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Traveling the Silk Road on a Virtual Globe: Pedagogy, Technology and Evaluation for Spatial History

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Abstract

This article describes the authors' experience teaching college students how to use Google Earth to create atlases of historical Silk Road journeys. It argues that a digital humanities classroom, with clearly defined assignments and extensive evaluation, is an exemplary setting for establishing and verifying genre conventions and review standards. Approaches that are developed for the classroom can be modified for professional settings. The authors introduce criteria for evaluating digital historical atlases as works of humanistic scholarship, and suggest that digital humanists do the same for other disciplines and genres as well.

I. Introduction

This article is inspired by Ruth Mostern's experience teaching an undergraduate history course about the Silk Road using spatial history principles and methods. Half of the classroom time in this Spring 2010 course at the University of California, Merced was a conventional history seminar. During the remainder of the class meetings, Mostern, along with graduate research assistant Elana Gainor, taught digital map design and development using Google's popular virtual globe application, Google Earth. Integrating these two practices, students produced gazetteers, descriptions of historical places, interactive maps, and term papers about historical Silk Road travel itineraries. 1

This article offers advice and lessons to others who wish to attempt such a course. However, it is also an article about reviewing and evaluating digital scholarship beyond the classroom. Mostern and Gainor sptook advantage of the structure and highly specified assignments of an undergraduate classroom to design and implement clear and actionable standards for digital historical atlases. The standards shaped student work and allowed a reviewer – in this case a professor with grading authority – to evaluate the results of their efforts and to distinguish in a fair and systematic way between more and less effective digital atlases. Classroom work and professional scholarship are not identical, but many of the same review principles apply to both. Since scholarly review of digital scholarship is still at an early stage of development, classrooms are a valuable and accessible venue for testing and evaluating review standards. We used our expertise in spatial history methods, theories and exemplars to introduce the digital atlas genre, set standards for student work, and grade student accomplishments. Based on our experience, we propose that our classroom standards can be modified and utilized by digital atlas developers and reviewers in the profession. 2

The first two sections of the article offer suggestions about spatial history as a research and teaching practice, based on the proposition that spatial history is not simply a set of techniques, but an informed approach to understanding past geography. The next two sections of the article are about the Silk Road class content and its implications for the digital humanities. The article concludes with one section that introduces recent writing about scholarly review of digital work, and another proposing guidelines for digital historical atlas review informed by classroom experience and professional good practice. 3

II. Interpretation and Analysis in the Spatial Humanities

Instructors who grade student work, as well as editors who review authors' submissions, are explicitly conducting evaluation. At the same time, scholars who assess how a given work contributes to their field are also engaging in assessment. That is particularly true in the digital humanities, since peer review and third-party publication are still rare. Putting aside technical review, evaluating digital scholarship is no different than assessing any other work. Those who do it recognize a work in its genre context, compare it to analogous works, and determine what it adds to its field. The task implies an intellectual agenda, but this has not yet been well articulated in the field of digital spatial history. In the following section, we survey the intellectual state of the spatial history field and propose a way forward. 4

We use the term *digital atlas* to refer to the typical genre of spatial history work. The term is shorthand for a multimedia project based upon a mapping platform, integrating spatially referenced features with non-spatial resources such as embedded or hyperlinked text, images, or video, organizing spatial information into layers by category, and filtering visible display by means of a time-slider for temporal scale and pan-and-zoom controls for spatial scale. Digital atlas users can turn layers on and off, control visibility, and explore hyperlinked data associated with georeferenced locations. Each atlas depicts a topic or theme; it has a coherent spatial and temporal premise like that presented on a single page in a paper atlas or a single map in a textbook. However, the advantage of a digital atlas is that it is backed by a database holding all the geographical information, map layers, and other resources from many atlases, and the same content can be reused for multiple thematic maps.[1] 5

Humanities scholars using methods from cultural geography and geographic information science have styled their practices as "geohumanities" and "spatial humanities," two names for a field that has emerged in the last decade.[2] The field involves a range of more and less computational approaches. Among them we are most interested in those that involve producing digital maps of historical phenomena and using them for analysis and communication. Barriers to entry for geographic information systems (GIS) software and methods have declined, and historians, archaeologists, and literary critics have, often in collaboration with colleagues in other fields, developed exemplary projects. There are a number of books and articles about methods and results; and conferences, workshops and opportunities for funding have all proliferated. Stanley Fish, humanities blogger at the *New York Times*, devoted a column to the field in summer 2011 [Fish 2011]. 6

The quantity of activity in this area is impressive. However, in lieu of careful development of theory, a critical apparatus, and standards of rigor and excellence, advocates of the field too often rejoice in its mere existence and engage in evangelism for it. The editors of the *GeoHumanities* volume, for instance, celebrate the fact that "a kaleidoscope of intellectual and artistic outputs" is leading to "excitement breaking out across the intellectual landscape" [Richardson 2011, 3]. Thus, although numerous methods for spatial analysis and spatial representation in the humanities have been proposed, implemented, and reported, there has been only limited critical and comparative evaluation of what approaches are most appropriate for accomplishing particular ends. The authors assembled in the *GeoHumanities* volume, for example, include proponents of animation (Ayers), gaming and immersive visualization (Harris et al.), "quantitative techniques combined with hermeneutics" (von Lünen and Moschek), integrating disparate sources (Schwartz et al.) or analyzing one difficult source (Hillier) using GIS, and gazetteer development (Bol).[3] All of the authors make excellent cases for their approaches, and all of them describe successful applications of the methods in question to their own projects. None of them, however, assesses which research and/or visualization problems other than their own are most suitable for the method in question, or whether their method is the most appropriate among a range of possibilities. Finally, none of them suggest criteria by which reviewers or readers should judge the quality of work produced according to the method in question, or, in most cases, the suitability of the particular method in question. This omission explains why we advocate reviewing and critiquing spatial humanities works, a practice for identifying how they help to frame and address questions in the humanities and for permitting developers to select a suitable method for a given purpose. 7

The current state of affairs is understandable for an emerging and rapidly evolving field. Nevertheless, scholars have a hard time engaging critically with one another's work because they lack generally accepted shared language and shared standards of evaluation and comparison. Moreover, without community standards there is no foundation for the peer review or assessment of spatial humanities applications. For these reasons, developing theory and common 8

methodology for the spatial humanities is not simply an intellectual exercise; rather it is essential for the maturation of the field. The remainder of this section proposes criteria for such standards.

9 Mostern has already written an article that reflects earlier stages of her thinking about this matter. Her 2010 article "Putting the World in World History" was an initial effort to articulate a theoretical grounding for the spatial humanities, specifically with reference to her field of world history, and particularly in the context of pedagogy.[4] That article was inspired by the work of geographer Doreen Massey. While Massey is not a historian, the question with which she opens her book *For Space* is fundamental to the field: "What might it mean… to question [the] habit of thinking of space as a surface? If, instead, we conceive of a meeting up of histories, what happens to our implicit imagination of time and space?" [Massey 2005, 4]. Using Massey's work to insist that the relationship between history and geography is more than the sum of "time" plus "space," Mostern argued that practicing critical and temporally minded geography means describing, mapping, and analyzing the spatial intersection of multiple narratives rather than simply producing singular histories of change over time; in particular by investigating the ways in which such intersecting historical events and processes create space and place. Mostern's article concludes that studying the geography of connections among peoples – whether structurally á la world-systems theory, or empirically á la world history – offers a way for historians to develop a more theoretically informed and analytically agile spatial humanities practice.

10 The current article is still not intended to articulate a complete theoretical foundation for spatial history, but it proposes four propositions that can support digital spatial visualization and analysis, permit the framing and resolution of interesting and unique historical questions, justify the adoption of particular methods, and assist in review and comparison. This is an intellectual basis for critiquing and evaluating spatial history work.

1. "The landscape is constituted as an enduring record of – and testimony to – the lives and works of past generations who have dwelt within it, and in so doing, have left there something of themselves" [Ingold 1993]. Spatial history should detail how landscapes (a term that overlaps with the concepts of both space and place) are constructed by human action.
2. People move through space and create narratives that describe the relationships between places. *Topos*, the most widely used geographical term of the Mediterranean classical era, referred to progress along an itinerary and (as in the related term topology) the relatedness of a given place to others which are proximate to it [Curry 2005].[5] Spatial history should not only be about space and place, but about the semantic relationships among places and the itineraries connecting them as well.
3. Spatial arrangements, like other human phenomena, sometimes emerge gradually and evolve slowly. However, change can also be abrupt, even violent, and refracted through power relations. "Eventful" spatial history needs to account for contingency as well as structure [Sewell 2005].
4. Historical events and processes may or may not be visible , either to historians or to people living through them, depending upon temporal and spatial scales of reference [Braudel 1980].[6] Scale in social process is like a recording in which musical instruments play at differing turntable speeds. Scholars of the past need tools to spin the vinyl variously at 33 1/3, 45, and 78 revolutions per minute in order to hear the whole work [Hull 2005]. Digital spatial history methods should be used to integrate multiple scales into historical analysis.

11 Douglas Richardson in the *GeoHumanities* volume claims, typically for the field, that GIS offers historians the "ability to combine time and space in one integrated system" [Richardson 2011, 210]. Many advocates assert this, but it is not clear what the statement means, or how it can inform theory or method. The four concepts we have proposed are intended to offer a more detailed foundation for spatial history practice. Integrated together, they form a statement like this: **Landscapes of varying size and duration emerge and endure as people move around them performing activities, as processes connect and modify them, and as events occur in them. Digital works should identify, depict, and analyze the dimensions of landscape emergence, persistence, and change.** [7] History and geography are both particularly capacious disciplines, and it would be pointless to be proscriptive. Still, if practitioners of computationally oriented spatial history improve its theoretical grounding, we can better design and evaluate atlases that contribute to humanistic scholarship and are not simply innovative works of GIS implementation. In the concluding

section of the article, we will suggest review standards for spatial history works that are consistent with this proposition.

III: Spatial Literacy and Spatial Thinking

12 Since we intend this article to inform peer review and critique, it may seem counterintuitive that the next two sections of it concern pedagogy. However, given the nascent state of scholarly review for spatial history, at present there are effectively no professional platforms for reviewing digital atlases. By contrast, any instructor with training in the field and the opportunity to design an appropriate course can assign students to create such works and complete them in the course of an academic term. Moreover, good teaching and fair grading compels instructors to precisely dictate the components of the atlas and the standards for its successful accomplishment. For these reasons, the classroom is an ideal location for learning to specify genre characteristics and review criteria. It is true that scholarly critique is a different task from grading and that analogous scholarly works differ from one another more than student projects do. We will discuss these matters in the last section of the paper. Nevertheless, we contend that it is precisely the controlled atmosphere of a classroom that makes it a good place to begin the neglected practice of describing digital atlases as a genre, determining whether individual exemplars are consistent with the aims of spatial history, and comparing them to one another.

13 Following from our emphasis on improved intellectual grounding for spatial history, our first proposal is that a historian teaching spatial approaches to the past should teach history, albeit with an understanding of disciplinary geography and interdisciplinary approaches to spatial theory adequate for introducing relevant concepts and methods. There has recently been extensive advocacy for the notion of cross-disciplinary “spatial literacy” or “spatial thinking” as a goal in its own right. However, spatial reasoning in support of spatial history is only a specialized portion of the domain of spatial reasoning. Indeed, in its focus on historical processes and human agency in landscape formation and transformation, spatial history is at the margins of the spatial literacy field as it has been articulated to date.

14 The notion of spatial literacy embraces some modes of thought and practice that are not at all relevant to the issues raised in the first section of this paper. According to an influential 2006 National Research Council report entitled *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum*, spatial thinking can be equally applied to spaces both abstract and concrete: life spaces, physical spaces, and intellectual spaces. Its disciplinary heritage emerges from math as much as geography. It includes thinking *in* space, or proxemics, which measures the kind of reasoning that allows people to efficiently load a truck, find their way, or park a car. These skills are not relevant to the spatial humanities, though they may be the kinds of competencies that the authors allude to in terms the relevance of spatial thinking to cognition and life skills. However, spatial thinking also involves thinking *about* space, which is the primary objective of the spatial humanities as well as many other academic domains, and thinking *with* space, or working with maps and spatial data.[8] Initially, one goal of the Silk Road class was to improve spatial literacy among history students, following the National Research Council recommendation that spatial literacy does not belong under the ownership of geography departments, but should be instructed throughout the curriculum [National Research Council 2006]. It is reasonable to believe that, similar to such established interdisciplinary fields of instruction as writing, critical thinking, or quantitative reasoning, spatial literacy is mastered through courses both within and beyond a discipline. Nevertheless, students most effectively and meaningfully filter these kinds of learning experiences through the conventions of a given discipline, as noted by a longitudinal study of undergraduate learning at the University of Washington [Beyer 2007]. The lead author of this study, Catharine Beyer, suggests that instructors need to think about improving student attainment of broad, interdisciplinary learning outcomes in the context of majors and disciplines. By analogy with professional spatial history practice, historians who design atlases should be articulating how they are relevant to their fields.

15 However, the National Research Council report also notes that it is still not clear how to incorporate spatial thinking into existing curricula or how to measure student proficiency in spatial reasoning outside of disciplinary settings. Indeed, most spatial literacy and spatial thinking websites do not promote curricula, learning outcomes, or assessment criteria. One representative initiative, Spatial@UCSB, has developed a website that includes a page of Learning Resources, prominently featuring a list of “spatial concepts as the driving force for spatial thinking.” [9] However, it does not detail any objectives that would represent the attainment of spatial literacy, or suggest any instruments that would indicate

whether students are becoming spatially literate or not.[10] This critique reinforces the need for teaching spatial thinking in disciplinary context and for designing criteria targeted to given disciplines. Outside the classroom it points toward our proposal to define an intellectual agenda for spatial history and to evaluate the technical accomplishments of its works in its context.

16 In the end, because of the conceptual breadth of the field, the difficulty of gauging student success in it, and the marginality of historical analysis to the geography mainstream, we came to criticize teaching or evaluating spatial reasoning *per se* as a spatial history objective. Nevertheless, there are specific concepts associated with spatial literacy, primarily drawn from disciplinary geography, that can help undergird spatial history practice. The Learning Spatially (LENS) initiative at University of Redlands defines spatial thinking as "the ability to visualize and interpret location, distance, direction, relationships, movement and change through space." This competence overlaps with the theoretical propositions that we introduced in the first section of this paper, though it does not embrace the notions of landscape creation, transformation and occupation that we consider fundamental to spatial history.[11] Likewise, Spatial@UCSB offers a list of spatial concepts that are meaningful across disciplines.

Location	Understanding formal and informal methods of specifying "where"
Distance	The ability to reason from knowledge of relative position
Network	Understanding the importance of connections
Neighborhood and Region	Drawing inferences from spatial context
Scale	Understanding spatial scale and its significance
Spatial Heterogeneity	The implications of spatial variability
Spatial Dependence	Understanding relationships across space
Objects and Fields	Viewing phenomena as continuous in space-time or as discrete

Table 1. Spatial@UCSB List of Spatial Concepts

17 All of these have some relevance to theory and practice in the spatial history profession and classroom and to a research agenda for spatial history. Nevertheless, this list does not conform to the spatial history conceptual agenda, since it does not focus upon social processes and changing phenomena over time, but rather emphasizes spatial geometry. For these reasons, we only implicitly instructed the Silk Road students about spatial thinking. Since competence in spatial reasoning for history is not the same thing as spatial literacy considered as an autonomous field, it was not feasible or desirable to design assignments and assessments for evaluating history students' proficiency in these areas. Likewise, the quality of spatial thinking in spatial history scholarship should be reviewed according to its contribution to history.

IV. Traveling the Silk Road on a Virtual Globe

18 In Spring 2010, as a professor of history and an expert in spatial history, Mostern taught a class on the history of the Silk Road using digital history methods. By the end of the semester, students were expected to be able to describe how Silk Road travelers represented routes and places according to particular historical and cultural circumstances; to communicate about historical phenomena using integrated images, digital maps, digital timelines, text, and hyperlinks, and to explain how long-distance Eurasian movements of microbes, people, ideas, goods, and population shaped world history. By producing atlases using Google Earth, they practiced many of the spatial concepts included on the Spatial@UCSB list reproduced in the last section of this article. However, they did so in the service of learning about the history of the Silk Road and the experiences of its travelers.

19 The Silk Road can refer to the steppe lands that stretch across Eurasia from Hungary to the Pacific; or to the land and sea routes by which traders moved goods and ideas between Africa, Asia, and Europe; or even to the broader notion of cross-cultural exchange in the Old World. The content covered in this class about the history of travel, exchange, and politics across Eurasia incorporated tens of thousands of miles of territory, many of the world's religions, dozens of

languages, and the entirety of human history from hominid migrations to contemporary conflicts in Iran and Afghanistan. [12]

The vast scope of a Silk Road class lends itself particularly well to a spatial history approach focusing on the production and reproduction of landscape, the geo-semantics of travel, and the notion of scale. Owing to constraints of climate and topography, the travel routes that constituted the Silk Road were limited and discrete, and amenable to reasonably accurate mapping. On land, Silk Road travelers traversed some of the world's most arid and high-altitude terrain. On sea, they were at the mercy of particular ocean currents, wind patterns, and safe harbors. Therefore, although routes changed over time, Silk Road geography is organized around particular mountain passes, desert oases, entrepôt cities, and ocean ports. Silk Road travelers exchanged goods — from pepper to porcelain to lapis lazuli — that were mined, harvested, or manufactured in distinct locales. Many travelers — Marco Polo is the best known — wrote narratives about their journeys or became the subjects of biographies. It is possible to reconstruct and trace the routes of Greek generals, Tibetan foot soldiers, Khotanese dancers, Chinese monks, and Persian sailors, and to study their experiences. 20

Once a week throughout the semester, the Silk Road course was a conventional history seminar, and once a week there was a lab session. There were no special prerequisites for the 18 upper division history students enrolled in this course. Students learned to use spreadsheet applications to organize georeferenced information about Silk Road history, to write enough HTML code to format attractive pop-up boxes that included images, captions, and text with multiple colors and fonts, and to use Google Earth to create maps that depicted historical narratives, including the modification of KML code to support time-stamping. They used the History Engine episode format to describe events in spatial history.[13] At the end of the semester, each student completed a digital atlas depicting the journey of one Silk Road traveler.[14] 21

Figure 1. A screenshot from an atlas by Silk Road student Patrick Swisher. The student used Google Earth's overlay feature to incorporate a title and a legend into his atlas. His atlas includes points of interest, routes depicted as vectors, and regimes depicted as polygons. The film projector icon on the left hand side of the map links to a fly-through animated version of the map and to the student's term paper. Customized map icons distinguish locations associated with different events in the traveler's journey, and link to pop-up boxes that describe the episodes that occurred at each place.

As the basis for their research and atlas development, the students each selected a Silk Road travel narrative to study 22

during the semester.[15] They wrote ten-page research papers about their chosen narratives, and in addition, they mined them for spatial information. They researched the contemporary equivalents of historical names in order to create gazetteers of the places the travelers visited, determined the travelers' routes from place to place, and wrote short descriptions of the travelers' experiences at particularly significant places. They created interactive maps that integrated all of this material, including even thumb-tacking their term papers, which focused on the geographic aspects of their travelers' narratives, to their maps. At the end of the semester, with the permission of the students and the assistance of the UC Merced library, Mostern created a video showcasing their accomplishments and depicting the features of the maps they created. It played on screens in the library throughout the Fall 2010 semester, and is available on YouTube and on a public website about the class.[16]

In addition to the sources that we have mentioned thus far, Edward Ayers' use of the History Engine collaborative database authoring tool at the University of Richmond was another inspiration for the class. Ayers' students use the History Engine to integrate primary source interpretation and historical research to create temporally and spatially referenced content. Like the digital atlas assignment, teaching with History Engine is grounded in theory as well as embodied practice. As he explains: "The episodes in the History Engine embody the principles of practice theory. …The History Engine shows that, at base, history is where singular events and larger patterns intersect…The History Engine shows how pattern, structure, event, and change are embodied at the local and personal level, in a collage of moments" [Bodenhamer 2010, 8–9]. Just as we did in the Silk Road class, Ayers used digital tools because they helped him teach historical principles, not because he wished impart technical mastery for its own sake. 23

Support from the UC Merced Center for Research on Teaching Excellence (CRTE)'s "Educating Future Faculty to Engage with a New Demographic" grant from the Fund for the Improvement of Post Secondary Education (FIPSE) allowed Elana Gainor to work as a graduate research assistant embedded in the class to evaluate teaching materials, assess student learning, and identify relevant literature about active learning and evaluation in a spatial history classroom. During the semester, with assistance from CRTE staff, Gainor designed and conducted two focus group interviews, one online survey, and one written survey of the students enrolled in the class. The surveys included open ended as well as scaled questions. The scaled questions offered quantifiable data, and the open-ended questions provided insight pertaining directly to the students' thoughts and ideas. Gainor administered one survey halfway through the course and one at the end. The first survey focused upon students' understanding of the learning outcomes of the class and their general response to Google Earth. The second survey asked them to reflect on the original survey questions once they had completed their projects. The discussions in the focus groups were based upon the survey responses, but they also gave students the opportunity to speak directly with Gainor and allowed her to assess student progress. 24

We used the survey and focus group results during the semester to make adjustments to the class, especially when they indicated the need for further instruction. That data is also the basis for the claims regarding the success of the class that we will make in the next section of this paper. There were 18 students in the class: too small a sample to establish statistical significance. Nevertheless, the survey data establishes a baseline to use as a benchmark for future comparison, and it is qualitatively meaningful. Moreover, the act of creating the survey allowed us to consider what information would best reveal student learning and accomplishment. For that reason, the surveys were essential for determining and testing review criteria. 25

Support from CRTE was critical to the success of the course in another respect as well. At present, humanities instructors are inhibited from designing assignments that utilize new technologies. One significant factor is that, as is equally true in the profession at large, standards and rubrics for evaluating student work in digital media have not kept pace with changes in technology. Instructors cannot design digital assignments if they cannot determine how to grade them, just as peer reviewers cannot assess their colleagues' work. In addition we worried about grading students on the basis of work submitted in a medium that they had never used before. Since this was a history class, we did not want to unduly penalize them for lack of aptitude with the tool if their conceptual grasp of spatial history and Silk Road history were good. Few of them had ever been graded on any history assignment other than papers and exams. Moreover, even outside the classroom, although interactive digital maps are widespread, no standards or guidelines have been 26

developed for them, either for students or for professionals. We knew that it would be particularly important to design and communicate clear standards and expectations. In order to accomplish that, we employed three approaches.

27 First, we created short assignments, due throughout the semester, that led up to the final digital map submission. The digital atlas project constituted 65% of the semester's grade, but it was assembled additively from multiple assignments, none of which was individually worth more than 30% of the grade. In addition, we developed and circulated very detailed lab slides and held extended office hours, particularly before the final due date. Finally, and of most significance for this article focused on review and assessment standards, we developed a detailed rubric that listed the components of a digital map project, explained our expectations about each component, and provided advice. Appendix 1 is the rubric that we developed. Our objective in designing the rubric was to clearly and comprehensively list the components that the atlases should contain and the standards by which we would evaluate each component. Our intent was twofold. First, that students should understand what they were being asked to accomplish: what we meant by a digital atlas, and how we were measuring success. Second, that each atlas should have a very similar structure so that in spite of the complexity and novelty of the atlas format we would be able to compare students' accomplishments in a fair and reasonably objective way.

28 We opted against using a standard grid-based rubric. The atlases required an unusual and paradoxical degree of both creativity and standardized structure. We developed the rubric according to Bob Broad's guiding concept from *What We Really Value*: moving students towards "self-authorship" and supporting our ability to evaluate their "ability to collect, interpret, and analyze information and reflect on [their] own belief[s] in order to form judgments" [Broad 2003, 3]. We wanted to ensure that the rubric constrained the atlas structure without inhibiting creative accomplishment. Thus, we structured the rubric as an outline that detailed the elements each atlas had to include, set standards for each element, and explained how each element would be evaluated. The rubric was like a journal's style guide, in that it allowed authors creativity and flexibility in content while imposing a standardized format. In keeping with Broad's concept of "dynamic criteria mapping" [Broad 2003, 41], we described exemplary accomplishment for each element, but we did not develop a formula to match descending grades with particular deficiencies.

29 The rubric had three categories that reflected the range of historical analysis, spatial thinking, and technical accomplishment required to create a successful digital atlas. As we will discuss in the final section of this paper, these categories collectively represent the mission of a digital atlas in the profession as well as the classroom. Digital atlases, like the pages of print historical atlases, include significant written elements, which usually include an overview as well as commentary about particular map elements. Print atlases also rely on cartography to illuminate the theme of each atlas page. Finally, the graphic and written elements of an atlas reinforce one another.[17]Reflecting that analogy, the categories of the rubric were Writing, Spatial Reasoning and Visualization, and Storytelling and Integration. Each of those areas had subcategories, and each subcategory detailed specific benchmarks. For instance, because place and itinerary are so important in spatial history, the rubric explained that every atlas was intended to include a gazetteer with at least 15 georeferenced locations and descriptions of them, with locations connected by routes depicted as lines. The cartography for every atlas needed to demonstrate a communicative visual style (which we defined as clear and consistent iconography, objects distinguished from one another by category, and a title and legend), incorporate contextual information (such as the boundaries and extent of regimes, important cities or ports near the traveler's route, and overlaid maps), zoom and tilt settings that controlled visibility in an appropriate way, and an animated tour or flythrough. The rubric explicitly enumerated all of those facets. We circulated a draft of the rubric to the students, then scheduled a lab session to walk through the draft point by point, and we encouraged students to ask questions for clarification and to offer feedback, which we incorporated into a revised version. The process granted the students some ownership over the format of the work they would submit. As the students embarked upon their atlas designs, our vision and grading standards were clear to them – and to us as well.

30 All of the atlases were intended to illustrate a clear historical argument about a single personage based upon one primary text, and to this end, the students were required to finish a draft of their term papers prior to embarking on their atlas designs. This helped to ensure that students were good historians first, and that they were using spatial reasoning and digital tools in support of their work as historians. The atlases themselves reflected core humanistic practices of research and communication. The rubric and course goals could have been more explicitly spatial, but they were not,

because we were not teaching spatial literacy as such. Rather we introduced spatial reasoning in the context of spatial history. We advocate the same approach to evaluating the technical aspect and the intellectual content of digital atlases in a professional context.

VI. Lessons Learned

Both the quality of the work the students submitted and the experiences that they shared through surveys and course evaluations reveal that they learned a great deal about spatial history reasoning, Silk Road history, and digital atlas development. Their growing competence in each of these areas reinforced their capacities in the others, and their performance and satisfaction exceeded that of students in other classes. However, as we will discuss in more detail below and as other recent research on the topic affirms, they were not the “digital natives” we had presumed before the semester began.[18] We had to instruct them in technical skills external to spatial history *per se*, such as file naming conventions, effective web searching, and routine editing tasks, but the time students devoted to those tasks paid off in the form of more sophisticated understanding of spatial and Silk Road history. 31

Student Learning

Student learning in the course exceeded our expectations. The students’ atlases are direct evidence of their ability to reason about historical geography and use multimedia spatial visualization to communicate about it. When we circulated the rubric to the students, we guaranteed them that any atlas that met all the benchmarks it enumerated would receive at least a B range grade. The grade breakdown was as follows: 32

Grade	Atlas	Term paper
A	6	3
A-	3	2
B+	1	2
B	1	4
B-	5	3
C+	0	3
C	2	0
C-	0	0
D	0	1

Table 2. The grade distribution for Silk Road atlases and term papers. Numbers represent the number of students who earned each grade.

Sixteen out of 18 students in this course met or exceeded the standards we set for a complex multimedia project that involved short and long form writing, visual storytelling, map design, georeferencing, and even simple coding. Half of the students exceeded our minimum standards for success and earned A range grades. None received grades below C. By comparison, the grade breakdown for the students’ research papers about the travel narratives they selected is a more typical range of grades for students enrolled in one of Mostern’s upper division courses. Fewer than a third of the students earned A range grades, and almost a quarter earned grades in the C range or below. Half of the students in the class clustered in the B range. Counterintuitively, students less successfully demonstrated proficiency at writing research papers, a core competency of the history major, than at developing atlases, which involved multiple novel skill sets. 33

The surveys that Gainor conducted with CRTE support also offer evidence of their accomplishments, and they help to explain the seemingly incongruous results presented above. The surveys reveal that almost 80% of the students felt that they learned more about history in this course than in a standard history course, though half of their class time was occupied by computer labs. This is a noteworthy finding, since the class involved less assigned reading and less time 34

for discussion than a more orthodox class. A large percentage of them also felt that they worked no harder than they would in another history class, although we assigned more work, requiring more disparate skills, than in most of Mostern's other courses. Students doubted their capacity to work with the technology at first, but took pride in their proficiency by the end of the semester. Appendix 2 is a series of charts and analysis of survey results. The most salient details are gathered here:

- 75% of the students found Google Earth a useful tool for learning about history, 75% of them "loved" using it, and a majority of them rated the workload for the class as below average in spite of the fact that we demanded more of them than Mostern does in her other classes.
- Their feedback included comments like "It allows us to view different regions and see how cultures spread out through history," "It's more interactive and forces the student to be more engaged in his/her work," "The spatial approach helps put history into perspective," "When I become a teacher, I will definitely use tools like the ones we have learned this semester in my own classes-they help put a physical location with historical texts," "It is sooooo nice to use Google Earth in learning about history and to see locations visually. It helps to make the ideas easier to grasp," and "It was one of my favorite courses to date. I have shown my finished project off to many friends and family and when I teach in the future I want to do something similar."

We did not develop instruments for measuring spatial literacy *per se*. Moreover, students could not consistently articulate their spatial thinking in language familiar to geographers, and they were not adept with a wide range of tools for spatial analysis and visualization. Nevertheless, by the end of the semester, they had completed sophisticated spatial history projects that exceeded our expectations. Spatial reasoning need not be framed as a new kind of literacy. Rather, it may best be characterized as an approach that engages with capacities that many students already possess. They can learn skills and procedures that allow them to articulate what they know and incorporate it into other kinds of academic reasoning. More advanced techniques and precise concepts would best be instructed in a different class, most likely in geography rather than history. 35

Teaching with Digital Tools

This was a rewarding and enjoyable course to teach, but it was time consuming. We had not used any advanced Google Earth functions before the semester began, but as people with backgrounds in spatial history and a high comfort level with digital tools in general, we found the application intuitive. The tutorials on the Google Earth website were particularly helpful. However, the students did not all share our facility with the software. In general, they did not demonstrate a "digital native" advantage. Certain skills that we considered to be matters of basic user technique were new to many of them: right-clicking to see properties (for PC users); copying, cutting, pasting, and dragging objects efficiently, and understanding file structures and file suffixes. They were most challenged by interacting with code, which most of them had never done before, and some of them found intimidating. They had to write simple HTML in order to format Google Earth popup boxes, and they had to write simple KML to time-stamp objects in Google Earth. It was difficult for some of them to understand which editing platform and which commands governed which behavior in the application. Some students were extraordinarily adept at some of these tasks, and one was a former computer professional. However, the baseline of computer knowledge and comfort for the class was low overall. 36

In order to teach Google Earth labs that were targeted to their level, to the discipline of history, and to the Silk Road in particular, Mostern spent many hours developing slides that used Silk Road geography examples to demonstrate step-by-step techniques for completing each of the tasks for which we would later hold them responsible. She also scheduled extended office hours near the atlas due date to tutor any student who needed assistance, to troubleshoot their atlases, and to check for compatibility problems as she downloaded the atlases onto her computer. Preparation and grading took more time and more creative effort than a conventional course would have, and this approach is best suited to a small, upper-division course. 37

There were also challenges inherent in the decision to use Google Earth, a free but commercial tool that was not developed specifically for classroom use, historical content, or publishing authored works. The choice between community-built and commercial tools in humanities computing is a common trade-off, and Google Earth – accessible, 38

intuitive, feature-rich, well-documented, and integrated with the whole Google ecosystem – had plenty of advantages over any other viable option. Still, it was not ideal. The template for exporting georeferenced content from a Google Docs spreadsheet into Google Earth was difficult to use; and this made it hard to work with gazetteers, which are an essential part of digital atlas infrastructure. Moreover, Google Earth lacks a time-stamping interface, which is why students needed to write a few lines of KML code in a text editor in order to time-enable their data; and it lacks a GUI editor for pop-up boxes, which is why they had to write HTML to create appealing placemark pop-ups that included images and formatted text. It also lacks a publication layout mode, so students had to handcraft legends and titles for their atlases outside of Google Earth using image editing software, and import them as overlays. While these procedures were not difficult, some students found them daunting or confusing, and even for the most adept students, it was not ideal to be required to manage and use so many tools. Finally, because Google Earth Community, Google Earth's public data repository, does not have a provision for creating closed groups, there was no way for the students to share content with one another short of making it public to the world. That would have been an unreasonable and unethical requirement, so we asked students to submit their digital map files using UC Merced's course management system. Although that was feasible, it meant that we were not able to fulfill one of our original goals. We had hoped to permit students to compare their maps to one another and to reason about their differences. For instance, if they had been able to evaluate how different atlases located the "same" place at somewhat different points on the map, it would have been a powerful lesson in the spatial ambiguity of historical maps.

The Silk Road class included instruction in multiple software tools and applications, spatial thinking and visualization, computer wrangling, and a relatively abstruse historical topic. It demanded that students complete a research project that demonstrated their proficiency in all of those domains, in spite of the fact that none of them had with experience with more than a few of these areas at the beginning of the semester. Many factors contributed to the success of the course. Among them, we particularly credit our insistence upon clear standards for the digital atlas. This permitted students to focus on communicating about spatial history without having to invent unique digital formats. We are convinced that the development of structures and criteria for digital atlases in the profession would have a similar benefit for authors and developers in the profession. For that reason, we turn next to review criteria in the digital humanities. 39

VII: Evaluation and Review in the Digital Humanities

As we have argued, pedagogy is a useful point of entry for contemplating issues of authorship and assessment that are significant throughout the digital humanities and spatial history in particular. We taught the Silk Road course in part to determine whether a digital atlas could be reviewed effectively as a work of history. Student work may be simpler and more standardized then professional work, but it need not differ categorically. A history student's research paper adheres to the same format as a journal article, and the student author aspires to excellence according to the same criteria as the professional. We believe that the same is true of digital atlases, and therefore that it is reasonable to develop digital atlas style guides and evaluation criteria to guide developers and peer reviewers. 40

A recent special issue of *MLA Profession* devoted to digital literary and media scholarly evaluation is germane to these issues. An *Inside Higher Education* article about the *Profession* issue notes that although humanities disciplines have acknowledged "to the point of redundancy" the need for a system of reviewing digital scholarship for publication and evaluating its practitioners for tenure and promotion, "practical change has come more slowly," and "while the work of digital humanists increasingly is seen as indispensible, it also remains impenetrable to most of their colleagues." Although digital humanists have largely persuaded colleagues and professional organizations that digital scholarship needs to be taken seriously, the field has not yet provided direction about how to evaluate it. As Geoffrey Rockwell explains to *Inside Higher Education*, digital humanities scholarly review is neglected "not for lack of will, but of methodology." [19] In *Profession*, Rockwell distinguishes between digital research, which is an activity, and digital scholarship, which is an outcome that can be shared [Rockwell 2011, 152]. When we asked the Silk Road students to produce term papers prior to embarking upon atlases and then graded the atlases for their capacity to enrich the papers, it was because we were teaching them to produce scholarship. That is also why we designed learning outcomes that were specific to history rather than basing them upon spatial literacy criteria. 41

We developed the rubric for the Silk Road student atlases with the conviction that the digital atlas was a coherent genre that reflected spatial history theory as well as digital technique. Likewise, several *Profession* authors explore the attributes and taxonomies of digital works, recognizing that determining a set of features for authors to master and for reviewers to evaluate is essential for review. For instance, Steve Anderson and Tara McPherson specify the elements of multimedia scholarship: multiple media, user interactivity, a networked or database structure, nonlinear components, and "a heightened attention to aspects of design, aesthetics, or form," along with infrastructure or systems development when works require new capacity in those areas [Anderson and McPherson 2011, 137]. Rockwell proposes a typology of digital scholarly works. Some of them, like online journal articles, can be reviewed using established procedures, while others, like blogs, may not be amenable to review at all. Some contributions, including tools and software, scholarly editions, and multimedia works, are creative works that require new methods for appraising scholarly significance [Rockwell 2011]. Jerome McGann contends that "It's important to remember that information technology has not altered the fundamental mission of the humanities: to preserve, investigate, and rethink our cultural inheritance" [McGann 2011, 184]. The task of evaluation is to identify how creative works in particular digital genres accomplish that goal. 42

We concur with Anderson and McPherson and with Rockwell that multimedia works have genres and identifiable conventions. A digital atlas has little in common with a network visualization or a portal into a document collection – no more so than a critical essay has in common with a short story or a library catalogue in the print domain, for instance – except that all of the former were created and/or disseminated using computer assisted methods. The review standards for various types of work will differ considerably. So, as we did with the atlas, we advocate that digital humanists identify genres within their own domain expertise, distinguish them from one another, determine the suitability of particular techniques for achieving specific scholarly goals, enumerate the elements of successful accomplishment, and define standards that can be used to evaluate each element. That is the work that the rubric performed in the Silk Road classroom. 43

We celebrate scholarly and creative work that crosses boundaries, undergoes continuous modification, and requires collaboration – in text, visual culture, and performance as well as digital modes. However, it cannot be reviewed effectively, at least not until after we learn more about how to assess less experimental accomplishments.[20] In the meantime, many digital humanities practitioners are completing works that meet existing criteria for humanistic scholarship. They can be evaluated based on whether their content contributes to humanistic colloquy. 44

The introduction to the *Profession* forum on digital humanities evaluation notes that not all work in the digital humanities adheres to established academic modes such as criticism and analysis. Thus some authors advocate that we "shift our notions of humanities scholarship away from a fixation on product and even publication" [Anderson and McPherson 2011, 141], that we abandon "an outmoded and sometimes patently incorrect vision of solitary scholarship" in favor of implicit and ongoing peer review via collaboration itself [Nowviskie 2011, 170] and that we conduct review by assessing the community's engagement with a work through comments and hyperlinks rather than via anonymous evaluation by subject experts [Fitzpatrick 2011]. These recommendations for new practices in the humanities are ingenious and bracing, and they may represent a possible future. At the same time, as McGann says, "while digital technology is introducing new critical methods and procedures, it does not fundamentally alter the sociologies of scholarship and education or their institutional mechanisms" [McGann 2011, 192]. Taking an experimental and open-ended approach to digital humanities scholarship and review ensures that it cannot be effectively ingested into actually existing academic institutions. As a practical matter, that will keep digital work isolated, if not marginal. It is problematic from an intellectual point of view as well. As long as we treat digital works as if they are all idiosyncratic and incommensurable, we cannot improve our practices, we cannot put our accomplishments in conversation with one another, and we cannot use them to expand and enrich our understanding of the world. In the end, we contend that while form is important to the digital humanities, it should be assessed based upon its appropriateness to the content and argument in a given field, and not simply its elegance or novelty. We advocate assessing and critiquing digital works with respect to their effectiveness for scholarly communication. 45

VIII: From the Classroom to the Profession

At the beginning of this article, we proposed four propositions for enriching spatial history. First, landscapes are constructed by human action. Second, itineraries create spatial relationships. Third, both processes and events transform landscapes. And fourth, spatial and temporal scale determines whether a landscape and its changes are visible to occupants and/or scholars. A successful digital atlas is a scholarly work that illuminates one or more of these concepts using methods appropriate to its topic and purpose. The Silk Road student atlases, for instance, were cartographic narratives of long-distance journeys based on works of travel writing. 46

The criteria we developed for the student atlases apply to atlas developers and reviewers in the profession as well. A digital atlas, an integrated multimedia work of scholarship with a map interface, should include: 47

1. Long form writing that makes a spatial history argument.
2. Short form writing and illustrations that explain the significance of specific locations and geo-located events to the overall work.
3. A map interface that includes the places, routes, fields and other spatial objects that comprise the landscape in question.
4. User control of spatial and temporal visibility and scale.
5. A clear, attractive, coherent and intuitive user experience.
6. Effectively integrated written and cartographic components.

For authors and developers, these guidelines support both consistency and creativity, while readers and reviewers can use them to judge and compare a wide range of works and assess their contributions to the spatial history field. The profession is a less constrained environment than the classroom. Nevertheless, an academic field like spatial history is still a distinct milieu, and the conventions that guide peer review are always quite specific. The review standards we are proposing here are intended to be suitable for spatial history, and not to all work in the digital humanities. The classroom experience is relevant to evaluation criteria in the profession. This article explains how we defined the intellectual terrain of a digital humanities field, created student assignments specific to it, and used that experience to propose standards for professional developers and reviewers. We urge specialists in other digital humanities fields to do the same. 48

In *Online Humanities Scholarship: The Shape of Things to Come*, historian Robert Darnton offers a rare and noteworthy critical review of a digital atlas: *The Grub Street Project*, a depiction of the publishing world in eighteenth century London. Darnton praises the project for its maps, its visuality, and its efforts to approach an ideal of *histoire totale* through a spatial interface, extensive context, and hyperlinked text. In its form, it is consistent with the criteria we introduced above. However, he additionally interrogates its contribution to history. In his view, the atlas comes up short by that standard, for conceptually it does not go beyond a 1972 print article on the same topic [Darnton 2010]. Our point here is not to stake a claim about the atlas in question, which concerns a topic about which we have no expertise. It is rather to applaud Darnton's insistence on asking humanistic questions about it and not only praising its rich detail and technological accomplishment; and to commend the editors of the volume in which the review was published for soliciting a response to the digital atlas from a leading cultural historian who is not a digital humanities practitioner. We reiterate, and we concur with Darnton, that a digital atlas needs to be critiqued for its contribution to the field of spatial history, and not only as a formal accomplishment. 49

In the end, we propose to hold digital atlases to existing standards for humanistic scholarship and to emerging genre conventions. The classroom, an ideal site for sustained, fair and actionable evaluation, can also serve as a laboratory for the development of digital humanities standards. Although the Silk Road atlases that the students produced are yeoman work, they exemplify a space in the digital humanities for projects which are creative but self-contained, and which use standard and tested technology. The *Profession* contributors insist that digital humanists need to educate outsiders to the field about our practices. We contend that we have work to do internally that is even more important: to value – and to evaluate – finished work that contributes to the disciplines. 50

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Appendix 1: Digital Map Rubric

1. Writing

A. Paper

Ten page paper	• Clear thesis, correct citations, good use of primary and secondary sources and examples, good mechanics, well-organized.
Based on a travel narrative and course themes	• Extensive and creative engagement with a narrative. • Citation and discussion of assigned readings and course themes.
Focused on geography	• A thesis and analysis that reflects the traveler’s movement through a particular human and physical terrain at a particular time.

Table 3.

B. Episodes

Six episodes	• Identify the most important places along your traveler’s route and describe what your traveler did at each place • Use the History Engine standard

Table 4.

2. Spatial Reasoning and Visualization

A. Gazetteer/Point Locations

At least 15 placemarked locations along your traveler's route	• Accurately located in space • Temporally located with date-stamps or date-ranges associated with your traveler.	• Even if you are focusing on one leg of your traveler's journey in detail, sketch in the whole route for context. • Be sure that your spatial locations match the terrain. • If you cannot determine dates for your traveler's waypoints, be sure to include that information somewhere. • 15 locations is a minimum: use as many as you need • Using the Spreadsheet Mapper tool is optional. You may use an offline spreadsheet to keep track of your locations, and thumbtack them in Google Earth by hand.
Descriptions of each placemark	• Brief information that may include: images, hyperlinks, quotes from your travel narrative, or standardized information related to your thesis such as city populations, religious practices, trade commodities, et cetera. • Consistently formatted in content and style	• This is in addition to the six required in-depth episodes.
Routes of travel	• Lines depicting the traveler's route between each waypoint	• These should be as accurate as feasible (e.g traverse passes instead of mountain peaks), but they may not be exact.

Table 5.

Google Earth Cartography and Visualization

Communicative visual style	• Clear and consistent iconography • Objects distinguished from each other by category (e.g. battlefields from monasteries, the route out from the route home, et cetera) • A title and legend placed on the map as an overlay.	
Contextual information	• This might include: important cities, ports, passes or other places in the vicinity of your traveler's route; map overlays; or polygons representing important regimes or other regions.	• The content and quantity of this information should be dictated by your project and your thesis.
Zoom/Tilt	• The visible range of your project should be appropriate to its spatial scope. • Some details may be visible only at a high zoom range.	
Animation	• Create a tour or flythrough. Determine how to communicate your project in this format.	• Consider creating a voiceover.

Table 6.

Storytelling and Integration

Integrated Map and Paper	• The thesis of the paper, the topics of the episodes, the theme of the map, along with any hyperlinks and images, should reinforce and reference each other. • The places and events mentioned in the paper, episodes, and the map should be the same. • The map should help to prove the thesis of the paper.
Intuitive User Experience	• Control how users experience and navigate your project. Use appropriate titles and filenames for layers (including flags like "start here"), organize the layers well, launch your paper from a placemark on the map, create a title and legend overlay.

Table 7.

Appendix 2: HIST 108 Student Survey Analysis

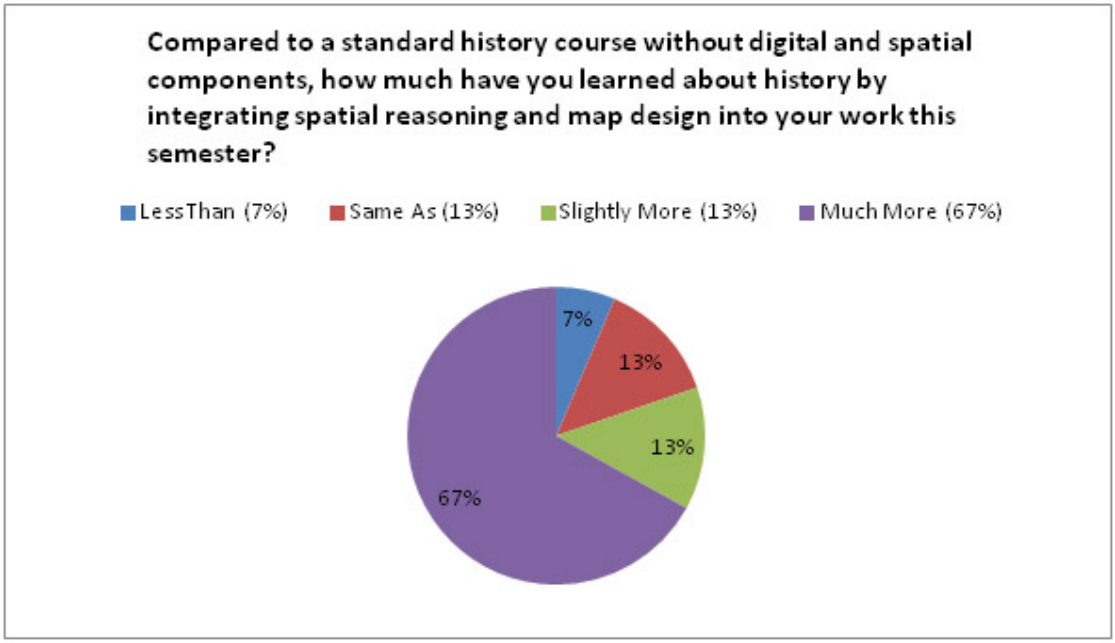

Figure 2. The digital and spatial focus of the Silk Road class influenced students' perception about how much they learned. While there is no actual way to measure learning by way of quantity, the responses to this question accord with Bob Broad's notion of learning via self-authorship, fostering agency and independent thinking. [Broad 2003]

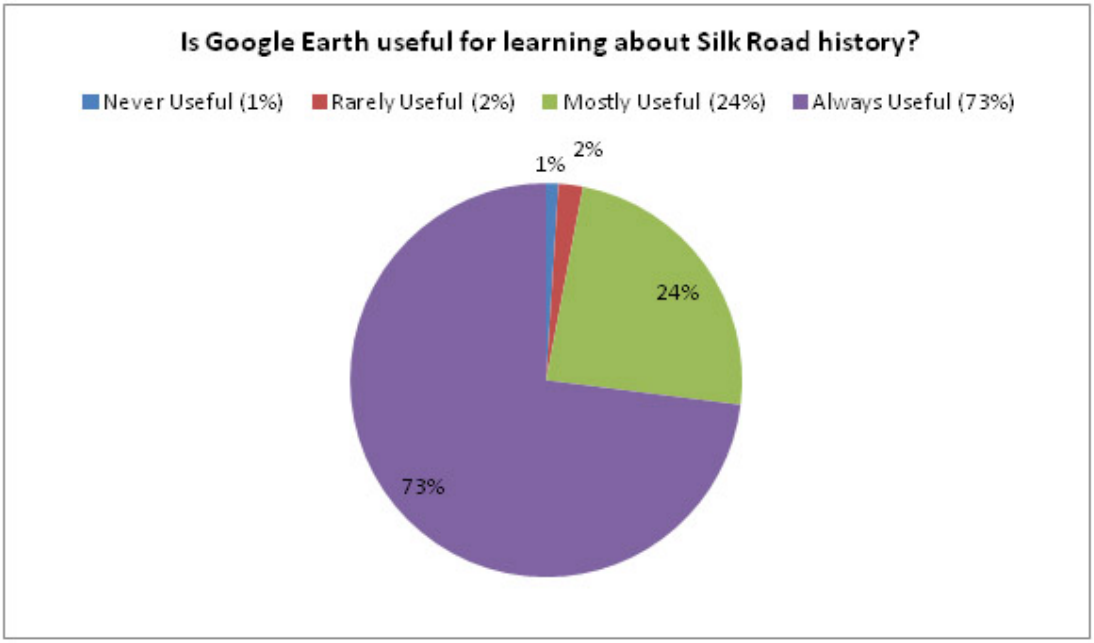

Figure 3. Students learned to reason spatially about historical phenomena by learning to use Google Earth and other tools. These results show that students felt that the use of Google Earth assisted them in learning about history. In addition to their overall sense of satisfaction and high level of learning in the course, over 75% of survey respondents were happy with the appearance and functionality of their Google Earth project and 80% of students said that they enjoyed working with Google Earth.

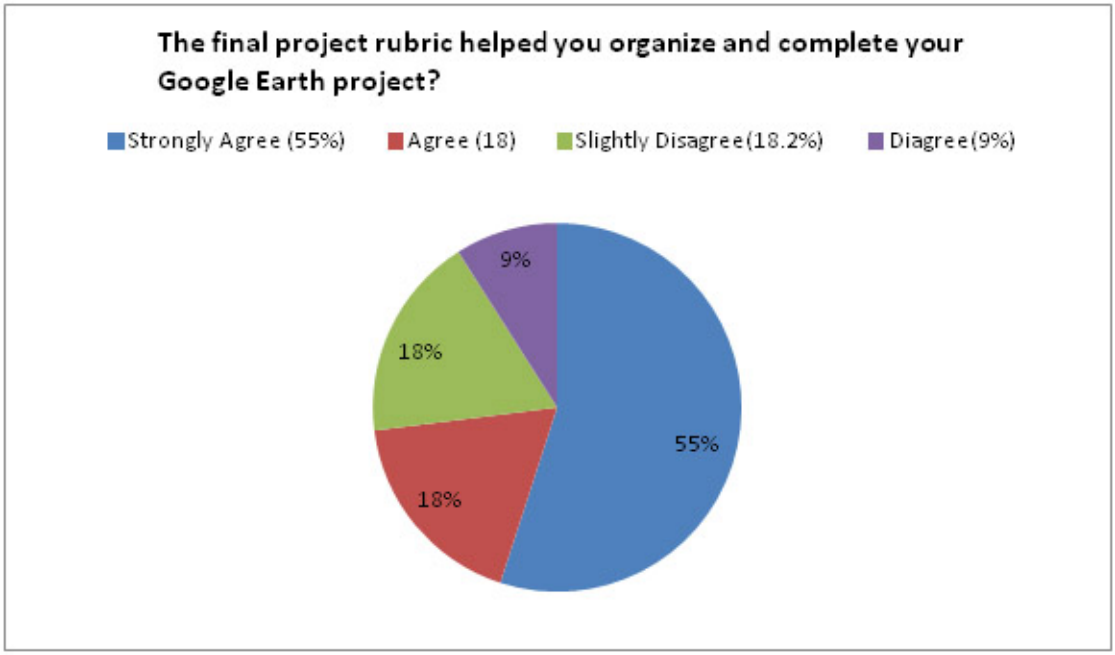

Figure 4. Students found the rubric useful. Students were involved with the creation and implementation of the rubric, and they attributed their success in part to the rubric. We infer that the rubric helped them to understand the project and to recognize what was required for a successful final project. The success of the rubric helps to explain the high final project grades for the course.

Notes

[1] The term digital atlas is inspired by the work of the Electronic Cultural Atlas Initiative (ECAI), which is the best known research program to use the atlas metaphor to refer to interactive digital maps of historical and cultural phenomena. ECAI, now largely dormant, was influential between about 1999 and 2005. See http://ecai.org.

[2] *GeoHumanities* is the title of a book edited by geographer Michael Dear and several colleagues, and *Spatial Humanities* is the title of a book edited by historian David Bodenhamer and two colleagues. The spatial humanities book focuses particularly on the use of GIS, while the geohumanities book, a conference volume, covers a wide range of other topics as well, including speculative mapping, and literary criticism informed by cultural geography. The term spatial history dates to Paul Carter's influential *The Road to Botany Bay: An Exploration of Landscape and History*, published in 1988. In contrast to the term historical GIS, it refers to a methodological stance more than an engagement with particular technologies. Judging by conference attendance and book and journal publishing profiles, there is remarkably little overlap between the digital humanities community and the spatial history community.

[3] All of these authors are from the final section of the volume, which is about history. Other sections of the book, concerned with art, representation, and literature, are less involved with spatial analysis and visualization technology, and are less pertinent for this discussion. *The Spatial Humanities* features articles by many of the same authors and reflects a similar range of approaches.

[4] [Mostern 2010]. That article was preceded by a related work that had less of a pedagogy focus but was also an effort to engage digital practices in history and geography. That article [Mostern 2008] argued for the utility of including information about events in spatial humanities databases in order to engage more effectively with contingency and change, the core points of analysis in the discipline of history.

[5] Similarly, [Mbembe 2000] introduces the notion of "itinerant territoriality" to connect the idea of travel as a place-making activity to the concept of (precolonial) political authority

[6] [Christian 2004] also offers tremendous insights about temporal scale.

[7] Ian Gregory's article in the *Spatial Humanities* volume [Gregory 2010], drawing on some of the same theorists, comes to a related conclusion, colored by his background as a geographer rather than a historian. "In an ideal world we would use spatial and temporal data to explore how a phenomenon has evolved over time, not by comparing two snapshots but by looking at continuous change. In doing so the aim is not to identify the story of how the process evolved but to use different places to explore the different ways in which the phenomenon could occur differently" [Gregory 2010, 66].

[8] University of Saskatchewan geographer Scott Bell helpfully introduced these distinctions at a Learning Spatially (LENS) Mapping People workshop at the University of Redlands that Mostern attended in June 2010.

[9] Spatial@UCSB (http://www.spatial.ucsb.edu/index.php). Another visible initiative, the Spatial Literacy in Teaching (SPLINT) Centre of Excellence in Teaching and Learning, developed by a consortium of British universities, likewise presents a variety of learning resources without defining the domain or including tools for assessing competency in it http://www.le.ac.uk/cetl/splint.html. TeachSpatial teachspatial.org is the site that most appears to be taking on a mandate of developing practical classroom tools, but it also falls short.

[10] See also Nora Newcombe, "A Plea for Spatial Literacy," linked from the Carlton website.

[11] Various other spatial thinking and spatial literacy initiatives are underway as well as those we have noted here. They include the teachspatial.org site at UC Santa Barbara and the Spatial Intelligence and Learning Center (SILC) at Temple. No participants in the field have developed curriculum or learning outcomes for spatial literacy yet, though discussions on the topic are underway. A book entitled Ontologies for Spatial Thinking is under development based on a 2011 workshop at UC Santa Barbara. Thank you to Karl Grossner for updating us about the state of the field.

[12] A website about the course, including the complete syllabus, is online at http://crte.ucmerced.edu/mostern.

[13] See http://historyengine.richmond.edu.

[14] For a good introduction about issues to consider regarding the use of virtual globes in the classroom, see Andrea Nuernberger, "Virtual Globes in the classroom" http://www.csiss.org/SPACE/resources/virtual-globes.php#GISdata (first published 2006, last updated; UCSB Center for Spatial Studies, 2009).

[15] UC Merced was founded only in 2005, and the library has limited print holdings. Students selected the travelers they wished to study by consulting Silk Road websites and then ordered print copies of the narratives and appropriate secondary works using interlibrary loan, which provides UC Merced students easy access to the entire ten-campus University of California collection.

[16] The YouTube video is available on the course website at http://crte.ucmerced.edu/mostern.

[17] [Grossner 2010] includes an excellent review of the characteristics of print atlases.

[18] A November 2011 special report from the *Chronicle of Higher Education* concludes that although today's college students use digital technology for many purposes, they are not necessarily "digital learners" who know how to work with their technology, and they do not necessarily prefer to learn with technology or in online environments. As we learned in the Silk Road course, the *Chronicle of Higher Education* advocates much more study about what technology in the classroom works, and what does not. "Online Learning" *Chronicle of Higher Education*, November 2011 http://chronicle.com/section/Online-Learning/491/.

[19] http://www.insidehighered.com/news/2012/01/04/evaluating-digital-humanities-enthusiasm-may-outpace-best-practices.

[20] As Jerome McGann points out, collaborative and socially authored works are difficult to review, and the ones most familiar to the humanities academy are "fundamentally stand-alone operations" [McGann 2011, 192].

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