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Community Standards for 3D Preservation (CS3DP)

Forum 1

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Progress Update of Community Standards for 3D Data Preservation: Project Background and Forum 1 Summary

Community Standards for 3D Data Preservation Team

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Overview:

Discussions and guidance on the preservation of digital 3D data have become increasingly necessary to address the stability, reusability, and persistence of this data type. Creation of digital 3D data has expanded rapidly over the last 10 years due to technical advancements in creation and capture. In parallel, emphasis on curation of research data, which aims to ensure digital data preservation, reusability, and reproducibility, has grown. While these phenomena have developed in tandem, they have not adequately intersected. At least in part, this seems due to a lack of mechanisms or opportunities for the respective experts to communicate.

Preservation and sharing of research data in physical and digital forms, as a parts of the scholarly record, are fundamental responsibilities of libraries and museums, and the data curation community has been active in establishing and promoting best practices and standards for many kinds of digital data to ensure that assets can be accessed and reused in perpetuity. Some of this work is applicable to digital 3D data, but attributes of this data type limit applicability. Libraries and museums require consistent standards to curate and preserve data to ensure stewardship expectations are met. However in practice, institutions are often scrambling to fill the gaps with ad-hoc, localized solutions. Local solutions can

create barriers to effective data stewardship and sharing, and they may inhibit efforts for large-scale, national or international data aggregation.

While some guidance exists regarding digital 3D data creation and use, guidelines and studies on management and preservation are woefully lacking. Piecemeal discussions have taken place, but up to now, a consensus on preservation and management practices has not been reached. Indeed, the appropriate questions are just being understood fully. Many institutions may never delve into creating a 3D modeling program, but they will likely be tasked with storing, preserving, and serving digital 3D data. Similarly, practitioners (i.e., those creating 3D data) may not be prepared or equipped to make models widely available or accessible for the longer term. Historically, standards built by librarians and curators without active engagement from practitioners are not successful, just as practitioner-developed standards produced without archiving and access expertise from librarians and curators have also struggled in the long-term. Recognizing this, the Community Standards 3D Data Preservation (CS3DP, http://CS3DP.org) project embarked to pull in these groups as equal partners in design.

The fledgling CS3DP effort first established that, although our backgrounds, institutional roles, and our approaches differed, the CS3DP organizing team shared common questions regarding curation and preservation of digital 3D data. With due diligence, the project team scanned the field to identify existing resources related to digital 3D data preservation. Notable efforts to address 3D data practices include the *London Charter*, which provides high-level principles for the preservation of 3D data ("Principles" 2017), *The Guides to Good Practice* from the Archaeological Data Service (ADS), which provide some basic suggestions for digital 3D data archiving (Trognitz 2017), and *3D-Icons,* which 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). Although we found the introduction of curation in in volume 2 of *Curating Research Data* incredibly valuable, there was only a brief case study describing a 3D preservation workflow (Johnston 2017).

Some other efforts preceding the CS3DP include the NEH funded a forum on 3D in 2015 and 2016, which was focused on the user experience rather than preservation (Humanities Heritage 3D Visualization 2015) and 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). Such efforts have proven invaluable in identifying

problems to be addressed in 3D preservation, community standards development, and formation of best practices, and these were useful blocks from which to begin the 3D community standards conversation.

The Community Survey:

To further assess whether this need of consistent guidance was indeed common for the 3D community, the organizing team decided to survey members of the community to better understand what resources, if any, were in use. The results were striking. We circulated the survey to 3D practitioners, data curators, librarians, museum managers, and researchers, and we received well over 100 responses from individuals who worked with 3D in various ways or had responsibility for taking care of data. Notably, 72% of all respondents said that they do not use documented 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. Most importantly, the vast majority (85%) of all respondents said they would like to collaboratively develop standards and best practices as a community.

The Proposal:

Because the survey reinforced the need to pull a community together to address standards, we began building an effort that we hoped would inspire investment from the various stakeholders. The organizing team developed a proposal for the Institute of Museum and Library Services (IMLS) to explore issues around digital 3D preservation. Just as the CS3DP project proposal was successfully funded by the IMLS, other complementary projects were also funded in the same cycle, such as IMLS NLG National Forum proposal, "Developing Library Strategy for 3D and Virtual Reality Collection Development and Re-Use" (LIB3DVR, http://lib3dvr.org), focussing on 3D/VR library services with the purpose of informing library administrative support, and also "Building for Tomorrow: Collaborative Development of Sustainable Infrastructure for Architectural and Design Documentation" (https://projects.iq.harvard.edu/buildingtomorrow/home), seeking to a national/international collaborative infrastructure to support long-term preservation of digital design data fields architectura/design domain. We see the Principle Investigators (PIs) of the aforementioned projects, Nathan Hall and Ann Baird Whiteside respectively, as essential participants and stakeholders in the CS3DP project, and we have all agreed to work together to progress on shared goals.

Planning Forum 1:

The CS3DP began work in October of 2017, and the first national forum was held February 5th, 6th and 7th of 2018.

The CS3DP project has aimed to not only be useful to those who create, but also those who curate, therefore the project's focus on preservation is meant to provide mutual benefit to practitioners, libraries, museums, and end users. Communication and collaboration is seen as key. The project team is engaged with experts domestically and abroad. Significant work on 3D data has been done in Europe, and therefore effort to gain knowledge and insight from a few European representatives was important, but US-based 3D experts and data curators were targeted as the majority of invited attendees for the first forum. The team identified invited experts through research, survey responses, networking at conferences and by other experts' recommendations. Further, a scholarship program was established, which offered lodging and airfare for those who were prepared to present topics in a poster session. We used the survey responses to identify five areas of focus for the panels and provided guiding questions for the panelists. Panelist presentations and posters were used to ignite discussion and inform the working groups, which would form in the second part of the meeting on Tuesday.

Forum 1 Panels:

The panel on best practices for preservation (http://ir.uiowa.edu/cs3dp/forum1/presentations/1/) included Lisa Johnston of the Digital Conservancy and the Data Curation Network, Francis Pierce-McManamaon from the Digital Archaeological Record (tDAR) and Kieran Nivon from the Archaeological Data Services (ADS). This panel unpacked preservation within digital curation. Data curators who are tasked with addressing many data types grapple with what to do with digital 3D data and require guidance from digital 3D experts on how to treat it. The aforementioned 3D-related content in *the Guides to Good Practic*e, provides broad direction for those within the field of archaeology regarding methods, 3D formats, and minimum essential metadata. However, even with these guides, repository managers find that digital 3D metadata is inconsistent from project to project and often bespoke. Additionally, because digital 3D data is made up of more than the final output, and can be created using various modes of production, the question arose; 'what is the authoritative, raw data?' In the management and storage panel (http://ir.uiowa.edu/cs3dp/forum1/presentations/2/), which included Doug Boyer of Morphosource, the importance of describing the creation modality and distinguishing between the rawest form of data vs processed data was also addressed. Here the question of whether the cloud is appropriate for preservation was raised; it was suggested that local servers may be preferable for preservation purposes.

In the largest panel on Metadata Standards (http://ir.uiowa.edu/cs3dp/forum1/presentations/3/) the essential role of metadata throughout the life cycle of a digital object was discussed. The panel included Andrea d'Andrea of the University of Naples and 3D Icons, Christina Harlow of Stanford University, Julie Hardesty of Indiana University and Jon Blundell of the Smithsonian Institution. This session included a digestible overview of metadata development and decoded confusing terms and approaches. Concepts such as paradata vs. provenance were discussed and ideas and developments in modeling and automation, as well as case studies based on localized work were described.

A lively copyright and ownership panel (http://ir.uiowa.edu/cs3dp/forum1/presentations/4/) included Kyle Courtney of Harvard and Melissa Levine of the University of Michigan.·Panelists described how intellectual property in the 3D realm have not been tested, but typically this is determined by deeming something a *fact* (faithful reproduction) or an *expression* (containing creative decisions). To date how much this applies to digital 3D reproductions is unknown. It emerged that in many cases, creators have had the expectation that their 3D data are subject to copyright,, although this is often not correct.

The final panel on Discoverability/Access (http://ir.uiowa.edu/cs3dp/forum1/presentations/5/) included Jamie Wittenberg of Indiana University, Angel Nieves of San Diego State University and Narcisse Mbunzama of the University of Kinshasa. This topic introduced the need for preservation and sustainability in 3D publishing. Powerfully, it was suggested that 3D access and preservation is *social justice work* contributing to decolonization and the distribution of access to those who are typically underrepresented in conversations about new data types and delivery. Discovery and accessibility challenges depend greatly on where contributors and users are located, therefore designing open source systems that consider developing countries' use of 3D data and development in this area whilst dealing with limited bandwidth and access is needed.

Poster Presentations:

Francesca Albrezzi	University of California, Los-Angeles	For Posterity and Pedagogy: Using 3D Models for Preserving Exhibitions
Katherine DeVet	Texas Tech University	SHAPES: Sharing and Helping Academics Prepare for Educational Success

Cynthia Hudson-Vitale	Washington University in St. Louis	[Digital Baboon: Curating 30 years of Primatology Research Data](#)
Chukwuemeka "Chuk" Ikebude	University of Texas at Dallas	Digital Artifact and Copyright Infringement: Implications for Ownership and Interpretation.
Lisa Johnston	University of Minnesota	Implementing a Cross-Institutional Staffing Model for Curating Research Data
Andrea Thomer	University of Michigan	Minimum information framework development through workflow analysis.
Marcia McIntosh	University of North Texas	Hosting Book History: The 3Dhotbed Project in the University of North Texas Digital Library
Heather Richards-Rissetto	University of Nebraska-Lincoln	Keeping 3D Data Alive
Will Rourk	University of Virginia	Artifacsimile : Democratizing Cultural Heritage Data
Carla Schroer	Cultural Heritage Imaging	The Democratization of Scientific Imaging through Metadata Management and Archival Submission Support
Pat Seed	University of California-Irvine	
Ann Baird Whiteside	Harvard University	
Tassie Gniady & Gary Motz	Indiana University	

Forum 1 Discussion and Outcomes:

Based on the five topics areas and inspired by the presentations and discussions, the working groups formed through self-selection. With the intention of making the meeting participatory and productive, the project team established a guiding document to launch working groups forward, but we also held a town hall at the end of the panel sessions so that, as a community, we collaboratively targeted specific questions and goals brought up in the presentations and discussions.

Topics	Guiding Questions	Discussed	Outcomes for WG
Preservation Best Practices	How do existing practices for digital preservation apply to digital 3D data? What are current digital curation practices and how do they translate to 3D data? What guidance exists or is being developed to provide steps for forward migration and format longevity of 3D data? What is raw 3D data and how do we record digital provenance? How can we work around proprietary file formats?	Define what a 3D model is; it's more than just a given output. Identification of authentic, raw data is undetermined. Important to establish sustainable funding model for long-term curation and storage. Define what we mean by long-term. Calculating costs requires consideration of human time. Develop sense of user needs and how to assess them. Archivists should be involved in the selection and context of data. Need to be able to identify risks via a presentation plan. Preserved models need to somehow reflect the creator's intent.	Guides for creators (incl. rights) on what to keep (and not) and what is needed (incl. obligations/contracts). Guides for what to share. Conduct assessment of costs. Assess how modality relates to these guides. Find a way to capture processes, workflows and use cases. Assess what are the limits of current preservation. Develop priority levels for preservation. File format guidance for communities. Capture info lost in conversion. Identify alternative methods for archiving complex interactive models.

Management & Storage	What data should be kept over the long term? How does one track digital provenance? Should we track digital provenance? What constitutes a master/archival copy? What options are being evaluated for storage of large data sets "in perpetuity"? Cost/benefit analysis for storage solutions? What challenges are repositories facing with this data type?	The use of subscription models for contributors to repositories varies. Subscription models should not be at the user level. The role of augmented data undefined; what if augmented and resubmitted. DOI essential for citation, reproducibility and preservation. Understanding multi-model workflows and how they link together is essential.	Scan existing platforms. Development of platforms. Identify resources/tech requirements, human time/skills. Solutions for migration. Identify institutional repositories; create registry; centralize? Explore problem of immediate open access vs. dark archives. Explore solutions for ingestion / technical validation.

Metadata Standards	Why do we need metadata standards development?	Configuration of declarative workflows needed.	Define scope of 3D that are included (e.g. PG, laser, CT/volume).
	How are standards developed?	Important to look at the metadata model established by 3D Icons for the CARARE metadata.	What is needed for minimal metadata element set
	Given the lack of agreed upon standards for 3D data, what solutions are institutions currently using? What are users' needs regarding metadata?	Questions of how metadata models needs to be.	Creation data - workflows vs. detailed metadata.
	Who are the targeted users?	Need to make use of existing resources; not reinvent the wheel.	Survey use of existing standards and explore mapping to existing documentation.
	What constitutes the minimal metadata for inclusion in a repository?	Establishing metadata and data vocabularies essential because terms are defined differently based on domain.	Weigh benefits of flat vs semantic metadata.
	How can linked metadata be developed for improved workflows.	Our metadata model must consider born digital 3D data as well as capture.	Create a user guide on metadata / tools.
	What would be required for data clean up or migration for previously unstandardized data?	Essential to build metadata model that facilitates interoperability and reusability.	Find tools for extracting embedded metadata.
	What is transparency?	Schema is good for capturing data about object, and not a specific technology, to grow with field. Descriptions of creation should be procedural as well as technical.	Find standardized descriptions by LOD.
		Flat metadata vs. semantic metadata. Need it to be readable by people and machines.	
		Metadata needs to also describe algorithmically generated data and data that was interpolated rather than captured.	

		Metadata needs to describe provenance of physical to digital object to be used for comparative analysis.	
		High-level guidelines will help bridge the gap between treatments of different modalities (e.g., surface vs. CT scans).	
		3D models may be subjective and may be produced with some uncertainty; lichard scale may help describe confidence level.	
		Use of paradata may best support the existence of subjectivity in 3D models	

Copyright & Ownership	What is the current interpretation of copyright law to 3D Data in the U.S. and abroad, and is it appropriate? What can be learned from case studies of copyright from other media? Who owns the data? Who owns copyright on collaborative project data? What are strategies for negotiating agreements for content with limited rights due to permits or cultural sensitivity?	Data is not subject to copyright, so often times it's a matter of contracts and licensing. Many of the questions around 3D data remain untested in law. Open data is essential because commercially protected data would make it harder to openly publish. We can set the tone now on how we want our policy to look.	Develop user guide - when copyright when contract/license. Evaluate from raw to derivative chain. Develop tools to understand when it is creative/original. Find and provide sample workflows / process to evaluate and list rights/choices. Guidance on sharing sensitive material/public. Understand ethical restrictions/consultation-not just "legal".
Access & Discoverability	What platforms are being used to share 3D data? What challenges are repositories facing? In what state are users expecting 3D access? How is the lack of consistent metadata standards impacting the ability to share 3D data? How can linked metadata impact discoverability? Who are the targeted users?	Government agencies don't consistently support making public domain data available. Considerations of data that exists in government agencies may have baggage due to past wrongdoings. Sensitivity needs to be figured into this problem. NAGPRA (Native American Graves Protection and Repatriation Act) influential in making sure people are held accountable. Preservation is a social justice issue, but it's important that we don't	Create a list and review of available repositories. Guide for user to identify reliable model. Criteria for peer review. Guidance on data citation. Explore 3D reviewers list. "Watermarking". Assess screen reader. Certifications/NINES - Nineteenth Century Scholarship Online.

		just add thin layers of social justice to 3D preservation; this means involvement of affected communities. We need to maintain the linkage between physical objects (e.g., at museums) and models to preserve both. May need to establish a model of peer-review.	

Working groups consist of two facilitators, one reporter and several members. One of the two facilitators was selected when the working groups broke out at forum one (the other was to be selected at the first virtual meeting to give more opportunity for those who couldn't attend forum one to take on a role) as well as the reporter. Working groups were asked to develop the questions and goals established in the town hall and work toward proposed solutions for 3D preservation. Groups will meet virtually and progress toward goals outside of the forum events; the whole CS3DP group meets on a monthly basis to share developments.

Working groups developed short, medium, and long-term goals, which include tasks such as producing a working glossary, creation of assessment tools, and workflow documents. To date, groups have been actively meeting and producing. Moving forward, the CS3DP project intends to host forum two in August 13, 14, and 15 of 2018, where presentations of working group developments and further work will occur. We also anticipate communication between CS3DP and the Building for Tomorrow and LIB3DVR projects, as they will have held one or more forum events respectively by this time. In the end, the work of CS3DP participants will be collected into a volume to both provide suggested solutions and move the larger community toward consensus on standards.

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