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Transforming the History Curriculum With Geospatial Tools

Thomas Hammond
Lehigh University

Abstract

Martorella's "sleeping giant" is awakening via geospatial tools. As this technology is adopted, it will transform the history curriculum in three ways: deepening curricular content, making conceptual frameworks more prominent, and increasing connections to local history. These changes may not be profound and they may not be sudden, but they will come as geospatial technology becomes increasingly ubiquitous and easy to use. Each of these three predicted transformations is described and illustrated, and implications for teacher education programs are addressed.

In 1997, Peter Martorella described technology as "a sleeping giant in the curriculum" (p. 511). He spoke for many, as evidenced by the wide and enthusiastic quoting of his metaphor (cf., Hammond & Manfra, 2009). In the years following Martorella's observation, the social studies education community has indeed embraced technology in a number of ways. Social studies educators and researchers have published books, such as Braun and Risinger's (2001) *Surfing Social Studies: The Internet Book*.

Social studies journals now present technology-themed issues or standing features (as in *Social Education*) or even exist completely online (*Social Studies Research & Practice*, www.socstrp.org, and of course, the Social Studies Education section of this journal). Even *Theory & Research in Social Education* has been archived online—a day some thought might never arrive!

A growing community of social studies researchers has explored the application of technology to social studies instruction, seeing how the integration of wikis might not only improve content learning outcomes but empower constructivist learning (Friedman & Heafner, 2007; Heafner & Friedman, 2008), how historical problem-solving with primary sources can develop students' civic skills (Saye & Brush, 2007, along with many publications), how blogs and discussion boards can help advance students' discourse about history (Blankenship, 2009; Manfra & Lee, 2011, 2012), or even how technology is changing the nature of history itself to create a new, digital history model for linking argument to evidence (Lee, 2002; Clark & Lee, 2004).

Some members of the community have pioneered new instructional techniques, such as digital documentaries (Hofer & Swan, 2006, among others) and even developed new technologies to bring them to life (e.g., Bull, Hammond, & Ferster, 2008). Finally, within the social studies practitioner community, teachers have widely adopted a range of technologies, from PowerPoint (Hofer, Ponton, & Swan, 2006) to Internet-based resources (Friedman & VanFossen, 2010; VanFossen & Waterson, 2008).

However, Martorella's more trenchant point is often overlooked: "If the giant does awaken, a surprise awaits him....The giant will be struck by how little the social studies curriculum has been affected by the technology changes sweeping the nation" (p. 511). In other words, social studies teachers are using new, technological means to accomplish the same, traditional outcomes. History curriculum and instruction, for example, still focus on survey courses driven by content coverage, be it "Plato to NATO" (Nash, Crabtree, & Dunn, 1997, p. 90) or "colonialism to Clinton" (Grant, 2003, p. 123). Accordingly, teachers have adopted technologies that recapitulate prior practices: PowerPoint enhances a lecture; students gather information on the Internet rather than in the school library.

Even as teachers increasingly integrate digital primary sources, their pattern of instruction remains didactic rather than inquiry driven (Doolittle & Hicks, 2003). Technology-based innovations that require a reimagining of the business-as-usual curriculum (e.g., Brush & Saye's *DecisionPoint!*, 2003, or Molebash's Web Inquiry Project, 2004) are far less widely adopted than models that mesh with traditional instruction (webQuests or multimedia packages such as DiscoveryEducation's streaming videos). The musicians may have switched from acoustic to electric to digital instruments, but often the song remains the same.

Is the social studies education community destined to remain trapped, like the doomed clowns of Beckett's play *Waiting for Godot*, waiting for a transformation that never comes? Will technological innovations only ever impact social studies curriculum and instruction on the margins—as dedicated, risk-taking teachers integrate out-of-the-box topics such as presidential propaganda (Journell, 2009) or tackle challenging instructional models such as digital documentaries (Manfra & Hammond, 2008; Schul, 2012; Hofer & Swan, 2006)? The record to date suggests that, yes, there will be no substantive change, at least not in response to technological changes.

However, we know that the potential is there: Specific technological tools have, in fact, had an impact on established curricula, but the change requires a sufficiently innovative (and disruptive) technology. In mathematics education, for example, a substantial reform was attempted in the 1950s and 60s: The New Math. This effort aimed to change the goals and practices of mathematics education, moving away from the rehearsal of mathematics facts and algorithms and toward concept development via a discovery process and logic. This effort failed due to many factors, among them, the high level of abstraction required.

The arrival of the graphing calculator in the 1980s substantially changed what teachers and students could expect to do with equations during a class period. Rather than emphasizing the skills to compute and plot a parabola, for example, the students could use the graphical display to see what happened as they manipulated the parabola, observing the relationships between the variables within the function. One research team observed students working with graphing calculators and reported that they began to think "graphically about problems before trying to solve them algebraically" (Quesada & Maxwell, 1994, p. 213).

Content that had previously been reserved for calculus began to creep into precalculus. As these tools became standard equipment in mathematics education, the curriculum shifted along with it, and subsequent technologies—such as math widgets on interactive whiteboards or mathematical suites such as Mathematica, Geometer's Sketchpad, Fathom, or Wolfram Alpha—have only served to reinforce this shift in curriculum and instruction. Where the New Math failed to initiate reform, the graphing calculator (along with other factors, such as the standards movement and the efforts of progressive math educators), in fact, triggered a sea-change in mainstream mathematics education. (Note that I make no claim as to the desirability of the changes that followed. I leave that decision to the math education community.) I suggest that, in parallel, social studies education may not be waiting for Godot, but rather waiting for the right tool to arrive.

In surveying emerging technologies, geospatial tools are one instance where Martorella's sleeping giant will have at least some of the anticipated effect of transforming an area of the social studies curriculum. Specifically, history teachers who integrate geospatial tools (e.g., Google Earth and GIS) will find their enactment of the curriculum changing in terms of the content addressed. The process is slow and the effects will not appear rapidly, but over time the history curriculum—as enacted by teachers (if not as written into the official curriculum guide)—will change to take advantage of the new suite of tools. Eventually, the sleeping giant of geospatial technology *will* awaken, and it *will* have an impact on the history curriculum. The scale of the changes may be modest or they may be profound, but a change is going to come.

Before detailing these changes, we must first define geospatial tools and illustrate their use for history education. Geospatial tools, or geospatial information technologies, comprise a family of both hardware and software that visualize, measure, and map geographically referenced information. For example, a global positioning system (GPS) is a dedicated device that allows the user to record an absolute location (i.e., latitude and longitude) to a geographic point. The capabilities of a GPS can be integrated with other devices (e.g., navigation systems) or software (Google Earth) to address many tasks: identifying latitude and longitude coordinates of *any* location, finding directions, planning vacations, and so forth.

In the context of history education, the two primary geospatial tools that will be of interest are both dynamic globes (such as Google Earth) and geographic information systems, or GIS (such as Esri's ArcGIS and National Geographic's MapMaker). Both technologies can run either as installed, client-side software or as a web service, accessed via a browser. Google Earth provides rich, contemporary satellite imagery and markup (see Figure 1a); GIS allows for far more powerful analysis of any geospatial data set (see Figure 1b).

Other geospatial technologies are, of course, interesting and relevant to the history curriculum—Flickr's map feature, online historical map archives such as the Rumsey Collection or the Perry-Castaneda Library map collection at the University of Texas at Austin—but dynamic globes and GIS illustrate the functionality that will be most appealing to history instruction.

An emerging literature documents geospatial tools in history education (e.g., Alibrandi, Beal, Thompson, & Wilson, 2000; Alibrandi & Sarnoff, 2006; Edelson, Smith, & Brown, 2008; Fitchett & Good, 2012; Knowles, 2002; Radinsky, Loh, & Lukasik, 2008; Snyder & Hammond, 2012). To date, this literature has addressed the development of datasets and instructional practices for a scattered collection of topics in the history curriculum: the Salem Witch Trials, the French and Indian War, the American Revolution, the

Constitutional Convention, the Whiskey Rebellion, American slavery, the Civil War, immigration, the Great Migration, the Dust Bowl, redlining, the Holocaust, and so forth.

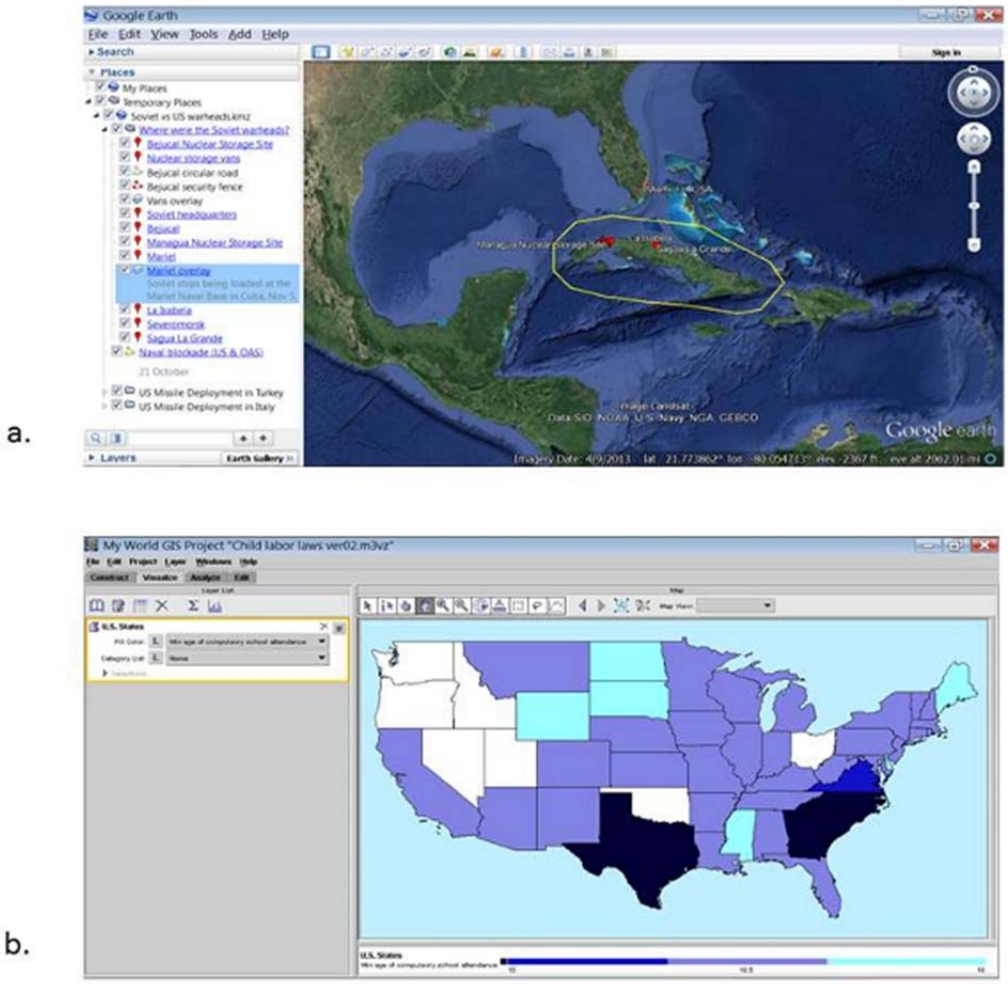


Figure 1. *Sample geospatial tools for history education: (a) Google Earth markup displaying nuclear missile sites and naval blockade during the Cuban Missile Crisis, and (b) GIS coverage showing child labor laws circa 1933. Cuban Missile Crisis data drawn from the National Security Archive at George Washington University; child labor data is from the US Department of Labor. [Google Earth file addressing the Cuban Missile crisis for Figure 1a. Note that this work extends the file created by historian Michael Dobbs at George Washington University, available at http://www2.gwu.edu/~nsarchiv/nsa/cuba_mis_cri/dobbs/warheads.htm*. GIS files summarizing U.S. child labor laws circa 1933 for Figure 1b can be found, as follows: map file, database file, index file.]

Looking across this literature, and drawing upon extensive personal experience teaching with and about geospatial tools, I predict that three changes to the history curriculum will result when teachers integrate geospatial tools into their instruction. These changes are explained and illustrated in the next section, and the implications for teacher educators are addressed in the following section. Unless otherwise noted, all datasets and displays are original.

Three Predicted Transformations to the History Curriculum

Each assertion is explained and supported by reference to specific topics in the history curriculum. This strategy is necessarily idiosyncratic: only one or a few datasets may exist to support isolated concepts in the curriculum, and discussions of broad, sustained examples of these transformations in action are not currently possible. However, the reader is invited to take the long view—as geospatial tools become more powerful and ubiquitous, as datasets grow more comprehensive and easier to use, those curricular topics that are spatially referenced—and they are myriad, from immigration to internment, from the reservation system to Jim Crow laws, from rise and fall of Rome to the rise and fall of the Soviet Empire—will have data and display techniques that are readily at hand for classroom teachers. Without this preliminary assumption, the following discussion may be moot.

Greater Depth in Curricular Content

The history curriculum as it exists at both the K-12 and collegiate levels emphasizes coverage over depth. The required history courses in high school are surveys of American and World History, with only elective courses offering a more in-depth look at an era (e.g., The Vietnam War) or a topic (e.g., Native American History). In college, history majors must wade through required introductory survey courses (e.g., Europe to 1648 or African Civilization) before they arrive at special topics seminars (Rise and Fall of the New Deal) or attempt to write their own historical accounts (i.e., a senior thesis). Consequently, speed and brevity are essential, and only the most salient concepts are included in lectures and readings and required of students on their assessments.

As an example, a lesson on British colonization of North America will typically present settlements in a vacuum: Jamestown appears all alone on the Virginia peninsula; Plymouth is all alone on the shore of Massachusetts Bay (see Figure 2). Although many other details are relevant for historians or other specialists—from the climate to natural resources to relationships with indigenous groups and other European powers—none of these additional considerations will receive more than a brief mention in a typical classroom discussion or textbook account.

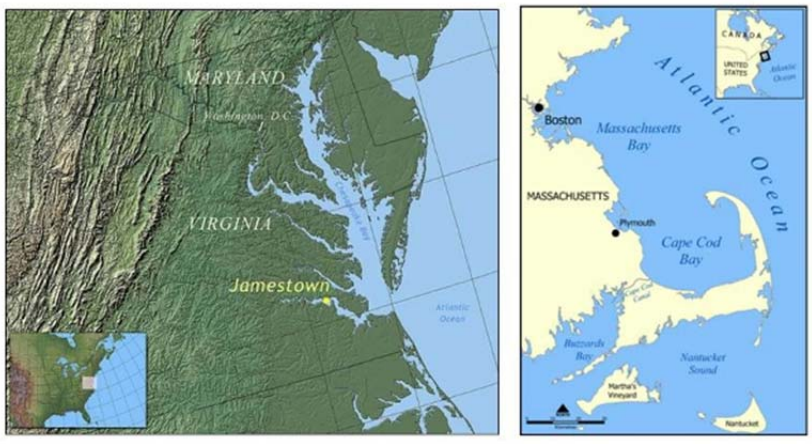


Figure 2. *Sample nonspecialist maps of Jamestown and Plymouth. Sources: Wikimedia Commons, University of Maine at Farmington.*

Conveniently, geospatial tools meet the existing need for presenting concepts quickly. Teachers can reproduce this same display using dynamic globes such as Google Earth. Again, the colonies are presented in isolation, as if they landed on the moon, with no reference to the critical contextual details that allowed colonies to thrive (Plymouth), caused them to fail (Roanoke), or supported them through challenges to survival (Jamestown; see Figure 3).

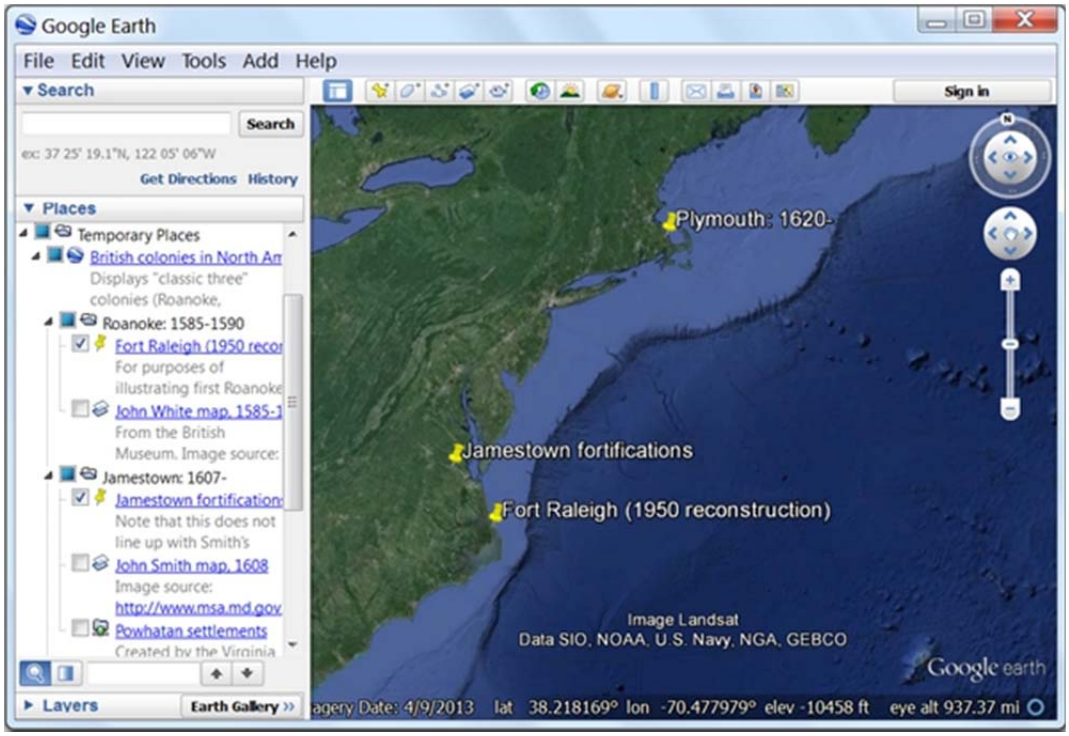


Figure 3. *Google Earth overlay showing locations of Plymouth, Jamestown, and Roanoke colonies. [Google Earth files to explore British colonial experience in continental North America can be found as follows: British colonies in continental N. America; and 'Indian groups' map created by the Virginia Center for Digital History, based upon John Smith's 1606 map compared against archaeological finds.]*

However, teachers using geospatial tools can go further if they wish, without sacrificing speed or, consequently, curricular coverage. An ambitious teacher can quickly supplement—or even subvert—the decontextualized approach by adding others' datasets to the map. For example, an American history teacher can introduce materials from the Virginia Center for Digital History's Virtual Jamestown, including a Google Earth overlay showing Native American settlements and trade stations. (See Figure 4.)

When students view this dynamic overlay—particularly in contrast to the static, isolated representation in the textbook or on an electronic slide—they will have much better sense of the world into which the colonists were interjecting themselves: a vibrant, active, culture and economy with its own politics and ambitions. If time does not permit an extended discussion, this dataset can be presented with little or no comment. At a minimum, students will be reminded of the existing, precolonial paradigm rather than viewing settlers' actions on a blank slate.

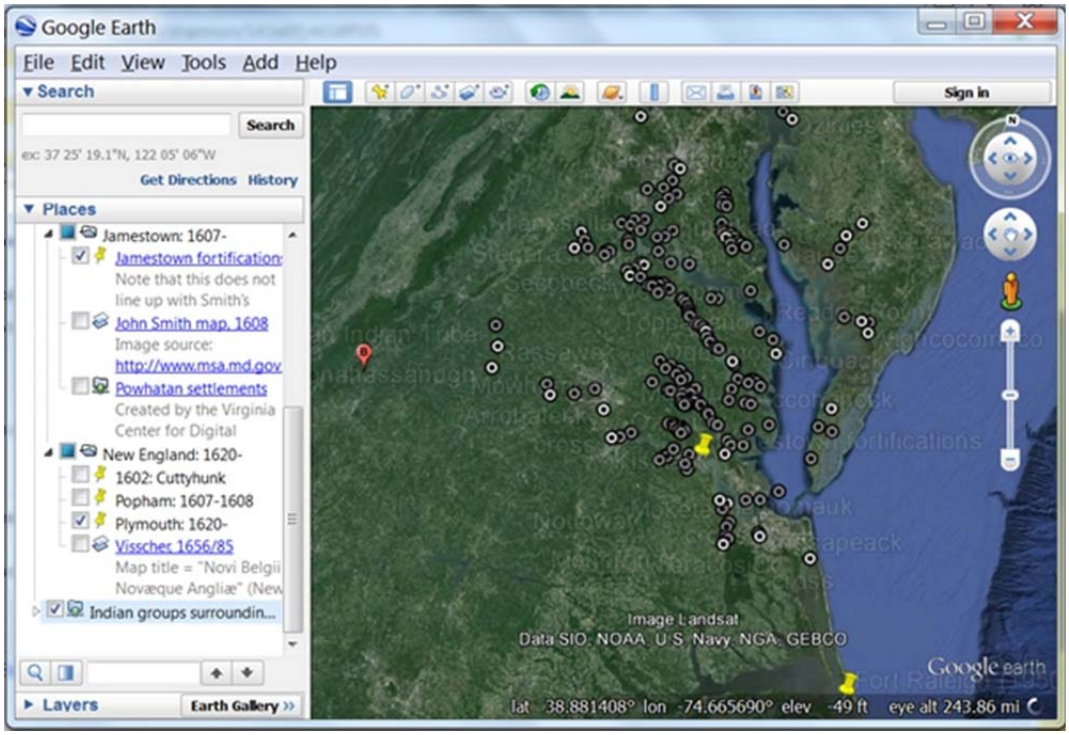


Figure 4. *Google Earth markup displaying Jamestown colony along with placemarkers noting Native American settlements, trade stations, and other areas of activity. Data source: Virginia Center for Digital History. [Google Earth files to explore British colonial experience in continental North America can be found as follows: British colonies in continental N. America; and 'Indian groups' map created by the Virginia Center for Digital History, based upon John Smith's 1606 map compared against archaeological finds.]*

More ambitious teachers can, with slightly more time and technological savvy, introduce the source for the data, John Smith's 1608 map, and place it in the context of Google Earth's satellite imagery (see Figure 5). This data not only deepens the curricular content but also reminds students of the evidentiary record underpinning the historical accounts presented in the textbook and other sources. What we know about the Native Americans in and around the Jamestown peninsula comes from the work of specific people: John Smith and other contemporary chroniclers, plus modern day archaeologists, anthropologists, and historians such as the staff of the Virginia Digital History Project. When viewed against the satellite imagery of Google Earth, the inaccuracies of Smith's map provide an opportunity for students to consider how fraught this entire enterprise of historical investigation is. Thanks to geospatial tools such as Google Earth, we can see the world as it is, but we can only ever imagine it as it was.

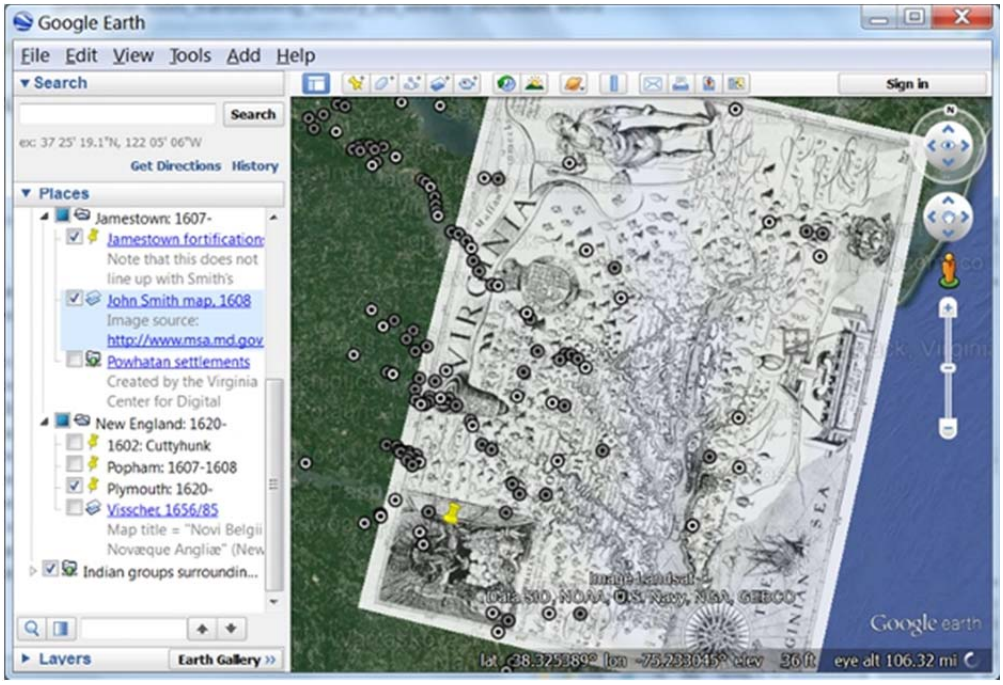


Figure 5. *Google Earth markup identifying the locations of Jamestown colony and surrounding Native American points of interest, with Adam Smith's map (1608) overlaid. Data sources: Virginia Center for Digital History, Wikimedia Commons. [Google Earth files to explore British colonial experience in continental North America can be found as follows: British colonies in continental N. America; and 'Indian groups' map created by the Virginia Center for Digital History, based upon John Smith's 1606 map compared against archaeological finds.]*

The K-12 history curriculum, at least in the required courses, will most likely never prioritize depth over breadth of content knowledge. However, as demonstrated, geospatial tools can lower the barriers to introducing more in-depth consideration of the topics within the existing, broad curriculum. This additional depth can take the form of additional, relevant content knowledge (Figure 4) or even historiographical considerations (Figure 5).

Even a teacher who is content to use geospatial tools at the current, shallow level of representation (Figure 3) will be nudged toward more sophisticated uses, whether via student project work with geospatial tools or by adopting materials produced by teaching colleagues, curriculum support staff, or social studies education researchers.

More Prominent Conceptual Frameworks for Content Knowledge

As history teachers race to cover the curriculum, students may become buried under the onslaught of data and lose sight of the big ideas. When the American history teacher introduces the causes of Southern secession in 1860-61, students tend to focus on capturing the testable facts (the Nullification Crisis of 1832, the Fugitive Slave Act, the Dred Scot decision, etc.) and forget the underpinning forces driving the split (the cultural, economic, and legal structures that profited from and reinforced the practice of slavery). As students begin to march through the military campaigns that followed Fort Sumter—

from First Manassas on through to the surrender at Appomattox—history can indeed become "just one damn thing after another," despite Toynbee's famous protestation (1961).

Given a rushed, coverage-driven instruction from the teacher and cognitive overload on the part of the students, the conceptual frameworks that endure are either simple (e.g., chronology – First Manassas happens before Second Manassas) or simplistic (the North is virtuously seeking to end slavery, the South is contemptibly attempting to defend slavery). These frameworks are reinforced through time-honored graphical representations, such as timelines, T-charts, or V diagrams. While these tools are certainly robust and helpful at concept development, they come with built-in limitations or even fallacies: post hoc ergo propter hoc, single cause, Manichaeism, and so forth.

Ambitious history instruction, however, calls for more sophisticated conceptual frameworks and, therefore, more sophisticated instructional materials. Again, geospatial tools provide a platform for generating flexible, dynamic instructional materials that support increasingly sophisticated conceptual frameworks. Consider the world history curriculum. While American history—as a narrower, more bounded slice of content—comes with certain built-in conceptual frames (e.g., post-Enlightenment social and political evolution; the shifting relations between the upper class, middle class, and underclass; approach/retreat from the ideals of the Declaration and Constitution), world history tends to be much more challenging for students.

For learners with little prior knowledge, the curriculum is a hopscotch across time, geography, and concepts. They see early civilizations in Sumeria and Egypt. They leap to Greece and Rome to explore evolutions in government and technology. They lurch over to India and China to repeat these themes and add new ones (e.g., the dynastic cycle, caste systems). And teachers tell students to keep in mind that civilizations were also ticking along in the Americas—and remember everything going on in Sub-Saharan Africa.

In a poorly constructed world history course, history is not even one damn thing after another; it loses even the concept of sequence. As students puzzle over the Moghul Empire and the Mongol Empire (Which was in south Asia, which one came first, and what is the connection between them, if any?) they may feel like Billy Pilgrim, the protagonist of Kurt Vonnegut's *Slaughterhouse-Five,* who is bounced around time and space by forces beyond his control.

To demonstrate how geospatial tools can address these challenges, consider two topics from the world history curriculum. The first topic is the cradles of civilization, typically addressed in the early units of a world history course. The conceptual framing for the topic is the geographic and environmental features that enabled the rise of states, as it occurred independently over time (College Board, 2001, p. 28). The time-tested instructional material for this topic is a world map, with early/independently-formed civilizations marked upon it. (See Figure 6a.)

While this map accurately conveys location, it loses any sense of time (or rather relies upon the students to do the temporal work by reading the footnoted dates) and provides no cues to the local geography and environment of each civilization (access to water, particularly river valleys). In contrast, a teacher can use Google Earth to present the same information (see Figure 6b) and use the dynamic data displays to discuss time (via the History feature) and explore the local geography by zooming in and out and adding/subtracting markup layers. (In fact, by zooming all the way to ground level, the class can even discuss the archaeological remains of these civilizations, from Olmec temples to the tomb of Qin Shi Huang near Chang'an.)

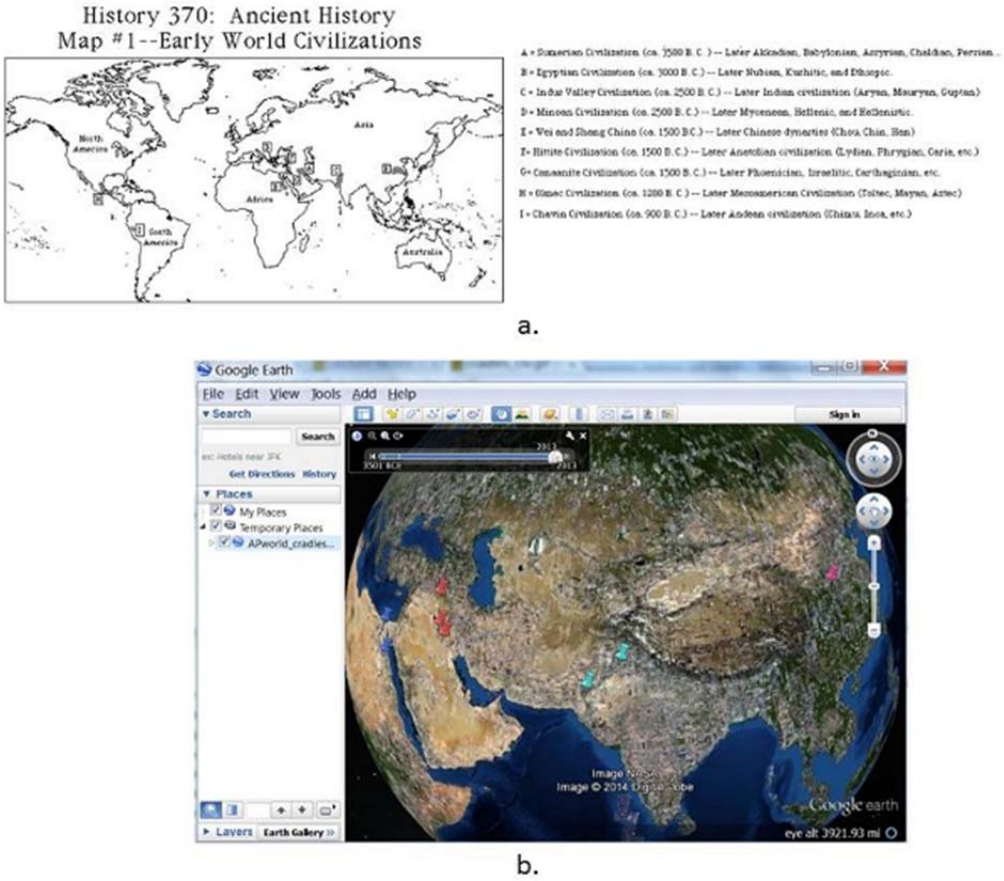


Figure 6. *Examples of (a) traditional, static map and (b) dynamic, geospatial technology-based display of early civilizations. Image source for (a): University of North Carolina at Pembroke. [Google Earth file showing the Cradles of Civilization]*

The geospatial technology provides a far more flexible, robust medium for exploring the topic and addressing the complete conceptual frame. Either the content (i.e., the details of each civilization) or the conceptual framework (the geographic and environmental constraints) can be foregrounded as required during instruction. In contrast, the traditional instructional support provides a partial presentation, and the student must assemble the full framework and content understandings across multiple platforms. In this process, the testable content tends to stay in the foreground, and the conceptual framework sinks to the background, reinforced only in part by materials such as the static map.

The second topic for demonstration is the Great Wall of China, a single point from which teachers can develop students' understanding of China's evolving administrative proficiency, responses to external threats, rise of successive elites, and grounds for underclass revolts (College Board, 2011). Instruction on the topic typically includes maps—typically highlighting only the Ming era—and photographs of the present-day remains or tourist attractions (see Figure 7a). Using geospatial tools, a teacher can again provide greater depth to this topic.

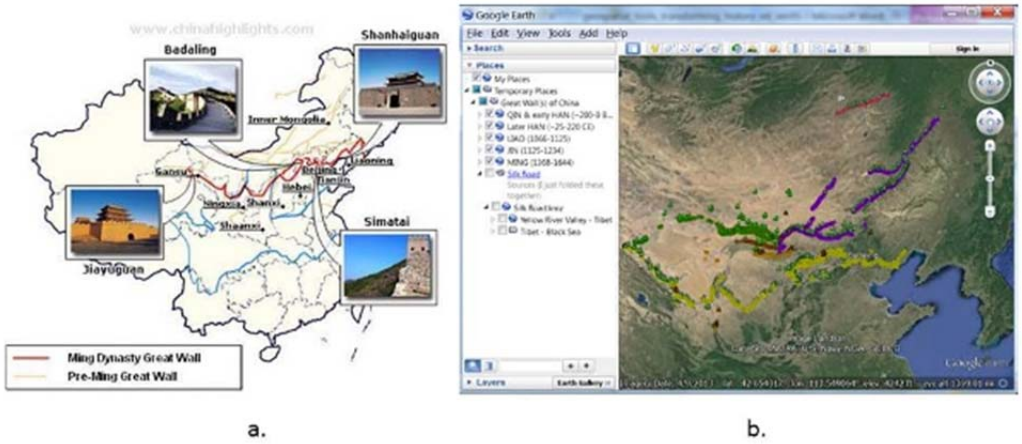


Figure 7. *Examples of (a) traditional maps and photographs and (b) dynamic, geospatial technology-based display of the Great Wall(s) of China. Image sources: ChinaHighlights.com, www.mine.mn [Google Earth file on the Great Wall(s) of China]*

The dynamic map can address the many stages of the wall's development and decline, and the teacher can zoom in to address specific features of topography (e.g., the early walls were built in the flat lands facing the mountains; the Ming walls were built on top of mountains). The fact that the sections of the wall are widely separated (e.g., the Liao and Jin sections are further to the north than the Han and Ming sections) allows students to infer the regional and sectarian differences among dynasties. The Liao and Jin were northern dynasties whose power base was outside the Yellow River valley. The Liao was, in fact, a Manchurian dynasty and ruled during a period of fragmentation, with separate dynasties existing in southern and central China. Again, the content and conceptual framework can trade places, moving between background and foreground as needed.

This topic, however, can demonstrate something new: Using the geospatial display, the teacher can incorporate issues that stretch beyond the content selection (China) and into other parts of the curriculum. For example, the same lesson on the Great Wall of China can easily reference the Silk Road (and equivalent maritime routes): the Han dynasty extended the wall west, toward the Taklimakan Desert, to protect the Silk Road as it ran west from the Yellow River valley (see Figure 8).

By placing these concepts in conjunction, students can consider the significance and impact of these routes, not only in terms of trade (allowing Chinese silks to move east) but also in terms of cultural exchanges (as Indian Buddhism spread to China and, centuries later, Christianity entered China as missionaries traveled the route). With the dynamic geospatial display, students can stay engaged with the big ideas of the world history course, of how the disparate parts of the world developed but also (increasingly) interacted over time.

By integrating topics, the teacher can break down the isolated schema that students may develop as instruction moves from one topic to the next. Toynbee and other historians have detailed, fully realized frameworks of the topics they study. They are able to make associations across schema as they investigate the past. Geospatial tools can help students see history as Toynbee did, thus making it *not* just one damn thing after another.

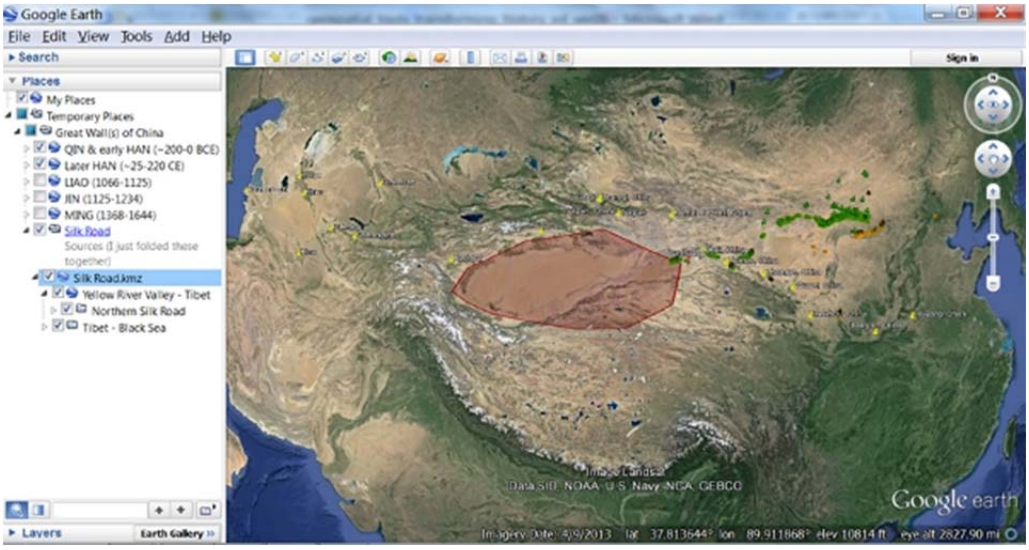


Figure 8. *Google Earth markup layer displaying Qin- and Han-era walls, stops along the Silk Road (yellow pins), and the Taklimakan Desert (red polygon). Data sources: www.mine.mn, www.norton.com, http://magnoliatech.wikispaces.com [Google Earth file on the Great Wall(s) of China]*

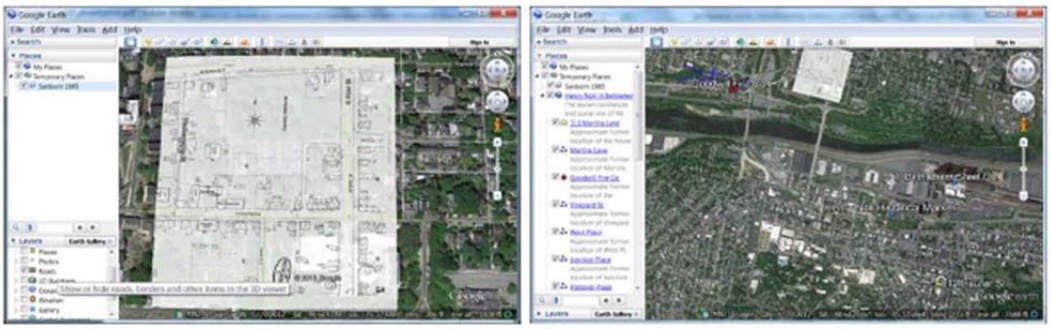
Greater Inclusion of Local History

A longstanding interest in social studies education is the learners' local environment (e.g., Milson, Lloyd, Estes, & Mayfield, 2009; Waring, Lipscomb, Good, & Franklin-Torres, 2008). In a history class, a common question might be what was life like *here* way back *then*? Indeed, a successful elementary history lesson revolves around this question, using historic photographs of the local community to exploring changes over time, whether in technology, culture, or the economy (e.g., Berson & Swan, 2005).

Another question might be what was life like *here* while events were going on *there*—how did the big issues of the Civil War present themselves in the local community in 1861-1865? Who supported the cause (whether Union or Confederate), who opposed it, who profited from it, and who was left orphaned/widowed/maimed by it? Again, the Virginia Center for Digital History has an amazing resource, *The Valley of the Shadow* (http://valley.lib.virginia.edu) for just this question. However, these resources are necessarily limited to two geographic locations: Augusta County, Virginia, and Franklin County, Pennsylvania (Ayers & Rubin, 2000). Students outside of these localities can benefit from these resources, but they will often be left to speculate as to what was happening then in their own communities.

The community of geospatial technology educators has had a longstanding interest in engaging students in local investigations (e.g., Alibrandi et al., 2000; Bodzin, Hammond, Carr, & Calario, 2009; Malone, Palmer, & Voigt, 2003; Shin, 2006). Geospatial tools provide a way to explore and illustrate local conditions, including connections to the master narrative presented in the history curriculum. For example, the question of what life was like *here* back *then* can be addressed in several ways.

A resourceful teacher can examine the digital Sanborn maps collection (http://sanborn.umi.com), or another archive, to locate a historical street plan of the local community. (Given the fact that many historic maps such as the Sanborn collection focus on urban areas, teachers in rural locations may have to settle for selecting a plan for a community that is familiar to students, not the one they live in themselves.) The digital image can then be imported into Google Earth or a GIS. (See Figure 9a.) This base layer can then be examined, noting differences between the current satellite imagery or street plan and what existed at the time of the Sanborn map. Teachers and students can even mark up the map to include historic photographs or biographical details of a contemporary resident (see Figure 9b).



a. b.

Figure 9. *Google Earth overlaid with (a) a Sanborn map of downtown Bethlehem, PA, 1885, and (b) markup displaying locations from the life of Henry Noll, a local steelworker. Sanborn map from ProQuest, Noll markup by Douglas G. Scott. [Google Earth file created by Douglas G. Scott (Lehigh University): Henry Noll in Bethlehem. (Also posted to Wikipedia entry on Henry Noll.)]*

The question of what was life like *here* during the event *there* is trickier. A teacher can often find a local map from a time period, but obtaining local data about that time is often an idiosyncratic process. If nothing else, a teacher can consider using census data as a starting point for consideration. For example, an American history textbook will typically describe patterns of racial segregation or mention the 1918 flu pandemic; using census records, teachers and students can explore what these national/global issues looked like in their own state, county, or municipality (see Figure 10).

Again, it is worth noting that the coverage-driven nature of the history curriculum will, as a rule, preclude lengthy investigations of local issues. Using geospatial tools, however, the teacher can, at a minimum, introduce the question of the local experience and then return to the national narrative dictated by the curriculum. Given that many of these tools and datasets are free for downloading, teachers can choose to set the local question as a challenge for students. The textbook tells us that American urbanization took place around 1900; is that true for our local urban communities? (For a classroom in the Northeast, it will not be true. The largest leaps in urban populations as a percentage of the entire state population took place in the late 1880s. For a classroom in the South, the largest leaps took place after World War II.)

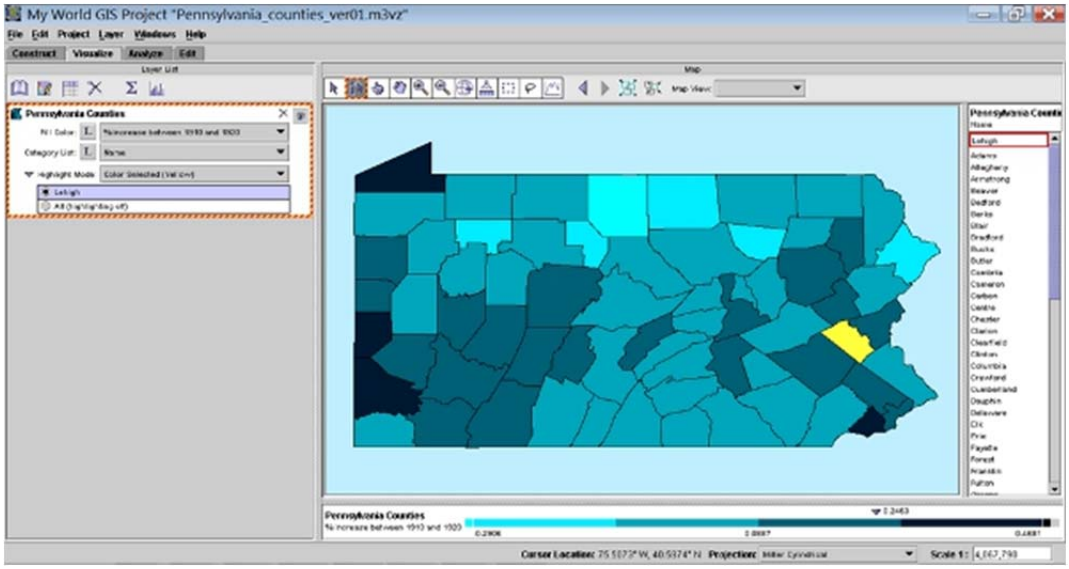


Figure 10. *Analysis of population in Pennsylvania counties between 1910 and 1920. Lehigh County is highlighted in yellow. Data source: Historical Census Browser at the University of Virginia. [GIS files of Pennsylvania counties and selected census data for 1900-1920 as follows:* map file, database file, index file

Geospatial Tools' Implications for History/Social Studies Teacher Education

While the social studies teacher education community has exhibited an interest in technology, broadly stated, geospatial tools have received limited attention. Most of the social studies work with geospatial tools has addressed geography (e.g., Bednarz, Acheson, & Bednarz, 2006; Doering & Veletsianos, 2007; Keiper, 1999; Milson & Curtis, 2009; Milson, Gilbert, & Earle, 2007; Shin, 2006; West, 2003; Wigglesworth, 2003) and far less has addressed history education. For example, in the *Handbook of Research in Social Studies Education* (Levstik & Tyson, 2008), the geography education chapter extensively discussed GIS; the history education chapter did not mention it. Cantu and Warren's (2003) *Teaching History in the Digital Classroom* contained a single paragraph on GIS (p. 294).

This disparity can be explained by the disciplinary connection between geospatial tools and geography versus the disjuncture between technology and history education. Geospatial tools such as GIS were developed in close contact with the geography community, and hands-on use of these technologies is written into the national geography standards (e.g., Geography Education Standards Project, 1994; see also Gatrell, 2004).

In contrast, historian Ed Ayers has observed that while "history may be better suited to digital technology than any other humanistic discipline" (1999, para. 4), the discipline of history has "remained virtually untouched and unchanged" (para. 3) despite the many new developments in instructional and information technologies.

Equivalently, the literature on technology in history (or social studies) methods is limited. Existing studies typically do not address geospatial tools and, instead, focus on more

widely recognized technologies for history education: WebQuests, digital primary sources, spreadsheets, slideware, and so forth (e.g., Bates, 2008; Crowe, 2004; Salinas, Bellow, & Liaw, 2011; Strickland & Nazzal, 2005). One publication discussed Google Earth, but only briefly before turning to other technologies (Brush & Saye, 2009).

Given that history teachers are unlikely to encounter geospatial tools, either in their methods courses or in reading the literature, how will they discover them? Another possible route is a dedicated class in geospatial technologies. For example, a course in geospatial tools can address technologies such as GPS, GIS, dynamic globes, and geo-referenced social media (Hammond & Langran, 2011). Given the lack of attention to geospatial tools in preservice teachers' methods courses, a dedicated course may be the only formal contact a teacher may have with these tools. However, these courses are rarely offered in a teacher education program and only then as electives.

At present, the most active area for introducing history teachers and teacher educators to geospatial tools is through professional development. The prospects here are small but growing. The now-defunct Teaching American History program, funding hundreds of projects over the course of 10 years, featured at least one program focusing on geospatial tools (Bunin, 2009). The National Council for the Social Studies, the premier social studies education association, has published a growing literature on geospatial tools in its journal (e.g., Alibrandi et al., 2000; Alibrandi & Sarnoff, 2006; Bednarz, Acheson, & Bednarz, 2006; Hammond & Bodzin, 2009; Milson & Curtis, 2009; Milson et al., 2007), and its annual conference regularly features several sessions addressing these topics. The Society for Information Technology and Teacher Education includes a special interest group on Geospatial Education, with a growing and active membership.

In light of these observations, the prospect of Martorella's giant awakening appears very distant. How can geospatial tools have any meaningful impact on the enacted history curriculum if they do not appear in the teacher education curriculum? The answer to this is threefold.

First, geospatial tools are becoming increasingly ubiquitous and easy to use. GIS software, for example, is migrating from a clumsy, client-side tool requiring a steep learning curve to far more user-friendly web services. The next generation of GIS tools will be on mobile devices, with far more intuitive interfaces, such as drag-and-drop data tables. Datasets are also becoming easier to find through web archives such as the Historical Census Browser at the University of Virginia or the National Historical Geographic Information System at the University of Minnesota.

More importantly, geospatial packages (base layer maps plus datasets and analyses) are becoming more sharable on the Web. As an example, Esri's ArcGIS Gallery (www.arcgis.com/home/gallery.html) features user-contributed maps, including over 2,000 history-themed maps. The end stage of this technological evolution is that teacher education students will eventually not require instruction in geospatial tools, just as they no longer require instruction in how to use a word processor or send email.

Second, the predicted curricular effects of geospatial tools align with a long-running tradition in the history education literature, which is ambitious teaching. History education researchers have examined teachers' conceptions of history, use of sourcework, and emphasis on historical thinking (Barton & Levstik, 2003; Stearns, Seixas, & Wineburg, 2000; VanSledright, 2004). Conversely, they have attacked, or at least questioned, instruction that is overtly expository, moralistic, or nationalistic (Barton & Levstik, 2004).

S.G. Grant (2003) distilled his ideal for history education after a year-long observation of two highly effective, veteran teachers. Both, he decided, engaged in "ambitious teaching and learning" of history, which takes place "(a) when teachers know well their subject matter...; (b) when teachers know their students well...; and (c) when teachers know how to create the necessary space for themselves and their students" (p. xi). Geospatial tools speak to both points (a) and (c). As teachers are exposed to the datasets displayed within geospatial displays, the technology will act as an educative curriculum material (Krajcik & Davis, 2005), deepening their understanding of the content knowledge. Furthermore, as teachers work with geospatial tools, students will be able to enter into the meaning-making that takes place as the teacher and students cocreate the enacted curriculum (Eisner, 2002).

Third, geospatial tools speak to a value held by the social studies community as a whole: interdisciplinarity. Geospatial tools sit at the intersection of many different disciplinary boundaries, whether within education (history, geography, science, environmental education, educational policy, etc.) or beyond (geology, forestry, oceanography, marketing, government and military, etc.). As an illustration, topics at Esri's annual user conference include agriculture, archaeology, engineering and construction, cartography, criminal justice, census data, defense and intelligence, disaster management, healthcare, transportation, and much more [a].

All of these topics can potentially enter into a social studies class—whether as history, geography, civics, economics, or a social science. Yet, the greatest value to be added is allowing social studies teachers to work across disciplinary boundaries. For example,

- A history teacher can include attention to geography, climate, topography, and ecology when using Google Earth to discuss the Pacific campaigns of World War II (Chapin, 2011, p. 47).
- A geography teacher can use historical census data to teach the concept of population density while also discussing the changes over time (Lee, 2008, pp. 156-7).
- An economics teacher can illustrate the production process from raw materials to finished goods, using real-world products' movements throughout our globalized factor markets while reinforcing geographic literacy and concepts such as transportation (Glanfield, Garvey, Pritchard, & Telzer, 2011; Rivoli, 2009).[b]

As social studies teachers in all disciplines seek to integrate multiple disciplines into their work, geospatial tools will play an increasing role in their instructional planning and implementation. Indeed, if geospatial tools are to make an impact on the social studies curriculum as a whole (which was Martorella's interest) rather than just the history curriculum (which is my narrower argument), it will be through this avenue of interdisciplinary work.

As long as the teacher education community encourages interdisciplinary instructional planning, pushes history teachers to be ambitious, and continues to explore the integration of new technologies into instruction, geospatial tools will make their way into the discourse. As they do, these technologies will reinforce powerful teaching by allowing teachers to deepen curricular content, highlight conceptual frameworks for historical understanding, and connect to local history. If the teacher education community takes an active interest in geospatial tools for history, this day will come faster and the changes will be more profound. But given enough time, the giant of geospatial technology will awaken, and the history curriculum will not be the same as before.

Notes

[a] To view the staggering variety of sessions at a recent user conference, visit http://proceedings.esri.com/library/userconf/proc13/index.html. Sessions that focus on K-12 education are a tiny portion of the total sessions, less than 1%.

[b] Milson, Gilbert, and Earle (2007) presented a model for teaching a world geography unit about Africa using a simulated Pan African Summit, informed by extensive use of web-based GIS. While the authors did not address the issue directly, this teaching strategy draws heavily upon civics content, such as the role of government policy and international interaction and cooperation.

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Author Note

Thomas Hammond
Lehigh University
Email: hammond@lehigh.edu

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