with display. First, a number of the pictures did not display. The URL needed for the CSV data file resulting from the Google Form had to be the path URL for the picture from the source code. This required going to the source html file and copying out the URL from there. With minimal admin intervention, sometimes we could get the correct source code, but not always. A computer science graduate assistant even wrote a java applet to convert the URL to the source path. But some students simply used the URL for a slide show in Flickr, which could not be converted. In a related problem, when the picture did display in the popup window, often the larger image would not appear when the thumbnail was clicked on.   Finally, sometimes the students entered the incorrect latitude and longitude so that the data points did not correspond to the actual location of the picture.

After presenting the results of the first pilot at a lightning talk for SDSU's Center for Human Dynamics in the Mobile Age (HDMA), at a technology conference at UCLA and at last year's ESRI conference, a few points stood out as critical for a follow up pilot.

1.0 2015 Florence Study Abroad

First, we needed a story map, which displays the full pictures in a sequential order, with the sequence spelled out with thumbnails at the bottom of the screen. The question would be how to make a relatively static instrument dynamic. Next, it became clear that a new system had to be developed for storing the pictures, and the optimal choice was on our own servers at LARC. Finally, after the lead of a study abroad project at CSU Monterey Bay, we wanted to employ the LESCANT model to tag pictures. The power of expression in the pictures displayed in the CSUMB project suggested that this approach could help focus the expression on cultural similarities and difference encountered in the study abroad experience.

Summer Intern

These then were the building blocks we took back to LARC with us in the summer of 2014. An intern from an engineering university in Lille, France, developed a webpage for us that seemed to capture the different elements in the design we wanted: http://larcmaterials.sdsu.edu/mappingplatform/welcome.html. Especially the form looked promising in allowing the students to upload their pictures directly to our server and then have the URL captured in a database. However, this was just a promise, and the platform as visualized here never actually functioned.

Understanding the Template

The first step for us was to get a story map up so we understood the features of the template. To do that, we used pictures taken in a tour of French cathedrals by a choir based in San Diego. Through this we were able to understand basic features like the ideal dimensions of the picture, ideal amount of text to display and configuration possibilities for the template on the ESRI server and the display of foreign accents with UTF-8. We then put a link up to this story map to advertise the project goals:
http://arcg.is/1qSUkbw

Initial Breakthrough

As the new academic year started, we were faced with the kernel problem of how to implement this conceptual plan. With the assistance of Ravichandra Reddy Chintalapelli, a graduate student in electrical engineering who was familiar with database management, a MySQL database was created to store the mapping data and personal information of each student. The web pages interacting with the database were written by Kavish Ghime, a computer-science graduate student. The pages include registration for a new user, login page, a home page to navigate through the site, a form to upload a new story, and a tabular view of previous uploads. The new upload form is used to submit the mapping information of a new story, which includes its title, description, picture and the coordinates of that particular place. Additional fields ask for a color for the map marker and LESCANT tag, both from a drop down menu. The picture, on submission of the form, is uploaded in a folder on the server, designated for that particular user. This complete mapping information is stored in the database, into a MySQL table named after the

user`s name. The table is then converted into a CSV (comma separated values) file using a PHP program that does this conversion. This CSV file is then saved into the same folder on the server, where the user`s pictures are stored.

Admin Intervention

There are four key administration interventions required in this rendition of the mapping project, and this is the one used for the 2015 Florence study abroad students. The four steps are:
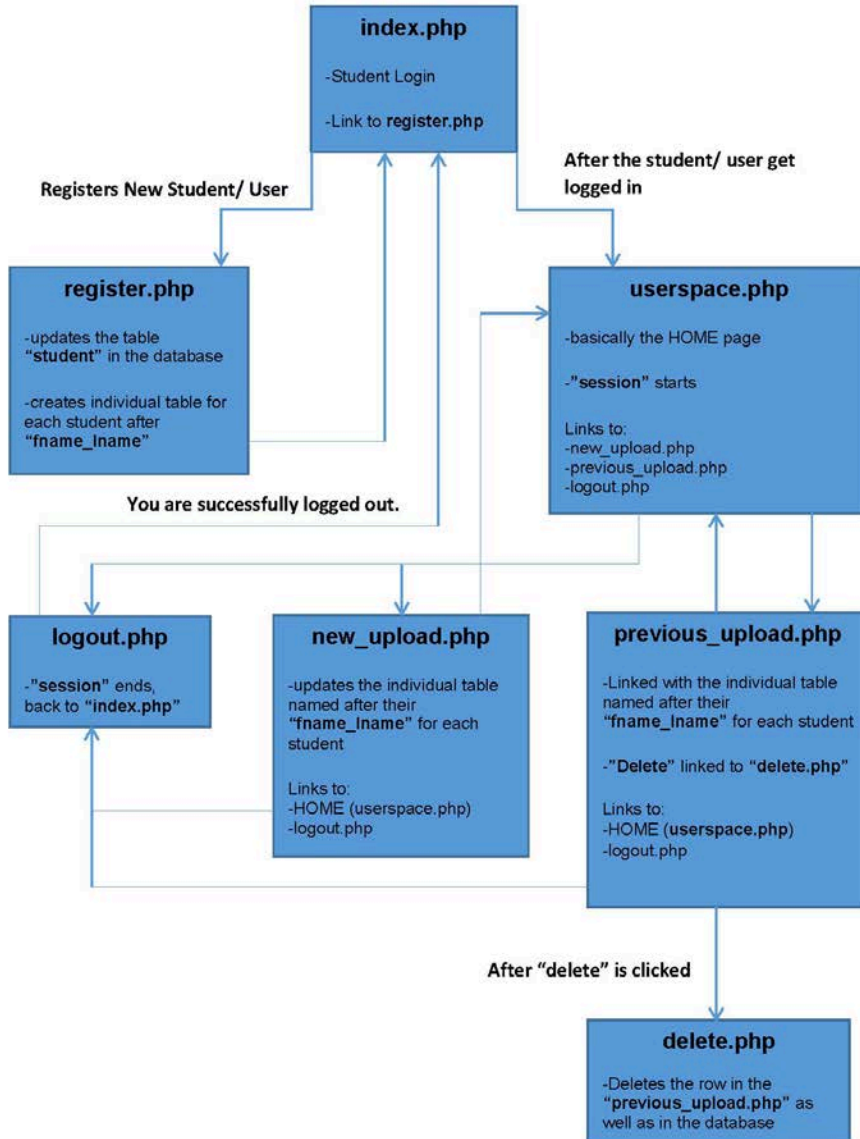
- Within ArcGIS online creating a map, and saving as a story map application;
- downloading the CSV file as soon as the student uploads the first picture;
- putting the CSV file into student folder on the server;
- linking web-based CSV file to map.

At the moment, the third step needs to be repeated every time the student uploads a new picture.

The figure on the next two pages provides a flow chart for the sequence of events involving the database:

Basic Flowchart of the Mapping Project
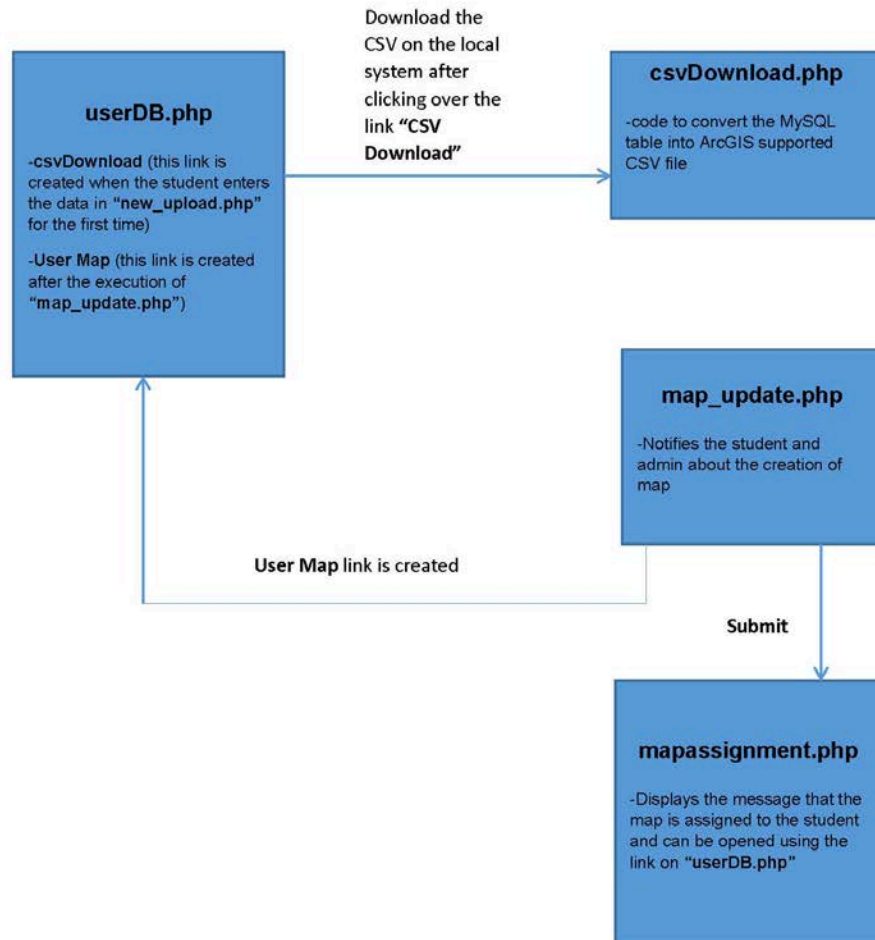
By: Kavish Ghime

index.php

-Student Login

-Link to **register.php**

Registers New Student/ User

After the student/ user get logged in

register.php

-updates the table "**student**" in the database

-creates individual table for each student after "**fname_lname**"

userspace.php

-basically the HOME page

-"**session**" starts

Links to:
-new_upload.php
-previous_upload.php
-logout.php

You are successfully logged out.

logout.php

-"**session**" ends, back to "**index.php**"

new_upload.php

-updates the individual table named after their "**fname_lname**" for each student

Links to:
-HOME (userspace.php)
-logout.php

previous_upload.php

-Linked with the individual table named after their "**fname_lname**" for each student

-"**Delete**" linked to "**delete.php**"

Links to:
-HOME (**userspace.php**)
-logout.php

After "delete" is clicked

delete.php

-Deletes the row in the "**previous_upload.php**" as well as in the database

userDB.php

-**csvDownload** (this link is created when the student enters the data in **"new_upload.php"** for the first time)

-**User Map** (this link is created after the execution of **"map_update.php"**)

Download the CSV on the local system after clicking over the link **"CSV Download"**

csvDownload.php

-code to convert the MySQL table into ArcGIS supported CSV file

map_update.php

-Notifies the student and admin about the creation of map

User Map link is created

Submit

mapassignment.php

-Displays the message that the map is assigned to the student and can be opened using the link on **"userDB.php"**

Figure 1: Flowchart

Process

When the student registers, an email is sent out to the map administrators. The information provided by the student during registration is stored in a table named "student" in the database, containing additional columns for Map Link, CSV File and Remarks.

```
+-----------+------------+-----------+-------------------+------------------------------------+----------+---------+---------+
| studentID | fname      | lname     | email             | password                           | maplink  | csvFile | Remarks |
+-----------+------------+-----------+-------------------+------------------------------------+----------+---------+---------+
|         1 | First Name | Last Name | email_id@mail.com | 0c83f57c786a0b4a39efab23731c7ebc   | NULL     | NULL    | NULL    |
|         2 | Student    | 1         | student_1@mail.com | 5e5545d38a68148a2d5bd5ec9a89e327  | NULL     | NULL    | NULL    |
+-----------+------------+-----------+-------------------+------------------------------------+----------+---------+---------+
```

Figure 2: The "student" table

For easy access of map administrator, a tabular view of this "student" table is created using PHP, which is accessed via a browser, as shown in Figure 3 below:

LARC Mapping User Database

Student ID	First Name	Last Name	Email	Map Link	CSV File	Remarks
1	Ravichandra	Chintalapelli	rchintalapelli@mail.sdsu.edu	User Map	CSV Download	Admin
2	Trevor	Shanklin	shanklin@mail.sdsu.edu	User Map	CSV Download	Admin
3	Kavish	Ghime		User Map	CSV Download	Admin
4	Clarissa	Clo	cclo@mail.sdsu.edu	User Map	CSV Download	Faculty
5	SDSUItalian	HipHop	sdsuitalianhiphop@gmail.com	User Map	CSV Download	Student

Figure 3: Tabular view of student table

The Student ID, Name and Email columns are read from the "student" table of the database, while the columns named Map Link, CSV File and Remarks are shown blank at first (set to NULL value by default in the database table "student"). When the student uploads his story for the first time, the "CSV Download" link is added under the "CSV File" column (column 6 in Figure 3) for that particular student.

Whenever a student uploads his/her story through new uploads, an email is sent out to the map administrator. This helps the administrator know that the particular student has uploaded his mapping story and can thus download the CSV file, by clicking over the "CSV Download" link (column 6 in Figure 3).

After the new user has uploaded the first picture, the administrator creates or selects a map from the ArcGIS site for the new user. The CSV file is then linked to the map, as a 'layer from web' and the path to the file on the LARC server is provided. The map is then shared as a story map web application. The short URL for that web application is inputted into another form, 'map_update,' only accessed by administrators. When this form is submitted the student automatically gets an

email with the map link, and the link is added to the student table (column 5, 'UserMap' in Figure 3).

After the first upload, the student can either choose to upload a new picture or go to 'previous upload' to delete a picture.   (At least this is how the project started off, though two weeks into the actual implementation the 'previous upload' form was fundamentally modified.) If the student chooses to delete an earlier picture, then this 'story' (represented as a row on the individual table) is deleted. If a new story is submitted, an e-mail is once again sent to the map administrators, who have to download the CSV file from the Larc Mapping User Database and place it into the student folder on the server. At this point the web application now displays the updated story map.   Currently the administrator has to be physically on SDSU campus in order to access the student folders on the server.

2.0 Launching the Pilot

Throughout the Spring 2015 term, the database was set up for the May 2015 study abroad in Florence, Italy. In April the first instruction sheet was created and presentations made to a linguistics class on computer-assisted language learning and to a second year and fourth year Italian class. Although students from the first two classes tried their hand at the maps, it was first really used in the fourth year Business Italian class.   This class investigated different types of media intensively and the story map was used to display the centers for hip-hop music in Italy:

http://arcg.is/1HnezVS

This was one of the artifacts displayed at the SDSU Digital Humanities Showcase on May 14 and drew praise.

Two Crucial Modifications

Unlike the 2013 pilot, the Story Map does not update instantly for the students. We can preserve that possibility by writing a program to take the CSV file generated by the MySQL database and have it automatically put into the student folder under uploads. The solution we found is to use file system commands in PHP to move the file name into the correct directory. This will be implemented at the end of the current pilot.   We are still exploring a way to have the old file available as a backup.

Another absolutely critical improvement is to have the Exif data from pictures that contain GPS data automatically inputted into the form. These two modifications: automatic uploading of the CSV files and automatic inputting of GPS data, were seen as essential for the ultimate success of the project, but were not ready at the beginning of this year's Florence Study Abroad program. The orientation for the new cohort was on May 4, 2015.

Problems Encountered and Remedies

As Raymond puts it in *The Cathedral and the Bazaar*, "You often don't understand the problem until after the first time you implement a solution" (25). Certainly for the team working on the project it was the case that the principles involved in setting up the database had to be learned as part of the implementation. Later in his guide for open-source software development, Raymond states, "you need to be able to present . . . a plausible promise. Your program doesn't have to work particularly well. It can be crude, buggy, incomplete and poorly documented. What it cannot fail to do is run…" (47). More experience with database management would have helped predict some of the stumbling blocks. This does not negate, however, the primary importance of getting the project running. Once we had a stable environment, as outlined above, the instructor was willing to take the risk to pilot the project.

Security & Validation:

The desire to have the pictures put on our own server at LARC and have the map entries managed that way threw us into a new world of database management. Exigencies of time required getting the modules in place in time for the first presentation to the study abroad students in the first week of May. Some stages in planning were missed in our concentration on getting the project up and running, in the flow of activity in the resource center. The most important of these was validating the input we are getting though the html forms. Doing this also helped prevent SQL injections, when malicious code can be injected into queries to gain access to the database and cause harm. The first action taken by the map administrator was to insert a PHP function in the code for the form between the user input and the database. This intermediate function strips the user input going into the database to prevent malicious access.

Other actions taken to validate the input data were:
a) Avoiding cross-site scripting (XSS);
b) stripping unnecessary characters (extra space, tab, newline) and removing backslashes from the user input data.

Only after the students had left for Florence, were all of the PHP programs validated. (Students arrived in Florence on May 24, 2015.) Before they left however, and before the presentation to the students, passwords for the registration had been encrypted through 'hashing.'

Character Encoding:

In the first week of the project start, UTF-8 character encoding was added to allow for the inclusion of apostrophes and foreign accents. This eliminated the appearance of question marks in the description of the map pictures. The map administrator was familiar with the solution from the work already done on the first prototype for the chorus visit to France.

Editing (Previous Uploads)

A second problem was that students were entering incorrect latitude/longitude information, or mixing up the fields. We could easily adjust this ourselves in the CSV file we uploaded, and did so, but next time the student entered data the old, incorrect information was repeated because the data base table that generates the CSV file had not been changed. We could go in and adjust the database as well, but this requires too much manual intervention. There had already been a feature that allowed students to delete a picture (or at least delete the row with information about the picture from the database table). Kavish built on this by altering the code so that student could easily edit the data themselves:

The picture below shows the window the student is taken to when they click on 'previous uploads' rather than 'new upload':

Your Submitted Information

Title	Description	Icon Color	Latitude	Longitude	Image	Video	Lescant	Delete	Edit
Cattedrale di San Lorenzo	Testing whether a picture shows also in web application	R	44.407611	8.932038	Image Url	Video Url	N	Delete	Edit
St.Paul Within The Walls	Testing: Adding image after the map web application is stated	P	42.842555	12.560184	Image Url	Video Url	S	Delete	Edit

Figure 3: Previous Uploads

By clicking on the 'Edit' button, student can reenter the data. The advantage of this system is that students can then make their own corrections:

Figure 4: Editing window

Instantly, students started correcting latitude and longitude, which also had the advantage of teaching this key geographical knowledge. In the third week, one student wrote us that her edits were not appearing in her map, and we realized that we were not getting notifications of editing changes and therefore did not know to update the maps. Kavish then adjusted the code to generate a message to the map administrators when editing changes were submitted.

3.0 Underway

Logging errors

When a data file failed to be generated, students saw the message 'error in generating map data.' The error message was handled in PHP script. When they shared this with us, it helped analyze the problem area at that time because it showed that the data could not be enabled at the table – however, we did not know

why.   However difficult this had been when the students were in San Diego, it was multiplied many times more when they were in Florence. When we received a notice that a student had uploaded a picture and went to the CSV link only to discover that the file was not generated, we were in a very unsatisfactory situation. Generally we would ask students to send us the data they inputted, which we could examine for possible problems. We discovered this way that students had entered file names so long that the URL became longer than the 100-character limit.   In another case it turned out that the ten characters allowed for longitude and latitude were not always enough and prevented the data file generation. In fact, when this was caught at the end of the second week, it resolved a major issue to prevent the generation of the data files.

Comments and Instructions to Fill in Required Fields

Using knowledge gleaned thus far, we adjusted the system to try to forestall the error messages. For example, Kavish created individual error messages for the specific required field. Before this was done in the second week, if students left a field blank, they would receive a common error message that all fields are required. After this adjustment, a notice appeared at each respective field, for example 'title is required.'

In addition, comments have been added to the fields, instructing students, for example, to use decimal entries and not degrees for latitude and longitude. Note that just deleting degrees would produce the wrong results as the decimal and degree system vary slightly, and one needs to be converted into the other. We also discovered through trial and error that the Esri map interprets the degree marker as a '0.'

Predicting Human Behavior

But we still cannot predict the kind of problems that might be encountered. One student uploaded all her pictures with the same name: pc1, pic2. Every time that she uploaded a picture with the same name as an earlier picture, this erased the earlier picture from the server and substituted the new one for the previous entry. Here we had to ask the student to use the editing window to post the renamed pictures, which she did without difficulty. Two days later another student uploaded three pictures all with the name 'image'.   So maybe this was predictable, and preventable. The solution was to use randomized time stamping to create a unique name for each file. This was implemented at the end of the second week of the project.   This correction also solved the problem cited earlier that had been isolated as preventing uploads: the database field for the picture URL was set to only take 100 characters. Through the solution to prevent the deletion of a file with the same name, we also solved the issue with file names that were too long, as the new code generated the file name for the picture within these parameters.

Because an earlier entry could be deleted unintentionally from the system, it became necessary to back up the uploads folder on the server to an independent

hard drive. We then established a system to copy the folder over on a daily basis. Some pictures from the student uploads were not showing because the students had posted different kinds of file formats (.html, pictClipping, etc.) in place of an image file, so the code was modified to only accept jpg, jpeg, gif and png files. At the end of the third week, it was discovered that the code did not account for case, rejecting the extension when written in all caps. This was immediately corrected.

Student involvement
Another point that Raymond makes concerns the value of beta testers: "If you treat your beta testers as your most valuable resource, they will respond by becoming your most valuable resource" (38). It became obvious that the effort of the students was necessary to better understanding the issues related to the code and database design. On our end, we were very, very careful, to treat the students with that gratitude, being both apologetic and supportive when problems were reported. Above all, we encouraged the students to work with us, for example, by sharing the data input that triggered an error message. In the end, that paid off. But we will get a better idea of which frustration level was reached in the survey distributed in the final week of the study abroad experience.

Time out Errors
After solving the input issues, those that led to the picture being uploaded but a data file not being generated, we encountered another issue when some students let us know that they had received a white screen when trying to submit their data. In this case, neither the data file was generated nor the picture uploaded. We were faced with possible intractable network errors or platform issues. Kavish then examined the PHP error log files located on the server and found a record of a fatal error with time stamp. The fatal error contained the message 'execution time exceeded 300 seconds'. Having found this, he had the IT consultant change the time allotted on the PHP configuration file from 300 to 1,200 seconds in the fourth week.

Going Smoothly
By the end of the fourth week, beginning of the fifth week, error messages stopped coming in and uploads were being made smoothly. A student who had informed us in the beginning of the fourth week that he could no longer upload, was now able to post pictures again. There were fewer students still with us by then, but those story maps were getting better and better. We could even advise students to edit changes, like deleting a picture that failed to upload correctly and uploading it again or making a minor adjustment to the long/lat data.   For example, one outstanding error was a picture uploading with 0 kilobytes, which failed to generate an error message. We advised two students to delete a picture that failed to upload correctly and upload it again, which fixed the problem.   It is not a serious drawback, but needs to be investigated.

In the fifth week, we looked through each story map to identify any changes that were needed. We made the template on the vast majority of the story maps

uniform, with the OpenStreetMap basemap, blue color theme, LARC Logo and extent that encompassed Florence (if that was the first picture). We also changed a number of pictures to profile from landscape that did not upload correctly. This was normally corrected by resizing the picture with the 1,000 x 750 pixel maximum. We notified two students about editing changes needed for the latitude and/or longitude on single pictures.

4.0 Still Coming

Another characteristic of software development that Raymond points out is the absence of intended features. He states, "leave feature list flexible, allowing features to drop off if not completed by the deadline" (Note 8). We are much closer to incorporating the key features outlined above through the current implementation, including automatic updating and the reading of Exif data. But there are other features which are on our wish list as well.

LESCANT Data

Although the forms input LESCANT data, in the template we have chosen, there is not room for these fields. There is a possibility of putting the template on our own server and making additional modifications, so this will be high on our list of priorities for a follow up to this initial pilot of our study abroad story map. Also, unlike the 2013 project there is a separate map for each student. We felt this necessary, as we don't know the limit for pictures that can be stored. But our goal now is to put different group story maps together based on the LESCANT tags and maybe other factors we are not aware of yet. In fact the instructor has created one group account that everyone can upload to. Also, the use of the LESCANT data requires training. In the CSUMB use, a two-week workshop was initially provided and this was later transformed into a full semester course. The LESCANT tags then were not really relevant for the 2015 LESCANT study abroad. However, the system is being set up so this could play a role in the future.

Configuration

With our current configuration, we are a little removed from the crowdsourcing inspiration, but not totally. In Cartography: maps 2.0, Crampton defines crowdsourcing as: "a form of emergent collaboration in which multiple people work together on a common project" (95). Even though students are creating their individual story maps, there is the option of a group login and of choosing the pictures and accompanying data for a group final project. For example, students could vote on the best pictures, or perhaps every student could contribute one or two favorite pictures through the group log in.

Display

We would like to work out a mechanism to establish an electronic kiosk showing a looping slide-show like presentation through the thumbnails. Actually the LESCANT project at CSUMB has displays on campus to show the photos created both by the study abroad students and the international students at the Monterey Bay campus.

One of the questions we posed to the current study abroad students is their interest in having such a display. (This survey was administered in the last week of the study abroad experience and the data is being analyzed.)

Videos and Audio Files

When we get more comfortable with the system, we would like to enable short videos to play in place of pictures. It seems from the ESRI documentation that videos can be enabled, but this will take some exploration on our part.   We have a field in the form currently being used to upload videos, and we would prefer that they play from our server rather than bringing in another online service, such as YouTube. Also audio files will be important for a more robust digital story telling with the use of maps, which in effect is what the Italian Study Abroad story maps had become.

5.0 Conclusion

As the mapping project has evolved, it seems to encompass learning in digital humanities, in showing "the role of digital tools in the transformation of writing, thinking and teaching in humanistic fields" (Dalbello, 480).   The author of that quote is thinking more about the digital tools in the hands of professionals to create corpora for teaching and learning purposes. But this applies equally to the learner, in exemplifying a new epistemology based on the interaction and expression with digital media. A key component is being able to instantly anchor cultural experience in the geography of the countries concerned. Another key plank of the project is to enable the use of that media by learners through a simple process. At the same time, the process fosters the mastery and understanding of different aspects of digital media, and geography.   One could think of the knowledge of latitude and longitude or what goes into making an effective picture, or a picture with an effective statement.

In setting up the mapping project for the Florence study abroad program, we have not only set it up for further study abroad programs.   We have also enabled it for any user who comes to the larclab website, whether through a visit to the resource center, an online activity or simply through searching.   Our next task for the database, therefore, is to ensure that the current "student" table is only for the Florence Study Abroad program and expand the database to include additional "student" tables for other classes and programs.

Instructions and log on information is contained on the larclab website: http://larclab.sdsu.edu

A link to thirteen of the Florence Study Abroad story maps can be found on the larclab home page, LARC Mapping Project. (We changed our display to use the Maps and Apps Gallery that we learned about at the ESRI 2015 conference.)

And looking ahead. . .

The story maps invite expression, sharing and collaboration. They are an excellent possible portfolio item or vehicle for a presentation. I have personally always been interested in historical atlases. When reading ancient literature, one has to navigate through various country and other place names that show the shifting sands of time. A personal goal would be to create an historical story map with the help of historians and classicists to trace the route of Xenophon after Cyrus's death from Mesopotamia back to Greece, going through the ethnic groups mentioned in that work with a backdrop of the current country designations.

References

Crampton, J. (2009) "Cartography: maps 2.0," In: Progress in Human Geography, 33(1), pp. 91 – 100.

Dalbello, M. (2011) "A Genealogy of Digital Humanities, In: Journal of Documentation, V. 67, No. 3, pp: 480 – 506.

Raymond, Eric S. (1999) The Cathedral and the Bazaar: musings in Linux and open source by an accidental revolutionary. O'Reilly.