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**Untangling the Web of Historical Thinking:
What the Structures of Student-Produced Wikis Reveal**

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PROJECT OVERVIEW

Background: “Untangling the Web of Historical Thinking” is the second phase of a pioneering effort to create a digital teaching and learning tool that helps history students better to comprehend and to demonstrate their understanding of the weblike character of historical knowledge. We are developing a tool for learning and knowledge construction that can enable students and teachers alike to visualize connections that otherwise often remain invisible or only implied.

While we believe most disciplines organize knowledge in ways that are at least as much web-like and non-linear as hierarchical and linear, we began with the humanities because bodies of knowledge in these disciplines are relational in ways that are often not visible--or even comprehensible--to novice students. Because its subject matter is thought by novices to be organized in a linear, chronological way, history, specifically, seems well-suited to teaching and learning strategies that encourage conceptual connectivity.

Wikis and Webs: The teaching and learning possibilities for wikis in history classes have long been established, from facilitating collaboration to illuminating how carefully we must evaluate the stories we read about the past. “Untangling the Web” is built upon experiments with wikis we conducted in the years prior to receiving a Digital Humanities Start-Up grant. We began by exploring the potential insights into student learning the linking function of wikis might provide. Through this linking mechanism, wikis allow for a multi-dimensional arrangement of information. We believe that when you place an explicit focus on connection-forming and visually render the multiple dimensions of a topic, the process enhances learning and the emerging structures creates opportunities of self-assessment and reflection.

We established it was possible to write software that could produce time-lapse visualizations of networks of student-produced links between wiki pages. We speculated that these visualizations had the potential to reveal how and when students are beginning to cross the threshold from understanding history as a collection of facts arranged in more or less chronological order to understanding history knowledge as more web-like than linear.

Evolution: After our few first iterations of using wikis and coding/scripting within them, we began exploring whether Google Docs could be used for the same purpose, since they provide wiki functionality (for example, one can place a web link from one Google Doc to another in almost exactly the same way one links a wiki page to another) but offer additional advantages:

- Student already know how to use Google Docs.
- Google Docs separates the name of a file from its body; consequently, a file can be renamed but all the connection to it remain intact (in many of the open source wikis, this was not the case which led to much confusion and frustration for our students).
- While Google Docs initially appear to be organized in the familiar folders-and-files

arrangement, this is actually an illusion; in particular, once a file or folder is created, in case be made to appear in multiple places (i.e. folders) which allow us to go beyond the confines of hierarchical organization.

- Google Docs has a robust application programming interface that reduces (even eliminate) the risk of our software being unusable a short time after we conclude our development efforts.

Although the actual software system for organizing information and producing visuals evolved significantly over the course of the grant (see below), the pedagogical and structural premise for using the system has remained constant. At the beginning of a course, the instructor identifies the major course themes and subthemes. For example, in the post-Civil War U.S. history survey course that served as one of the pilots for the system, Michael established “Forging a Pluralistic Society”, “Becoming a World Power”, and “Industrialization and Urbanization” as the main themes with four sub-themes for each.¹ These themes and subthemes are then entered into the system as “tags,” which keeps the nomenclature consistent with other digital organization systems. The second step in the process of initiating the system is to create a set of “Resources”. For the course-based pilots of the alpha version of the software these resources were exclusively primary sources, but they could be any kind of reading or other source material that the instructor wanted students to respond to and tag.

Initially we experimented with using the folders feature in Google Docs, having students organize the documents according to the major course dimensions (we are using this word rather than the more common—to the humanities at least—word “themes” because it better captures the essence of a web) they believed each reading best fit into. They then further categorized them according to sub-dimensions (3-4). Readings could relate to more than one dimension (up to 2) or sub-dimension. Herein lies one of the chief virtues of using a tool like Google Docs to organize one's learning. As in our brains, in Google Docs (or in an actual wiki), information can be (i.e. contextualized) in two places at once: the magic of indirection.

While this approach had potential, there were worries of user understanding and overhead. In order to use Google Docs in this way, users would first have to understand the concept of indirection, then learn how to actually perform this action in Google Docs, followed by managing all of their folders/files themselves. This seemed like too much work for end users so we simplified the role of Google Docs to be just for file storage and as an editing tool for students. We designed our own tag-based system which fulfilled our goal of indirection. Our application can manage the files for students while they only have to focus on which of the instructor-created tags (which represent the dimensions described above) best reflect their understanding of course documents.

¹ All but one of the courses in which the system was piloted were introductory history courses at Ithaca College, taught by either Michael Smith or Matt Klemm. Mr. Klemm also used a very early version of the system in an interdisciplinary first-year seminar (Fall 2012), which was mostly helpful in determining the shortcomings of the system and making refinements for subsequent use.

From these principles we proceeded to build the first version of our application which allowed us to gather data from multiple classes and to validate the feasibility of the tool and its usage. Our use of Google Docs in this version of the system confirmed the promise of our ideas for creating software that could help students master multi-dimensional thinking.

At this point, we were content with our conceptual design but we realized we had to make two improvements for usability before our system was ready for deployment. First, it was not easy (or even possible) to reconfigure a course once the associated semester had started. Second, the communication overhead between our server running the web application and Google's servers behind Google Docs was creating significant latency issues (i.e. the system did not appear as responsive as it could be). This led to the current/final version of the software that runs on a single service called Firebase (which has since then been purchased by Google, confirming its longevity) which is far more dynamic in terms of configuration and is far smoother in interaction. In addition, by virtue of doing our own file management (i.e. by not outsourcing students' editing actions to Google Docs), we are able to collect much more information about the way our system is being used. This, in turn, will allow us to better understand the process students follow from the very start of an assignment to the production of its final deliverable. In the transition, we did lose the familiarity and brand affiliation of Google Docs as well as particular features (e.g. advanced formatting, robust multi-user editing, and a more natural file control). We believed this trade off was acceptable because the user experience (as a whole) is now better/faster and we are able to collect the highest possible usage resolution which will help us with the analysis aspect of our work.

Making Connections: Instead of asking students to identify connections they see among the different readings as one of the first steps of learning, we ask them merely to tag the resources as they deem appropriate—this could (and perhaps almost inevitably will, if our theory about the web-like structure of knowledge formation and retention is correct) involve tagging the resources with multiple tags. Ideally, the students should do this with some care and self-consciousness, not a guarantee given the wide range of motivations students bring to a course, especially an introductory one. That said, the visuals generated by the tagging process will reveal to both the students and the instructor whether the students are a) taking the assignment seriously, and b) understanding the material—i.e. are on their way to crossing an understanding threshold.

In our experiments with the system we included another step for the students as they digested the primary sources. In addition to tagging the source with the themes the student deemed appropriate, each resource has a text box in which the students can write a response to the source.² These responses are intended both to justify the selection of tags and to encourage the student to note preliminary interpretations of the source's meaning and significance to the course. These responses become the rationale for the tags, as well as the raw material for

² Before the current stand-alone system was completed in the summer of 2014, this text box was, in fact, a Google-doc that was generated by the software. See Appendix for the technical details of this version of the system.

synthesis assignments later in the term (in the case of the pilot courses, these assignments were papers).³

Visualizing Learning: For much of this project we debated whether it was more valuable for the students to have access to the visuals of their interconnections only at the end of the term or all along. One concern we had was that if students could see the visuals from the start and knew they captured something meaningful about their learning, they might focus on consciously constructing the visual rather than letting it organically emerge from their tagging selections. Based on student feedback, however, we decided that a system with complete transparency would still mostly result in a software-generated concept map that authentically represents the tagging process and the interconnections that emerge from it. The system allows the the instructor to determine when s/he thinks it is pedagogically appropriate to reveal and explain the visualization function. One exercise that has proven useful in the pilots is having students explain/justify the connections between resources that the visuals reveal, both at the end of the semester and at some intermediate point.

The visuals constitute a network representation of how knowledge/information has been organized that can then be used to help students understand the inherently interconnected nature of their learning—and the interconnected nature of knowledge in any discipline. We also believe this enables them to recognize visually the most significant connections in the material being studied, ones either they have already made themselves or the ones the instructor has identified as keys to making progress in the discipline—the threshold concepts. The student then goes on to reorder/reorganize as needed and write a paper, which becomes the key assessable artifact in a humanities course (since writing papers remains a signature pedagogy of the humanities and creating coherent, linear narrative will remain an important skill for the foreseeable future). Although it has not yet been piloted in a course, the programming team included in the final version of the software a feature that allows students (and, in modeling the system, the instructor) to code the tags as strong, weak, or neutral. We believe this will allow for finer granularity when assessing the relative importance of connections among different resources.

One additional virtue of this method—especially for introductory courses—is that it helps faculty members in course planning to identify the key themes of the course and have a clear sense of how s/he her/himself would organize course material and make connections among the different pieces. In other words, once students have approached mastery, their visuals

³ It is possible to use the system as strictly a tagging system with no additional input from the students. Although we have not used it this way, we can imagine that at institutions with large lecture courses it might be realistic to use the tool in this way. The web of connections among the resources—visible through both the visuals generated and the labels themselves—could by itself help both students and instructors to develop the kind of integrative, synthetic historical analysis skills that constitute conceptual progress in the discipline.

(concept maps) will resemble the instructor's. Both the instructor and the students become very conscious of the dimensions of conceptual space for the class—and it will be crucial to identify these dimensions as some of the learning outcomes/goals for the course.

Final Developments:

The primary features of the final version of our system can be summarized as follows:

- Persistent accounts for users to prevent students/instructors having to create a distinct login for each course.
- Persistent resources for instructors to simplify subsequent uses of the system.
- Definition and use of major tags/dimensions and minor tags/dimensions.
- Coupling of strength (weak vs strong) with the instructor defined tags.
- Tracking edit changes at the character resolution.
- Associative visualization (of network structure) to directly show students' tagging choices.
- Resource based visualization (of network structure) to identify conceptual neighborhoods, as they form based on students' tagging choices.
- Tag based visualization (of network structure), to reveal the importance as well as orthogonality of the tags defined by the instructor.
- Robust and scalable deployment using Firebase's infrastructure.
- Features to simplify the tracking of student progress.
- Features to simplify the creation of assignments (with calendar support).

PROJECT GOALS, STATED AND ACCOMPLISHED

At the beginning of the grant period we already had produced prototype visualizations of the wikis created by students in the 2010 U.S. History since 1865 course. These visualizations were invaluable in helping us understand that there were patterns in the visuals that could then be studied analytically. The visuals showed potential for being used as a "self-awareness of comprehension" instrument when shown to the students who created them (with the caveat that, if done carelessly, the project could turn into a link-creation exercise, preventing structure to be representative of authentic learning). We proposed to choose an open source wiki that fulfilled certain architectural constraints and couple it with a visualization component. We planned to explore the degree to which students should have access to these visuals.

Our focus on wiki structure led us to tap into the tools and techniques from the field of networks. Specifically, our final system gathers quantitative data to analyze, characterize, and categorize the student-created networks to search for educationally relevant meaning. We proposed to study these structures at particular moments of pedagogical significance, such as when students perform major changes or when the associated projects are complete. Our prior work had shown us that these structures typically start out as hierarchies and subsequently transition to more

interconnected (i.e. network) forms. We speculated that these forms are not random but we were not sure what they meant. We speculated that significant jumps in comprehension (passage across learning thresholds) may be caught/observed as significant structural changes. Our goal for this project was to try to confirm this speculation both with the data we gather from the wikis themselves and from pre-post assessments we conduct of students' historical thinking skills. By the end of the grant period we hoped to be in a position to argue that major structural changes might serve as indicators of jumps in comprehension. Furthermore, we wanted to explore the issue of whether these structures could serve as proxies for the types of mental models forming in our students minds.

We are confident that we produced a complete deployable software system to conduct all of the above inquiries. In fact, in the absence of an open source wiki system to be used for our research, we developed our own system from scratch, one that incorporates the linking elements of wikis but also offers user features specifically designed to enhance student awareness of the interconnectedness of historical thinking. The tagging feature is one of these innovations. We also refined the visualization application of the system, allowing both students and instructors to observe the evolving network produced by the tagging process. We collected evidence that our tool does help students cross conceptual thresholds in their study of history (see Assessment/Evaluation below).

Since the funding period (and the funds) were used to develop the system, it is only now that we are moving on to full-scale data collection and analysis. By looking at the evolution of a student's software-produced network, we think we can observe conceptual progress (or lack thereof); however, this is not something we can make an evidence-based argument for yet. We still need to develop assessment instruments for this purpose (which is itself a research question, since such tools themselves are very recent addition to education).

AUDIENCES

For this phase of the project our audiences have primarily been a small circle of scholars of teaching and learning and others who are intrigued by the potential of the tool. As noted below, we have presented at several conferences (ranging from regional educational technology events to international conventions on the scholarship of teaching and learning). These presentations have largely served as a way to solicit feedback on the tool from a wider range of disciplinary and educational technology perspectives than our advisory board offers. With the closing of this grant, we hope to reach a broader audience of post-secondary (for now at least) humanities educators who would be interested in experimenting with this tool.

Our tool has also found an international audience. Ali Erkan has introduced our software to two universities in Turkey (Koç University and Bosphorus University, both located in Istanbul); we are anticipating two formal presentations in March. One of the aspect of the system that received their attention is that the response text provided by the students are seen as mini-papers. And since these Universities officially use English but work with students who

are yet to master the language, these “mini-papers” are perceived as a stepping stone to writing more complete (i.e. college level) papers for non-native English speakers.

One additional audience for the project has been the Ithaca College community, especially prospective students and parents. The project has been featured in the college’s [“Ready” promotional campaign](#) since 2013.

ASSESSMENT/EVALUATION⁴

Because the kind of tool we have developed is somewhat unique, there really were not pre-existing assessment strategies we could utilize. Rather, we have had to adapt assessment strategies from the limited literature on assessing concept maps and develop our own assessment tools. We have also relied upon evaluations of the tool we are developing produced by the grant advisory board. Finally, we received some informal evaluation from audiences at the conferences where we presented our work.

Advisory Board Evaluation: Our advisory board⁵ was a valuable resource for the project. Its members served as a sounding board for our evolving ideas. They provided important feedback on both the theoretical underpinnings for the project and for the tool itself, especially as we shaped the tool into its final form. They suggested that we think more carefully about whether, in fact, recognizing the weblike character of historical knowledge is a threshold concept for novice students. There is not yet consensus about what the threshold concepts in history actually are and at what stages of cognitive development it is appropriate to introduce them.

One advisory board member made the following observation that we will consider carefully as we continue to develop and make the case for the utility of our tool: “I’m not sure I rank ‘recognizing the web-like nature of historical knowledge’ high on the list of threshold concepts for an introductory course. Not as high as other concepts I’m teaching, like how to ask historical questions, or how to recognize the Main Point of a secondary source, or how to apply the sourcing heuristic to information, or how to make an argument with evidence. ‘Recognizing the web-like nature of historical knowledge’ feels like frosting on the cake after these more basic skills. I say this not to criticize your work, but as an explanation for the following suggestion: when you make your argument on behalf of [the tool], don’t skimp on justifications for the importance of your objective. Why is it critical that beginning students recognize the nonlinearity of historical cognition? Examples of the harms of not recognizing the weblike nature of historical knowledge would be helpful.”

⁴ There is a fuller analysis of the assessment data in Appendix I.

⁵ David Pace, Professor Emeritus of History, Indiana University; Lendol Calder, Professor of History, Augustana College; Chris Sperry, Director of Curriculum and Staff Development for Project Look Sharp, Ithaca, New York. Susannah McGowan served as an ex-officio member of the advisory board, while providing specialized expertise in assessment for the project.

One other critique had to do with the “top down” creation of the tags by the professor. We share the concern that this approach reduces student agency in the learning process. In the next iteration of the tool we plan to include the capacity for the students themselves to generate tags, perhaps revisiting material previously tagged with the instructor’s themes.

The board also identified several weaknesses in the User Guide for the Beta version of the iteration of the tool under development at the end of the grant period: Learning In Networks of Knowledge (LINK) (see the link to the guide in Appendix III). An updated version of the User Guide should be available in early 2015.

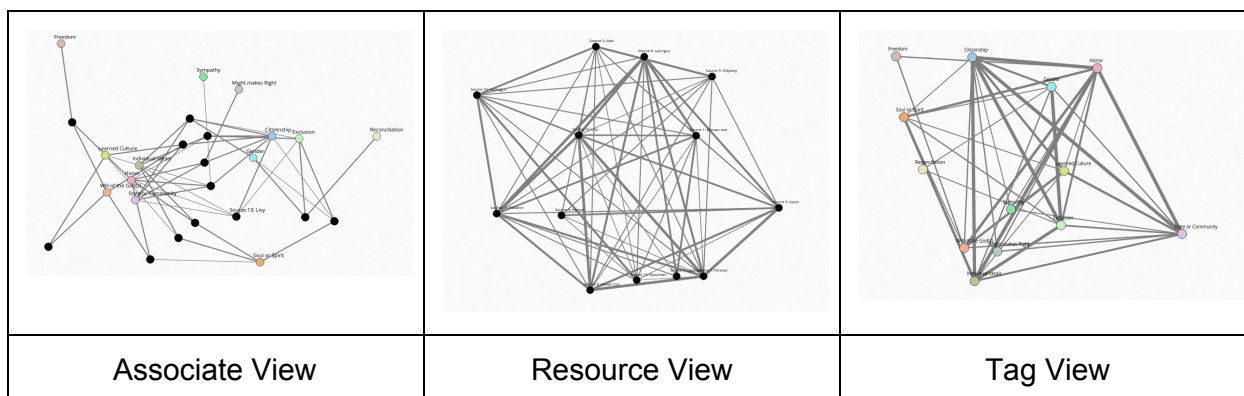
Internal Assessment: We decided early on that some kind of a pre-post survey would be one useful way to gauge how the process of using the tool had affected student student perceptions of the discipline of history and of how historical knowledge is constructed. We combined this with a more targeted survey late in the semester about the functioning of the tool itself. The Fall 2013 and Spring 2014 experiments with the system also included a reflective essay about using the tool, which generated some additional helpful feedback, although any kind of self-reported improvements in learning must be viewed cautiously. Finally, a sample of students from the Fall 2013 class were interviewed in the spring of 2014 about their experience using the system.

Survey Data: While our pre-post surveys were not as useful as we might have liked, they did provide a sense that students using the tool found it helpful in making sense of historical knowledge in a survey level course. As was the case with other feedback from students, they seem to have benefitted more from the tagging exercise than the visuals the software produced of the tagging. Summary data from spreadsheets and assessment surveys can be found in Part 2 of Appendix I.

Reflective Essays: While it is clear from the reflective essays that there was some degree of students telling the instructors what they thought the instructors would want to hear, these pieces of assessment evidence did offer additional support for our belief that this system can enhance student learning. Most students articulated an appreciation for the way the system helped them organize information and make sense of it, especially when it came to synthesizing material for essays. As one student wrote, “I liked the fact that my taggings and reasonings were online in one spot because it made it very accessible and easy to use when it came time to write essays. By having them already connected, it was simple to formulate essays with a lot of textual evidence.” And “If this course has taught me anything it is the fact that I can relate so many parts of history together that I never would have thought to do prior to taking the class.”

Although the responses to the visuals were by no means uniform, it is clear from the feedback we received on the alpha version of the software that after a few weeks of tagging, the visuals became so cluttered that they had limited utility in terms of helping students understand how

knowledge in the course was interconnected (see images of final webs in appendix--some screen shots). One student told us that “if the future versions of this program were to resemble the more simplistic style of the tags web, I believe this would be more helpful for the participating students.” We have tried to address this cluttering problem in the Beta version of the new software by creating three possible network views of the connections between tags. Our system supports three network views on the tagging choices of students:



The associative view is the most fundamental of the three since it directly shows how tags have been assigned to resources. Colored nodes represent tags, black nodes represent resources, and connections represent tagging choices. For example, if a resource R has been tagged with tag T, then the visual contains a line drawn from a colored node (representing T) to a black node (representing R).

The nodes in the resource view all represent resources; tagging choices are, in turn, represented with connections between these nodes. For example, if two resources R1 and R2 carry a common tag T, then the resource view shows a line drawn between the nodes representing resources R1 and R2.

The nodes in the tag view is essentially an inversion of the resource view; that is, nodes represent tags and connections represent resources. For example, if a resource R has been tagged by the tags T1 and T2, then the tag view shows a line drawn between the nodes representing tags T1 and T2.

The system also allows students determine three levels of strength in how they tag each resource (strong--the theme is dominant in the resource; neutral--the theme is present but not dominant; weak--hints of the theme but it is modest at best). These changes seem to produce webs that are more comprehensible and less cluttered.

Despite the limits of the concept maps the visualization software produced, even the visuals seemed to aid students in developing their understanding of historical knowledge as a weblike structure. As one student wrote, “I have to admit, that after looking at the final product of my

webs, I was a bit intimidated. But I think that's the real purpose of this class and studying history. By seeing connections between sources, connections between themes, and even connections between connections, we see that history does not happen like a movie. There's no one lens to look at history through and every story seems incomplete until you've looked at it from all angles." And as another observed, "The main thing that I gathered from examining these visuals is that it is impossible to fully understand a certain event in U.S. history without also examining the events surrounding it, both before and after. The fact that all of these documents are connected in some way is very telling to the nature of historical analysis. It is important to understand that things don't 'just happen,' and usually it is possible to get a very clear idea of what led to an event occurring."

Interviews: Although people at conferences repeatedly urged us to engage students who had used the tool in some kind of "think aloud"⁶ process as they did their tagging and examined the resulting visuals, we did not manage to do this. We did, however, interview a sample of students from each of the three courses in which the alpha version (Google Docs based) of the tool was piloted. Each of the seven students interviewed was enthusiastic about the way the tagging process helped them organize what they were learning in the course.

Students also commented on ways the thematic, non-linear way the system helped them organized information altered their perception of history. One student said "with the tagging it was a lot easier to see connections between long spans of time, which I think is more beneficial than just clumping them by the date." Said another, "as we read more and more we found that there were connections between the things we had learned at the very beginning of the class and the things we were learning at the end so it was interesting to see how everything connected even if you didn't immediately think that it would and then you could write about connections that you didn't see before." Students were unequivocal on that last point: the tagging-generated connections were very helpful when it came time to synthesize different sources in a historical analysis paper. As one observed, "tagging helped a lot in organizing your ideas and putting a theme to them. It helped a lot with not just summarizing the paper or anything like that but you had to actually think a little deeper into meanings behind the sources. So the tagging helped a lot in paper and other accumulative type aspects of it because you have all of it in one place and you've tagged them all then you're able to go back and look at that they were and the web also helped to make you be able to draw connections that you wouldn't have seen otherwise from just having a list of responses so it definitely helped later on in formulating a better response."

These interviews--along with the other assessment data--will be fully explored in a forthcoming article on assessing the kind of tool we have developed. But it seems clear that many students were able to digest the material of an introductory history course more readily by using the system.

⁶ See, for example, Sam Wineburg, *Historical Thinking and Other Unnatural Acts: Charting the Future of Teaching the Past* (Philadelphia: Temple University Press, 2001).

Other Feedback: Our “public” was small, but influential. The most helpful audience we presented this work to was the History--ISSOTL group at the 2012 ISSOTL conference. This was our first opportunity to explain our theories about how tagging and visuals might help students cross the threshold from thinking about history as a linear system of knowledge to understanding historical knowledge as more weblike in structure. Like the advisory board they pushed us to answer the “so what?” question about the meaning of the visuals--they are interesting but do they really reveal something meaningful about threshold moments, or even of less significant student learning. From our first presentation of this project audiences had been impressed by the visuals and intrigued by the possibility that they

We also received some feedback about the possible applications for the tool from the Koc University people mentioned above.

Issues Still to be Resolved:

None. Since the funding period was used to create a responsive, scalable, robust web application to expose students to multi-dimensional thinking in such a way that connections are automatically associated with meaning, we need subsequent semesters to collect large datasets to mathematically analyze (e.g. spectral analysis of the resource view) and search for meaning.

DISSEMINATION

Executed: In addition to working on an article about the pre-grant phase of the project that addresses the challenges we would be exploring with the grant, we have been actively sharing our development process the entire duration of the grant.

October 2012--ISSOTL Annual Meeting (Hamilton, ON): Our formal presentation was on a survey instrument we ultimately decided was not useful for this project. More valuable was our presentation to the History-ISSOTL group, described above.

April 2013--Whalen Symposium of undergraduate research at Ithaca College; student research assistant Steve Lam presented his work.

April 2013--Ed-Tech Day, a regional conference hosted by Ithaca College, where Ali, Matt, and Steve gave a presentation of the software as it existed at that point.

August 2014--Koç University and Bosphorus University, Turkey. Ali gave an informal presentation to faculty and administrators about the potential of the tool for non-native English speakers.

October 2014--ISSOTL Annual Meeting (Quebec City, Quebec): Ali Erkan co-presented a poster, "Design of LINK: A Tool for Students to Express Conceptual Connections" with Joe Rodriguez (one of the terrific student programming assistants on the project). We received powerful validation of our work, including an invitation to Indiana University to be the featured presenters for their Scholarship of Teaching and Learning Program during the spring semester of 2015.

Planned: In January we will be presenting the entire project as a teaching and learning roundtable (co-sponsored by the Roy Rosenzweig Center for History and New Media) at the American Historical Association Annual Meeting in New York City. Most of the project team will be involved in this presentation entitled "Learning in Networks of Knowledge (LINK): Toward a New Digital Tool for Cultivating Historical Thinking." Given that the tool was initially designed for application in history courses and that all of the pilots for the tool were conducted in history courses, we anticipate receiving valuable feedback about the system. This feedback we no doubt be crucial for subsequent grant applications and refinements.

NEXT STEPS AND LONG-TERM IMPACTS

Next Steps: At this point, we have produced a functional system that accomplished all of the goals we laid out in our grant application. Indeed, we have something that has the potential to contribute to teaching and learning not only in the humanities, but for many disciplines. We are currently prospecting for new collaborators in both the humanities and other fields. Once these collaborators have committed to working with us, we anticipate applying for additional grant funding from both federal and foundation sources to expand the piloting of the tool.

While we did not formally establish any new collaborative partnerships over the course of this grant, we did benefit from our association with the History-ISSOTL group and plan to utilize the contacts we made there in pursuing the next phase of our work. The History Learning Project at Indiana University has been both an inspiration and a source of feedback for our work, and we would like to bring this working group into the next phase of the project in a more formal way as both consultants and as possible co-investigators.

Long Term Impact: It is difficult to assess the impact that our project had on the public's perception of our institution. Apart from the initial press release about the grant and the "Ready" campaign spot cited above, the college did not publicize our work very much. The project has generated some excitement in the scholarship of teaching and learning field, and once our work is published there should be even more interest. There is no question the project has shaped all of the participants' thinking about the ways this digital tool can enhance learning in history classrooms. Now that the summer 2014 final redesign of the tool is functional, we plan to promote its use with colleagues at Ithaca College as a way to pilot the tool without additional funding. That said, as noted above additional grant funding will be pursued in order to further develop the tool.

ACKNOWLEDGEMENTS

This project would not have been possible without the generous encouragement of Randy Bass, David Pace, and Peter Felton, who recognized the potential for this work when we first presented it publicly at the 2009 ISSOTL conference in Bloomington, IN. Jennifer Serventi was supportive and helpful from our first inquiry about funding, and has proven to be the best contact we could have hoped for at the NEH. At Ithaca College we owe a debt of gratitude to Bashar Hanna, Will Kay, MaryAnn Taylor, Susan Weatherby, and Wade Pickren. Matt Klemm was a tremendous asset as a patient and thoughtful colleague who was willing to pilot the tool in his classes as it evolved. Steve Lam and Joe Rodriguez deserve enormous credit for their work as a student researchers--between them they basically created the software for our system. Drew Winston was our first student research assistant that worked with us to bootstrap the first visualization components. The Departments of History and Computer Science provided administrative support; Terrie Miller was especially helpful. And thanks to the scores of students who have used the system in its various forms and provided thoughtful feedback about its strengths and weaknesses. Our advisory board of David Pace, Lendol Calder, Chris Sperry, and Susannah McGowan (whose expertise in assessment was invaluable) performed an indispensable service.

APPENDIX I--Project Assessment (primarily compiled by Susannah McGowan)

Part 1: Pre-Post Survey Analysis

In looking at the responses to one specific question, we were able to parse out the possible effects the tool had on how students view the study of history. Forty-three students answered this question on both the pre- and post- surveys for the Fall 2013 pilot (the course for which there is comprehensive assessment data):

If you were to explain to a friend what it means to study history, what would you say?

27 (out of 43) student responses indicated some form of change between their pre-survey response and their post survey response. 10 student responses remained the same (“study the past to understand the future” type responses); 5 student responses indicated a less developed response than on the pre-survey (this could be due to survey fatigue or general disinclination to complete the whole survey); and 18 students did not bother answering this question on the post-survey.

For the 27 responses that indicated some degree of change, the change came in the form of specific word choices on the part of the students. Word choices indicated knowledge of the specific actions of historians: analyze, interpret, connect, find causation, develop context. For example, where in the first response the student talked about the act of studying history helps the “understanding of life as we know it,” the post-survey response indicated the study of history was about analysis and interpretation.

Studying history is very significant because it is training you to become more culturally aware of the world around you. To study history means to increase your comprehension of different cultures and rituals that the human race takes part in. Studying history earns your respect and wit as well as a greater understanding of life as we know it.	it means to analyze and interpret the past in order to find out the basis of the truths that we know today.
Keeping up on current events as well as educating oneself on historical events throughout time in different places in the world.	To review, interpret and understand the events that went on in the past.

Other responses that indicated change reflected the function of the tool as helping render history as connected and “linked:”

Studying history means we are taking the time to understand what happened in the past, why events happened the way they did, and how it effects the world today.	It means to look at all the things that happened in the past to inform yourself on why events happened the way they did and how they are all interlinked to form our history.
Studying history means studying how things came to be the way they are today.	Linking past events together in a way to better understanding how we came to how we are today.
To not only learn the dates and names that define our history, but to get a true understanding of how our country works/ worked and why we are here today.	To study our past and how it is all interconnected to have brought us to where we are today.

Other responses indicated awareness of understanding history within the term of multiple perspectives or worldviews or within contexts:

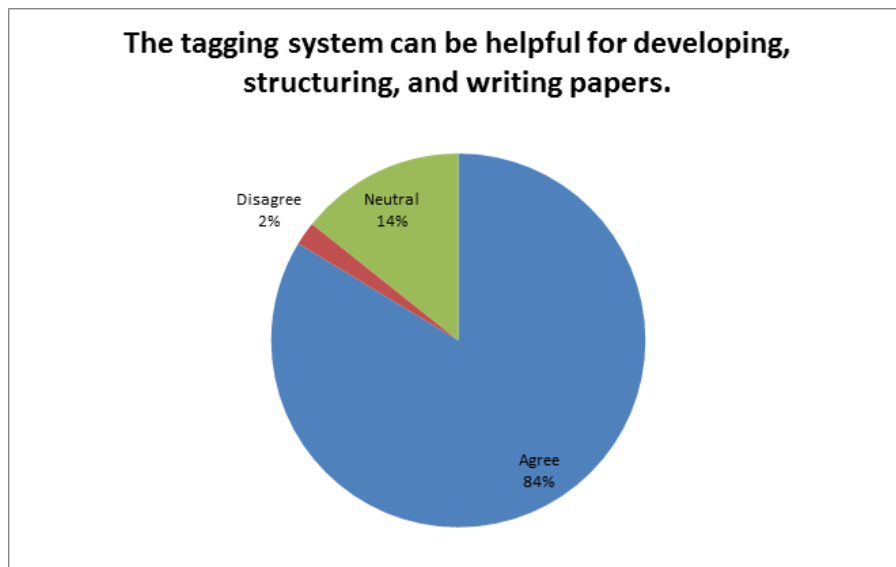
I would say that it means to study a time period that is important.	I would say that it means to study events in context . I would say that history can show us how events happen, how they evolve and how they were resolved.
I would say that it is a study of the past and how to learn from it	I would say that it means to study the world and its past is many different lights politically, economically, and culturally.
History is the who, what, where, when, why and how of the past. When we answer these questions about certain things in the past it helps us to see how these events, and or people shaped our world to how it is today.	Learning how connect events and what they mean to their outcomes in the grand scheme of events .
Studying history makes it so that they ways of the	To have a full view of what happened during a

past do not become the ways of the future.

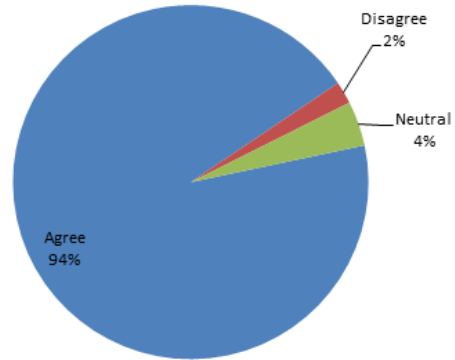
time period

This preliminary data showed potential in the use of the tool to not only teach students more specifically what historians do (analyze, corroborate, interpret, contextualize), but the visual nature of the tool itself demonstrated its efficacy in helping students see historical context and connections among sources not previously seen [see Reflective Essays portion of this report.] Another interpretation of this initial data lends itself to the idea that students are not only reading primary sources but the process of making their concepts maps led them to new insights they might not have had otherwise, similar to Stephen Ramsey's argument that making digital representations of historical objects (such as GIS maps, web sites, etc.) leads to new forms of humanistic inquiry.¹

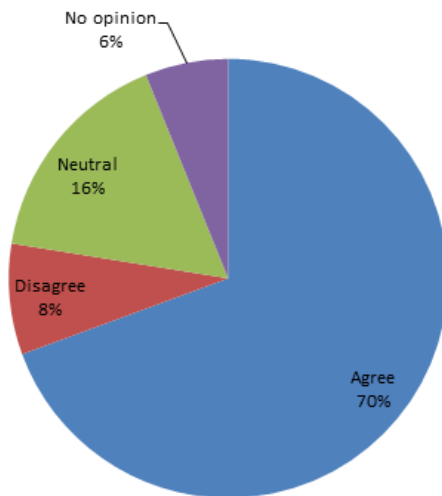
Other Survey Data:



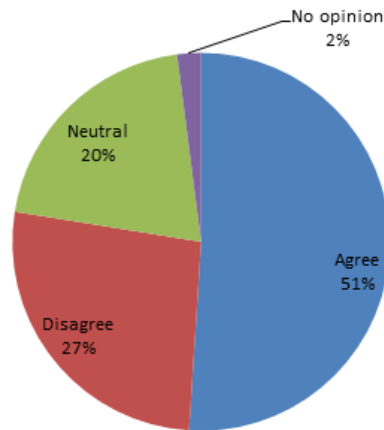
The tagging system can be helpful to understand the interconnections between the different material covered in a history course.



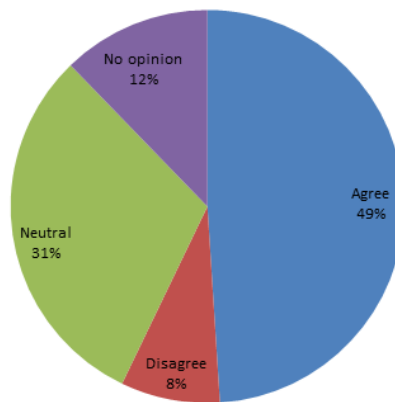
This system can encourage analytical thinking in the context of a history course.



This system would not be a technological distraction in a history course.



This system could also be used in other courses.



Part 2: Interviews

Although colleagues repeatedly urged us to engage students who had used the tool in some kind of “think aloud” process as they did their tagging and examined the resulting visuals, we did not manage to do this. However, we interviewed seven students (non-history majors) from each of the three courses in which the alpha version (Google Docs based) of the tool was piloted. Each student interviewed was enthusiastic about the way the tagging process helped them organize what they were learning in the course.

Students also commented on ways the thematic, non-linear way the system helped them organized information altered their perception of history. One student said “with the tagging it

was a lot easier to see connections between long spans of time, which I think is more beneficial than just clumping them by the date.” Said another, “as we read more and more we found that there were connections between the things we had learned at the very beginning of the class and the things we were learning at the end so It was interesting to see how everything connected even if you didn’t immediately think that it would and then you could write about connections that you didn’t see before.” Students were unequivocal on that last point: the tagging-generated connections were very helpful when it came time to synthesize different sources in a historical analysis paper. As one student observed,

tagging helped a lot in organizing your ideas and putting a theme to them. It helped a lot with not just summarizing the paper or anything like that but you had to actual think a little deeper into meanings behind the sources. So the tagging helped a lot in paper and other accumulative type aspects of it because you have all of it in one place and you’ve tagged them all then you’re able to go back and look at that they were and the web also helped to make you be able to draw connections that you wouldn’t had seen otherwise from just having a list of responses so it definitely helped later on in formulating a better response.

Another student wrote about the connection between the tool and the writing assignment:

It seemed to be an interesting connection that I wanted to think about and wanted to write about and talk about and that helped create engaging papers that I want to write. [It] wasn’t just sort of a begrudging thing I wanted to explore these papers I wanted to invest more in [teasing] out that connection and understanding it better.

These interviews--along with the other assessment data--will be fully explored in a forthcoming article on assessing the kind of tool we have developed. But it seems clear that many students were able to digest the material of an introductory history course more readily by using the system.

Part 3: Reflective Essays--Student-Reported Feedback on Tool

The reflective essay assignment allowed students to reflect on their use of the tool following an in-class discussion among students comparing the visualizations they built during the semester.

The essay prompt is as follows:

In an essay of 3-4 double-spaced pages, reflect on what these concept maps reveal about the ways we can weave historical information together to understand the past. You might consider why some connections between sources and themes seem obvious, while others surprised you (what connections did someone else make that you hadn’t thought about before). You might consider how the in-class discussion about themes changed your thinking about your own network/map and whether there were connections made in the discussion that you had not thought about before.

We gleaned information about the tool and about possible ways the tool affected student learning from these reflective essays.

Although the responses to the visuals were by no means uniform, it is clear from the feedback we received on the alpha version of the software that after a few weeks of tagging, the visuals became so cluttered that they had limited utility in terms of helping students understand how knowledge in the course was interconnected (see images of final webs in appendix--some screen shots). One student told us that, "if the future versions of this program were to resemble the more simplistic style of the tags web, I believe this would be more helpful for the participating students." We have tried to address this cluttering problem in the Beta version of the software by creating three possible network views of the connections between tags. Our system supports three network views on the tagging choices of students: associative view, resource view, and tag view.

The associative view is the most fundamental of the three since it directly shows how tags have been assigned to resources. Colored nodes represent tags, black nodes represent resources, and connections represent tagging choices. For example, if a resource R has been tagged with tag T, then the visual contains a line drawn from a colored node (representing T) to a black node (representing R).

The nodes in the resource view all represent resources; tagging choices are, in turn, represented with connections between these nodes. For example, if two resources R1 and R2 carry a common tag T, then the resource view shows a line drawn between the nodes representing resources R1 and R2.

The nodes in the tag view is essentially an inversion of the resource view; that is, nodes represent tags and connections represent resources. For example, if a resource R has been tagged by the tags T1 and T2, then the tag view shows a line drawn between the nodes representing tags T1 and T2.

The system also allows students determine three levels of strength in how they tag each resource (strong--the theme is dominant in the resource; neutral--the theme is present but not dominant; weak--hints of the theme but it is modest at best). These changes seem to produce webs that are more comprehensible and less cluttered.

Essays ranged from contrite pieces that shared little information, to more formal attempts to demonstrate how they connected primary sources (possibly excerpts from their papers), to more thoughtful demonstrations of what the tool offered them in terms of learning in a history course.

Among the essay responses, student feedback could be categorized into four main themes of what the tool affords in terms of usability for students.

1) Visualization of primary sources prompted “multiple looks:”

One student wrote the following:

Once you decide that an event or primary source is related to a theme, if you examine the other tagged items under that theme you can find the connection. For example, initially I did not see the relationship between the primary source ‘Pear soap advertisement’ and the theme of forging a pluralistic society.

On first view, it appeared to me that this primary source only related to the theme of becoming a world power and how we wanted to ‘civilize’ other nations. **On second look I saw the advertisement raised the issue of race.** Once I realized this, I saw that this advertisement was also part of the progression of America becoming a pluralistic society. This shows me that **sometimes you have to test a primary source** or in this case cartoon against all three themes to see its full meaning.

Another student wrote:

When reading the sources, I was forming opinions just like when I read any piece of writing, **but when I had to tag the source, it shaped my opinions even more.** Instead of just saying that the source is under the category of urbanization or building an empire, I was able to go deeper and put it into smaller, more specific terms.

One student wondered why the thickness of a connecting line in the tool was not as representative as other connections, thus promoting further analysis:

These concept maps formed over the course of this semester show evidence of countless numbers of these connections, some more obvious than others. I found the ones that ended up being the most important, however, were the ones that required analytical explanation, represented by a thin, colored line on the concept map.

The process of reading the source and then determining the appropriate tag led to closer examination of the sources. In two instances, students returned to their sources following a class discussion to understand why they did not tag a source the same way another student had. In terms of historical thinking, the process of analyzing sources and Wineburg’s term², corroboration (details of documents are compared with those of another), are present in these responses.

2) Connections among primary sources

Another historical thinking practice present in student responses was contextualization, “the act of creating a spatial and temporal context for a historical event” (Wineburg, 1998, p. 322). Through the use of the tool, students were physically making connections among the primary sources thus building a context for the sources in which to view their significance. Despite the limits of the concept maps the visualization software produced, even the visuals seemed to aid students in developing their understanding of historical knowledge as a web-like structure. As one student wrote:

I have to admit, that after looking at the final product of my web, I was a bit intimidated. But I think that’s the real purpose of this class and studying history. By seeing connections between sources, connections between themes, and even connections between connections, we see that history does not happen like a movie. There’s no one lens to look at history through and every story seems incomplete until you’ve looked at it from all angles.

Another student observed:

The main thing that I gathered from examining these visuals is that it is impossible to fully understand a certain event in U.S. history without also examining the events surrounding it, both before and after. The fact that all of these documents are connected in some way is very telling to the nature of historical analysis.

In these student responses, we can see that the act of making connections extends to the heart of historical inquiry and interpretation. The act of making the concept map helped these students visualize what historical context looked like thus changing their definition of what studying history means. In a comical entry in the final survey, one student reflected on what he and his discussion partner thought about the comparison of their concept maps in the final discussion of the class, “Takes a lot of work to get to where we are today.” While the comment indicated humor, it resonates with the rewarding challenges of historical inquiry.

3) Organization of primary sources leading up to the written assignment

Making connections and taking “multiple looks” at sources, led students to articulate how the first two actions led to helping them organize information and make sense of it, especially when it came to synthesizing material for essays. The organization of the sources was discussed more thoroughly in the student interviews, however, the importance of the tool as an organizational space surfaced in the reflective essays as well.

As one student wrote:

I liked the fact that my taggings and reasonings were online in one spot because it made it very accessible and easy to use when it came time to write essays. By having them already connected, it was simple to formulate essays with a lot of textual evidence.

Another student reflected, “[the tool] not only simplifies the process of doing research, but creates a forum for ones thoughts and research to be turning into connections, which in turn can be used to come up with better deeper ideas when it comes to the major themes discussed in class.” Other students talked about organizational practicality of the tool as a “timesaver” and a visual timeline. One student commented on the time it saved to see the primary sources and excerpts he/she already tagged in relation to what he/she wanted to write about. Another student used the tool as a visual timeline, “Being able to look at where we tagged things as the semester moved on and figure out where we were in American history was the most helpful part of the visualization in my opinion.”

4) Interpretations: Maps led to multiple interpretations and change among students

One aspect of the reflective essays most helpful in determining the efficacy of the tool was the part where we asked students to give examples of what surprised them most when comparing concepts maps to other students’ concept maps. In these sample excerpts, students remarked that other students’ tagging of sources led them to wonder, compare, or to reinterpret how they themselves tagged sources. In the essays, students described this as looking at multiple interpretations of sources.

The pedagogical combination of tagging and then comparing those tags within a class discussion allowed students to reflect in profound ways on the nature of the primary sources. One student remarked, “Many times, my partners drew connections and identified relationships between texts that I had overlooked or simply not thought about.”

Another student gave a specific example:

The connections that other students made on their concept [maps] were mostly similar to mine, however one student’s connection of the Executive Order 9066 Japanese Internment to race in the forging a pluralistic society theme was something I never thought of. When I thought about the Internment Act I thought it just related to war. When I heard the student explain it I could see that there really was a connection between the internment act and the theme of forging a pluralistic society.

When examined carefully, the act of tagging directly connected to how students interpreted a primary source. Pairing the semester-long work with an in-class discussion allowed to students to verbalize connections they had made that others might have not made in their own concept maps. The pedagogical approach led one student to return to her concept map following an in-class discussion:

For example, in the primary source, ‘Jane Addams The Subjective Necessity for Social Settlements’ I tagged it as gender due to the fact its about a woman giving her views about the conditions of cities. It wasn’t until class that we talked about the Hull House and how Addams talks about how working class people were trying to gain living

wages to improve their living conditions. I have recently changed that tagged but with the class discussions, I was able to understand and see how other students view this source and other sources which help benefit my understanding about this nature of historical knowledge.

There were three other instances in the essays where students returned to their concept maps following the in-class discussion showing further reflection and thinking on the students' part.

Finally, the sum of these four themes or concepts— multiple looks, organization, connections, and interpretations – in terms of what the tool afforded students can be summarized within one student's comment as helping her to see the fundamental nature of historical inquiry:

I learned when comparing my concept map with other people's that how the sub-themes are connected depends on what resources are used and how they are tagged, which is affected by the lens that people view them through. This is important because while the actual events of history do not change, how people interpret them can Because interpretations matter, history is less concrete in the sense that there is not one right answer of what it means.

Seeing history as a collection of interpretations connects to the historian R.G. Collingwood's contention of history as having an "inherent paradox" (Collingwood, 1946). He explained history as a discipline void of right answers because the past is unknowable and only the interpretation of evidence from past events is what scholars actually know.³ Through some of the excerpts seen from the essays, interviews and surveys, we contend that the tool facilitated students' abilities to enact historical thinking.

¹ Ramsay, S. On Building, <http://stephenramsay.us/text/2011/01/11/on-building/>

² Wineburg, S. (1998). Reading Abraham Lincoln: An expert/expert study in the interpretation of historical texts. *Cognitive Science*, 22(3), 319-346.

³ Collingwood, R.G. (1946). *Ideas in History*. New York: Oxford University Press.

APPENDIX III

The Beta version of the software developed for the project can be found at: www.tagnet.com

The user guide for the system (Beta version) can be downloaded [here](#).