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Supporting Faculty Research through Collaborative Digital Projects: The Mongolian Altai Inventory

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Supporting Faculty Research through Collaborative Digital Projects: The Mongolian Altai Inventory

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Abstract

This article provides an overview of a collaborative project of the University of Oregon Libraries, Infographics Lab, and an art history professor to create a virtual research guide, entitled, "Archaeology and Landscape in the Altai Mountains of Mongolia." Offering accompanying digital image archives, this project serves as a model for humanities data preservation and presents a collaborative strategy for promoting faculty research output in a new media environment. In addition to the typical challenges faced in digital projects, the specialized nature of the content and multiple participants with varied areas of expertise added further challenges. Drawing on "lessons learned," a new model was created for libraries to support and preserve faculty research.

Keywords: Digitization; Digital Libraries; Project Management; History; Digital Scholarship; Interactive Media; Grants; GIS; User Design

Introduction

> **Altai Region**
> Dividing North from Central Asia, desert from grassland, taiga from mountain steppe, the Altai Mountains have functioned for thousands of years as a homeland for the emergence of hunting, herding, and nomadic cultures of Eurasia. Archaeology in the Altai thus reflects the evolution of human culture from the Paleolithic Period through to the present. [1]

Dr. Esther Jacobson-Tepfer, Maude I. Kerns Professor Emerita of art history at the University of Oregon (UO), is one of the foremost authorities on archaeology in the Mongolian Altai. She also is Manager of the Mongolian Altai Inventory Project, an enterprise that represents the culmination of her years of field research and that seeks to make this research widely available to future scholars. In 1992, Dr. Jacobson-Tepfer began working on field research in the Altai with James Meacham, Infographics Lab Director in the Geography Department. In 2007, Jacobson-Tepfer and Meacham were awarded a grant from the National Endowment for the Humanities for the Mongolian Altai Inventory Project. Now involving the University of Oregon Libraries, the Project resulted in two primary dissemination methods: an interactive website[2] with digital image archives, and a print atlas.[3] This article will describe the collaboration needed to create the interactive website and the digital image archives.

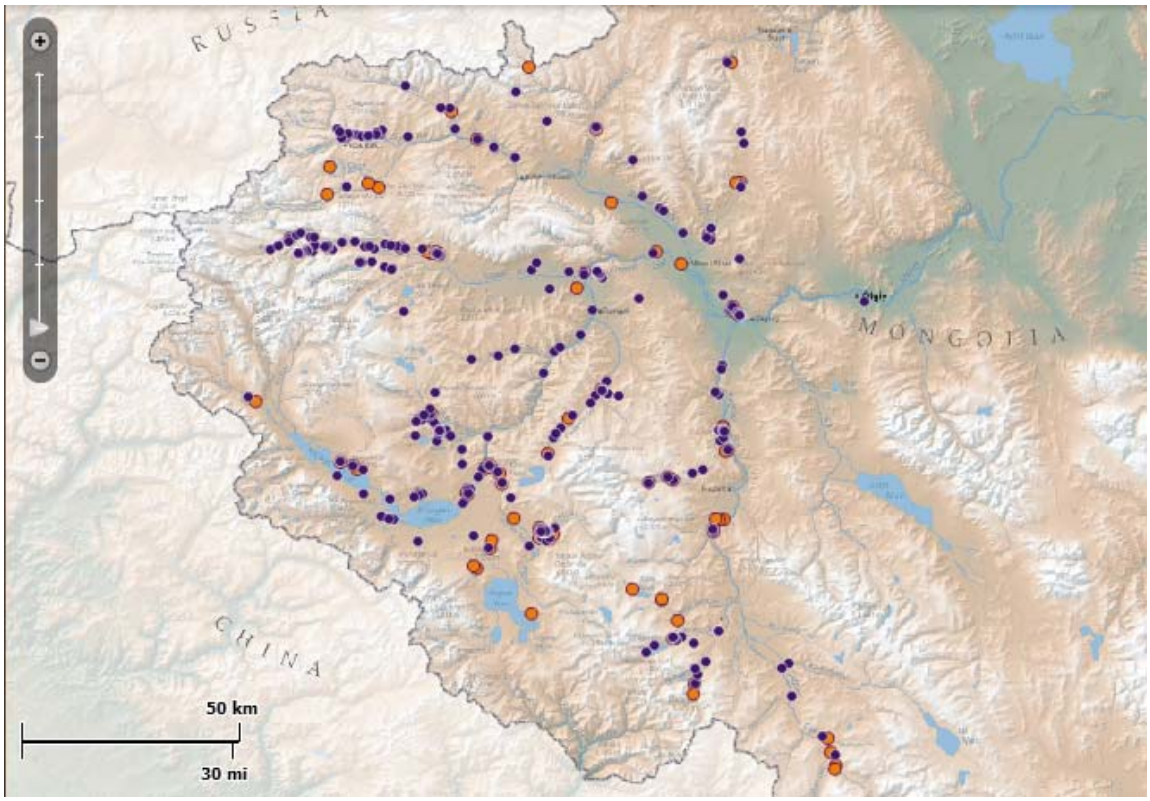

Figure 1: Map of Archaeological Study Sites Created by the UO Infographics Lab. Permission to use from the Mongolian Altai Inventory Project, 2009, Esther Jacobson-Tepfer and James E. Meacham, University of Oregon.

The foundation for this collaboration was built on previous relationships with the UO Libraries: Earlier, Infographics Lab had worked on a project with UO Libraries' Interactive Media Group that involved the Department of Anthropology and the Department of Geography as well as the Map/GIS (Geographic Information System) Librarian to acquire maps and GIS datasets for lab and other departmental needs. Jacobson-Tepfer also had a relationship with managers of the Visual Resources Collection who digitized images for her art history courses. In the summer of 2006, Ken Kato, Assistant Director of the Infographics Lab, approached the Interactive Media Group along with Dr. Jacobson-Tepfer and James Meacham and the geography subject librarian, Jon Jablonski, about participating in a grant proposal for the Mongolian Altai Inventory Project. The Libraries' digital projects group was brought in to lead the creation of the image archive and link it to the new website. The project thus became an internal collaboration between four different units in the UO Libraries itself as well as the Infographics Lab and the Geography and Art History Departments. All phases of project development were conducted in partnership: the grant proposal, project requirements, needs analysis, content analysis, image digitization and cataloging, information architecture, graphic and database design, project development, quality assurance testing, and final implementation.

Project Team

Once begun, execution of the project and staffing changes necessitated modifications in the duties of the participants from the original grant. [4] The unit responsibilities were as follows:

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- Dr. Esther Jacobson-Tepfer, Project Director: intellectual lead, content selector, metadata cataloger, and client
- James Meacham, Project Director: cartographic editor and Geographic Information Science, lead
- Infographics Lab (Ken Kato, lead): design and develop the interactive mapping and its application
- UO Libraries:
  - Document Center (Jon Jablonski, lead): supply historic maps
  - Metadata Services and Digital Projects (Karen Estlund, lead): direct the development of the image archives and its integration with the interactive website
  - Visual Resources Collection (Julia Simic, lead): oversee the digitization of 35mm slides and consult on metadata
  - Interactive Media Group (Kirstin Hierholzer, lead): direct the development of the interactive website

Creating this new kind of digital project that directly supported faculty research output involved many challenges that participants had faced on previous projects, but new struggles surfaced because of the project's collaborative nature. These included uniting historically independent project teams, ensuring transparency in project decisions, navigating shifting roles and responsibilities, and adopting a consistent approach to client management. Despite the challenges, the Mongolian Altai Inventory Project was a tremendous success, and one that has inspired a subsequent collaborative project, now in development, focusing specifically on rock art[5] of the region.

Project Launch

The initial meeting for the Mongolian Altai Inventory Project took place in spring 2007. However, due to staff resignations, the make-up of the final team was in flux, allowing conversations to take place only at a very high administrative level. In the fall of 2007, the full collaborative project was launched. The Digital Collections Coordinator and Visual Resources Librarian met with Dr. Jacobson-Tepfer to discuss workflow for the digitization of her collection of research images, the metadata dictionary, controlled vocabularies, and the preservation of digital files. Subsequently, larger, complete unit meetings were held to provide an overview of the project for all participants and to discuss ideas and possibilities for the interactive website. Early on, it was necessary to determine the metadata structure and initial infrastructure for the images as a precursor to web site design. In the winter of 2008, development of the website commenced.

Introduction to the Content

Highly detailed, specialized content is inherent in working with faculty research materials. Special expertise was required to understand the logical description and integration of content with the geography and the needs of potential users. All the participants approached the project with different levels of understanding. James Meacham and the Infographics Lab had been working with Dr. Jacobson-Tepfer on her Altai research for 15 years. This long collaboration meant that the Infographics Lab had a thorough understanding not shared by the UO Libraries units. To help others expand their grasp of the material, Dr. Jacobson-Tepfer gave a presentation about her research to the full Project Team that provided opportunity for thoughtful discussion and questions about the subject matter and a general understanding of Dr. Jacobson-Tepfer's work and objectives of the project. This meeting was crucial, although not anticipated in original planning.

Figure 2. Round khirigsuur with four rays, clear rim, on terrace, left bank of river (RNKH_00002_OI), photograph by Gary Tepfer, http://boundless.uoregon.edu/u?/maic,1480. Permission to use from the Mongolian Altai Inventory Project, 2009, Esther Jacobson-Tepfer and James E. Meacham, University of Oregon.

Communication

The various units began working independently on their assignments and communicated largely through email. Full Project Team meetings were called to review progress, but were irregular and led to scheduling problems. Each unit developed their own workflow and client management processes. Although processes were similar, the perceived independence of each unit within their assignment resulted in redundancy, and sometimes cross-purposes, as time went on. Unit managers did not have a full understanding of the technical limitations of each unit's assignment which complicated the management of client expectations. In addition, development of the print atlas was accomplished simultaneously by the Infographics Lab and the Project Directors without the participation of the Libraries units. Issues affecting both the print atlas and website development thus went unaddressed, or were miscommunicated, across units. Each group was effective in its own area, but the development of communication "bubbles" led to confusion, uninformed decisions, and misdirection of tasks.

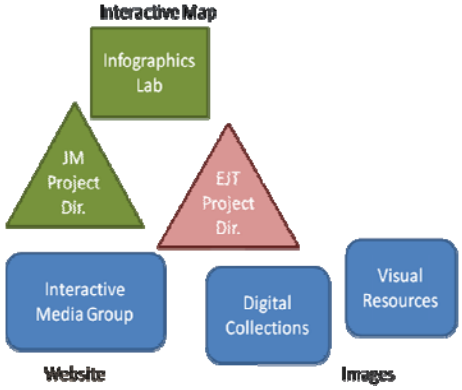

Figure 3. Communication Bubbles

In retrospect, the project should have begun with the establishment of a shared workflow and development process by the Project Team as a whole. This would have included the appointment of a single Project Manager to oversee all units, as well as the adoption of a virtual project management space to

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process documents and to share all communications, files, notes and progress reports. While these seem like obvious solutions, uniting separate units, managing existing relationships, ensuring ongoing communication and maintaining a collaborative workflow would challenge even the best administrator. And in an academic environment, there are no leaders who do not already have a full plate and minimal support.

Building the Digital Image Collection

The digital image collection infrastructure was the linchpin for the project. Coupled with Dr. Jacobson-Tepfer's field notes, the images composed the primary research assets. The metadata provided for the images would determine the functional abilities of the interactive map and website. Tangentially, the image collection provided a new direction for collection development in the UO Libraries in that the original 35mm slides were not acquired by the libraries but only the digital surrogates. As digital files, the images and the specialized information provided in the metadata will be accessible to future researchers long after interactive website technologies become obsolete. Digital preservation, therefore, was also an integral part of the project.

Workflow

Dr. Jacobson-Tepfer approached the UO Visual Resources Collection (VRC) unit to digitize her analog image collection, consisting of 35mm cardboard-mounted Ektachrome slides taken on-site during her research trips. The choice of the VRC was based on the existing relationship Dr. Jacobson-Tepfer had with the unit, as well as her concerns for the safety of this unique resource. The professor's office was, at the time, in the same building as the VRC, thus eliminating the need to transport the slides in large groups across campus to the Libraries Imaging Services Lab. The slides were in reasonably good condition with very few scratches aside from the blue cast characteristic of Ektachrome film which the professor was anxious to correct. A test batch of ten slides was digitized and the software settings adjusted to produce the best image possible. A former graduate student of Dr. Jacobson-Tepfer, and current employee in the VRC, was hired to oversee the bulk scanning of the slides and perform color correction and clean up of the resulting digital images.

The slides were scanned at 4000ppi in 16 bit color on a Nikon Super Coolscan slide scanner and saved as uncorrected TIFF files. A copy of these files was burned to DVD and given to Dr. Jacobson-Tepfer. The images were then color corrected and cleaned using Photoshop, saved again as TIFF files, and burned to DVDs to be housed in the VRC. These corrected TIFFs were then reduced in size to 2000ppi for uploading into the Libraries' digital asset management system.

Due to ongoing commitments in the VRC, the post-production work could not be accomplished in the VRC's imaging lab. Instead, Dr. Jacobson-Tepfer arranged to have the graduate student use her faculty office and computer at times she was elsewhere. The workstation was color calibrated and updated to handle the large image files which were stored temporarily on a Libraries server for easy access. The student was able to bulk scan the original slides in the VRC and upload uncorrected TIFF files to the Libraries server, take the slides to Dr. Jacobson-Tepfer's office, and correct the digital images with the original slides as reference and resave them to the server. The concerns of the professor for the safety of her original research proved prophetic. One evening the student finished the bulk scanning, but was unable to start her post-production work immediately. She slipped the box of slides into her bag and went home. That night her car was broken into and the bag stolen. The slides were never recovered, and this research now exists only as digital surrogates.

The post-production work proved problematic in another way. Well into the project Dr. Jacobson-Tepfer voiced concerns about

the correction of the Ektachrome blue-color shift. The light, she said, just didn't look the way it did in the Altai. Because only she and the photographer had been to the Altai, she knew that the correction was inaccurate. To remedy this Dr. Jacobson-Tepfer needed to review each digital image. This image editing process took place throughout the project timeline.

The software used to host the images also influenced the digital image workflow and metadata structure. The UO Libraries had been using CONTENTdm for several years, and it had been identified in the grant to host the publically accessible copies of the digital images. Early in the project, the decision was made to use JPEG2000s rather than JPEGs as the access images in order to enable users to zoom in on important details.[6] CONTENTdm was used to auto-generate the JPEG2000s from the TIFF files uploaded. CONTENTdm allowed users to then download JPEG versions of the images. To avoid Dr. Jacobson-Tepfer having to learn CONTENTdm, it was decided to have her recreate annotations in Excel, then UO Libraries staff would upload the data along with the images to CONTENTdm. The TIFF images would then be sent to the Libraries' archival server. At a later stage, due to corrections needed outside of the UO Libraries staff expertise, a user account was created for Dr. Jacobson-Tepfer, and with some training, she was able to edit the data directly using the CONTENTdm web administrative interface.

This was the first digital collection hosted by the UO Libraries where the majority of the descriptive cataloging was done by a faculty expert, with Libraries staff providing only quality control and non-contextual metadata concerning administrative, technical, and preservation matters. Dr. Jacobson-Tepfer was involved in all content-related aspects of cataloging including the metadata dictionary, controlled vocabulary, and metadata creation itself. Using both common and technical terminology, a basic introduction to cataloging theory was created along with a description of how search engines work. For example, Dr. Jacobson-Tepfer called her descriptive practice "annotation," and librarians refer to it as both "cataloging" and "creating metadata." Using shared terminology and emphasizing the relationship between metadata and user access to content was a reasonably successful strategy. However, sharing more of the Libraries' expertise regarding the CONTENTdm search engine and how best to employ controlled vocabularies would have streamlined the input of metadata by the professor.

Metadata Dictionary and Controlled Vocabularies

Dublin Core was selected as the guide for creating the metadata dictionary for the digital images with local fields mapped to unqualified Dublin Core whenever possible and when desired.[7] An examination of VRA Core 4.0 led to borrowing some fields such as "Work Type" (later renamed to "Monument Type") and "Measurements."[8] The local customization of Dublin Core maximized flexibility and allowed the images to be easily harvested through OAI-PMH for any future uses. The metadata dictionary and controlled vocabularies were based on extensive discussions with Dr. Jacobson-Tepfer and influenced by the interactive website design process.[9] The audience for the metadata was identified as expert-level scholars, and discussions focused around what fields were necessary for an expert to navigate the collection. The most important fields for discovery were identified as geographical (primary and secondary drainage fields) and Monument Type since they describe the object(s) in an image. Additional fields were created exclusively for the interface: fields such as "Available on Map" acted both as a queue to the users and allowed a script to determine whether or not the image viewer would display a "View on Map" button next to the image.

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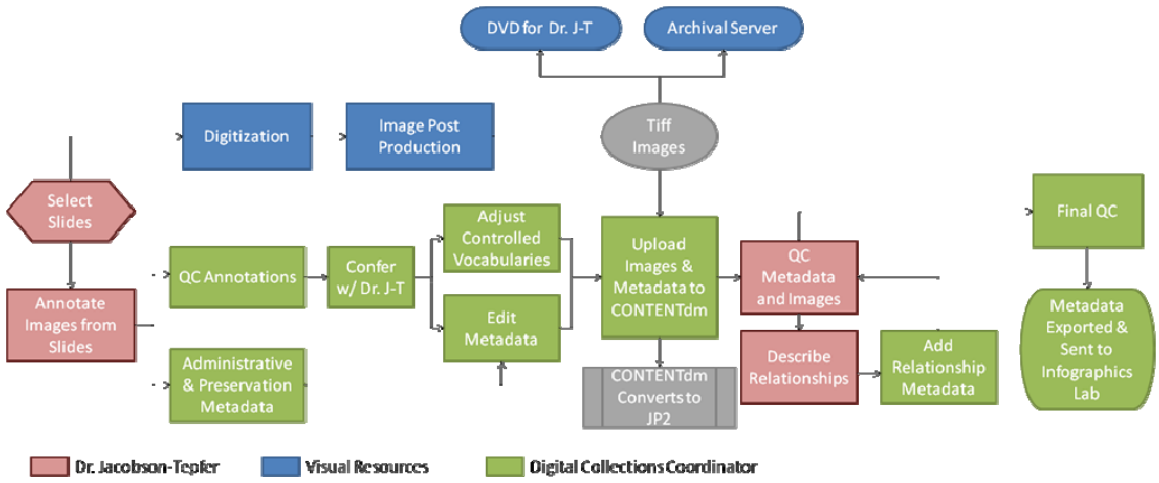

Figure 4. Digital Image Collection Workflow

As with many archaeological collections, even though landscape and geography are intrinsic to the value of the data, Dr. Jacobson-Tepfer asked for restrictions on what was made available to the public. This was necessary primarily because of site looting in the Altai region. The "Site IDs" identifying the location of monuments were abstracted. These values were matched with actual values hidden in the Infographics Lab database so that the images were able to be mapped without giving away the precise location. Even so, at-risk objects such as rock art and image stones were removed from the mapping application. Because the "Site ID" was stripped of meaningful value, as the project progressed this field was renamed with an instruction, "See all images at this site," prompting the user to click on the field value and retrieve the set of images from that particular site.

The use of "Subject" terms for the images resulted in two fields: a primary "Monument Type," used to describe the type of object(s) as the subject of the photograph, and a secondary "Subject" field reserved for petroglyphs, where the image of the photograph may have its own subject as well. The "Subject" field for the petroglyph images was built as images were cataloged. As Dr. Jacobson-Tepfer chose a term(s) for the image, the Digital Collections Coordinator attempted to match the term to the Library of Congress Subject Headings and consulted with the UO Libraries Authorities Specialist when necessary. The term was then vetted back to Dr. Jacobson-Tepfer.[10] The "Monument Type" controlled vocabulary field was constructed at the beginning of the project and was altered only slightly during the cataloging of the collection. The introductory presentation given by Dr. Jacobson-Tepfer to the Project Team was especially useful in the construction and use of the "Monument Type" field. A search for a common corpus of terms to use in this field was made but no standard vocabulary matched the cultural language. Terms were taken from the *Art & Architecture Thesaurus* as appropriate.[11] Vocabulary such as "balbal" and "khirigsuur" and more abstract terms such as "serpentine features" were added as needed. The Infographics Lab database contained a unique list of Monument Types drawn from the work of Dr. Jacobson-Tepfer for over 15 years, but different labels existed for the same fields used in the Libraries' system. The Libraries' controlled vocabularies and field set were sent to the Infographics Lab at various intervals in time, but Infographic developers operated on different premises. This lack of coordination between the Infographics Lab list and the image archives fields proved to be problematic during the construction of the interactive map application. Having a better understanding of the legacy database would have helped to avoid some confusion and duplication. The problem that persists is one of building different

data models for different purposes and ensuring that a data model can evolve appropriately.

Cataloging

The use of an expert in the field, such as Dr. Jacobson-Tepfer, to catalog the images was important not only for identification of objects and description of the images, but also for contextual information. The description, as listed in Figure 2, could be supplied only by someone who had been on site and knew the context of the photograph. Other essential fields such as "Period" and "Drainage" required the professor's expertise. Her willingness to spend time analyzing each image, transcribing old notes, and reassessing data according to standardized cataloging practices was invaluable.

The hurdles in cataloging were primarily related to the use of controlled vocabulary terms. Adopting terms in the plural based on the number of objects in a particular image was not intuitive, but Dr. Jacobson-Tepfer adapted well to this cataloging practice. For example, a petroglyph with one woman would still get the subject of "women." Because the singular and plural forms continued to cause database searching problems, and with respect to alternate spellings of terms such as "khirigsuur" (the plural form) and "khirigsurrs" (a less used plural form) and "khirigsur" (an alternate spelling), a hidden field was added to complement the "Monument Type" field. This ensured that a user would retrieve all the images for a monument type regardless of terminology.

An inherent workflow problem exacerbated the controlled vocabulary issues. Since Dr. Jacobson-Tepfer was cataloging images in Excel, she was unable to select interactively the precise controlled vocabulary term, and was required to reference constantly expanding lists. This resulted in the Digital Collections Coordinator performing extra clean up that could have been avoided. The struggle of whether or not to train a non-librarian field expert in library systems or to perform extra clean up work is still a question for future workflow considerations.

As with the creation of most complex databases (that faculty research will invariably lead to), the issue of how to communicate the interrelations of different pieces of data is difficult. In this project, the problem existed when describing "full," "detail," and "alternate" views of an object. The "Relation" field in Dublin Core is an obvious place to put this information; however, the way to add the information efficiently was elusive. The goal of uploading images so that a user could click on an active link in one record and view alternate images required all image locations to be stable before adding the link to the metadata. It was also necessary to determine the types of relationships, the syntax used for relationships, and which relationships were to be described. A larger view would link to all "detail" views, but detail views would link only to larger views and not other details, thus forcing the user to return to the larger view before accessing other object details. There were two reasons for this decision: to minimize work and to eliminate contextual confusion. If, for example, a user looking at a hunting scene clicks on a link in the metadata record and is taken to a domestic scene, the relationship between the two images is ambiguous without the context provided by the full image. Dr. Jacobson-Tepfer created an Excel spreadsheet describing relationships between images, and the UO Libraries unit then added the image identifiers and links using the proper syntax. This was a grueling manual process. Although the relationships will be maintained through the identifiers, this practice has long-term sustainability issues, since the links are based on the particular digital asset management system (CONTENTdm) currently in use and not on permanent, stable URLs.

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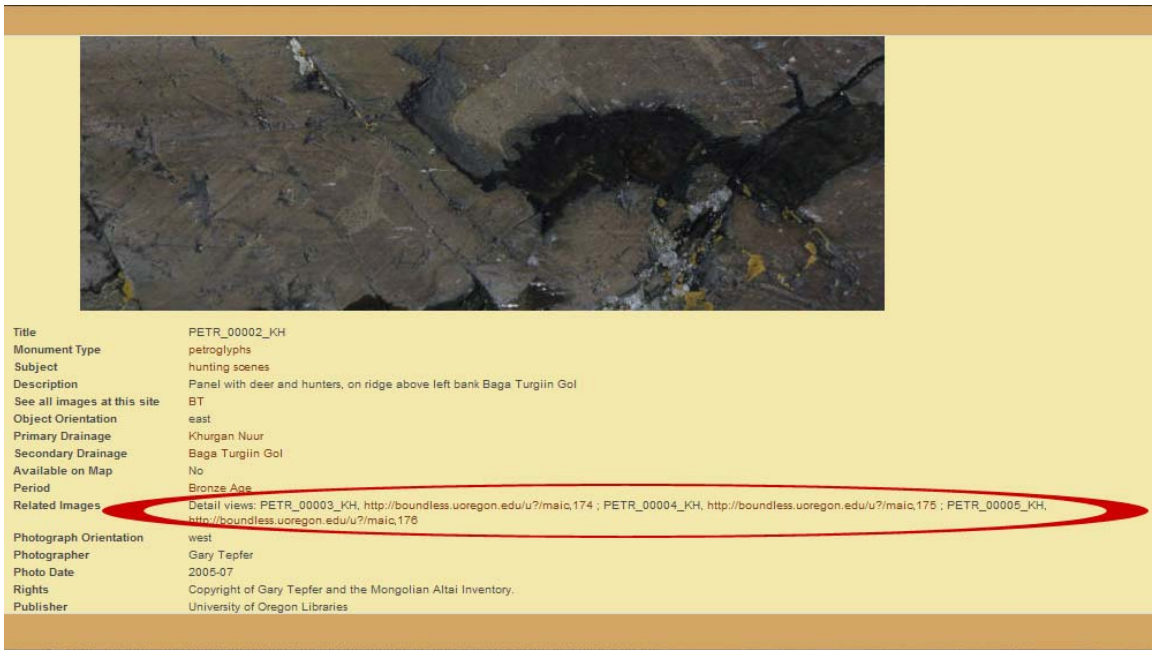

Figure 5. Image with Relationships to Multiple Images.

Preservation and Rights Management

Because the TIFF image files became assets of the Libraries, the digital files were integrated into the UO Libraries digital preservation workflow. The CONTENTdm full resolution manager was used to link the metadata and access image to the archival server location of the preservation level file. Automatic scripting was used to send images to the server where check-sums are regularly run for data integrity. The archival server is backed up on LTO (linear tape-open) magnetic tapes and stored both on and off-campus.

The Mongolian Altai Inventory Project used a professional photographer to photograph the images. As an independent professional, he retained copyright to his images and although JPEG versions are available as downloads from CONTENTdm, the full resolution images are not available.[12] Originally, an elaborate plan existed whereby faculty and researchers could register on the website and login to download full resolution versions of the files. (This method was also considered for access to more precise locations of monuments). The responsibility of determining who was a valid researcher remains unresolved. The UO Libraries did not wish to take on this responsibility, nor did it seem feasible for Dr. Jacobson-Tepfer to be the "guardian" of website content. An agreement was reached to provide full resolution images only to faculty on the UO campus or by direct request made to the UO Libraries through Dr. Jacobson-Tepfer. Existing access does offer downloadable JPEGs suitable for PowerPoint presentations or document files and the JPEG 2000 images provide online zoom capabilities.

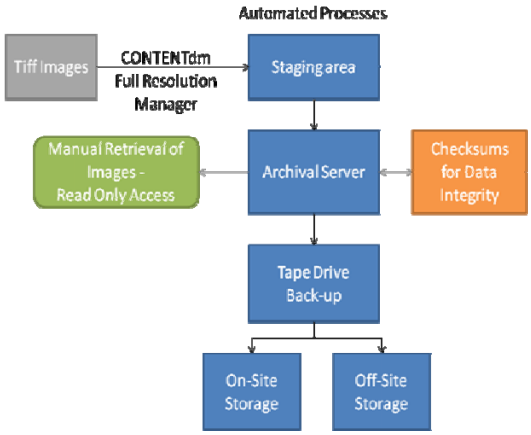

Figure 6. UO Libraries Digital Preservation Workflow

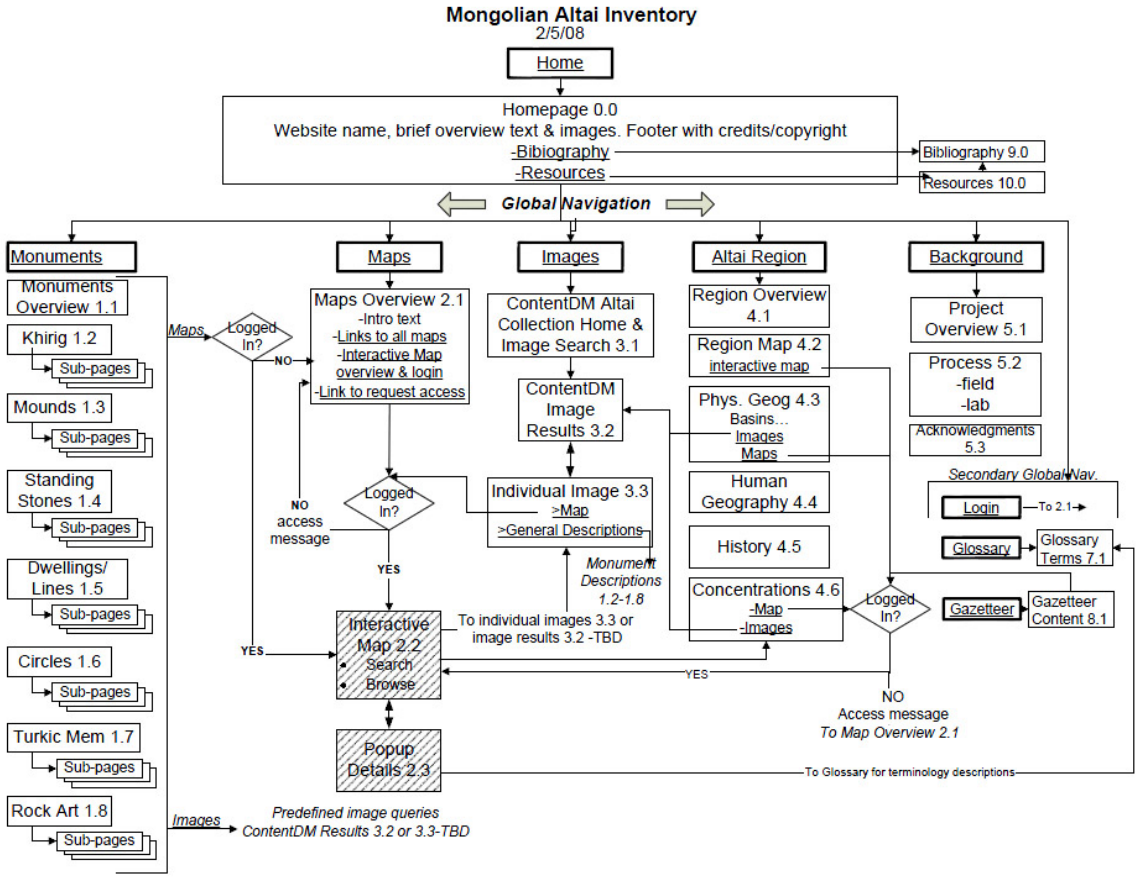

Figure 7. Early Design of Interactive Media Group's Interactive Website Architecture

Future UO Libraries projects collecting digital formats of files will require a Creative Commons license or a version of an "Educational Use" license in order for the Libraries to distribute full resolution files. [13] Additionally, it is essential that these types of projects also have documentation allowing the archives to reproduce images for preservation and future file format migration.

Building the Interactive Website

Analysis & Design

Many of the issues facing the Project Team during the analysis stage naturally flowed into questions of web design. During the analysis, unclear roles and responsibilities led both the Interactive Media Group and the Infographics Lab to develop a version of the website information architecture (see figures 7 and 8).

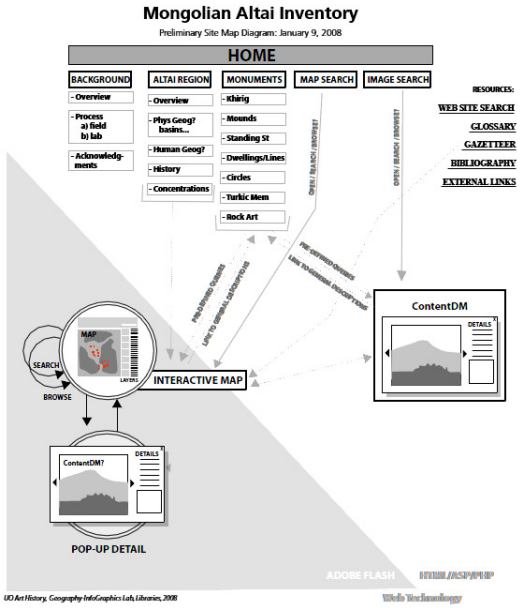

Figure 8. Early Design of Infographics Lab's Interactive Website Architecture. Permission to use from the Mongolian Altai Inventory Project, 2009, Esther Jacobson-Tepfer and James E. Meacham, University of Oregon.

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The Interactive Media Group, whose sole responsibility was to develop and design the website, moved forward with their established process: first, identify website requirements, second, work one-on-one with the client to understand the content and prioritize the information flow, and third, create wireframes to visually represent these decisions. While this would have not been an issue for most projects, the collaborative nature of this project required a complete understanding by all Team members of roles and responsibilities. As Dr. Jacobson-Tepfer collaborated daily with the Infographics Lab on other aspects of the project, conversations and decisions about information architecture and the website naturally arose. The Infographics Lab easily guided many of these decisions because of their own background in media development. Unfortunately, because expectations were not articulated to the larger Team, overlapping conversations with Dr. Jacobson-Tepfer about information architecture and design were taking place. This resulted in both the Interactive Media Group and the Infographics Lab creating different wireframes for the website. The problem of shifting responsibility for information architecture away from the web team was not intuitive to the client. From Dr. Jacobson-Tepfer's perspective, she had worked with the Infographics Lab to give the Interactive Media Group exact directions on how the website should look and work. From Interactive Media Group's perspective, they were being asked to create a design with limited input from the client into content organization, navigation, terminology and overall usability that was required to successfully support the project goals and to target audience needs. In addition, the Infographics Lab was not familiar with CONTENTdm and its limitations on data retrieval and design.

The result of these misunderstandings and miscommunications was a prolonged design process. Information architecture and functionality continued to change as the Infographics Lab and Dr. Jacobson-Tepfer worked through the content. Every change impacted Interactive Media Design's design and development, and often the structure of data within the image archives as well. Ultimately, an intuitive information architecture and beautiful design were created, but at the expense of timeliness and maximal workflow at a late stage in project development.

Website Development

During the development stage, the independent tasks of the Project Team became and issue as communication and overall management of the project fell to the individual units. Team meetings were replaced by email correspondence as each group focused on their particular tasks. The Infographics Lab concentrated on the GIS database, interactive map and print atlas; Digital Collections attended to quality control of the metadata; and the Interactive Media Group focused on web design. While everyone felt confident about their specific piece of the project, the areas requiring cross functionality were more clouded. The project required not only the ability of users to move fluidly between multiple components of the project, but also backend systems needed to be able to pass along information to support this movement.

The Interactive Media Group developer worked with the Digital Collections Coordinator to modify the CONTENTdm templates to fit the changing needs of the project. The decision to display image results in a pop-up window necessitated the elimination of header information from view. However, if the images were found through Google or via other means, the header needed to display attribution and context. The Interactive Media Group developer created a script so that header information would be viewable only when coming from somewhere other than the interactive website and would be absent for users working within the context of the interactive website.

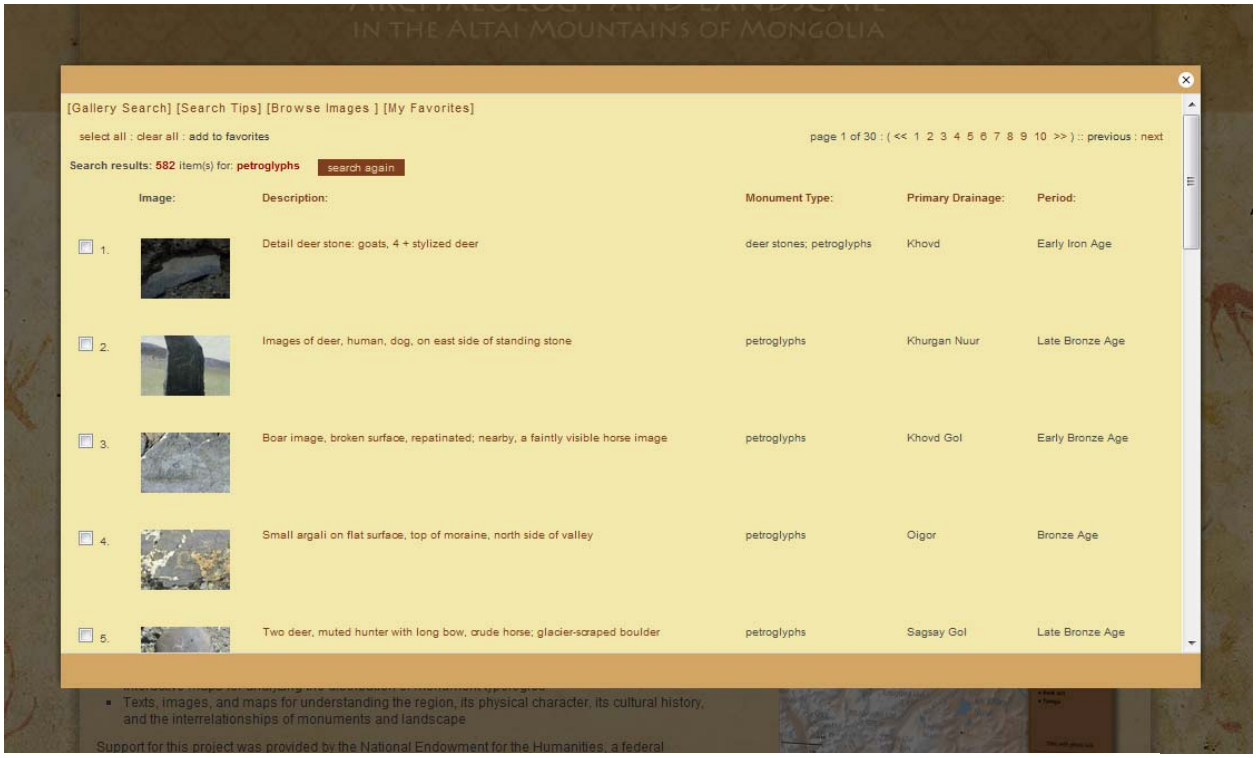

Figure 9. Image Search Results through Interactive Website.

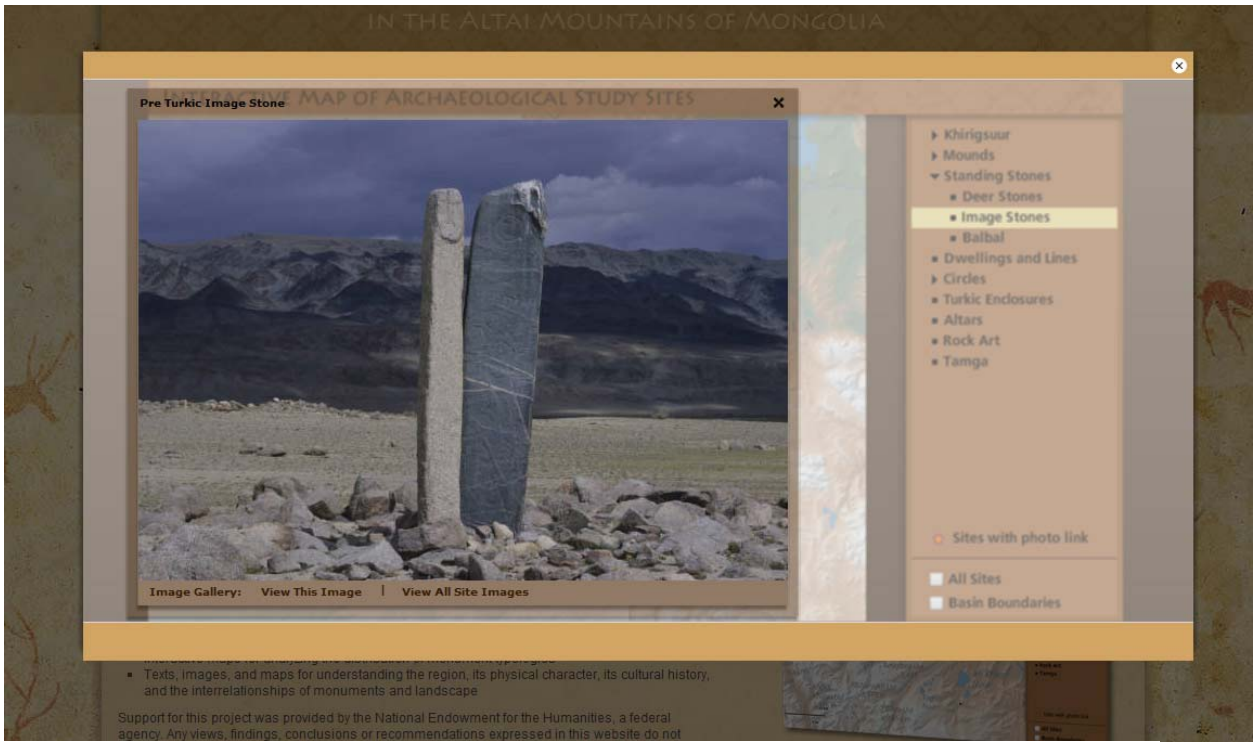

Figure 10. Image Selected through the Interactive Map, photograph by Gary Tepfer. Permission to use from the Mongolian Altai Inventory Project, 2009, Esther Jacobson-Tepfer and James E. Meacham, University of Oregon.

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Figure 11. Interactive Website Home Page.

In 2008, two main developers transitioned away from the project just months into the website design process. The Infographics Lab interactive map developer left in June, handing his assignment over to the Interactive Media Group developer. The Interactive Media Group developer reduced to being a part-time employee in August that year, juggling a full-time job at another institution with his work on this project. While efforts were made to smooth this transition, the decisions behind the GIS database structure and functionality underlying the interactive map were not clear to all on the Project Team.

As the Interactive Media Group developer began work linking the various systems, serious questions arose about user expectations regarding the interactive map and the underlying data structure of the mapping application. Questions remained about what image was displayed as an example at a site and how to ensure that users could easily go to the details about that image and other images at the site in the image gallery (see Figure 10). This was perhaps the most challenging part of the project: trying to get the various parties, some no longer at the institution, to communicate, create a plan, and complete the work. Ultimately, the Project Team and Dr. Jacobson-Tepfer were able to make some fruitful decisions about how a user should interact with the mapping application and the images. This allowed development to come to a close and final testing of the site to commence.

Conclusion

Past relationships established by the UO Libraries units allowed for a new type of collaboration represented in the Mongolian Altai Inventory Project. Partnerships with internal or external units and with individuals inevitably raise the same issues of project management and communication, but effective collaboration often can result in rich and unique outcomes. Working with specia-

lized content requires education across all units and the ability to adapt to the methods and styles of non-librarians. In retrospect, some of these challenges were not completely overcome which impacted the effectiveness of the whole project. No one can predict personnel changes or timelines when trying to connect complex backend systems. But the most important lessons learned were simple: create united teams across campus units under one project manager with agreed upon roles, responsibilities and processes, and supported by one project management and communication tool. The success of this project will help build a new model within UO Libraries to collect information in digital format and help faculty with new methods of scholarly dissemination.

References

[1] Esther Jacobson-Tepfer. "Altai Region" in "Archaeology and Landscape in the Altai Mountains of Mongolia," University of Oregon Libraries, http://mongolianaltai.uoregon.edu/altai_region.php.

[2] Esther Jacobson-Tepfer and James E. Meacham, "Archaeology and Landscape in the Altai Mountains of Mongolia," [photography by Gary Tepfer], University of Oregon Libraries, http://mongolianaltai.uoregon.edu/.

[3] Esther Jacobson-Tepfer and James E. Meacham, *Archaeology and Landscape in the Mongolian Altai: An Atlas,* [photography by Gary Tepfer], (Redlands, CA: ESRI Press, 2010).

[4] The Head of Metadata Services and Digital Projects left the UO before the grant began, and Karen Estlund, Digital Collections Coordinator started five months after the grant kick-off. Shayne Huddleston, Interactive Media Group programmer, transitioned to working on the project remotely in August 2008 after accepting another position. Erik Steiner, the Infographics Dynamic Cartographer responsible for the interactive map, moved off the project in June of 2008, transferring much of the remaining work to Interactive Media Group. Jacob Bartruff, Infographics Programmer Analyst, did not join the project until April 2009.

[5] Rock art refers to petroglyphs and pictographs.

[6] See JPEG 2000 standard: "JPEG 2000," International JPEG Committee, http://www.jpeg.org/jpeg2000/.

[7] "Dublin Core Metadata Element Set, Version 1.1," Dublin Core Metadata Initiative, http://dublincore.org/documents/dces/.

[8] "VRA Core 4.0," Visual Resources Association, http://www.vraweb.org/projects/vracore4/VRA_Core4_Element_Description.pdf.

[9] "Mongolian Altai Inventory Metadata Guide" in "Metadata Guides," University of Oregon Libraries, http://libweb.uoregon.edu/catdept/meta/data_dictionaries.html.

[10] "Library of Congress Authorities," Library of Congress, http://authorities.loc.gov/.

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[12] Individual image JPEG download script for CONTENTdm developed at UO Libraries; My Favorites Image download script adapted from: Eric Luhrs, "CDM2OIV," http://ww2.lafayette.edu/~luhrse/presentations/cdm2oiv/.

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