

## **Community Standards for 3D Data Preservation (CS3DP)**

To meet the pressing need for nationally-shared resources for the preservation and management of collections of digital 3D data, the Washington University Libraries, in collaboration with the University of Iowa Libraries and the University of Michigan Museum of Paleontology, seek \$99,960 to hold a set of National Forums, titled Community Standards for 3D Data Preservation (CS3DP), to bring together a broad community of stakeholders to work toward establishing standards, practices and technologies for 3D data preservation, documentation and dissemination.

3D digitization is frequently used for preserving and sharing reproductions of endangered or rare physical objects. Creating and capturing digital 3D data is labor, skill and time intensive. While there are many resources for learning how to create and work with digital 3D data, resources relating to preservation are lacking. Existing minimal and piecemeal guidance is not comprehensive or flexible enough for general adoption. While such guidelines provide some vague direction, institutions are left filling in the gaps with ad-hoc, localized solutions. Local solutions can create barriers to effective data sharing and may make large-scale, national or international data aggregation and cooperative projects difficult. In a recent survey conducted by the project team, responses from over 100 members of the 3D digitization and data curation communities revealed a virtually universal desire for shared national standards and a high level of interest in participating in developing such standards.

The ultimate project goal is the development and adoption of standards for digital 3D data preservation through the establishment and facilitation an ongoing, organized community of practice. The national forums will lay the foundation for this effort. We propose two 2½ day forums bringing together a diverse group of about 70 stakeholders, the first to take place at Washington University in St. Louis in January 2018 and the second at the University of Michigan in July 2018. The format will include expert presentations, discussions and collaborative work. We would assemble multiple working groups at the first forum to meet regularly and develop reports on key issues for presentation and discussion at the second forum. Outcomes from the CS3DP project include: 1) a community-developed plan to move 3D preservation forward; 2) recommendations for data standards and best practices; 3) a report to be disseminated through IMLS and among communities engaged in 3D research and/or data preservation and curation via institutional repositories; 4) a plan for funding to move the project forward as needed; and 5) publications, conference presentations and listservs.

The project team includes PI Jennifer Moore, GIS & Data Project Manager and Anthropology Librarian, Washington University in St. Louis, and Lead Partners: Hannah Scates Kettler, Digital Humanities Research & Instruction Librarian, University of Iowa; and Adam Rountrey, Research Museum Collection Manager, University of Michigan Museum of Paleontology.

# Community Standards for 3D Data Preservation (CS3DP)

## Introduction

To meet the pressing need for nationally-shared resources for the preservation and management of collections of digital 3D data<sup>1</sup>, the Washington University Libraries, in collaboration with the University of Iowa Libraries and the University of Michigan Museum of Paleontology, seek \$99,960 to hold a set of National Forums, titled Community Standards for 3D Data Preservation<sup>2</sup> (CS3DP), to bring together a broad community of stakeholders to work toward establishing standards, practices and technologies for 3D data preservation, documentation and dissemination.

The two forums will convene leading experts and key stakeholders, including librarians, curators, faculty and professionals from the U.S. and abroad, in consultation with organizations such as the Digital Preservation Coalition, MorphoSource, and the Digital Curation Network. Each 2½ day forum will include presentations, discussion and collaborative work. The project team<sup>3</sup> will assemble multiple working groups at the first forum to meet regularly and develop reports on key issues for presentation and discussion at the second forum. The national forums will lay the foundation for an organized community of practice (CoP) to move forward on shared standards for 3D data preservation.

The CS3DP is an ideal fit for the curating collections project category: catalyzing national efforts to establish plans for shared standards for preserving, conserving, and providing access to digital content.

## 1. Statement of National Need

The preservation and sharing of research data is a fundamental responsibility of libraries and museums. Increasingly, this data is in digital form. Although standards and best practices have been developed for many kinds of digital data to ensure that assets can be accessed and reused in perpetuity, the applicability of these standards to digital 3D data is limited. As the use of digital 3D data in research has grown, libraries and museums have been increasingly involved in the creation and/or stewardship of such data – and many of them are grappling with how to curate and preserve this data. While some guidance exists regarding digital 3D data creation and use, guidelines and studies on the problems of management and preservation are woefully lacking. Institutions are left filling in the gaps with ad-hoc, localized solutions. Local solutions can create barriers to effective data sharing and may make large-scale, national or international data aggregation and cooperative

---

<sup>1</sup> Digital 3D data are digital representations of physical 3D objects or spaces. This data can be created via close range photogrammetry (camera), laser or structured light scanning, or be drawn in software such as CAD.

<sup>2</sup> Sometimes the term preservation is used in the narrative to incorporate these three issues: preservation or the long-term viability of data, documentation or metadata, etc. and dissemination referring to the accessibility of the data, which are distinct and complementary actions in curating collections.

<sup>3</sup> The project team refers to the proposal's PI (Moore) and partners (Rountrey and Scates Kettler).

projects difficult. Clearly there is a pressing need for comprehensive shared standards for preservation, documentation and dissemination of digital 3D data. With their increasing expertise and investment in data preservation and access initiatives, libraries and museums are well positioned to lead the effort for digital 3D data preservation and curation.

### **Assessing the need for 3D data standards**

To assess the need for standards and begin identifying the community of stakeholders, the project team conducted a survey of hundreds of individuals across the U.S. and abroad involved in digital curation and 3D data acquisition and research across disciplines. The 116 respondents were primarily at U.S. universities and museums. A sample of survey results is shown in Table 1 and [the full results can be found on the project site](#). Notably, 72% of all respondents said that they do not use best practices or standards for preservation, documentation and dissemination of 3D data. Of this group, 69% said that they did not use them because they were unaware of such standards. Respondents who said they were using standards largely developed them in-house. The vast majority (85%) of all respondents said they would like to collaboratively develop standards and best practices as a community. Survey comments such as, “I am very excited to see that you are doing this survey and potentially pulling this community together,” from an expert at a leading museum, capture the desire for collaborative development. Interest is so great that the CS3DP project team has been contacted by national and international conference organizers requesting presentations on the results of the survey; while the project’s focus is national, the project team welcomes broader conversation.

Table 1: Sampling of survey results (see link to full results)

Of all respondents, those who DO NOT use guidelines or standards	72%
Of those who use guidelines or standards, they developed them locally	35%
Of those who use guidelines or standards, they use a combination of sources	29%
Of those who use guidelines or standards, they use the ADS	16%
Of those who use guidelines or standards, some other guideline	10%
Of those who use guidelines or standards, they are under development locally	3%
Of all respondents, those who would like to collaboratively develop standards	85%

The survey asked respondents what kind of guidance would be most helpful; responses fell into the following general themes: preservation best practices (the most common response), management and storage, metadata standards, discoverability/access and copyright/ownership. Another theme that

emerged was a desire for general workflows for 3D creation services and discoverability. Preservation is implicit in this theme, as without preservation, there would be no 3D research to discover. One cannot build effective services based on ad-hoc, esoteric or unknown standards for future deposits without a consensus on standards for 3D preservation practices. In some instances, as volunteered by one respondent, they have been “flying blindly” in terms of what to do with 3D data.

### **Existing resources related to 3D data preservation**

The project team has scanned the field to identify existing resources related to digital 3D data preservation, listed in the references in supporting documents. Recent projects on 3D data include the London Charter, which provides high-level principles for the preservation of 3D data (“Principles” 2017), and The Guides to Good Practice from the Archaeological Data Service (ADS), which provide some basic suggestions for digital 3D data archiving (Trogitz 2017). Doyle (2009) documents the need for preservation of digital 3D data and describes a framework based on emulation and metadata for preserving these data. 3D-Icons produced a report on 3D metadata and thesauri for the European Commission to support the preservation of 3D digital objects in cultural heritage (D’Andrea and Fernie 2013). Additionally, there was recently a brief case study of a 3D preservation workflow in volume 2 of *Curating Research Data* (Johnston 2017), provided by the ADS. The NEH funded a forum on 3D in 2015 and 2016, which was focused on the user experience and not preservation (Humanities Heritage 3D Visualization 2015). One timely resource is a white paper resulting from the PARTHENOS Workshop held in France in late 2016, which was a gathering of predominantly archaeological stakeholders focused on the creation, use and reuse of 3D anthropological data (“Digital 3D Objects in Art and Humanities: challenges of creation, interoperability and preservation”, Alliez et al., 2017).

While these efforts have contributed toward understanding the problems to be addressed in 3D preservation, community standards development and formation of best practices, they are incomplete or lack specificity and adaptability as broad-based standards for digital 3D data preservation. These issues are outlined in a forthcoming article authored by project team members Moore and Scates Kettler, *Who Cares About 3D Data Preservation*. Previous efforts also tended to reflect only the needs of specific disciplines in their development and original intent. However, these resources do provide a solid foundation from which to discuss the 3D preservation needs of the broader community.

### **Meeting the 3D data preservation needs of the stakeholder community**

The CS3DP project will build upon previous efforts by engaging several of the experts involved, such as: Kieron Neven from The Archaeological Data Service to lend expertise based on their Guides to Good Practice; Andrea D’Andrea who authored the report for 3D Icons to address their approach to linked metadata for digital 3D data; Piotr Kuroczyński from the Herder-Institut for Historical Research and project manager for “Virtual Reconstructions in Transnational Research Environments – the Web Portal: Palaces and Parks in Former East Prussia” working to develop the Cultural Heritage Mark-Up Language schema for 3D research environments; or Julie Doyle from University College Dublin, who

authored “Long-term Digital Preservation: Preserving Authenticity and Usability of 3-D Data”. Project team members have established relationships with some of these experts, or would like to work alongside them to frame the discussions during the forums. As significant work on 3D data has been done in Europe, it will be of tremendous benefit to gain knowledge and insight from a few European representatives.

U.S.-based 3D experts and data curators will be the majority of invited attendees at the forums, including from institutions such as the Smithsonian, the Chicago Field Museum, University of Minnesota, and others, as well as repository experts such as MorphoSource. Additionally, the project team is in close contact with another team proposing U.S. forums on virtual reality work and 3D applications. While the CS3DP project is distinct, the project team recognizes great value in their broad survey of 3D application in libraries. Their project, IMLS NLG National Forum proposal, "Developing Library Strategy for 3D and Virtual Reality Collection Development and Re-Use", is complementary to the CS3DP work and participants are considered stakeholders. If funded, the project team will work with their Project Director Nathan Hall of the Virginia Institute of Technology and State University, to invite formal representation at our forums and encourage their representatives to present their work and actively engage in the forums. Similarly, PI Moore will sit on their advisory board and attend the appropriate forum for their project. Members of our respective teams are already working together and have proposed a presentation on 3D applications in libraries at the Digital Library Federation Forum in fall of 2017.

The CS3DP project is unique and essential in its focus on preservation, which will be of benefit to all libraries and museums. Some institutions may never delve into 3D scanning or a model building program, but many will be tasked with storing, preserving and serving digital 3D data, as evidenced by the results of the survey. The standards that the CS3DP project develops will be useful to those that create and those that only curate. Collaborative community development is truly the key element to this project. Standards built by librarians and curators that don't actively engage practitioners will not be successful, just as practitioner-developed standards without the archiving and access expertise from librarians and curators will not be successful in the long-term -- but together as equal partners in design, the potential is immense.

Libraries and museums that manage, share and preserve data, all creators of 3D objects and research, and ultimately the end users of that data, will benefit from the CS3DP project. The forums will generate buy-in from a variety of stakeholders and increase the possibility of adoptable community-supported standards that will greatly increase longevity, discoverability and access to digital 3D objects.

## **2. Project Design**

The overall design approach is to use a Community of Practice (CoP) model. CoPs require a community engaged in a domain to come together and develop *practice* through working together. The CoP model as described by Lave and Wenger is a keystone of social learning, which has been used by humans

throughout their existence (Wenger 2000). CoPs are brought together by collective understanding and need, build their community by engagement in shared practices and produce common resources. A community of practice can be gathered by a public event, and its success is dependent on an understanding of the community's purpose. This project has endeavored through the survey to identify the community and its purpose. A CoP can be informal or formal, and in the case of this project, the community will be formalized through the development of working groups, although other community members may participate informally.

Developing a CoP is an ideal method for the forums and an essential element for success. Implementing the CoP model involves: 1) establishing a CoP with broad representation of 3D practitioners and data curators by identifying those invested in these topics and bringing them together into a forum; 2) facilitating CoP member discussions to explore and better understand the challenges of 3D preservation. Curators and practitioners come to understand the complexities involved in each other's work and collaboratively find ways to address them; 3) forming working groups to address challenges and look for solutions; and supporting working group functioning and overall CoP interactions to achieve mutual goals.

Using the CoP model with the goal of creating a truly inclusive and community-developed forum has great potential and some risk. Allowing the large group to develop content puts the trajectory of CS3DP project at risk. Because the aims are shared and community driven, this should not be overly problematic, but partners will plan and practice good facilitation techniques to allow the group to explore, unpack, and reorient, but always keep the end goal of preservation standards as the focus. The great potential of the CoP is garnering true investment in the development of standards and best practices. The alternatives are a continuation of the current situation of ad-hoc, narrowly-focused or incomplete guidelines that only respond to the needs of specific constituencies, or a top-down set of standards that will not be responsive to the needs of all community members and will not be adopted in practice.

## **Project Activities**

In keeping with establishing a CoP, the project team is designing the forums in a participatory manner, engaging interested stakeholders (and likely attendees) in the identification of topics and program content. This strategy ensures that the forums will meet community needs and interests and will help foster the CoP. The first step was administering the survey, from which critical needs emerged, as noted earlier. The next step will be inviting selected experts and attendees, who will include survey respondents and representatives from organizations focused on data preservation, such as MorphoSource, Research Data Alliance, Data Curation Center, IASSIST, SHARE, and the Digital Library Federation. The goal is to confirm about 70 attendees who will participate in both forums. Experts and attendees will be invited to submit position statements and other relevant information on the [CS3DP community wiki via the Open Science Framework](#) (OSF), which is currently in development.

The wiki will be one of the main tools for collaboration and will be publicly viewable throughout forum and post-forum work.

Grant-funded activities would commence in October 2017 and continue for one year, although the overall effort will continue into the future. Forum one planning would occur during Oct. – Dec. 2017.

The first forum, to be held at Washington University in St. Louis in late January 2018, will encompass topic presentations and discussions, laying out a common vision, and forming working groups. The topics and themes that emerged from the survey will be addressed, such as unpacking 3D data methods, the state of current practices, extant metadata and standards, availability and use of digital tools and services and existing workflows. Day one will feature expert presentations and group discussions. Morning discussions will be dedicated to digital 3D data creation in practice. The afternoon will be dedicated to data curation/preservation principles and practice. Day two will be a workday. Participants will move into groups to discuss the previous day's topics. Based on survey data and previously submitted position statements, working groups will likely focus on metadata, archival practice, standardization, ownership, and copyright. However, final group topics will, in part, emerge from discussion. At lunch, groups will come together to share insights and in the afternoon the groups will focus on planning work for the months ahead. Plans will be shared with the larger group and there will be a forum wrap-up. For participants who are able to attend, a more informal working meeting will take place the following morning.

All forum activities at both forums will be recorded and shared publicly via the community wiki. This will be particularly useful for working groups in that important presentations and discussions can be revisited. Furthermore, stakeholders who were unable to participate at the physical forum can do so via the web.

Each working group will be facilitated by a project team member (Moore, Rountrey or Scates Kettler and select specialists) and include technologists and stakeholders specific to the working group topic. Work will take place at and between forums with ongoing communication using the wiki, Slack and monthly group web meetings, which will be open to the greater community. Between forums, working groups will meet regularly, and meeting minutes and/or meeting recordings will be shared via OSF for the entire CoP and the public. Each meeting will begin with a designated presenter(s) and end with a task/responsibility list that the working group has self-generated and members will claim ownership of tasks. The CoP model will be very useful here because members will bring a variety of expertise and experience and individuals can contribute and share based on their strengths. The project team will lead a larger monthly meeting involving members of all working groups to share overall progress toward goals. Working groups should have monthly development reports posted 24 hours before the monthly full group meeting so that members have an opportunity to read, reflect and bring questions to the meeting. A progress report recommending standards and documentation will be circulated to the group by March 2018 for comment.

Topics that emerge from the working groups will be slated for inclusion in the second forum. A call for proposals to the community will also be issued.

The second forum at the University of Michigan in July 2018 will reconvene the original forum group with additions for hands-on exploration of working groups' solutions and discussion of development, community member presentations, funding, and deliverables. Day one will include parsing working group feedback, presentation of deliverables as well as the winning presentations from participants. On day two participants will plan next steps to make the standards realizable. The forum will also include discussions of funding plans for sustainability.

Based on the work achieved, a white paper and report will be produced to be disseminated publically and in various community driven platforms of communication such as listservs. After the second forum, working groups will continue to work together remotely using the online tools and will target September 2018 for completed working documents to be available publicly, a project report will be submitted to the IMLS by October 2018 and the full deliverable completion will be released by October 2019.

Assessment milestones include: 1) the formation of a CoP that reflects broad stakeholder representation; 2) the development of recommendations for best practices and standards; and 3) a detailed roadmap for establishing widely-applicable and useful 3D preservation standards that are expandable and adaptable. Significant progress has been made toward milestone one, with well over 100 respondents to the community survey and project team contacts with many experts and stakeholders.

### **Diversity Plan**

The CS3DP project team is committed to maximizing the inclusion of women, underrepresented racial and ethnic groups, and people with disabilities in this project, the forum and subsequent activities. As guidance, the project team will use ongoing programs at Washington University, the University of Michigan and the University of Iowa that focus on inclusion of individuals from diverse backgrounds that are typically underrepresented, including individuals from disadvantaged backgrounds and people with disabilities. One method of inclusion is reaching out to relevant groups or organizations such as the Black Caucus of the ALA and the ALA BLGTRT round table, for example.

### **Project Management**

The PI and two project partners bring a wealth of library, archival, collections, digitization and data curation experience to this effort. Each has been involved in other national forums and community development efforts and they have complementary experience working with 3D research data from both the creation and curation perspectives. All have a vested interest in the development of community standards, as each of their institutions is currently grappling with the management of rapidly accumulating amounts of digital 3D data.



**Jennifer Moore, PI** - Moore is an anthropology librarian and project manager on the Data and GIS team at Washington University in St. Louis. She currently leads a project to capture, manage and preserve structured light scans of 2000 plaster jaw casts from baboons. Moore has worked on other national gatherings, such as meetings for a NSF-funded project to develop community standards for behavioral ecology, *Ethoinformatics*. She will lead project management, forum and working group planning and implementation, deliverable development and grant management and reporting.

**Adam Rountrey** - Dr. Rountrey has been involved in 3D digitization and research at the University of Michigan for over a decade. He manages an online 3D repository project (UMORF) and has experience with a variety of 3D research workflows. He has also recently helped coordinate iDigBio conference at the University of Michigan. As a museum manager, researcher and 3D practitioner, Dr. Rountrey's collaboration with the CS3DP forums is essential for a holistic approach. Dr. Rountrey will work in collaboration with Moore and Scates Kettler on forum planning and development, as well as coordinate local arrangements at Michigan.

**Hannah Scates Kettler** - Scates Kettler is a digital humanities librarian; her work with the Digital Scholarship & Publishing Studio at the University of Iowa Libraries focuses on making 3D representations of cultural heritage objects using modeling practices, photogrammetry and laser scanning accessible to the public. Scates Kettler was one of two librarians in the NEH Advanced Topics in 3D Cultural Heritage group where she gained insights about end user needs and expectations related to 3D preservation. Scates Kettler has experience in several national forums and in running an international informal community of practice with a membership of over 40 people. She will work in collaboration with Moore and Rountrey on forum planning and development.

Project team member institutions will support all salary and benefits costs of time devoted to the project. The project team is seeking support from the IMLS in the amount of \$99,960 to fund the costs of two forums, including: travel for expert participants (25 per forum) and project team members, room rental and food during the forums, materials and supplies, and a small amount for conference travel for team members to disseminate findings. The total budget also includes indirect costs at the federally-negotiated "other activities" rate of 36%.

### **Outcomes and Deliverables:**

The ultimate goal and impetus for the proposed CS3DP project is to establish community standards for preservation, documentation and dissemination of digital 3D data. Specific outcomes for this National Forum grant include: 1) a community-developed plan to move 3D preservation, documentation and dissemination forward; 2) recommendations for standards and best practices; 3) a report/white paper to be disseminated through IMLS and among communities engaged in 3D research and/or data preservation and curation via institutional repositories and applicable channels and venues; 4) a plan for funding to move the project forward as needed; and 5) project team articles, blogs, presentations and/or workshops at applicable conferences, such as the Digital Library Federation Forum, Society of

American Archivists, Society of Architectural Historians, IASSIST and others identified by members of the CoP.

The project team will regularly update and disseminate information via the OSF wiki, community listservs, Slack channels and newsletters and encourage the community to be engaged virtually between forums. After the forums, papers, presentations and workshops will dovetail with domain specific conferences and other forums pertinent to 3D.

Next steps discussed in forum two will include exploration of further funding and partnering with various domain conferences to support workshops and presentations by the project partners in partnership with forum participants. By building a CoP, project reach will extend beyond the networks of the project team. The shared ownership and expressed need by the community also underscores the buy-in and possibilities to share the work across many people and institutions.

### **Success and Sustainability**

To measure success during the forums, the project team will use forum attendance, contributions to the community wiki, number participating in working groups, number and diversity of institutions represented and retention of participants as measures. After forums, the project team will survey the community to evaluate efficacy and discover how many institutions have or intend to adopt recommendations and desire to continue the effort as measures of success.

To ensure the sustainability of continued work, time in forum two will be dedicated to exploring avenues of funding, possibly including an IMLS research grant to build upon the recommendations for standards into a fully realized standard, with guidelines for extension.

### **3. National Impact**

The CS3DP project will be the foundational event for digital 3D data preservation in the United States. The forums will have the immediate impact of bringing stakeholders in this field together to develop 3D preservation standards as a community of practice. The value of the network itself is immense because it opens the possibility of broad-based national-level discussion, problem solving and solutions that will be applicable to libraries, archives, museums and other institutions across the country. The survey administered by the CS3DP project team has begun the process of building the network by identifying those invested in digital 3D data preservation at a national level. The project team will use the information and momentum from the survey to construct the forums and further engage the community and increase impact.

Practitioners are not often the ones taking preservation actions and curators are often not the ones creating the data. Practically, this set of forums will initiate standards development so that practitioners and curators are no longer forced to recreate the wheel at expense to themselves and the end user.

The impact of shared standards is immense for productivity and cost savings. The deliverables from the forums and the working groups will serve as scalable, freely available resources for the broader community to use, adapt and build upon.

Focusing on 3D preservation will address a critical missing link in the digital 3D data world and greatly impact the field. Because these methods are often employed as a way of preserving valuable physical 3D objects, the absence of standards to ensure that the digital data are also preserved calls the value of the method into question. If the physical objects and surrogate digital data are both at risk, what has been accomplished? While the CS3DP survey exposes this as a concern to the greater community, there are certainly practitioners living in hope while making the best of ad-hoc solutions. Preservation standards for digital 3D data make the entire practice of creation more reliable and effective.

## Schedule of Completion

[illegible]

## DIGITAL PRODUCT FORM

### Introduction

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded digital products (i.e., digital content, resources, assets, software, and datasets). The products you create with IMLS funding require careful stewardship to protect and enhance their value, and they should be freely and readily available for use and re-use by libraries, archives, museums, and the public. However, applying these principles to the development and management of digital products can be challenging. Because technology is dynamic and because we do not want to inhibit innovation, we do not want to prescribe set standards and practices that could become quickly outdated. Instead, we ask that you answer questions that address specific aspects of creating and managing digital products. Like all components of your IMLS application, your answers will be used by IMLS staff and by expert peer reviewers to evaluate your application, and they will be important in determining whether your project will be funded.

### Instructions

You must provide answers to the questions in Part I. In addition, you must also complete at least one of the subsequent sections. If you intend to create or collect digital content, resources, or assets, complete Part II. If you intend to develop software, complete Part III. If you intend to create a dataset, complete Part IV.

## PART I: Intellectual Property Rights and Permissions

**A.1** What will be the intellectual property status of the digital products (content, resources, assets, software, or datasets) you intend to create? Who will hold the copyright(s)? How will you explain property rights and permissions to potential users (for example, by assigning a non-restrictive license such as BSD, GNU, MIT, or Creative Commons to the product)? Explain and justify your licensing selections.

Ownership of the assets will remain with the creators. The project team will expect and encourage the wide distribution and sharing of the materials through the Open Science Framework, git/github, and other appropriate locations. The project documentation and survey results will be licensed as CC BY-ND and the deliverables CC BY-SA.

**A.2** What ownership rights will your organization assert over the new digital products and what conditions will you impose on access and use? Explain and justify any terms of access and conditions of use and detail how you will notify potential users about relevant terms or conditions.

The documentation and survey results will be CC BY-ND, which means anyone can share these, but they may not modify them. The deliverables will have a CC BY-SA. This means the deliverables can be shared and extended as long as they are attributed to the project. The project team will share all documentation and deliverables on the OSF site and display the terms of use there.

**A.3** If you will create any products that may involve privacy concerns, require obtaining permissions or rights, or raise any cultural sensitivities, describe the issues and how you plan to address them.

The project team will share all of the results, including survey results, but they will be de-identified.

## Part II: Projects Creating or Collecting Digital Content, Resources, or Assets

### A. Creating or Collecting New Digital Content, Resources, or Assets

**A.1** Describe the digital content, resources, or assets you will create or collect, the quantities of each type, and format you will use.

Survey results will be in CSV format. 3D models may be created and shared as obj, ply and stl formats. Reports will be generated on the project and shared as PDF's, recordings (mp4) and minutes meetings (PDF) will be created and shared. The final deliverables will be a white paper (PDF) and standards recommendations (PDF, etc).

**A.2** List the equipment, software, and supplies that you will use to create the content, resources, or assets, or the name of the service provider that will perform the work.

Survey responses were generated via an online survey. Scans may be generated via a structured light scanner, triangulated laser scanner, camera or using software such as CAD, etc.

**A.3** List all the digital file formats (e.g., XML, TIFF, MPEG) you plan to use, along with the relevant information about the appropriate quality standards (e.g., resolution, sampling rate, or pixel dimensions).

Survey results will be shared in CSV format. 3D models will be shared in a variety of formats, including stl, obj, ply, etc. Recordings will be in mp4 format. Deliverables will be in PDF formats.

## **B. Workflow and Asset Maintenance/Preservation**

**B.1** Describe your quality control plan (i.e., how you will monitor and evaluate your workflow and products).

The topic of the conference will be discussing quality control measures and will be developed within.

**B.2** Describe your plan for preserving and maintaining digital assets during and after the award period of performance. Your plan may address storage systems, shared repositories, technical documentation, migration planning, and commitment of organizational funding for these purposes. Please note: You may charge the federal award before closeout for the costs of publication or sharing of research results if the costs are not incurred during the period of performance of the federal award (see 2 C.F.R. § 200.461).

Data will be preserved in repositories at 1) Washington University's Digital Research Material Repository (DRMR) which accepts data and is built on the BPress platform. The DRMR has standard data treatments in place, 2) the University of Michigan's Deep Blue Repository, which accepts data and has standard treatments in place and 3) the University of Iowa's Iowa Research Online.

It should be noted that this project will be reviewing specific treatments needed for preservation of 3D data. The project team is aware that attention to 3D preservation needs are not occurring anywhere currently.

## **C. Metadata**

**C.1** Describe how you will produce any and all technical, descriptive, administrative, or preservation metadata. Specify which standards you will use for the metadata structure (e.g., MARC, Dublin Core, Encoded Archival Description, PBCore, PREMIS) and metadata content (e.g., thesauri).

A major aspect of the forums is to develop standards for metadata, but the project will use Dublin Core as a base.

**C.2** Explain your strategy for preserving and maintaining metadata created or collected during and after the award period of performance

This is a major aspect of the forums, but project team members will archive (using local treatments) in their respective institutional repositories as well as sharing via the Open Science Framework as an interim solution. Having a better answer is among the project's main goals.

**C.3** Explain what metadata sharing and/or other strategies you will use to facilitate widespread discovery and use of the digital content, resources, or assets created during your project (e.g., an API [Application Programming Interface], contributions to a digital platform, or other ways you might enable batch queries and retrieval of metadata).

Immediately, content will be available via the OSF instance. Products of the forums will be distributed via community networks, institutional repositories and the DPLA, etc..

## **D. Access and Use**

**D.1** Describe how you will make the digital content, resources, or assets available to the public. Include details such as the delivery strategy (e.g., openly available online, available to specified audiences) and underlying hardware/software platforms and infrastructure (e.g., specific digital repository software or leased services, accessibility via standard web browsers, requirements for special software tools in order to use the content).

All documentation and deliverables will be freely available online. 3D models are often created with proprietary software and it is among the problems we will address in the forums. Products of 3D software such as .stl or obj formats can be consumed in opensource software such as MeshLab or Blender.

**D.2** Provide the name(s) and URL(s) (Uniform Resource Locator) for any examples of previous digital content, resources, or assets your organization has created.

This project has not produced collections to date.

## **Part III. Projects Developing Software**

### **A. General Information**

**A.1** Describe the software you intend to create, including a summary of the major functions it will perform and the intended primary audience(s) it will serve.

**A.2** List other existing software that wholly or partially performs the same functions, and explain how the software you intend to create is different, and justify why those differences are significant and necessary.

### **B. Technical Information**

**B.1** List the programming languages, platforms, software, or other applications you will use to create your software and explain why you chose them.

**B.2** Describe how the software you intend to create will extend or interoperate with relevant existing software.

**B.3** Describe any underlying additional software or system dependencies necessary to run the software you intend to create.

**B.4** Describe the processes you will use for development, documentation, and for maintaining and updating documentation for users of the software.

**B.5** Provide the name(s) and URL(s) for examples of any previous software your organization has created.

## **C. Access and Use**

**C.1** We expect applicants seeking federal funds for software to develop and release these products under open-source licenses to maximize access and promote reuse. What ownership rights will your organization assert over the software you intend to create, and what conditions will you impose on its access and use? Identify and explain the license under which you will release source code for the software you develop (e.g., BSD, GNU, or MIT software licenses). Explain and justify any prohibitive terms or conditions of use or access and detail how you will notify potential users about relevant terms and conditions.

**C.2** Describe how you will make the software and source code available to the public and/or its intended users.

**C.3** Identify where you will deposit the source code for the software you intend to develop:

Name of publicly accessible source code repository:

URL:

## **Part IV: Projects Creating Datasets**

**A.1** Identify the type of data you plan to collect or generate, and the purpose or intended use to which you expect it to be put. Describe the method(s) you will use and the approximate dates or intervals at which you will collect or generate it.

**A.2** Does the proposed data collection or research activity require approval by any internal review panel or institutional review board (IRB)? If so, has the proposed research activity been approved? If not, what is your plan for securing approval?



**A.3** Will you collect any personally identifiable information (PII), confidential information (e.g., trade secrets), or proprietary information? If so, detail the specific steps you will take to protect such information while you prepare the data files for public release (e.g., data anonymization, data suppression PII, or synthetic data).

**A.4** If you will collect additional documentation, such as consent agreements, along with the data, describe plans for preserving the documentation and ensuring that its relationship to the collected data is maintained.

**A.5** What methods will you use to collect or generate the data? Provide details about any technical requirements or dependencies that would be necessary for understanding, retrieving, displaying, or processing the dataset(s).

**A.6** What documentation (e.g., data documentation, codebooks) will you capture or create along with the dataset(s)? Where will the documentation be stored and in what format(s)? How will you permanently associate and manage the documentation with the dataset(s) it describes?

**A.7** What is your plan for archiving, managing, and disseminating data after the completion of the award-funded project?

**A.8** Identify where you will deposit the dataset(s):

Name of repository:

URL:

**A.9** When and how frequently will you review this data management plan? How will the implementation be monitored?