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Teaching Spatial Literacy in the Classical Studies Curriculum

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Abstract

Over a decade ago, the Collaboratory for GIS and Mediterranean (CGMA) was created with two stated goals: (1) to create an on-line GIS inventory of survey projects in the greater Mediterranean and Europe and (2) to introduce advanced undergraduates to GIS concepts through Mediterranean archaeology. Through a specialized GIS course a small group of advanced undergraduate students learned how to interpret map data, create effective maps, and build map hypothesis - skills that are recognized as necessary for enhancing spatial thinking and thus spatial literacy. In the last decade GIS technologically has changed dramatically. The advent of Geospatial Semantic Web (Web 2.0) now makes it possible to integrate spatial thinking concepts at all levels of the undergraduate curriculum. This paper argues that spatial literacy must be more intentionally integrated into the Classical Studies curriculum and illustrates how we have begun to do that at DePauw University.

Introduction

Over a decade ago my colleague Pedar W. Foss and I initiated the Collaboratory for GIS and Mediterranean Archaeology (CGMA).[1] As faculty members at a liberal arts college (DePauw University), we were looking for ways to integrate undergraduate students into our research program and to bring our research into the classroom. The original goals of CGMA were twofold: 1) to develop a web-based GIS of Mediterranean archaeological survey projects and 2) to introduce undergraduates to GIS and create more research opportunities for those students. We had been using GIS for some time in our archaeological fieldwork and we were aware that GIS technology was rapidly becoming a tool for spatial analysis in both a wide-range of academic disciplines and various industries. Indeed, GIS&T degree programs (Geographic Information Science & Technology) have flourished across the United States in the last twenty years [Sinton 2012a]. In the liberal arts environment, however, courses in GIS&T are rare: to-date the technology has been resource intensive and there is an ongoing perception that GIS&T is a technical skill rather than an academic discipline. Yet, despite the fact that we live in a world in which practically everyone carries a digital globe in their pocket, the critical thinking skills at the heart of GIS are surprisingly lacking amongst undergraduate students. Those critical skills – the ability to locate places in space and time, evaluate spatial data, and understand relationships between places across space and time – are also essential for developing a nuanced understanding of the ancient world. Classical Studies courses are thus well suited to introducing spatial literacy skills. In this paper I argue that spatial literacy should be more intentionally integrated into the Classical Studies curriculum and I provide some examples from courses that we taught at DePauw University. 1

Competence in spatial literacy is now widely recognized as a necessary skill for college graduates seeking employment in a wide range of industries. From specific training in GIS&T to more general competence in logistics and marketing, students with a background in spatial studies are more competitive on the job market [Sinton 2012a]. In 2006, the National Research Council published, *Learning to Think Spatially: GIS as Support System in the K-12 Curriculum*. Although this study focused on K-12 education, its conclusion that “without explicit attention to [spatial literacy], we cannot meet our responsibility for equipping the next generation of students for life and work in the twenty-first century” [Learning to Think Spatially 2006, 10] is equally applicable to the undergraduate general education curriculum. Diana Sinton has defined *spatial literacy* as “the competent and confident use of maps, mapping, and spatial thinking 2

to address ideas, situations, and problems within daily life, society, and the world around us" [Sinton 2012b]. To achieve a competent level of spatial literacy, one must engage in activities that enhance *spatial thinking*, that is, the process that helps link aspects of spatial literacy together. D. Sinton thus defines *spatial thinking* as "the ability to visualize and interpret location, distance, direction, relationships, change, and movement over space" [Sinton 2012b].

3 Place, space, and time are concepts integral to analysis in Classical Studies. Our discipline has always employed spatial technologies in our teaching and research, from analog map sequences in textbooks depicting the shifting landscapes and cultures of the ancient Mediterranean to archaeological phase plans of individual sites. Classicists and archaeologists were early adopters of digital technologies for organizing, visualizing, and analyzing spatial data. In the last decade open-source, web-based resources have been developed by Classicists to address specific research questions. Several of these projects were presented at "Word, Space, Time", for example Orbis, RomeLab, and MAGIS (the research component of the CGMA project). The Ancient World Mapping Center (AWMC) and its child projects, Pelagios, Pleiades, Antiquity À-la-carte, and The Barrington Atlas for mobile devices, are poised to become the foundational resources for future developments. Using these resources effectively, however, is not trivial. One needs a certain amount of content knowledge as well as critical understanding of the source data and visualization tools. In other words, one needs a degree of *spatially literacy*.

4 When it comes to teaching spatial technologies and spatial thinking to undergraduates, Classical Studies is now somewhat behind the curve. Courses on GIS in Classics and Classical Archaeology are rare (although they are increasingly part of the graduate curriculum in archaeology). Not surprisingly, much of the momentum to increase spatial literacy in higher education has been motivated from the Geosciences, and to a lesser extent the Social Sciences [Tsou and Yanow 2010]. Programs such as SPACE (Spatial Perspectives on Analysis for Curricular Enhancement) at the UCSB Center for Spatial Studies have funded workshops for faculty seeking to increase spatial thinking in their classrooms.[2] While the Humanities overall has begun to adopt (or readopt with new technologies) spatial analysis, most of this debate has remained in the area of research in Spatial Humanities and building content for research [Bodenhamer, Corrigan, and Harris 2010].[3] Geospatial technologies may be presented to students as methods used by archaeologists and historians to investigate the ancient landscape, but students are rarely asked to use those technologies in the classroom. This is understandable. Until recently, high-end use of GIS applications, such as ESRI's ArchView, necessitated high degree of expert knowledge of the software - never mind the ability to convey the concepts. Moreover, even those professors who have a background in GIS will need the support of an on-campus GIS center (or equivalent technology program) to manage the software licensing, provide data back-up, and assist students when the professor is unavailable.

5 Despite those challenges, for some of us, integrating spatial thinking skills into our courses may become a matter of survival for the Classical Studies Curriculum as well as the Humanities at large. As the Humanities are generally losing ground in higher education, we must continue to make the case for our relevance within the larger curriculum. Bryan Alexander and Rebecca Frost Davis argue that, "at a time when the academic humanities seems otherwise threatened and contracting, the digital humanities remains a viable growth area, even a potential source of salvation for threatened disciplines." [Alexander and Davis 2013]. This may be putting too much pressure on the digital humanities and commentators have cautioned against investing in Digital Humanities projects as a means of financially bolstering departments in jeopardy [Koh 2015]. This is not the place to engage in that debate. The point here is that the Digital Humanities, and in this example spatial technologies in particular, provide a way for us to revitalize our curriculum and reimagine our pedagogy in a way that engages students in our discipline and imparts transferable knowledge and skills.

6 At DePauw University, we are now building off the success of the CGMA project, which included a "high-end" GIS course, by developing "low-end" mapping and visualization exercises into our general education courses.[4] Like many Classical Studies programs, our department is able to maintain major offerings in Greek and Latin by teaching large sections of general education courses. But, we are increasingly asked to justify our existence based not only on the significance of our content but also on the "skills" we impart to our students. Critical thinking, reading, and writing are no longer sufficient; we now need to be incorporating the intentional teaching of the spatial thinking skills that are necessary for a wide range of careers.

The advent of the Geospatial Semantic Web (Web 2.0), which allows users to access, produce, and share map data through sites such as Google Maps and applications like Google Earth, makes it possible to integrate spatial thinking concepts at various levels of the curriculum. Our students use this technology everyday, from mapping directions on their smart phones to geo-tagging their photos on Instagram. Teaching spatial concepts in a hands-on manner is no longer limited by hardware and software requirements. Any classroom with a computer and an Internet connection can access an array of resources useful for teaching. Sinton and Schultz [Sinton and Schultz 2009, 75] provide a list of ideas and resources for integrating mapping and spatial visualization exercises into the classroom. In what follows, I highlight a “high end” and a “low end” approach to teaching GIS and spatial literacy in the Classical Studies curriculum at DePauw University. 7

High-End GIS Teaching in Classical Studies: The CGMA Course

Over the last two decades, graduate programs in Classical Archaeology have begun to offer courses, or at least training, on the use of GIS in Archaeology. At the undergraduate level, however, such opportunities are less common. Students may get some field training in GIS, if they happen to participate in an archaeological field project utilizing GIS, or they may elect to take a GIS course in a Geoscience department. Yet, GIS training has not only become expected for graduate work in Classical Archaeology, GIS concepts (i.e., the fundamentals of spatial literacy) are necessary for success in a wide range of careers. With this in mind, Pedar W. Foss and I, along with colleagues at three other undergraduate institutions, designed the Collaboratory for GIS and Mediterranean Archaeology (CGMA) to provide archaeological research opportunities to undergraduates and develop a discipline specific undergraduate course in GIS. 8

On the research side, we constructed a web-based, platform-independent, GIS for Mediterranean wide survey archaeology. Mediterranean Archaeology GIS (MAGIS) was released in 2007 and continues to operate. On the teaching side, undergraduate students were involved with the project through a seminar class, grants and internships to work on MAGIS, and participation in the meetings with the CGMS advisory board. For the purposes of this paper, I will focus on the seminar class. Further information on how we built MAGIS and the involvement of the students can be found on the project website. 9

The CGMA seminar was designed to be taught over the Internet synchronously between the four participating institutions. The course has been taught every two to three years since 2003, with a longer hiatus between 2010 and 2014.[5] Technological support was originally provided by the Associated Colleges of the South through their course delivery system, which has now been subsumed under the National Institute for Technology in Liberal Education (NITLE),[6] and by the GIS centers on the participating campuses. The course begins with lectures, exercises, and discussions on the history, theory, and method of both Mediterranean survey archaeology and Geographic Information Systems (GIS). In the first iteration of the course, students contributed data to MAGIS, but the core of the course has always been a multi-stage practicum on GIS. Working in teams on each campus, the participants design a local survey project (that can be completed within the semester), collect data, create a database, map the information in a GIS, and develop some preliminary analyses of their project. Students have to write a report on their projects and present their results to the rest of the class. We have also encouraged students to participate in the annual Sunoikosis Undergraduate Research Symposium. 10

The heart of the CGMA course is the practicum, a semester-long GIS research project that is designed and implemented by the students on each campus. The work is divided into five stages from formulating questions to database design to collection to implementation to reporting of results (see sample syllabi at http://cgma.depauw.edu/seminar.html). The topics have varied widely over the years, including Elvis Presley's Performance venues in Memphis, TN, a historical GIS of the churches in Greencastle (dubbed "God in Greencastle" by the students), and a survey of the old perimeter of Jackson, MS prior to the Civil War fire that ravaged the town. We have learned that the more manageable projects are either campus-based or conducted in local cemeteries. In the example illustrated here (Figure 1), students at DePauw University surveyed the oldest cemetery in Greencastle, IN. They began with a historical map retrieved from city archives. The cemetery was too big to survey completely in the allotted time, so they did a 20% sample; the 10x10 meter grids are recognizable by the clusters of data points superimposed on the aerial map in the GIS. In their initial research proposal, the students had hoped to trace the 11

development of the cemetery over time. However, it became clear that a 20% sample size was too small to generate enough useful data.

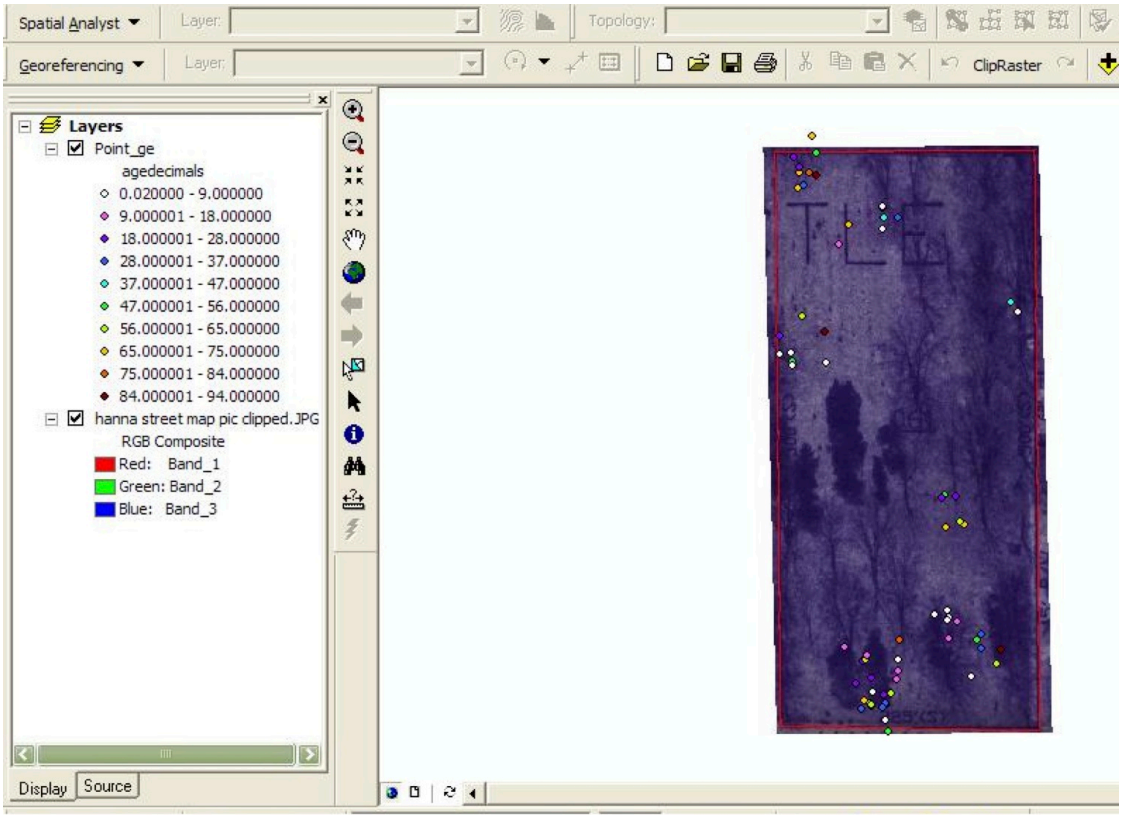

Figure 1. GIS of the Hanna Street Cemetery in Greencastle, IN made in ArcGIS by DePauw University students for the CGMA course.

This in itself is an important lesson and the students learned that, if they were to pursue this project beyond the limits of a semester-long course, they would have to redesign their collection practices. The CGMA course is, thus, more concerned with *process* than *product*. In the assessment of the students' work more emphasis is placed on their ability to describe and reflect on their process and progress than on the final GIS product. At each of the five stages of the practicum, the student groups report to the class on their progress and on any questions or problems that they had encountered. 12

Despite the problems the students encounter along the way, the CGMA seminar has been successful at introducing advanced undergraduates to GIS concepts, i.e., spatial thinking, and to methods and theories of survey archaeology. Some of our former students have gone on to graduate work in Classics and archaeology. By necessity, however, the course is limited to a few students from each of the participating campuses. Moreover, the course practicum demands a lot of supervision and resources. The software — we use ESRI's ArcGIS suite — is not easy to learn. Faculty members teaching the course need a level of expertise, often outside of their own academic training. Maintenance of the computers, servers, and software also requires significant technical support not available on every campus. This has been the main hurdle in expanding the CGMA course through NITLE. 13

Low-End GIS Teaching in Classical Studies: Examples of web-based geospatial assignments

The CGMA seminar is not a general education course and we are now seeking to introduce GIS concepts, and hence spatial literacy, to students throughout the Classical Studies curriculum. As noted, the Geospatial Semantic Web (Web 2.0) now makes this possible. With this proliferation of map 'data', there is an even more pressing need for undergraduate students to understand precisely what maps can depict and what they can obscure. While “virtual 14

globes” are a far cry from actual GIS technologies, as they have limited analytical capabilities, they can be an effective introduction to spatial thinking and a means to scaffold that skill through the curriculum [Bodenhamer and Gregory 2012, 243], something most liberal arts curricula have developed with other critical thinking skills, such as writing and quantitative reasoning. It is also the case that the highly sophisticated, quantitative tools of GIS are, in fact, not always necessary to do research in the humanities. Harris et al. argue that the Geospatial Semantic Web “is capable of providing the core of a humanities GIS able to integrate, synthesize, and display humanities and spatial data through one simple and ubiquitous Web interface” [Harris, Rouse, and Bergeron 2010, 130]. They suggest that web-based interfaces can serve as a “Pareto GIS”, that is, that for the Humanities 20% of GIS capability may be sufficient to produce 80% of the outcomes. “The Geospatial Semantic Web may indeed become the cornerstone of the future humanities GIS” [Harris, Rouse, and Bergeron 2010, 141]. For Classical Studies, thanks to the Ancient World Mapping Center, Antiquity À-la-carte now provides Mediterranean World specific web-based GIS interface that can be used to create customized maps with layering and drawing features that fall between a virtual globe and a full-scale GIS application.[7]

The following examples use Google Maps for course content and assignments to introduce spatial thinking concepts to students and enhance their appreciation for the role of topography and geography in the formation of human societies. These examples are all drawn from classical archaeology courses but the framework of the assignments and the skill set that they are designed to address could be easily modified to work Greek and Roman civilization as well as Classical literature courses, or, indeed, any history or culture course. 15

The first two examples are from the 200-level archaeology sequence at DePauw. Those courses are designed for students at the sophomore/junior-level some of whom are majors in Classical Studies, but the majority of whom enroll for general interest and/or to fulfill the arts and humanities requirement of the general education curriculum. In CLST 254: Hellenistic and Roman Art and Archaeology, P. Foss uses Google Maps to enhance the students' experience learning about Ostia Antica. He marks the site of Ostia Antica using different pin designations for different types of structures and provides links to information from another web resource (Figure 2). This example leverages an existing (and well maintained) digital resource, http://www.ostia-antica.org/. In addition to reading about Ostia in their textbook, students are required to use the site in a dynamic way, following connections that catch their interest and developing new questions based on their visual analysis of the site. It can take some time on the part of the professor to build a resource like this, but once it is completed it can be saved and modified for future use. 16

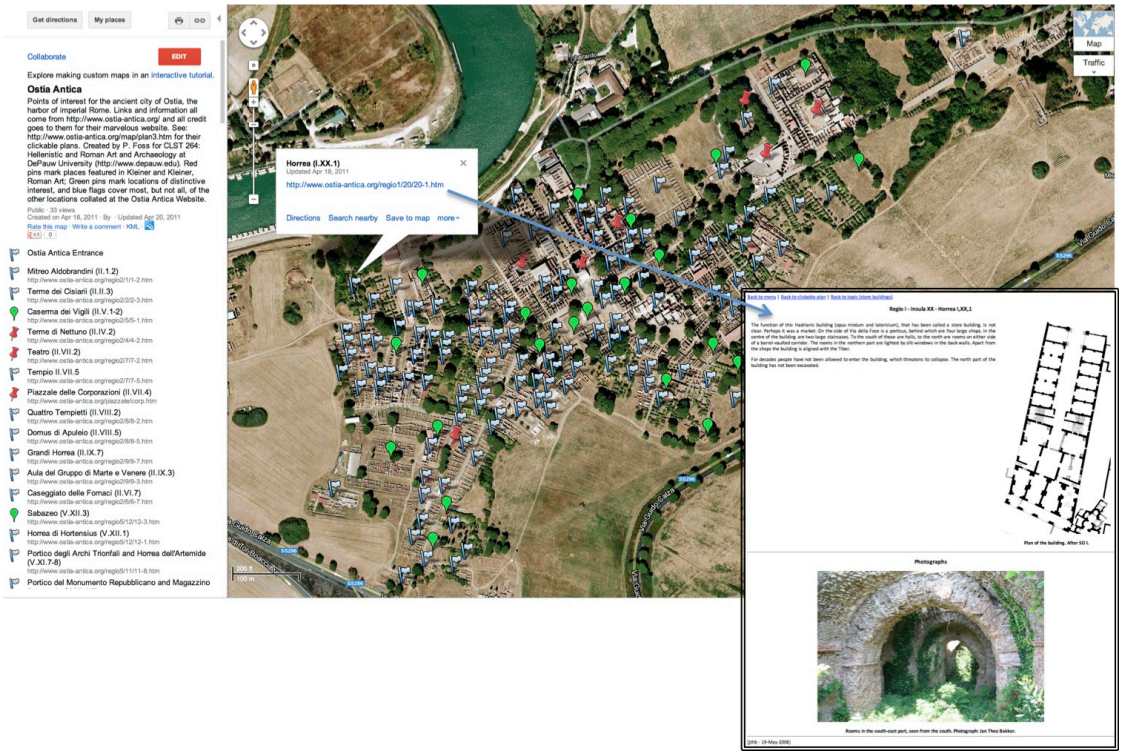

Figure 2. GIS of the Hanna Street Cemetery in Greencastle, IN made in ArcGIS by DePauw University students for the CGMA course.

In this first example, the professor creates a dynamic map and the students follow along. The current generation of students, however, is accustomed not only to referencing digital maps for information but also contributing their own content in the form of location data and digital images. What they are less familiar with, and needs to be intentionally taught, is how to generate new information by connecting data with specific places in order to ask questions about the use of space. The second example attempts to address this issue. 17

In CLST 263: Greek, Etruscan, and Persian Art and Archaeology, I assign an article by Catherine Morgan that examines the relationship between the distribution of sanctuaries in the Corinthia and the development of the Greek *polis* (city-state) in the early Iron Age [Morgan 1994]. The original article asks readers to think about how the distribution of sanctuaries in the landscape can be related to social and political developments in early Corinth. Students have trouble visualizing the connections that Morgan attempts to evoke because they are not familiar with the topography of the region and they have no idea how far it is from the sanctuary at Isthmia, for example, to the city of Corinth. Moreover, their ability to spatially comprehend the landscape is not helped by the fact that the only map published with the article is a simple line drawing with dots indicating cities and sanctuaries in the regions; no topography is depicted nor is there a distance scale. 18

To enhance their understanding of the article, I ask my students to create their own map of the sanctuaries and cities Morgan references; they can use either Google Maps or Bing Maps. The goal of the assignment is to produce an interactive map that allows students of early Greek history to gain a better understanding of the sacred landscape in the Corinthia between 1000 and 800 BCE. Students are told to accurately mark the sites and to use other tools to indicate area and distance between sites. They are also required to provide some description of each marker and encouraged to include photos and/or links to external sites. Once they have marked the sites, they are instructed to examine the relationships between the cities and the sanctuaries taking into account the topography (i.e., they are supposed to look at the satellite imagery) and write an analysis. They are also warned that simply “Googling” site names does not necessary give them accurate locations for the ancient sites. They are encouraged to use other web-based resources, such as Pleiades, an on-line spatial gazetteer of ancient sites, to geo-reference the ancient sites in Google or Bing. 19

The results of this assignment display a range of student enthusiasm as well as capability. In Figure 3, Student A took 20

advantage of the tools available in Google for both display and annotation. They integrated information from Morgan's article with the sites on the map (although they did not supplement this with reference to other web sites or images) and they provided analysis of the physical relationships between the sites. However, they did not necessarily take into account the visible topography. This was one of the few students to place the sanctuary at Isthmia in the correct location. In a second example (Figures 4 and 5), Student B provided a lot of information in the pop-up boxes, including links to useful websites. They also took advantage of the drawing tools in Google Maps to highlight individual features at each site. Unfortunately, they were not precise in their placement of sites, Isthmia is marked at the modern city and Perachora is 'off' slightly from the site. Student C really experimented with the symbolism available in Google Maps (Figure 6), using different pin icons and colors to indicate different categories of information. This student also did not assume a straight line between places as Student A did, rather their route from Corinth to Isthmia follows the modern road (I am not sure how they determined the routes across waterways). This demonstrates that Student C understands that the spaces between places determine relationships, but they relied on the modern determination of the relationship rather than considering the physical environment as it would have existed in antiquity.

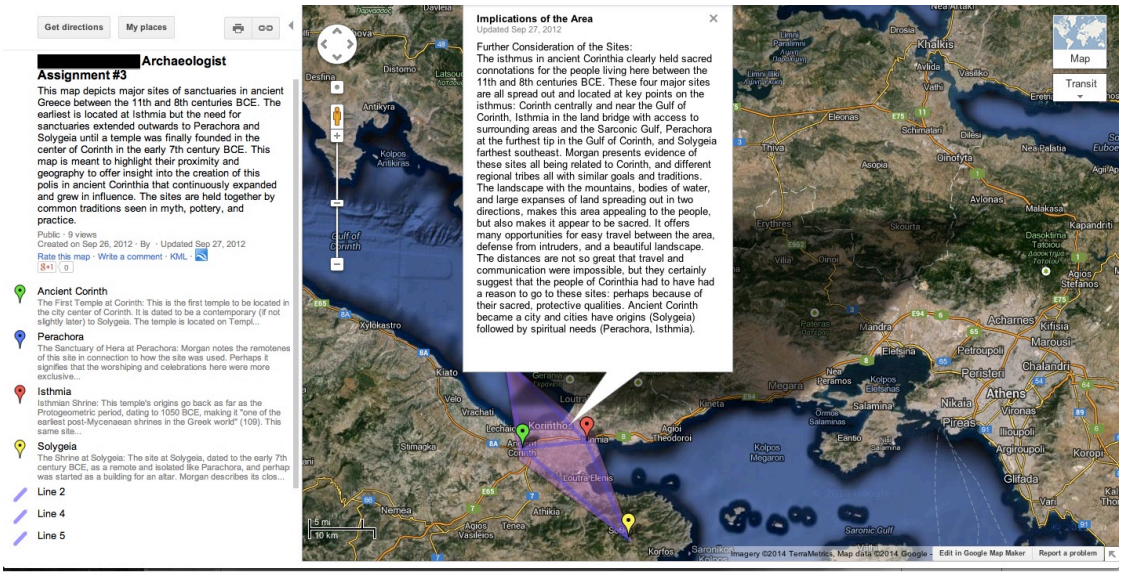

Figure 3. Student A's Google Map of the Corinthia in the early Iron Age created for CLST 263 at DePauw University.

Figure 4. Student B's Google Map of the Corinthia in the early Iron Age created for CLST 263 at DePauw University.

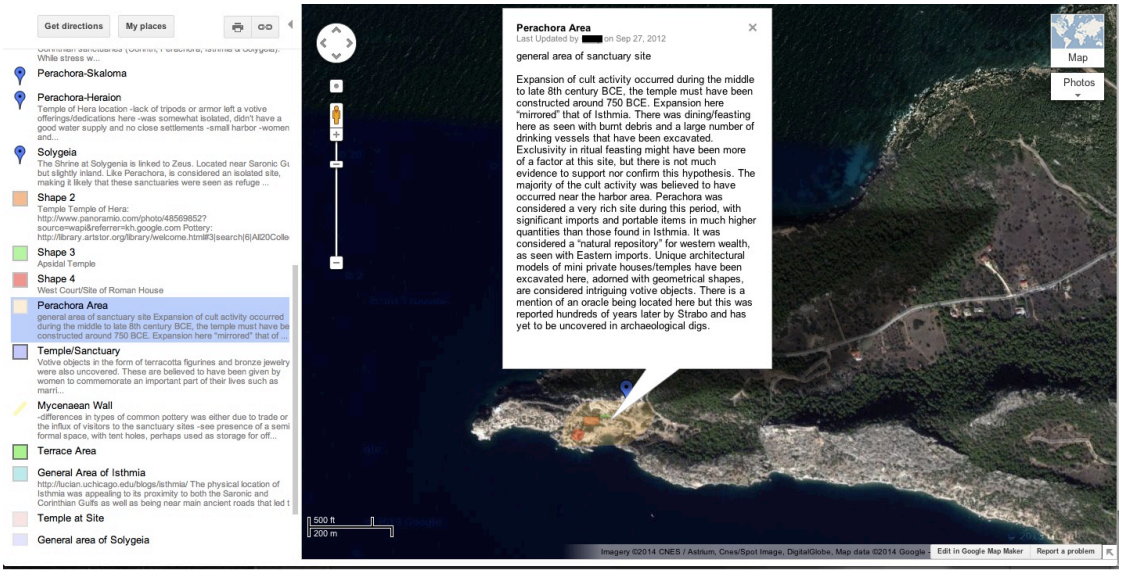

Figure 5. Detail of Student B's Google Map of the Corinthia in the early Iron Age created for CLST 263 at DePauw University.

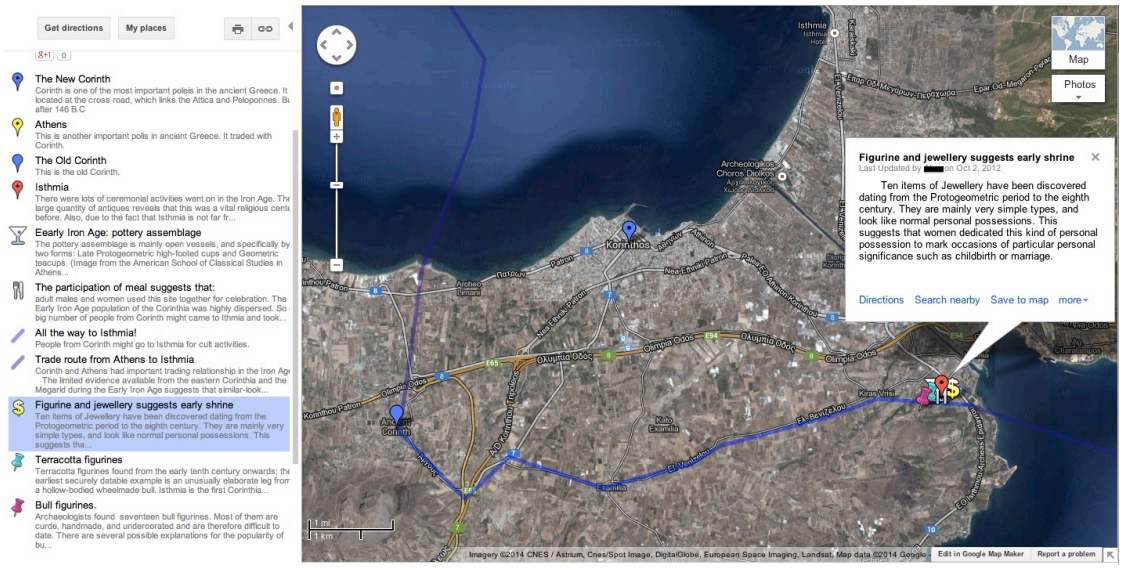

Figure 6. Student C's Google Map of the Corinthia in the early Iron created for CLST 253 at DePauw University.

Our third example comes from an upper level topics course in archaeology, CLST 310: Ancient Britain. This course is designed for majors in Classical Studies as well as students in allied fields such as history, anthropology, art history, and geology. In this case, the mapping assignment is one component of a semester-long research project. The professor, P. Foss, provides an example of a Google Map that documents prehistoric sites in Orkney (Scotland) by drawing outlines around the sites and providing information with links to reliable websites (Figure 7). The students are then asked to build their own maps of an ancient landscape from a set of choices: Thornborough (Yorkshire), Avebury, or Stonehenge. They are required to research the sites on their own and then create their map by marking, with an outline and/or place pin, the important sites. Students are instructed to make use of color, line-weights, transparency, etc., in order to convey meaningful information. They are also expected to annotate each site with pertinent information from their sources, which could include links to relevant web sites.

Figure 7. Annotated Google Map of prehistoric sites in Orkney (Scotland) created by P. Foss for use in CLST 310 at DePauw University.

Again with this assignment, students display varying levels of attention to detail and presentation strategy. In Figure 8, Student D's map of Avebury looks relatively impressive graphically and in terms of the data. A closer look, however, reveals that while they include some links to scholarly articles, they also link to a 1969 public domain book that, although not intrinsically un-scholarly, is woefully out of date. Of course, this sort of 'mistake' affords the opportunity to talk to the students about careful evaluation of sources before posting them publically. 22

Figure 8. Student D's Google Map of Avebury created for CLST 310 at DePauw University.

In Figure 9, we can see that Student E's map has some serious deficiencies. They did not bother to correlate the satellite image with maps of the Stonehenge landscape that would have provided them with accurate names (rather than 'possible settlement') and date ranges for the sites. It does not appear that they even zoomed in to look closely at the satellite image as the pin for Stonehenge itself is placed in the parking lot of the (old) site museum rather than on the actual stone circle. They also did not experiment with the drawing capabilities of Google Maps to make their map visually interesting as well as informative. 23

Figure 9. Student E's Google Map of Stonehenge created for CLST 310 at DePauw University.

In both the CLST 263 and the CLST 310 assignments, students are asked to demonstrate several key skills in spatial literacy: 1) the accurate identification of sites or features in a landscape, 2) the use of cartographic symbols to convey meaning, 3) the presentation of useful data connected to a specific place, and 4) the visual analysis of a landscape based on the integration of that data with the spatial relationships between sites. The fact that some of our students cannot even accomplish skill 1 affirms for us the importance of spatial thinking exercises in our Classical Studies courses. Students need to practice spatial thinking skills in the same way that they need to practice writing. Thus, assignments need to be scaffolded and repetitive, helping students build a set of skills that they can apply. They should also be given the opportunity to fix their mistakes and we should emphasize *process* over *product*. 24

While Classical Studies may not be an appropriate curricular space for a full-on GIScience course, we can certainly utilize the available technologies to enhance our students' spatial skills and at the same time challenge them to use those technologies for critical analysis of real questions about the ancient Mediterranean world. The Geospatial Semantic Web (Web 2.0) presents an opportunity to advance teaching in Classical Studies beyond the textbook two-dimensional map. Students, at all levels of the curriculum, can be encouraged to take advantage of this technology to create their own map content, visualize spatial relationships between place, and develop questions about those relationships. This is not just a “cool tool” to get students engaged with Classics, it is dynamic way to introduce spatial thinking into the curriculum (implicitly or explicitly), provide stepping-stones towards spatial literacy for our students, and enhance our course content. 25

Notes

[1] We gratefully acknowledge the Andrew W. Mellon Foundation for its initial support of the CGMA Project. The collaborating schools included DePauw University, Millsaps College, Rhodes College, and the College of Wooster.

[2] At the 2012 Specialist Meeting on “Spatial Thinking Across the Curriculum” hosted by Center for Spatial Studies, only three of the forty-three participants came from humanities backgrounds.

[3] An exception is the work of Mostern and Gainor (2013), who have used Google Earth with students to create digital historical atlases of the Silk Road.

[4] The distinction between “high-end” and “low-end” can be read as both technological and financial. “High-end” assignments necessitate expertise that not all instructors have acquired and both the software and hardware require resources not available on every college campus. On the other hand, “low-end” assignments take advantage of free technologies with a less significant learning curve.

[5] In the most recent iteration, P. Foss has broadened the course not only to address GIS but also other trends in electronic archaeology such as gaming simulation and digital modeling. This version of the course was taught for the first time in fall 2014, after the original version of this paper was presented at the 2013 DCA conference. Details can be found in the syllabus on the CGMA website: http://cgma.depauw.edu/seminar.html.

[6] When NITLE became involved we had plans to make the course nationally available, but that has not yet become a reality.

[7] Antiquity À-la-carte was released after the assignments presented here were developed. Moving forward, this may prove to be the best web-based resource for teaching spatial thinking concepts in Classical Studies.

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