

3D Research Data Curation Framework (3DFrame): Understanding 3D Data Creation, Analysis, & Preservation Practices across Disciplines

Three-dimensional, or 3D data creation and analysis techniques are increasingly being used for research and instruction across disciplines; however, such methods present major challenges to existing digital curation frameworks in academic libraries and other institutions. "3D Research Data Curation Framework" is a 3-year, \$584,517 Applied Research project led by Dr. Zack Lischer-Katz (Asst Professor, UArizona, School of Information) and Matt Cook (Digital Scholarship Program Mgr, Harvard Library) that will use qualitative methods to study 3D data creators in order to develop a digital curation framework that aligns 3D data creation and curation methods with FAIR (Findability, Accessibility, Interoperability, and Reusability) data principles. This framework will enable academic libraries and other institutions, including public libraries, to support the creation, curation, analysis, and use of 3D data. This project is aligned with IMLS Program Goal 3, as it aims to "improve the ability of libraries and archives to provide broad access to and use of" 3D information resources, and Objective 3.2, as the project will "support innovative approaches to digital collection management," specifically the curation and reuse of scholarly 3D data for a range of institutions and users. Within the framework, PIs will develop: 1) Service/curation models (including roles and responsibilities) for libraries to support digital curation of 3D research data through their lifecycle; 2) metrics for evaluating the quality of 3D research data; and 3) workflows for creating, evaluating, exhibiting, and preserving 3D data. The PIs will build upon findings of their previous, IMLS-sponsored project, [LIB3DVR](#), which identified a pressing need among researchers, 3D creators, and library professionals for new digital curation models for 3D data formats. The PIs will contribute their unique expertise: Dr. Lischer-Katz uses qualitative methods to study the curation of visual media formats and is co-editor of the CLIR report, [3D/VR in the Academic Library](#); and Mr. Cook facilitates 3D and virtual reality-based research at Harvard Library and founded the emerging technologies unit at U. of OK Libraries.

Project Justification: Addressing the challenges of 3D data curation is an urgent problem for researchers, instructors, and collecting institutions. 3D data creation and advanced visualization (e.g., virtual reality) have matured and are increasingly used in a range of research disciplines and in library-supported makerspaces. Moreover, researchers are producing high-resolution 3D data in a number of disciplinary contexts ranging from cultural heritage to STEM. A comprehensive, multidisciplinary understanding of the specific methods of 3D data creation and analysis necessary for building digital curation models has yet to be empirically developed. In the age of COVID-19, when access to physical collections may be limited, it is important that 3D data are interoperable and reusable. In order to maintain provenance and data quality, information institutions need digital curation models built on empirical analysis of the practices of 3D creators. Because smaller institutions outside of research libraries, including public libraries, are also adopting 3D/VR technologies, there is a broad need for empirically-based 3D data guidelines and workflows.

Project Work Plan: This project seeks to answer the following questions: 1) How do researchers evaluate and document the quality of their research data throughout the 3D data lifecycle and how do these practices shape their quality control and interpretive activities? 2) How do researchers use immersive technologies to visualize and analyze their 3D research data? 3) What roles and methods should information institutions adopt to best support 3D data creation, analysis, and curation workflows? To address these questions, this project will use a comparative, multi-case study of 6 sites that are currently creating and analyzing 3D data. The PIs have established relationships with 4

research labs actively producing 3D data (Harvard, UArizona, UC-San Diego, and UMass-Amherst). Partners at these institutions work with zoological specimens, [mineralogical and archaeological specimens](#); and historical buildings and landscapes. Two additional research sites will be recruited to represent public libraries and smaller cultural heritage institutions (e.g. local and/or regional museums). **Phase 1** of this 3-year project will consist of participant recruitment and data generation. PIs will travel to research sites to generate data and document participants' workflows, using participant-observation and interviews with 3D creators. The PIs will build computer workstations that will emulate the participants' working environments, enabling close analysis of how participants use 3D software and hardware for creation and analysis. In **Phase 2**, data will be transcribed and coded following grounded theory methods and guided by assumptions drawn from science and technology studies concerning the social shaping of technology. The PIs will develop case studies and cross-case analyses, which will be used to develop data curation models, quality control criteria, and service models. In **Phase 3**, findings will be disseminated through conferences, publications, an online toolkit, and an immersive, multi-user online exhibit with VR support.

Diversity Plan: Additional 3D creation sites will be recruited from smaller institutions, so that the project findings will benefit institutions of diverse sizes and stakeholder groups. An advisory board that includes early-career information professionals from underrepresented backgrounds will help ensure that the project is executed with diverse input. Participants who are currently creating 3D data at varying scales will be recruited. Participants' projects will range from the microscopic (via tomography), to the macroscopic (via structured light), to the landscape scale (via drone-based photogrammetry). This diversity will enable the PIs to study 3D creation practices along a continuum of creation scales and scanning paradigms, ensuring that project outcomes are broadly applicable.

Project Results: Understanding how researchers are creating and curating their 3D data will advance knowledge and best practices for 3D data creation workflows and curation strategies for libraries and other collecting institutions across the U.S. The PIs will publish findings in top-tier LIS practitioner and research journals, and will create an open access toolkit (i.e. throughput workflows, quality control procedures, etc.) that will provide guidance for library and information science professionals and aid in the design of 3D data repositories and curation tools. The toolkit will consist of a guide containing models and techniques for customizing digital curation approaches, similar to the [Data Curation Profiles Project](#). Research outputs will be useful for other projects that are also developing guidelines, including the [CS3DP project](#), which recently published a guidebook, including case studies, for supporting 3D data curation and preservation in libraries, but does not include empirically-grounded analysis of 3D creation practices gathered from the field. Members of related 3D initiatives, experts on 3D and virtual reality, library and museum practitioners, digital curators, and researchers will be recruited for the advisory board to ensure broad usability of project results.

Budget: The \$584,517 budget includes \$94,551 for student support (graduate stipends and undergraduate hourly wages); \$30,000 for travel (PI and student site visits for data collection, and conference travel to present results); \$4,000 for computer hardware; \$3,000 for software; \$11,400 for VR hardware; \$40,000 for a consultant to design/build the VR exhibition; \$107,661 for 3 years of the 2 Co-PI's salaries: Dr. Lischer-Katz (20% effort, 9-month appointment), Mr. Cook (15% effort, 12-month appointment); fringe benefits for Co-PIs, and grad student (with tuition remission) of \$88,929 for 3 years; and \$204,976 in total indirect costs, at the on-campus, negotiated rates of 53.5% (U. of Arizona) and 69.0% (Harvard subaward).