

White Paper Report

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Project Director: Peter Asaro (asarop@newschool.edu)

Institution: New School

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**National Endowment for the Humanities
Digital Humanities Start-Up Grant**

White Paper

Grant ID Number:

HD-51513-12

Project Title:

Digital Video Navigation and Archival Content Management Tools for Non-linear Oral History Narratives

Project Director:

Dr. Peter Asaro

Assistant Professor, School of Media Studies

asarop@newschool.edu

Name of Grantee Institution:

The New School

Date Submitted:

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a. Project Activities

The major activities that occurred during the grant period focused on the development and improvement of a proof-of-concept and working prototype for the non-linear navigation of videos in the Oral History of Robotics archive. The primary goal was achieved and the primary products were created. The dissemination of results has begun, and the products will be fully implemented and further built upon in a follow-on project.

The basic concept of the project was to utilize the functionality of HTML5 to navigate to specific time-points within a video in order to navigate in a non-linear fashion among the videos of an oral history archive. The realization of this concept required three key elements: the archive of videos, a navigator which allows viewers to “surf” through the videos, and a data-entry interface. Each of these was implemented, first as basic functional elements that were then iteratively improved upon, and each will be further developed in the future.

The archive itself has been completed with over 100 interviews averaging about one hour each, under the auspices of another grant. The full-length interviews have been color-corrected, their audio cleaned up, and they were compressed into H.264 MP4 video format, resulting in ~90GBs of compressed 1080p HD video data. This work of conducting the interviews and constructing the archive was funded by a grant that preceded the NEH grant, provided by the IEEE Robotics and Automation Society. The video archive has been delivered to the IEEE Robotics and Automation Society for hosting on a free publicly-accessible website. It will go online for the public in the Spring of 2015, as a “flat” archive. Once it is up, we can redirect our non-linear navigation tools to point to those video sources, and begin the project of encoding the full archive with metadata. Once we have encoded a sufficient amount of metadata to make the non-linear navigation tool useful, we will work with IEEE to provide this functionality on their website for the public to use as well. The IEEE will provide funds for this stage of software development, as well as funds for the entry of the metadata, and will provide long-term hosting of the archive.

To test the working navigation and data-entry prototypes, we prepared a set of 20 demonstration videos from the archive, and uploaded these to the Vimeo on-line video-hosting service. As the meta-data for our tools is encoded and indexed according to the timecode of the video, it does not matter where the video is hosted, provided it can be reached via a URL link. Thus, it is relatively easy to redirect the system to point to a new video hosting service by changing the URL link in the database entry for a given oral history interview. However, given the size of our archive, and the limits on size and number of videos that can be uploaded to Vimeo, it was not desirable or feasible to host the entire archive on

Vimeo. We are currently working with IEEE and their IEEE.TV website to host the entire archive at full HD resolution. This will require upgrading their video servers to support MP4 video formats, which necessary for our HTML5 video navigation.

For the navigator tool, we demonstrated early in the grant period that we could create timecode based triggers that would provide links to “in-points” of other videos in the test set. We also explored various mockups for the navigator interface (see the Appendix for screenshots of these mock-ups, as well as the initial working prototype and the improved navigator and data-entry prototypes).

In order to create an effective “back” functionality (to jump back to the middle of a previous video from where the viewer left off, as with text hyperlinks), we needed a more sophisticated database architecture which could track the actions of individual users, as well as the preset meta-data markers for each video. To implement this database architecture, we needed both a flexible relational database platform, and server/hosting platform. After much research and experimentation, we settled on the MongoDB database platform, which we hosted on the Heroku cloud-based server platform. Together these provide a powerful and portable architecture for both meta-data entry and video navigation. With this architecture, the video archive itself can be hosted on any internet-accessible video server that is HTML5 compliant, including Vimeo and Youtube, making the resulting design useful to a broad range of video archive and database applications.

The most challenging element was the development of the meta-data entry tool. This required all of the functionality of the navigator, plus the additional ability to add new meta-data tags, and to indicate the “in” and “out” points for each meta-data tag. This allows archivists to watch a video, designate in and out points by point-and-click or typing, designate various tag types, and enter the content of the tag. It also provides a graphical representation of what tags have been entered along a timeline representation of the video. Tags can overlap chronologically, and they can be deleted or edited. Entering all of the requisite meta-data for the entire archive will be time-consuming. This tool will make the process much more intuitive and efficient, allowing for archivists to be trained quickly and work efficiently.

b. Audiences

There are two primary audiences for this project, the general public and digital scholars. Because we are coordinating with another organization, the IEEE Robotics and Automation Society, we can expect to reach a large audience of robotics engineers and students when it launches on their IEEE.TV website. We are also aiming to bring these materials to a broader, non-specialist public. We have sought, in the course of the interviews for the archive, to make the history of robotics as accessible to a general audience, and younger students as possible.

Each interview ends with asking the roboticist about their advice for young people interested in robotics, and how they themselves first became interested in robotics. We have sought to include as many influential women and roboticists from underrepresented populations as possible in the archive, and will be working with IEEE to present a “women in the history of robotics” video presentation at their next major conference in Spring of 2015 based on the archive. We have also insisted on making the archive freely accessible to the public on the web. As it has not yet launched, we have no demographic data on the audience it will draw. In order to build an audience, we plan to produce promotional videos, and publish short articles in *IEEE Spectrum* and *IEEE Robotics & Automation* magazines and *RoboHub* websites, announcing the launch.

In terms of the scholarly audience, we have already presented results of our work at a workshop on science communication in Tokyo, Japan. Scholars there were interested both in the archival project itself, and in the tools we are developing. After attending the NEH Project Directors meeting in Washing DC, the PI met a number of other digital humanities scholars who are also very interested in how we are using meta-data for time-based materials. We will continue to promote our results and the tools we have built at upcoming iConferences, HASTAC conferences, and other digital humanities conferences.

c. Continuation of the Project

As suits a start-up project, the Oral History of Robotics archive, and the Digital Tools for Non-Linear Navigation of that archive are just getting started. With the launch of the archive scheduled for the Spring of 2015, and the implementation of the non-linear navigation over the whole archive to follow soon after, the work done under this grant will provide a firm foundation for continued work. In particular, the software architecture, database implementation, navigator interface and meta-data entry interface will all find immediate use and continued development.

There is a great deal of interest in both the archive and the navigation tools, among both the professional community and the general public. The IEEE Robotics and Automation Society has been exceedingly pleased with the results, and plans continued support for the project in a number of ways, including hosting the archive, supporting the further implementation of the non-linear navigator, promoting and publicizing the project, keeping the archive open and free to the public, and continuing to grow the archive itself.

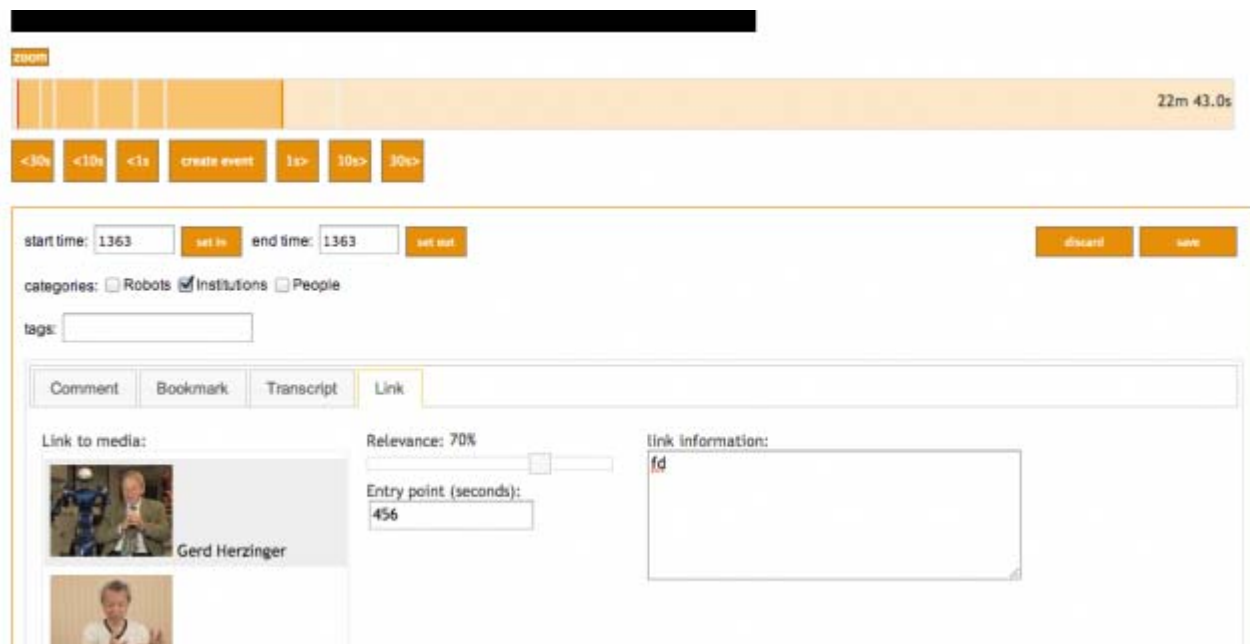
d. Grant Products

The main product of this project is the working prototype of our Tools for Non-Linear Navigation of Oral History video archives. It is a cloud based web application developed for

research and data mining of oral history material. It enables non-linear navigation of time based media (video or audio) based on user input or similarities discovered using data mining, as well as a repository for meta-data and other related documents. Though it has been mainly developed for oral history research, it could be used for annotating and hyperlinking any sort of time based media.

The user interface allows users to input information and meta-data related to each time-based artifact such as:

- Entering transcript for the audio/video
- Commenting on different sections of the audio/video
- Bookmarking
- hyperlinks between different sections of the audio or video file for non linear navigation
- Attaching other related documents to a section of the video such as images, text documents or external audio and video files.
- Adding custom meta-data to sections of the audio/video file



Users viewing material on the web site will see the information mentioned above based on their access privileges.

Architecture:

Our meta-data entry tool has a rich javascript/ajax based user interface, in which all the interactions happen in a single HTML5 web page without page being reloaded. This allows better user experience as well as consistency of the context of interaction especially for entering data. The audio/video files could be hosted on the server or loaded of any major audio or video hosting service such as Youtube, Vimeo or SoundCloud which gives more flexibility. The

material is displayed using HTML5 player or the player provided by hosting service API. For triggering events at different timestamps, Popcorn.js is used which is an open source HTML5 audio/video framework developed by Mozilla.

Due to the changeable structure of the meta-data, we chose a schema free NoSQL database so users can define any structure for the meta-data they want to enter into the system. NoSQL databases allow the storage of any type of key/value pairs defined at runtime. Specifically we have used MongoDB. To take most from the flexible structure of MongoDB, and also the consistency between front end and backend, we have used Node.js technology for backend and API services. Node.js is an open source Javascript based server side solution for web development.

All the technologies and libraries are open source and royalty free. The application could be hosted on a single server or a cloud based server such as Amazon AWS or Heroku. We chose Heroku since the deployment is easy and the server cost is based on usage of resources and during development and when the usage is light, it is free.

The working prototype can be found here:

<http://oral-history.herokuapp.com/>

The website for the Oral History of Robotics Archive can be found here:

<http://robotichistory.indiana.edu/>

Our set of test videos can be found here:

<http://vimeo.com/user12408939/videos>

Appendices:

Mockups of the navigator tool, with various representations and layouts for related videos:

Hyper Video



Related Videos

80%

- President Obama speaks at the by whitehouse 1:57 80%
- President Obama speaks at the by whitehouse 29:59 60%
- President Obama speaks at the by whitehouse 30%
- President Obama speaks at the by whitehouse 20%

Hyper Video



Related Videos

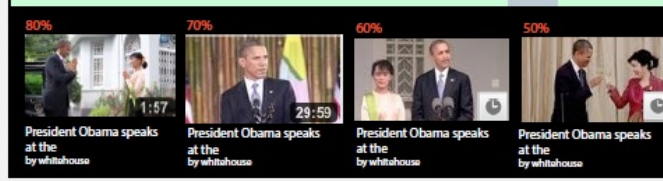
80%

- 80% President Obama speaks at the by whitehouse 1:57
- 70% President Obama speaks at the by whitehouse 29:59
- 60% President Obama speaks at the by whitehouse
- 50% President Obama speaks at the by whitehouse

Hyper Video


Related Videos

80%









Video navigation functional demo screen shot:

Video Title



paused

The [transcript](#) of the current section of the video with some keywords [highlighted](#). Clicking on the words brings videos that are most relevant to that word.

	video 2 80%
	video 3 70%
	video 5 60%
	video 6 60%
	video 3 30%
	video 4 20%

The bars on the right featuring nominated videos, change in real-time based on the metadata that associates each video with the content of the current video.

Video navigation functional demo screen shot:

ORAL HISTORY OF ROBOTICS



Jean-Daniel Nicoud

Select another Video



Minoru Asada

80%

zoom



<30s

<10s

<1s

create event

1s>

10s>

30s>

The bars on the right featuring nominated videos, change in real-time based on the metadata that associates each video with the content of the current video.

MetaData Input interface:

The screenshot displays a video player interface. The main video area shows a man with glasses, wearing a light blue shirt and khaki pants, sitting on a stool and holding two small, colorful robots. To the right of the video, there is a small profile picture of the man, labeled "Minoru Asada", and a progress bar indicating the video is at 60%.

Below the video player, there is a "zoom" button and a progress bar showing "2m 54.7s". Navigation buttons include "<30s", "<10s", "<1s", "create event", "1s>", "10s>", and "30s>".

The metadata input form contains the following fields and options:

- start time: 174.73 (set in) end time: 174.73 (set out) [discard] [save]
- categories: Robots Institutions People
- tags: Trento Conference
- Buttons: Comment (selected), Bookmark, Transcript, Link
- comment: I showed these robots a the Trento, Italy robotics conference.