Analysis of Annotation Needs at Harvard University Faculty of Arts and Sciences

December 2015 Update

Executive Summary

Faculty have ongoing and growing needs to create and share annotations of digital artifacts for both teaching and research. Tools developed for the Course iSites platform met limited teaching needs, so the imminent decommissioning of the iSites platform has brought renewed focus to the need for more robust and sustainable tools.

Interviews with FAS faculty helped to identify seven key use cases:

1) Careful reading and discussion of selected text
2) Analyzing Images
3) Creating a Multimedia Essay
4) Annotating Sound
5) Annotating a digital archive of sound
6) Annotating Video
7) Using Annotation to reconstruct art exhibits

Nine tools were evaluated for their alignment with the use cases, with the annotation of text, images, and multimedia as priorities to replace functionality in the retiring iSites annotation tool. Two tools were selected for piloting in the fall of 2015.

A. **AnnotationsX**: The annotation tool developed for HarvardX has been adapted for use within Canvas. It is being used for text annotation in Fall of 2015 and will be expanded to support image annotation to pilot in Spring of 2016.
B. **VoiceThread**: A vendor-provided tool that can be used to annotate multimedia. It is being used in a limited number of courses in Fall of 2015, with expanded use in 2016.
C. A third option, **Critiquelt**, is another vendor-provided tool that we expect to also offer a video annotation tool to pilot in Spring of 2016.

Investigations continue in the areas of Digital Asset Management (DAMS), image annotation, and open source. We are examining the role of DAMS and the interaction of annotation tools with the collection of resources in services like the Digital Repository Service. With the introduction of the new Mirador page viewer, the image annotation feature of AnnotationsX is now available in Canvas.

Annotation work continues, and will continue to develop internal tools, identify third party tools, and work with faculty to understand their evolving needs. We welcome feedback on our efforts and suggestions for directions to move in the future.

Overview

In January 2015, Professor Richard Wolf of the Music Department circulated a petition to FAS deans and HUIT leadership requesting a renewed focus on supplying faculty with digital annotation tools for teaching and research. The petition combined the comments of five faculty members (Wolf, Donoghue, New, Hamburger, and Nagy) and was signed by an additional 25 faculty. The petition summarized the history of the various annotation tools that had been developed, mainly for iSites, and made the point that over the past two years the available functionality had decreased with the discontinuation of iSites just as the use of annotation for teaching in edX and residential courses was rising. Professor Hamburger also made an eloquent case for the importance of annotation as a research tool that contributes directly to efficient publication and a deeper understanding of primary sources.

Anne Margulies, with the support of Diana Sorensen, the Dean of Arts and Humanities, encouraged an immediate response by HUIT but also including HarvardX, the only unit of the university working at that time on the development of new annotation tools. An open faculty meeting with HUIT and HarvardX stakeholders was held on February 23. In the wake of that meeting, Annie Rota and Jud Harward proposed three work streams to be carried out over the spring and summer, with pilots in Fall 2015:

1. **Interviews with faculty members** (drawn from those who signed the petition) about their experiences with digital annotation and their requirements for their future teaching and research;
2. **Examination of currently available annotation software**, both open source and commercial;
3. **Initial pilots** of software tools with willing faculty during the Fall 2015 semester.

The goal of this paper is to provide an interim report to faculty and other stakeholders on progress made since the February meeting. Three sections follow. The first summarizes the faculty interviews that have been carried out by organizing and prioritizing faculty use cases for annotation. Instead of presenting the use cases in the context of individual interviews, we list use cases that were mentioned by multiple faculty ordered by the number of faculty interested in each use cases, the most frequent first. The second section focuses on tools, both open source and commercial. The ATG and A&HRC have explored and tested a number of tools and will continue to do so. This section describes the results of this exploration. The third section lays out next steps for this project through the start of the academic year including plans for supported pilots of the AnnotationX tool in fall semester College classes using Canvas as their LMS (Learning Management System).

Finally, we emphasize that the faculty petition alerted us to the danger of paying only episodic attention to a fast evolving technology. The current set of annotation tools and

standards is not stable but the market for these tools is expanding rapidly despite the lack of stability. HUIT will need to continuously monitor the state of the art in digital annotation for the foreseeable future, but actual investment in development and/or adoption will rise and fall in sync with faculty demand for new technologies and perceived leaps forward that may lead to greater stability, longevity, or functionality of digital annotation for the Harvard community.

I. Interviews with Faculty

Interviews with eleven of the faculty members that signed the petition helped us identify key use cases, which are summarized below.

1. *Use case: Careful reading and discussion of selected text:*

The most common use instructors described is to have students practice careful reading of a specific short text and share ideas with each other and the instructor prior to the next class meeting. A typical assignment would involve an instructor posting a short reading, followed by two scheduled waves of student activity. For example, students would be asked to make initial comments on the text via an online annotation tool by a particular date (say a Wednesday), and then go in again before the next class (say by Sunday before a Monday class), and make additional comments on other students' annotations.

The benefits faculty described of this type of assignment are that when students return to class they have already engaged with the posted text as well engaged in an online dialogue with each other about the material. According to the faculty that we interviewed, this type of activity enables a more engaging discussion of the material in person when the class reconvenes.

In discussing this use case with Faculty, it was emphasised that it is very important to consider the work flow of assessing students and grading. Faculty would like to see an easy to use interface for reviewing comments submitted by each student.

HUIT developers are working so that the LTI-enabled HarvardX annotation tool in Canvas will meet this need and will be available as a pilot in the Fall of 2015.

a. ***Faculty interviewed*** *who use this method of teaching: Ann Blair, Dan Donoghue, Greg Nagy, Lisa New, Leah Price.*

b. ***Tools*** *that have been used in the past for this method of teaching: Annotation Studio, The Collaborative Annotation Tool (CATool), NB, HarvardX Annotation Tool.*

c. ***Recommendations****:* The HarvardX Annotation Tool which is now available within Canvas environment in Fall 2015, and is under active development, can meet this need.

2. Use Case: Analysis of Images

The use case for annotating images is similar to the above use case describing annotating text. The goal of the assignment is for an instructor to have the students closely look at an image and select a small section to analyze in detail. An example case would be an instructor uploading a digital image of a Chinese scroll describing a story and asking students to select a section of the scroll for their close examination. In the same way that students are encouraged to closely analyze a passage of text, they can analyze a section of an image, such as a historical photo or an image depicting a work of art. Similar interactions between students can also be fostered. It also becomes possible to crowd-source analysis of a large artwork and distribute the work.

a. ***Faculty interviewed*** *who use this method of teaching: Greg Nagy, Jeffrey Hamburger.*

b. ***Tools*** *that have been used in the past for this method of teaching: CATool, HarvardX Annotation tool, Annotation Studio.*

c. ***Institutionally supported Tools we recommend to instructors*** *interested in this method: The HarvardX team is working on implementing image annotation functionality (using functionality of another software product called Mirador) within the HarvardX Annotation Tool. ATG will also plans to bring this functionality into our version of the tool for Canvas. We expect to be able to pilot image annotation in Canvas in the Spring of 2016.*

3. Use case: Creating a Multimedia Essay

Another use case involves instructors tasking students with researching and finding a series of multimedia objects, and putting them together with a narrative that pulls the objects together into a together in a cohesive way for their peers see and discuss. This presentation would then be shared with other students, who could add comments on each others presentations.

a. ***Faculty interviewed*** *who use this method of teaching:* Peter Galison (The Einstein Revolution). David Odo of the Harvard Art Museums for his HAMM classes.

b. ***Tools*** *that have been used in the past for this method of teaching: Voice Thread and Omeka.*

c. ***Institutionally supported Tools we recommend:*** The FAS Academic Technology group has just started piloting VoiceThread incorporated in Canvas to support this method of teaching.

4. Use Case: Annotating Sound

Professor Ingrid Monson is interested in a tool that will allow synchronized visual displays that appear while a sound file is being played. This is a valuable teaching technique as students can listen to a musical score, and view visual items that describe or enhance understanding of what they are listening too. For example, the instructor may play a jazz piece and as the music plays, an animation that is synchronized with the music appears describing the composition. This form of Annotation has also been used by Professor Richard Wolf for the past 8 or 9 years. He has been using a custom built tool using Flash technology, which unfortunately, is not compatible with Canvas via LTI, and is also an older technology not supported by many modern devices. It also requires customized set up, so is not scalable for wide use. This is one of the pieces of functionality Professor Wolf has requested in proposal for grant funding and alluded to in the original petition.

a. ***Faculty interviewed*** *who use this method of teaching: Ingrid Monson, Richard Wolf.*

b. ***Tools*** *that have been used in the past for this method of teaching: Variations Audio Time Liner, Klynt, custom built Flash applications. VoiceThread allows an audio file to be played, and can have text (or other annotations) available from the side bar. However, this doesn't provide the fine grained synchronization of the Flash tool used in the past.*

c. ***Institutionally supported Tools we recommend:*** *This in an area we are investigating. VoiceThread is a tool that allows commenting on sound files, but not as tightly synchronized animation as the Flash tools provided. CritiqueIt is a vendor that provides software that may help address this need in the future. We are working with them to see if we can pilot it. We also can provide consulting on a case by case basis.*

5. Use Case: Annotating a digital archive of sound

Professor Richard Wolf supervises the physical Archive of World Music at Harvard University. He would like researchers to be able to annotate sound files in the database, and annotate the recordings by timestamp. He would like to preserve the insights gained from these annotations in perpetuity. He would also like students to be able to access these recordings and interact with them. The annotations of the students would not need to be preserved beyond the time frame of the semester of the course.

a. ***Faculty interviewed*** *who use this method of teaching: Richard Wolf.*

b. ***Tools*** *that have been used in the past for this method of teaching: This is a new initiative.*

c. ***Institutionally supported Tools we recommend:*** *This in an area we are investigating. VoiceThread and SoundCloud can provide limited annotations to sound files. We also expect to offer an LTI-enabled version of software called CritiqueIt, which may help. We can provide consulting on a case by case basis. We are also working with colleagues in the libraries supporting the digital repository to work towards institutionally supported solutions.*

6. *Use Case: Annotating Video*

In talking with Professor Robb Moss, he mentioned that it would be valuable for an instructor to be able to have students watch a video that has different tracks of annotation. (either text or audio.) In this manner, students could watch a video clip several times, with the annotations set for different topics. For example, the first time students watch a video, they could be hearing (or reading) annotations about lighting. The second time, they may be paying attention to acting technique. This follows the model of watching a DVD with director's comments enabled. The difference is that the clip may be shorter, and one could watch the same scene multiple times, paying attention to different aspects during each viewing.

a. ***Faculty interviewed*** *who use this method of teaching: This was described as something that would be useful by Robb Moss.*

b. ***Tools*** *that have been used in the past for this method of teaching: Video editing tools could be used, but video annotation tools could also be used.*

c. ***Institutionally supported Tools we recommend to instructors*** *interested in this method: We are currently looking into options. CritiqueIt is working on an LTI video annotation tool that may meet this need. We expect to be able to offer a limited pilot for the Spring semester of 2016. VoiceThread also allows instructors to provide commentary on video, but not with as much granularity in terms of being able to have simultaneous audio tracks running as this use case would require.*

7. *Use Case: Using Annotation to reconstruct art exhibits*

The question was raised of how do we reconstruct ephemeral works, such as art exhibits after they no longer exist. If we could give visitors an opportunity to record their experience

in the moment, this could have value for future research into past installations. Such an experience could also be created as part of the exhibit so that it would become part of the installation. This is different than annotations from a single person (which also has value). For example, we could have the Artist's view, and the Curator's view.

a. ***Faculty interviewed*** *who use this method of teaching: This idea was presented as part of brainstorming.*

b. ***Tools*** *that have been used in the past for this method of teaching: None have been identified.*

c. ***Institutionally supported Tools we recommend to instructors*** *interested in this method. We don't have a recommendation, as this is an experimental idea, that would require further discovery efforts.*

II. Currently Available Annotation Software

Harvard-developed tools:

AnnotationsX
AnnotationsX is an LTI-compatible tool developed jointly at Harvard by HarvardX and the Academic Technology Group that allows text annotation and image annotation. Since AnnotationsX is incorporated into the Canvas LMS, all students in a class set up with the tool will have automatic access, and there is no need to set up user accounts. The tool is under active development, text annotations have been piloted in the FAS in Fall 2015, and the image annotation features of this tool will be piloted in the FAS in Spring 2016. HUIT has been able to take advantage of the good work being done by HarvardX, as well as contribute features back to the product that we expect will also be useful for instructors using the tool who are teaching HarvardX courses.

Consilience
Consilience (http://datascience.iq.harvard.edu/about-consilience) is a tool developed by Harvard's Institute for Quantitative Social Sciences (IQSS). It's main functionality is to aid researchers in organizing and tagging large data sets, aiding in discoverability. However, it also has annotation capability.

Mirador
Mirador, a joint project between Harvard (HarvardX, LTS, and HUIT Arts & Humanities Research Computing (DARTH)) and Stanford (Libraries), is first and foremost a web-based image viewer designed to simulate the experience of viewing and object or reading a book while perusing online visual resources from the Harvard collection or any other IIIF (International Image Interoperability Framework) compatible image server. It is LTI

compliant and annotation integration is now available, so it is likely to be part of the educational tool landscape at Harvard moving forward.

It debuted as an important part of HarvardX's Fall 2015 "History of the Book" modules, some of which were taught by faculty interviewed for this document (Blair, Hamburger, Price).

iSites Collaborative Annotation Tool (CATool)
The CATool is a custom built tool designed to work within Harvard's iSites, and will be completely phased out along with iSites by June 2016. We do not recommend anyone to start using this tool. It supported text, image, video and audio annotations. It was partial inspiration for the HarvardX Annotation tool, which has all of the functionality of the CATool. The CATool is listed here for historical purposes, and not as a recommended solution as it will not be available after June 2016.

Third party tools

Annotation Studio
Annotation Studio (http://www.annotationstudio.org/project/), developed at MIT, is a feature-rich tool with a modern interface that allows multimedia annotations. The drawbacks are that there is not an interface designed for grading. Also, along with being feature rich, some instructors have indicated that it is more complex to set up that simpler tools, such as another annotation tool developed at MIT, called NotaBene or NB (see below).

CritiqueIt
CritiqueIt (https://edu.**critiqueit.com/**) offers annotation to video and images. It also has recently had LTI compliance added, so it could be used within the Canvas environment. The video annotation feature in particular is a solution we may recommend to faculty, given that we do not offer video annotation currently. It has a well developed user interface, and seems intuitive to use. We will investigate licensing costs.

Klynt
Klynt (www.klynt.net) by Honkytonk Films is a multimedia authoring tool for the web. The software began as a tool for digital journalism and filmmaking, with a particular focus on support for interactive nonlinear narratives, but has since evolved to include features that make it suitable for dynamic presentations and other pedagogical applications. The interface is largely drag and drop atop a canvas arranged in mind map format. There is also a timeline, similar to Flash, where users can define the exact behavior of text, images, video, and audio used in their presentations. After projects are completed, they are exportable entirely as HTML5/JavaScript that will play directly from the browser. Klynt has responsive design functionality, which can be toggled on or off.

NB (NotaBene)
NB (http://nb.mit.edu/about/), like Annotation Studio, is another product developed at MIT. NB is not as modern as Annotation Studio, and has a more outdated UI and is limited to annotating PDFs. However, some instructors who have used it at Harvard prefer it for classroom use as it has a nice dashboard feature that makes it easy to drill down on individual student annotations and makes it easier to evaluate students' contributions. It also is relatively straightforward to use, and simple to set up. It can only be used to annotate PDF or HTML documents.

Omeka
Omeka (http://omeka.org/) is not annotation software, but we include it in this list as it has been used to good effect for instructors tasking students with creating an online digital exhibition for their peers. It's well structured content management system allows users to post a sequences of captioned images.

Perusall
An early-stage entrant in the textbook and PDF collaborative reading market, Perusall promises to let students comment on and ask questions about their texts. It also provides feedback on student activity to their

VoiceThread
VoiceThread (https://voicethread.com/) is a third party application that also implements LTI, so it can also be incorporated into the Canvas environment. Thus students can use VoiceThread directly from a Canvas course site.

An instructor can create what is called a "Voice Thread". The instructor will select a series of images, or a combination of images, documents and even video. She can then add her commentary to each of the objects. Students can also create Voice Threads, and can leave video, audio or text comments on each other's presentations.

From the VoiceThread website: *"VoiceThread is a totally web-based application that allows you to place collections of media like images, videos, documents, and presentations at the center of an asynchronous conversation. A VoiceThread allows people to have conversations and to make comments using any mix of text, a microphone, a web cam, a telephone, or uploaded audio file."*

III. Next Steps

We have focused our efforts on two pilots in the fall. One is a software development effort to adapt the HarvardX Annotation tool that some faculty have had experience with as part of EdX classes. We have been collaborating with the developers from HarvardX to enable use of the HarvardX Annotation Tool within Canvas, and customize it to meet the needs of residential courses. The HarvardX Annotation Tool is an open source project, and we are

coordinating our efforts so that we can merge our code so that feature enhancements are available to users of the tool on the EdX platform as well as the Canvas platform.

We are currently running a Fall 2015 pilot use of VoiceThread in Canvas with three instructors. VoiceThread has been used by instructors in Harvard courses and is a widely used educational technology and was mentioned in interviews. Since they also offer an LTI version that is easily integrated into Canvas course sites, we decided that this would be of significant value to faculty and students.

Current Pilots:

A. **HarvardX Annotation tool in Canvas** - The HarvardX development team has incorporated a technology called LTI into their tool, which allows it to run in different Learning Management Systems, including Canvas. The Academic Technology group has been working with the HarvardX team to run an instance in Canvas so it can be used by FAS faculty within the Canvas platform, as well as add features as prioritized by FAS faculty. This has been piloted for text annotation in the Fall of 2015. We will expand the pilot and add image annotation features in the Spring semester of 2016. If you are interested in using it in your course, please reach out to atg@fas.harvard.edu.

B. **VoiceThread -** VoiceThread is a third party application that can be used to collaborate and annotate multimedia. It can be used either as a stand-alone application, or within Canvas via an LTI enabled version. In Fall 2015, we are piloting VoiceThread within Canvas in three language classes and a Museum Studies class. We plan to expand the pilot in Spring 2016. Faculty interested in participating are asked to contact us at atg@fas.harvard.edu.

Related ongoing discovery work

A. **Digital Asset Management** - In the course of investigating annotation, it has become apparent that our goals for Annotation tools are related to Harvard's strategy for Digital Asset Management as some of the tools will interact with the DRS (Digital Repository Service). There is an existing DRS working group and an existing Digital Asset Management Strategy working group, which may be more (or at least equally) relevant here. We have started working with colleagues to participate in the discussion of incorporating existing content into our tools used for teaching.

B. **Image Annotation** - ATG has collaborated with HarvardX on the implementation of the Annotation tool in Canvas to address the need for text annotation in teaching.

HarvardX has recently implemented Mirador viewing and image annotation functionality into the AnnotationsX tool. ATG will also provide this feature in our Canvas version for a fall image annotation pilot. While HarvardX is focused on delivering MOOC content, a priority for the FAS Academic Technology Group is enabling Annotation in the small classroom. A common use case for the classroom instruction involves managing images that are not part of the DRS, such as an instructor's private collection. As we collaborate with HarvardX to use their image annotation features, ATG is also planning to develop image management functionality to enable instructors to set up their own customized image collections for in class annotation. This also may be of value for the HarvardX instructors as well.

In order to incorporate images in the AnnotationsX tool, instructors must provide their images files to the technical team to upload to an IIIF server for the images to be able to display. ATG is working on developing a new solution that will allow instructors to upload image files on their own, and create collections that can be integrated into the Annotation tool without the need to involve technical staff to manage their image files.

We plan to offer the image annotation capabilities in the AnnotationsX tool in Canvas as a pilot in Spring 2016, as a follow up to the text annotation capabilities in the piloted in Fall 2015. We also will work during the Spring 2016 to develop image management capabilities.

C. **Open Source** The AnnotationsX project has been a useful collaboration in that ATG has been able to take the the LTI code provided to us by HarvardX, and run it in our instance of Canvas, and develop and share features back with HarvardX. We've used github as the platform for a shared code repository and have merged changes in as needed. We are planning to use what we've learned from the experience and establish processes for Open Source projects to further streamline cross-group collaboration from within Harvard and potentially with external contributors for Annotation related development.

Conclusion

This concludes our initial report back on work done in Spring and leading into Fall of 2015. We are grateful to those faculty who took time to meet and share their experiences and desires for using digital annotation technologies in the classroom and in their research. We're also very appreciative of the collaboration and great work done by HarvardX that we are able to incorporate into the Canvas environment for the benefit of Harvard courses.

Annotation work continues, and will continue in the future as we work to develop internal tools, identify third party tools, and work with faculty to understand the evolving needs. Our

support for Faculty digital annotation is ongoing, and we welcome feedback on our efforts and suggestions for directions to move in the future.