NATIONAL ENDOWMENT FOR THE Humanities

DIVISION OF **PRESERVATION AND ACCESS**

Narrative Section of a Successful Application

The attached document contains the grant narrative of a previously funded grant application. It is not intended to serve as a model, but to give you a sense of how a successful application may be crafted. Every successful application is different, and each applicant is urged to prepare a proposal that reflects its unique project and aspirations. Prospective applicants should consult the NEH Division of Preservation and Access application guidelines at http://www.neh.gov/divisions/preservation for instructions. Applicants are also strongly encouraged to consult with the NEH Division of Preservation and Access staff well before a grant deadline.

Note: The attachment only contains the grant narrative, not the entire funded application. In addition, certain portions may have been redacted to protect the privacy interests of an individual and/or to protect confidential commercial and financial information and/or to protect copyrighted materials.

Project Title: The Giza Project: Consolidated Archaeological Reference Database II

Institution: President and Fellows of Harvard College

Project Director: Peter Der Manuelian

Grant Program: Humanities Collections and Reference Resources

The Giza Project: Consolidated Archaeological Reference Database II
New Models for Integrating 3D Visualization Data in Archaeology

3. Narrative

SIGNIFICANCE:

The Giza Project: Mission and Objectives

The Giza Project is a collaborative international initiative based at Harvard University, dedicated to the creation of substantial new types of resources that provide unprecedented global public and scholarly access to the extensive historical and material legacies of Giza, Egypt, one of the most famous and important ancient heritage sites in the world. Ancient Egypt's widespread, nearly universal appeal to global audiences makes it extremely well-suited to be a focus for humanities exploration, education, research, and experience. As is the case with many of the most significant archaeological sites, field work at Giza has spanned over a century and been undertaken by multiple international teams. The records from their work comprise many tens of thousands of artifactual finds, archaeological field records, photographs, correspondence and other diverse types of media that document surviving, as well as now lost, contexts of the physical archaeological site. This immense trove of extant Giza remains informs us about all facets of ancient Egyptian culture during Egypt's earliest manifestations of statehood in the third millennium BCE, as well as several later historical periods.

These records are now housed in archival collections in museums and universities around the world. Difficulty of access to the physical archives, as well as the large volume and varied nature of datasets employing different organizational systems, nomenclature, and languages, have traditionally made comprehensive study, tailored educational use, casual interaction and "browsing" both cumbersome and time-consuming, if not logistically impossible.

The Giza Project aims to level the playing field by facilitating access to all records germane to Giza archaeology and culture, making them available and easily discoverable online for scholars and the public at every experience level. We will ultimately produce a new online educational, reference, and research portal that is "all things to all people." It will offer general browsing and guided exposure to Giza's "highlights" on one hand, while facilitating advanced Egyptological, archaeological, and (art) historical research, as well as many other avenues of humanistic inquiry, on the other. In pursuit of this goal, the Giza Project has followed two primary, complementary strategies: (1) data management and informatics, and (2) 3D-graphic modeling and visualization. Both facets of the Giza Project have well-established histories of innovative organization and output (see below, History, Scope and Duration). In track (1), with previous NEH support, the Project has undertaken the assembly, processing, and cross-linking of numerous disparate international collections of digitized archival data to create the Giza Consolidated Archaeological Reference Database (GizaCARD), the most inclusive repository of Giza's record—past, present, and ultimately future—ever built. GizaCARD is the centralized hub for presenting Giza's entire material legacy to a global audience through both familiar and newly-conceived online interfaces, production of educational and exhibition materials, and publications aimed at users of all skill levels and interests. In track (2), based on this wealth of primary research documentation, the Project has produced ambitious, archaeologically accurate, 3D virtual models of the Giza landscape and monuments for use online, in education, and in media productions.

While some projects digitize and electronically curate archival collections and others visualize ancient sites and monuments in computer graphic renderings as a means of understanding and communicating knowledge or theories about them, the Giza Project undertakes both, for the first time situating the models back into their data-derived contexts to help users visualize and understand that original data. The longer-term outcome will be the integration of GizaCARD—the most robust Giza knowledge base ever built—and the Project's 3D models—the most accurately constructed "virtual Giza" environment—into an online visual search engine and interactive educational resource the likes of which have never been produced. The future Giza Project website is being planned in parallel with GizaCARD. We have submitted a proposal for a 2015 NEH Digital Projects for the Public (DPP) Prototyping Grant

that, if successful, provides for the completion of a prototype website during a funding period of 2016–2017 (submission title: *Digital Giza: A New Portal to the Pyramids*). Whereas the work proposed for that grant would greatly further progress on the planned web resource, an unsuccessful DPP proposal would not prevent a much slower, scaled creation of the website. Some Harvard-based programming staff and resources will be made available to the Giza Project by the Faculty of Arts and Sciences' Research Computing.

This NEH Humanities Collections and Reference Resources (HCRR) proposal seeks two years of funding to further this important work and support the merging of the Giza Project's two heretofore discrete tracks via the incorporation of these 3D computer reconstructions of monuments, objects, and even individuals associated with Giza (as well as all related derivatives, source files, and documentation employed in the construction of these models) into our core data management system, GizaCARD. These born-digital models themselves thus become new forms of data, which will be integrated into the database and interlinked with more traditional types of data (photos, maps/plans, PDFs, etc.) on which they are based. This integration serves several important functions:

1) It provides transparency for the model, documenting the construction process by linking all the disparate pieces of information that were used by scholars and technical artists to build the finished product.

2) It allows for all data, archival and born-digital alike, to be intelligently cross-referenced so as to provide the broadest and most inclusive foundation for the forthcoming public Giza web resource, which will make these 3D model assets available to users online.

3) It provides a useful best practices model for the preservation and long-term storage and management of born-digital visualizations (and their associated files), created in the service of promoting knowledge, whether archaeological, (art) historical, or scientific.

Giza Consolidated Archaeological Reference Database (GizaCARD)

The work proposed for this two-year HCRR request is the completion of the Project's main data management platform, GizaCARD, via the creation and cross-referencing of database records for all of the Project's 3D modeling assets and associated source and derivative files. The essential foundation for implementation of the future web resource is the comprehensive population, interlinking, and back-end organization of this database, for which purpose we have been processing and linking tens of thousands of digitized documents and media related to Giza's archaeological record. The integration of these traditional archival data types into GizaCARD was the subject of a previous HCRR grant award, and is on schedule to be completed in the designated two-year period covered by that grant (2014-2016). The inclusion of the 3D modeling assets as a brand new data type is the final necessary major step in readying the database to support the Project's upcoming integrated web resource.

The data amassed by the Giza Project at Harvard now represent the largest self-contained digital assemblage of Giza archival and documented artifactual materials in the world, totaling approximately 170,000 files and occupying 820 GB of storage space, all of which have been or are currently in the process of being integrated into GizaCARD. Three-dimensional modeling assets to be incorporated into the database during the period covered by this grant proposal so far total approximately 150 primary models and media productions (including narrated video fly-throughs and animated featurettes), as well as more than 5,000 derivative (2D) media files used in modeling processes and output. Additionally, all source files utilized in the production of a model will be compiled and presented in logically-constructed citation documents for each finished model in order to provide complete transparency in the choices made during the modeling process. These modeling assets will for the first time, as part of this proposal's implementation, become fully integrated data types, accounting for an additional 1.2 TB of stored files. The totality of this substantial volume of records will become publicly available as a vast and complex array of interrelated information that reflects Giza's important material and cultural legacy. It also provides a new model for best practices concerning the production, documentation, and management of born-digital reconstructions.

Audience(s) and Use

The inclusion of the 3D modeling assets into GizaCARD is essential to providing optimal paths for research and casual exploration in the future Giza Project web resource, which is our longer-term focus. The information will vary primarily on the basis of how *deeply* into the data users wish to go. For example, **scholars** may use the 3D models in order to visualize differing experimental research hypotheses. To do this, they will require detailed documentation of the choices and decisions that went into the construction of these models in order to assess the value of various forms and sources of data. For this reason, we will provide several types of precise model citation documents to allow for complete transparency in the modeling process (see Methodology and Standards below for details).

Students will also need to understand how the primary data underpins the models as they assemble diverse materials to discuss a particular historical topic or archaeological feature (for example, a statue) for class presentations or papers. They will be able to conduct a simple search with an object accession/field number and retrieve all original documentation— in-situ photos, modern color studio imagery from its home institution, field diary entries describing its discovery, architectural plans of its findspot and archaeological context, as well as published and unpublished manuscripts—associated with the designated artifact. They may also choose to pull up the 3D computer model of that statue, as well as a data-derived model of the tomb or temple in which the object was discovered, allowing them more easily to contextualize the piece's provenance.

For **the general public**, the 3D model will provide views and experiences of the plateau at any spatial scale and vantage point, including from positions no human could attain: for instance, underground, allowing for visualization of relative positions and sizes of the countless burial shafts beneath the tombs. It will also offer access to areas of the Giza Plateau that are closed to visitors, reburied, deteriorated since excavation, or otherwise inaccessible. We see the benefits of the website as an educational hub centered on digital archaeology as a new learning forum for the participation of anyone equipped with a web browser and some interest in ancient peoples, history, or human heritage in general.

Research and Educational Significance

We include the following examples among the many important questions and themes that the resources drawn from GizaCARD will address:

The cemeteries of the Giza Plateau represent the first examples of ambitious "mortuary urban planning." How did their tombs develop chronologically, both internally as discrete cemetery zones and in the larger context of the entire Giza Plateau?

Users will be able to view juxtapositions and comparisons within the virtual 3D environment, both above and below ground, providing a new matrix of spatial relationships between structures as key details for clarification of architectural phasing.

What were the politics and socioeconomics of space and place at Giza? The Western Cemetery contained one of the largest non-royal tombs at Giza, belonging to Hemiunu, the architect of the Great Pyramid itself; was this area therefore the premier elite cemetery of the entire Giza Necropolis?

Data-derived 3D models recreate original spatial and use contexts of architecture and artifacts, providing opportunities to detect hierarchies of space and consumption.

How do genealogical and other relationships between tomb owners impact the historical reconstruction of the Old Kingdom, the first flourishing of ancient Egyptian statehood?

The assembly and visualization of tomb wall scenes alongside archaeological documentation provides broader insights that would be missed by studying single tombs in isolation.

What is Giza's contribution to the overall development and metamorphosis of Egyptian art?

Giza's monuments include unique stages in the decorative program of funerary chapels, sculptural forms, and modes of artistic expression.

How was Giza revived and reimagined in later eras, long after the end of the Old Kingdom Pyramid Age?

Virtual reconstructions are a particularly good way to visually trace the development of particular locations and monuments over time.

The scholarly potential of GizaCARD's content extends well beyond the Egyptological and archaeological communities to encompass a number of other areas of the humanities and social sciences. These include, for example (see also Dissemination below): the early history of scientific archaeology, field methods (e.g. stratigraphy), and technology (e.g. photography); military history: World Wars I and II; socioeconomic history (historical references to prices, wages, food shortages, labor disputes); colonial history (Egypt under British rule, 1882–1952 CE); history of museum acquisition and presentation practices; cultural and environmental histories (e.g. photographic documentation of local life before and after the Aswan High Dam quelled annual Nile flooding in Egypt); and other topics (e.g. travel narratives, visits to Giza by prominent world figures; local crime reports).

Some of the many publications that drew information from previous Giza Project websites dealt with narrowly-focused Egyptological research topics, while others harnessed the data to address subjects in fields far outside traditional Egyptology. For example, Stangl's 2010 master's thesis (http://www.ub.tuwien.ac.at/dipl/2010/AC07808887.pdf) for the Technische Universität, Vienna, utilizes a 3D computer model of a decorated tomb at Giza as "both a reference and a related visualization project" for a case study for simulating interactive virtual spaces in the digital humanities. Wendy Doyon in her forthcoming PhD dissertation for the University of Pennsylvania examines the lives of native Egyptian workmen employed by Western Egyptologists of the late 19th and early 20th centuries, whose experiences are recorded in our English and Arabic Expedition diaries. Kulitz & Ferschin, in their chapter on "Archaeological Information Systems" in H.G. Bock *et al*. (eds.), *Scientific Computing and Cultural Heritage: Contributions in Computational Humanities* (2013), laud the Giza Project as one of only a "few projects [that] store all kinds of documents in databases and make the information accessible via internet." Other major online academic and popular resources, such as the UCLA Encyclopedia of Egyptology (http://escholarship.org/uc/nelc_uee) make extensive use of our earlier Giza Archives website (www.gizapyramids.org). We anticipate that the future Project web resource, based on our successful integration of the synthesized archival data of GizaCARD with the visual and interactive capabilities of the3D model assets, will advance a new paradigm for future information management and dissemination for complex archaeological sites, because it offers optimal versatility for the widest array of end users.

HISTORY, SCOPE, AND DURATION:

Project History and Context

The Giza Project at Harvard University is the product of the culmination and expansion of an earlier archival project with a proven track record of more than a decade of archaeological data processing and an award-winning website. The Principal Investigator of the current proposal initiated work in 2000 as an employee at the Museum of Fine Arts (MFA), Boston, with the support of the Andrew W. Mellon Foundation. The primary goal of the MFA's "Giza Archives Project" (GAP) was to provide world access to the Giza data from the Harvard University–Museum of Fine Arts (HU-MFA) Expedition to Egypt, active from 1905 to 1947. Project personnel scanned, transcribed, and created database records for tens of thousands of original Giza photographs and glass plate negatives, excavation diaries and object/photo registers, architectural and site maps and plans, epigraphic drawings, researcher notes, shipping paperwork, correspondence and unpublished manuscripts, modern publications, etc., which were then made freely available online to scholars and the general public when the first GAP website was launched in 2005 (http://www.gizapyramids.org).

A series of succeeding Mellon grants eventually totaled more than $3 million over ten years (2000–2011), while 475 individuals contributed to the work: Egyptological staff, undergraduate and graduate students, museum docents and volunteers. There are currently more than 80,000 individual HU–MFA Expedition records on www.gizapyramids.org. The Society of American Archivists selected the Giza Archives Project website as the winner of the 2010 Philip M. Hamer and Elizabeth Hamer Kegan Award in recognition of its outstanding efforts in promoting the knowledge and use of collections (http://www2.archivists.org/governance/handbook/section12-hamer). The Giza Archives Project was also a 2011 Computerworld Honors Program laureate, in the Training and Education category (http://www.eiseverywhere.com/ehome/CWHONORS2011/35791/?&).

This digitized, open access approach has since become the preferred means of providing access to previously hard-to-find or restricted scholarly information. Many art and archaeology museums have incorporated these types of data into their own public webpages for their own collections. However, very few of them are also able to include all the complementary data from other museums with related materials. Through collaboration with all the institutions throughout the world that sent expeditions to Giza and now hold objects originating from the site, the Giza Project database and planned website will comprise an unprecedented global effort with the pioneering goal of being the central repository and research hub for all Giza data from all collections and spanning all time periods.

In 2009, the PI and the Project launched a collaboration with 3D modeling partners Dassault Systèmes (http://www.3ds.com/), with the goal of building a three-dimensional virtual model of the entire Giza Necropolis based on archaeological data made available on the GAP website. A preliminary pilot website (http://giza.3ds.com/) was launched in May 2012, combining some of the traditional Giza archival data with a navigable 3D model of the entire site. Selected tombs and temples were constructed in detail, and animated guided tours with the PI's narrated voiceover, and other interactive features, enhanced the experience. This allowed the Project to expand its outreach greatly beyond the original Mellon Foundation mandate of providing an online resource primarily for scholarly research. Hundreds of newspapers, magazines, online blogs and technology reviews from all over the world have featured articles praising the "Giza 3D" website. Dassault has collected a selection of this global press coverage in dozens of languages (please see the 583-page, 60 MB PDF document available for download at http://www.hightail.com/download/UW16TkF0OW5ubHlFQk1UQw). The website itself enjoyed over 450,000 hits in its first six months, while an introductory two-minute YouTube video about the website has garnered over 100,000 hits (http://www.youtube.com/watch?v=r46ADKia6l0).

More recently, Dassault Systèmes has ceased supporting the proprietary infrastructural components of Giza 3D's modeling platform and of the Giza 3D website itself, which will eventually cause the site to cease functioning. After that point, the forthcoming new Digital Giza web resource will be the only interface through which these sophisticated models will be available (see Sustainability of Project Outcomes and Digital Content below for our shift to non-proprietary, open source solutions).

Current Scope and Duration

The PI became the Philip J. King Professor of Egyptology and Director of the Semitic Museum at Harvard University in 2010, and the Giza Project found a new home there the following year. On the occasion of the Project's new incarnation at Harvard in 2011, it received a one-year grant of $240,000 from the Leon Levy Foundation (http://leonlevyfoundation.org/), which supports research and scholarship in the arts and humanities, particularly the study of the ancient world. In 2014, the Giza Project was awarded a 2-year NEH Humanities Collections and Reference Resources (HCRR) grant (ID number PW-51569-14) for the creation and population of our core data management system, the Giza Consolidated Archaeological Reference Database (GizaCARD). Over the course of the grant period (2014–2016), Project staff members continue to process and cross-reference thousands of digitized Giza documents and media from collections in North America, Europe, and Egypt. The consolidation and cross-referencing of these separate archives (which together total nearly 1 TB of information) in GizaCARD effectively configures these individually isolated "islands" of data into an associated comprehensive framework.

The incorporation into the database of Project-generated 3D computer models of monuments, objects, and individuals associated with Giza, as well as the creation and incorporation of all related source file records and citation documentation employed in the construction of these models, is the work proposed for this second HCRR grant iteration. We will be carefully following (and also, in some cases, establishing) best-practice protocols for this innovative approach to documentation of these 3D model assets: chronicling production stages (e.g., still images); recording citation sources; and developing and implementing a documentation system for "live scenes" in our models and educational narrative videos. These models along with all their derivative files will then be fully networked to all other traditional data types in GizaCARD to create a new form of research tool, which will provide the back-end data foundation for the upcoming free online public resource (not part of this grant proposal). This new

educational and immersive website will include a groundbreaking visual database, a freely navigable, real-time "virtual Giza." With the scholarly resource strategy established by http://www.gizapyramids.org, and the 3D immersive and world outreach strategy demonstrated by http://giza.3ds.com/, we believe that all the key pieces are now in place to form the largest and most innovative publicly-available Giza knowledge base ever assembled.

The following is a summary of past, present, and future goals and objectives for the Giza Project. These goals have been divided into three stages:

Stage 1 (2000–2011) [Mellon grant period]. The Giza Archives Project at the Museum of Fine Arts, Boston, collected and digitized all materials pertaining to the 40+ year-long HU–MFA Expedition to Giza, resulting in the creation of more than 80,000 database records. To provide access to this information, the Project produced two free public resources: the scholarly research website http://www.gizapyramids.org and the pilot 3D website http://giza.3ds.com/.

Stage 2 (2011–2016) [including current HCRR grant period (2014–2016)]. The Giza Project at Harvard University is producing an all-inclusive and fully integrated new database (GizaCARD), amalgamating all of the major collections of Giza objects and archival holdings across three continents, as well as periodically continuing to construct new 3D models for eventual inclusion in the upcoming new public web resource.

Stage 3 (2016–2020) [including proposed HCRR grant period (2016–2018)]. The Giza Project will create, incorporate, and interlink all 3D model-related assets, derivatives, and source files, as well as accompanying documentation, into its database (GizaCARD). It will then construct a new fully-searchable interactive public Giza website, combining the archival "deep" data from all the individual global collections with an immersive 3D virtual model interface.

METHODOLOGY AND STANDARDS:

Primary Activities

The methods proposed for the HCRR grant period include two primary types of activities, both advanced as model practices in information management for 3D visualization data. The following practices should be readily adaptable to most research-based disciplines: (1) the generation of formal, consistent documentation for all sources of information applied to the construction of the models and all productions using the models, and (2) the thorough integration of the models (along with their components, derivatives, reference documentation, and any media productions in which they are used), with the complete holdings of primary archaeological data. This level of documentation is virtually absent from most kinds of visualization that circulate outside of specialized academic and technical circles. Popular online outlets for releasing 3D models, such as Google's 3D Warehouse (https://3dwarehouse.sketchup.com/) and Sketchfab (https://sketchfab.com/), are venues for display and distribution, without readily available means of citation and documentation beyond minimal annotation/caption functionality. Although theoretically ideal, in practical terms a step-by-step, decision-by-decision narration of the complete process of model building is far too cumbersome for both creators and consumers to be a realistic expectation. This fact, along with the relatively recent adoption of visualizations in academic disciplines (as compared with other forms of data representation), likely explains the slow development of documentation standards beyond the traditional bibliography and/or a basic slate of "movie credits," even in academic applications.

As a solution we propose a suite of three reference documents to accommodate a reasonable and necessary level of transparency and documentation for archaeological visualizations: (a) the general build process in the creation of the model; (b) the documentation of sources used in the model's creation; and (c) proper citation for all instances of the model's use, both on its own and as a component of larger productions, including references to how it and associated elements of the production have been employed. A more detailed exposition of these three reference documents follows immediately below and

corresponds with examples of templates and completed sample documents included in Section 8: Appendices.

Reference Type #1: Visual Construction Summary (VCS)

Please see Section 8: Appendices for the sample Visual Construction Summary for The Mastaba Tomb of Queen Meresankh III.

This documentary device is the least formal of the three. Its function is to act as a visual "quick-reference" sheet for the overall progression that a 3D-graphic model underwent from start to finish. Its aim is not to be all-encompassing or systematic in coverage of the model. Rather, it is the digital equivalent of periodic or time-lapsed photography of a real-world construction site—a sequence of images and figures assembled to generally illustrate steps in the process that led from earliest construction planning to finished structure (or object, avatar, landscape, etc.). Simple in form, the Visual Construction Summary allows ample choice of how much or how little to show based on several factors, including the size and complexity of the model, special artistic techniques, areas of particular difficulty/attention, etc.

Reference Type #2: Model Sourcing Document (MSD)

Please see Section 8: Appendices for (a) blank template for the Model Sourcing Document, with instructions; (b) completed Model Sourcing Document for The Mastaba Tomb of Queen Meresankh III.

This form is composed of sections that collectively fulfill several important needs of archaeological visualization data. First and foremost, it includes a complete record of the source materials used in the creation of a model (e.g., primary data records and images, publications, theoretical interpretations, specialist communication, unusual or non-traditional sources, etc.), one that extends considerably beyond a standard written bibliography. A section for "Interpretive Specifications & Commentary" encourages the explanation of decisions and special details that are particular to a given model, especially for instances in which extension of data and/or artistic license were required. Documentation includes accessory files such as images of model surface textures (e.g., materials, ground types and coverings, human and animal "skins," etc.) and sound files (e.g., environmental sounds, activity sound effects, ambient noise, etc.) This sourcing document also preserves attributes of the model as a data object, such as the 3D formats in which it exists as well as the file formats used as underlying or integrated components. Similarly, technical background is reflected by a listing of the primary software tools with which the model was made. The sixteen categories of information identified as essential for this document are based largely upon the combined recommendations of the Archaeology Data Service and Digital Antiquity, as published in their Guides to Good Practice for "virtual reality" projects. We have adopted several recommended elements for general documentation, methods and techniques (see http://guides.archaeologydataservice.ac.uk/g2gp/Vr_5-2; http://guides.archaeologydataservice.ac.uk/g2gp/Vr_5-4). We include some categories as presented, while others are adjusted slightly or conflated in the interest of crafting a template that is suitably comprehensive but still manageable.

Reference Type #3: Scene Composition Documents (SCD)

Please see Section 8: Appendices for (a) blank template for Scene Composition Document, with instructions; (b) completed Scene Composition Document for one segment of the animated video "The Wonders of Queen Meresankh's Tomb."

Although archaeological models of monuments, objects, avatars, and landscapes may be used and presented individually to much benefit, most often they are combined into vignettes, scenes, animated video productions, and applications (e.g., real-time environments, educational media, games, etc.). A modelled monument may itself be the environment, with other modelled content (e.g., avatars and artifacts) inserted as elements to create a larger composite production. For this reference document we apply the term "Scene" broadly to encompass all of these uses of model assets in media productions.

Visualized Scenes communicate information in order to serve a wide expanse of research, educational, entertainment (and indeed, "edu-tainment"), and exploratory purposes. So, their target

audiences are equally diverse. However, the importance of providing the means to understand the material being presented is nonetheless the same for *all* viewers/users. Archaeological information is fundamentally about spatial and situational relationships among people and things—*who* did *what*; *when* and *how* did they do it; *where* and with *what*? Ultimately archaeologists then address interpretive questions of *why*. Visualizations are powerful tools for communicating and testing these aspects of understanding the past, and perhaps no tool is better-equipped for conveying all of them at once.

The processes and decisions by which the inherent limits of archaeological data are overcome to produce finished models and Scenes are, by necessity, combinations of empirical, interpretive, extrapolated, conjectural, and artistic information. The proportion of each must be gauged mainly by the information that the visualization production must convey— which we refer to generally as the "narrative." Seldom are these background details available to viewers/consumers along with a media production itself. The majority of viewers cannot dissect what aspects of a Scene stem from recorded or extrapolated data, which are derived from a scholar's theory, and which are educated conjecture or required wholly artistic license in order to generate a complete Scene or suit the narrative.

Our proposed Scene Composition Document (SCD) is adapted directly from a methodology advanced in the recent *Nature Methods* article "Transparency in film: increasing credibility of scientific animation using citation" (Jantzen *et al.*, 2015). This article is itself a response to a similarly urgent need in the biological-biomedical sciences ("Bio-cinema verité?" 2012), which has in recent years turned increasingly to animated visualization as a means of demonstrating biological structures, mechanics, and interactions at the cellular and molecular levels to visualize theoretical models based on lab experiments. Once again we have slightly simplified and adapted portions of the published approach to be more conducive for use with archaeological datasets.

Preparing for a Scene Composition Document begins with the identifications of all **elements** that comprise a scene. These are:

ELEMENT TYPES	DESCRIPTION
ENVIRONMENT	Setting and surroundings of scene subject or activity; provides containment, spatial parameters, and context
CHARACTERS-primary	Primary subject(s) of the scene; central to theme or narrative
CHARACTERS-secondary	Secondary subjects of the scene; peripheral or supportive to the theme or narrative
OBJECTS	Non-fixed elements of the Scene, i.e., "props" or scenic elements that are not fixed components of another element such as the environment
DATA OBJECTS	A primary data item, included wholly or partially in the scene; may appear statically/dynamically/interactively
TEXT	Written, on-screen text
ACCESSORIES	Assistive communication device
INFORMATION GRAPHICS	Visual representation of data synthesis, generated for this Scene (i.e., not a data object)
AUDIO	Auditory Track (e.g., soundtrack, ambient sounds, narration/dialogue, etc.)

The remaining part of an SCD is dependent upon the Scene elements themselves. Where applicable, three kinds of information are recorded for each element: (1) its **properties** (structure, appearance, activity/interaction, grouping); (2) the **reference categories** that guided choices for those properties (visual, quantitative, qualitative, conjectural/artistic); and (3) the manner of **reference uses** that guided the creation of the element (direct import, adaptation, interpolation, extrapolation, sampling, reduction). It is important to stress that the purpose of the SCD is to document how sources have influenced the composition of the scene, as opposed to every facet of individual model assets that appear, an objective that is satisfied rather by the Model Sourcing Document (MSD) described above (and which

can be cited within the SCD as well). Usually only minimal redundancy between these two documents will be useful. Once completed for the entirety of a Scene production, its set of SCDs will collectively function like an annotated storyboard, identifying how it reflects sources of information that have been selectively used in service of the narrative.

Database Integration

GizaCARD, the Giza Project's powerful relational SQL database, runs on The Museum System (TMS) platform (www.gallerysystems.com). Its cross-referenced modules include Sites, Objects, Media, Constituents, and Bibliography. During the 2016–2018 granting period, the Project will design customized database records for new data types, including 3D model renderings, to be integrated with all other records, both old and new, in the existing five TMS modules.

A peculiar aspect of conceptualizing 3D visualizations as archaeological data is that the 3D model is both a form of representational media *and* a data-object. We have developed GizaCARD with a site-centric organizational structure that optimizes the power of TMS for the idiosyncrasies of archaeological datasets (See GizaCARD Data Structure Chart in Section 8: Appendices**)**. Sites are the central nodes in a complex web of relationships among data types. The TMS software organizes these relationships as background data tables from which queries can be quickly performed through the database itself or, more importantly, via online searches. The incorporation of the 3D visualization data (models, Scenes/media productions, model derivatives, and our three newly proposed types of reference documents) will be a substantial addition to this web of data relationships.

We propose that this approach will be a replicable (or easily adapted) standard for digital archaeological data management, one that is best implemented now while 3D-graphic archaeological visualization is in its infancy as both an academic and popular medium. The pace of technological advancement and increasing speed with which 3D graphics can be produced makes establishing transparency standards and defining documentation criteria all the more urgent.

Data Formats

The vast majority of traditional archival data from partner Giza collections has been received by the Giza Project in unprocessed electronic form, usually in common digital formats (e.g., TIFF, JPEG, PDF, MPEG, etc.), or as tabulated information in common document or database files (e.g., MS Word, MS Excel, Filemaker Pro). All information in these sources is studied and parsed intelligently by our Egyptological staff according to content (e.g., objects, tombs, people, and other features in question) prior to entry into GizaCARD. This allows an online search for a single tomb, for example, to produce all the relevant photos and other documentation for that tomb across all archival collections. 3D models, as well as some of their components and byproducts are non-traditional file formats and thus cannot be stored directly in database systems in the same way as digitized 2D media without extensive customizations. In the future, when 3D modeling is an even more mainstream and widespread phenomenon, the Giza Project expects to include models, model components, and model derivatives as downloadable data.

Metadata

As with traditional archaeological data types, processing of visualization data must apply consistent metadata standards. In order to promote optimal online discovery of GizaCARD resources across domains, and in the interest of broadest access and interoperability, the Giza Project generally applies the widely employed, simple yet flexible Dublin Core Metadata Initiative (DCMI) base set of descriptive terms (dublincore.org/documents/dces/#DCTERM) to our data. Use of the DCMI term set is also a measure to build in roughly equivalent search sensitivity by exposing our metadata to interoperability solutions such as the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH).

The creation of GizaCARD records already includes population of data fields that correspond directly with several DCMI terms. As part of the coding of the future web resource, information from these relevant fields will be attached to all media output directly from the database (via an API) such that

data updates will register almost immediately. For visualizations, metadata tagging applies primarily to archived model derivatives (e.g., images) and media products (e.g., movies files) in the database's Media Module, and to models themselves in the Objects Module. The following table provides a concordance between DCMI terms applicable to visualization data and GizaCARD fields.

DCMI Core Term	GizaCARD Object Module Field	GizaCARD Media Module Field
Contributor	Department; Object-Related Constituents (consultant)	Department
Coverage	Classification; Title	Media View
Creator	Department; Object-Related Constituents (artist, specialist)	Rendition-Related Constituents
Date	Date	Rendition Date
Description	Description	Description
Format	Medium; Media Size	Technique; Medium Type; Media Size; Duration
Identifier	Object Number	Rendition Number
Language	Language	Language
Publisher	Department	(Default: Giza Project)
Rights	Credit Line	Copyright; Restrictions
Subject	Title	Public Caption
Title	Sub-Title	Rendition Number

SUSTAINABILITY OF PROJECT OUTCOMES AND DIGITAL CONTENT:

The perpetuity of the Giza Project's collection is a paramount objective. All collected and generated data become permanent, archived holdings of the Project, and the web resource currently in development is envisioned as a permanent, upgradable resource. Harvard University Faculty of Arts & Sciences Research Computing (RC) remains current in applying best policy standards of file storage and backup infrastructure, updating and expanding when required. Its primary role in all sectors of Faculty of Arts & Sciences research ensures the long-term preservation of the Project's holdings and institutional stability. Original and post-processed files are housed on an electronic storage system maintained by RC. RC infrastructure consists of a robust EMC enterprise storage array configured to guard against both human error and catastrophic data loss. Currently the Giza Project is allotted 20 TB of space, which allows ample room for foreseeable growth. When this capacity is approached, RC will supply additional space as necessary. The file system receives daily "checkpoint" snapshots of all data, of which the seven most recent versions are cached. Complete backup copies of all storage holdings are stored at two additional secure, managed datacenters, one on the Harvard University campus and one in downtown Boston. Fourteen days' worth of incremental backups (i.e., files that have been altered since last backup) are retained as well.

The Museum System (TMS) supported the original Giza Archives Project website at the Museum of Fine Arts, Boston, and has been chosen by almost all Harvard museums as well. We thus have built-in, University-wide support in place for this collections management software with the accompanying assurance that, should tides turn in the distant future and a new platform be favored, systematic institutional migration of GizaCARD records would follow. Similarly, as GizaCARD grows and technologies evolve beyond the HCRR grant period, we will continue to explore moving beyond SQL databases to the next generation of data parsing, free-text searching, and open-source systems. With its underlying XML data layers, the TMS-based GizaCARD is extremely flexible. Other collections could easily be incorporated into the database and, conversely, data is exportable to other systems. Additionally, as part of the development of our *Digital Giza* web resource, we are already planning to format all back-

end GizaCARD data in JavaScript Object Notation (JSON) format, an extremely versatile language that will open our data to external use well beyond SQL queries to include types of inquiry we ourselves may not yet have conceived. Far from an isolated data silo, our results are, and will continue to be, extensible for other archaeological projects within Egyptology, world history, and beyond.

DISSEMINATION:

Optimal worldwide availability and long-term sustainability are core objectives of the Giza Project's work. Ultimately, all holdings and products of the Giza Project, including the products of this proposal's activity, will be freely available to the global public via the Giza Project's future online resource, *Digital Giza*. Prior to the completion and launch of the site, dissemination of the deliverables produced during the grant period will take several forms. In print, the PI has a forthcoming book on "Digital Giza" with Harvard University Press (Metalab Projects Series), a historical description of the entire Project from its inception in 2000 to the present, as an example of a groundbreaking Digital Humanities initiative. The PI and Giza staff will contribute scholarly articles based on the Giza Project's 3D modeling and sourcing work to international peer-reviewed Egyptological journals, such as the *Journal of the American Research Center in Egypt* (*JARCE*) and *Egyptian and Egyptological Documents, Archives, and Libraries* (*EDAL*), archaeological/anthropological outlets, like *Visual Anthropologist* and *Journal of Archaeological Method and Theory*, and/or specialized publications like *Digital Applications in Archaeology and Cultural Heritage* (*DAACH*), as well as popular articles to ancient Egypt-themed magazines with wide readerships, such as *KMT* and *Egyptian Archaeology*. We regard these venues in particular as important conduits for actively promoting the adoption of transparency and documentation in archaeological visualization, with our own methods put forward as model practices.

We will also continue to present Project results in both popular lectures and scholarly conferences, among them the annual meeting of the American Schools of Oriental Research (ASOR), national and local meetings of the American Research Center in Egypt (ARCE) (where staff have already given several Project-related talks in recent years), and at technology conferences such as South by Southwest (SXSW) and the Digital Heritage International Congress. In addition to numerous lectures and discussions at Harvard and in the greater Boston area, the NEH has asked the PI to speak about the Project's progress on GizaCARD at the upcoming annual meeting of the Archaeological Institute of America (Jan. 6-9, 2016 in San Francisco).

Dozens of Project-generated, data-derived virtual models, built from archival information processed by the Giza Project, are currently available to educators and the general public on http://giza.3ds.com. A steady stream of press coverage has followed the major releases of new models and has been picked up by Egyptological blogs and electronic bulletin boards, both professional and amateur, all over the world. Additionally, our Giza content has already appeared in exhibits at the Oriental Institute Museum of the University of Chicago, the Roemer- und Pelizaeus-Museum, Hildesheim, and the Kunsthistorisches Museum, Vienna. We expect to continue to "loan" our content to a wide range of special exhibitions with themes encompassing archaeology, pyramids, ancient technology, 3D modeling, etc. Furthermore, we intend it eventually to be on view in the upcoming Grand Egyptian Museum, located just north of the Giza Plateau in Egypt and slated to open within the next few years. These exhibits will provide broad exposure of our work to the museum-going public at venues around the world.

Closer to home, the Project's modeling content currently appears in the recently renovated Semitic Museum at Harvard University, and will continue to feed into the PI's undergraduate and graduate Egyptology classes, forming an on-campus teaching resource in 3D immersive classrooms and theaters, as well as contributing to full semester-long courses and smaller educational "modules" in HarvardX and EdX (www.edx.org), the online teaching initiatives currently under development by a growing consortium of universities. These online courses have the potential to reach tens of thousands of students at a time. We may also explore output through online research data publishing venues, such as Open Context (http://opencontext.org).

We have also begun to create a number of animated video featurettes and interactive guided tours utilizing our 3D model environments and avatars of ancient Egyptians and modern archaeologists, which

illustrate various themes and features of Egyptian culture, society, and religion. The first two of these, one describing the discovery of the mysterious burial of Queen Hetepheres I, mother of the builder of the Great Pyramid, and the other exploring the richly decorated burial chapel of Queen Meresankh III, are available on YouTube (http://www.youtube.com/watch?v=-yAibZvP6pY and https://www.youtube.com/watch?v=sdezf5p41_g&feature=youtu.be respectively).

Moreover, the Giza Project aims to harness the powerful influences of online social media (e.g., Facebook, Google+, Twitter, Pinterest, etc.) to disseminate information "virally" more widely than possible through a single online venue. Media files (including derivatives of 3D model assets) accessed via the new Giza website will be accompanied by social networking icons through which users can post them directly to their accounts on relevant social websites, organically opening countless new outlets for appreciation of the project's holdings. We anticipate that as creation and use of 3D-graphic models expands and becomes commonplace, a broader awareness of the importance of responsible referencing and transparency will be fostered.

"Edu-tourism" is another potentially powerful dissemination tool. For those planning travel to Egypt, the future Giza website will provide an exemplary organizational and educational tool, even providing digital access to parts of the site that are not routinely open to tourists. Ultimately, we foresee the new web resource and 3D content being made available through one or more mobile apps as well as immersive interface devices, such as home-use virtual reality headsets (www.oculusvr.com and www.samsung.com/global/microsite/gearvr). In the future we intend to explore augmented reality solutions, so that visitors to Giza will be able to point their smart devices' cameras at a hill of sand or debris and see the original excavation and discovery photos for that space and the artifacts it once revealed, complemented by a fully documented 3D reconstruction of those archaeological remains.

WORK PLAN:

Over the course of the twenty-four-month grant period, the Giza Project (led by Project Director Peter Der Manuelian and supported by Egyptological research staff Nicholas Picardo, Rachel Aronin and Jeremy Kisala) will create and interlink nearly 6,000 new 3D model-related records within the Project's TMS database, GizaCARD. The database will have already been populated with traditional data from institutions around the globe holding major collections of Giza materials (including excavation records, museum collections data, and historical and current research). For this HCRR grant cycle we propose integrating into TMS the Project's 3D computer models of Giza monuments, objects, and associated people, constructed based on the aforementioned collected archaeological materials, along with the creation and inclusion of specially compiled Project-designed citation documents and all related derivative visualization files. Some of these types of assets (such as the 3D models themselves) have never previously been incorporated into GizaCARD; once new records are created, further augmentation, systematization, and integration with the archival data will lead to a comprehensive, fully cross-referenced database. The result will truly comprise an all-inclusive dataset greater than the sum of its parts.

We have scripted for GizaCARD a specifically-tailored batch-upload process, the first step of which involves the creation of Excel spreadsheets containing the requisite information for each database module. Uploading these into TMS simultaneously creates multiple records, each with a limited slate of fields populated from common, non-specific data (e.g., real-world referents, data classification, etc.) as well as specific fields (e.g., unique identifiers, media creators, etc.). Additional detailing of records is accomplished individually or in smaller subsets thereafter. These timesaving batch-upload processes are critical; without them, the creation of so many complex new records during the span of two years would be impossible. Another scripted process batch-links these newly-created records, thereby similarly reducing the amount of labor that would otherwise be necessary to manually forge the connections between them.

As an example of the work proposed, the Giza Project has constructed an archaeologically-accurate digital model of G 7530-7540, the tomb of Queen Meresankh III at Giza. This model, designated *3D_G 7530-7540*, will receive its own new object record in the database. Two accompanying citation

documents, a Model Sourcing Document (providing all basic information about and resources utilized in the construction of the model) and a Visual Construction Summary (illustrating the actual process of building the model) will each receive a new object record, both of which will be linked to the *3D_G 7530-7540* record. (Templates for the new citation documents, as well as completed examples of each for the tomb of Meresankh, may be seen below in Section 8: Appendices.) Approximately 100 derivative files (still images) of the model at various stages of its production, showing different rooms and views, alternate lighting and design choices, etc., will become new media records in TMS, and will also be linked to the tomb model record.

A number of people associated with the tomb (Queen Meresankh as the tomb owner, Egyptologist George Reisner as its excavator, etc.) have been modeled by the Project, and these digital avatar models will also receive their own records in GizaCARD, along with the appropriate citation documentation and derivatives. The same is true for various objects (furniture, funerary goods) that were found in the tomb and have been modeled. Additionally, the Project has produced a 6-minute-long animated video featurette introducing the viewer to Meresankh's tomb (referred to above https://www.youtube.com/watch?v=sdezf5p41_g&feature=youtu.be), which will be incorporated into the database as a new media record, accompanied by a set of 5-10 Scene Composition Documents that break down each scene and describe the creation and utilization of each element therein (characters, objects, environment, etc.) (See Section 8: Appendices for the template of this type of document.)

This process of creating new modeling records will commence after a period of careful pre-processing and standardizing of all 3D modeling asset data to ensure that the new records created via batch-uploading will be as complete and accurate as possible, thereby requiring less individualized correction when further processed by Egyptological staff within the database. Record construction will progress at a rate of approximately 10 new model and video records per month for 15 months, along with all associated documentation and derivative records, resulting in the creation of approximately 400 new modeling records each month. Once all the new modeling asset records have been created in GizaCARD, the last six months of the grant period will be spent detailing and checking them, and making the necessary links between different types of records (i.e., models, documentation, images) via batch-linking. The 3D model records will then be interlinked with all the traditional types of data that were used in their construction (and are listed in their citation documents): real-world monuments, individuals, and objects; photographs; PDFs of scholarly articles and books, etc. All parsable information will be recorded in the linking spreadsheets so that the appropriate records may be properly connected in the database, thereby interweaving all the multiple strands of data to provide the clearest possible picture of whatever facet of Giza one wishes to study.

After the construction, linking, and checking of these records, the Giza Project will make this information available on its forthcoming public Giza website, which will be fed by the fully integrated GizaCARD and will utilize the 3D virtual models as one innovative new interface to all the different types of linked and synthesized data. This website is currently in the planning and design stages (see mockups in Section 8: Appendices) and will go live after the completion of database construction (i.e., after the two-year period covered by the Humanities Collections and Reference Resources grant).

PHASE 0 [Pre-grant period]. Before the start of the grant period, the Giza Project Advisory Board will meet with Project and technical staff to review plans for the processing and integration of 3D modeling data and database population, offer advice on best practices, and oversee the beginning of the project.
PHASE 1 [Implementation: May 2016–April 2018]. *Note: The projected processing schedule is necessarily flexible as it is not always possible to predict precisely which model records will take the most time to complete. The option of adding more student volunteers from Harvard University and other institutions ensures the viability of all work being completed within the requisite time frame.*

May 2016–July 2016: Analysis, pre-processing and systematization of disparate 3D modeling asset types. Creation of Excel spreadsheets for all new database records to be made for batch-upload process. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers

Aug. 2016–Oct. 2016: Batch-uploads and creation of first group of 26 model records (monuments, avatars, objects) and 4 video records, along with accompanying documentation and associated derivative records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers
Nov. 2016–Jan. 2017: Batch-uploads and creation of second group of 26 model records (monuments, avatars, objects) and 4 video records, along with accompanying documentation and associated derivative records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers
Feb. 2017–Apr. 2017: Batch-uploads and creation of third group of 26 model records (monuments, avatars, objects) and 4 video records, along with accompanying documentation and associated derivative records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers
The Giza Project Advisory Board will hold its second meeting (via conference call) at the end of the first year of the grant period. The board will review progress and discuss any issues that have arisen.
May 2017–July 2017: Batch-uploads and creation of fourth group of 26 model records (monuments, avatars, objects) and 4 video records, along with accompanying documentation and associated derivative records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers
Aug. 2017–Oct. 2017: Batch-uploads and creation of final group of 26 model records (monuments, avatars, objects) and 4 video records, along with accompanying documentation and associated derivative records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala; student volunteers
Nov. 2017- Apr. 2018: Individuation and detailing of all new 3D modeling records. Batch-linking of all new GizaCARD records. Completion and final systematic linking and checking of all new database records. — Rachel Aronin, Nicholas Picardo and Jeremy Kisala
The Giza Project Advisory Board will hold its third meeting at the end of the second year of the grant period to review the final database product and discuss plans for the construction of the new website.
PHASE 2 [Post-grant period] At the end of the HCRR grant period, the Project will move into its next phase, the construction of the new public Giza Project website, to allow global access to the fully-populated and cross-referenced database (GizaCARD).

STAFF:

- *Peter Der Manuelian*, Ph.D. Egyptology, Project Director and Principal Investigator. Role: Supervisor of all aspects of the Project; decisions on Egyptological data organization; overall design and implementation; relations with international Giza partners in Egypt and Europe; responsible for hiring and managing Project Egyptology/technology part-time staff, supervising university students, and fundraising. Project continuity directing the work since inception in 2000 at the MFA, Boston. Support requested at 8.33% FTE.
- *Rachel Aronin*, Ph.D. candidate in Egyptology (University of Pennsylvania), Art Historian, Giza Research Associate. Role: TMS Giza data entry and integrity for all 3D modeling asset records, verifications and corrections; concordance work on Harvard–MFA Expedition materials and European Giza collections; supervision of students/volunteers. Academic and archival research for processing international archival records and 3D model construction. Continuity expertise with the Project since 2008. Support requested at 45% FTE.
- *Eugene (Rus) Gant*, Giza Project lead technical artist. Occasional consulting on the ongoing development of Giza 3D model construction, and production of documents for TMS integration. Support requested at 2% FTE.
- *David Hopkins*, Giza Project technical artist (consultant). Production of 3D model asset files, and assistance with creation of source documents for integration in TMS. Contracting support requested at 20% FTE.
- *Jeremy Kisala*, BA in Egyptology (University of Chicago), Giza Research Assistant. Role: TMS Giza data entry and integrity for all 3D modeling asset records; supervision of Giza Digital Library PDF processing workflow; supervision of students/volunteers. Continuity expertise with the Project since 2006. Support requested at 45% FTE.

- *Nicholas Picardo*, Ph.D. candidate in Egyptology (University of Pennsylvania), Archaeologist, Giza Research Associate. Role: TMS Giza data entry and integrity for all 3D modeling asset records, verifications and corrections; concordance work on Harvard–MFA Expedition materials and European Giza collections; supervision of students/volunteers. Academic and archival research for processing international archival records and 3D model construction. Continuity expertise with the Project since 2009. Support requested at 33% FTE.

Giza Advisory Board

- *W. Judson Harward*, Director of Arts and Humanities Research Computing, Harvard University Information Technology. With a background in archaeology, digital humanities and the MIT iLabs prior to coming to Harvard, Mr. Harward is uniquely positioned to assess the role of our project within the academic community and beyond. We will look to him for guidance on how well we are reaching our intended audiences with our 3D modeling assets.
- *Jim Waldo*, Gordon McKay Professor of the Practice of Computer Science, and Chief Technology Officer, Harvard University (http://www.eecs.harvard.edu/~waldo/). As the University's Chief Technology Officer, Mr. Waldo will comment on the backend infrastructure of our database integration (3D modeling assets with traditional object and media records). He has a humanities background (MA in Linguistics; PhD in Philosophy), prior to his work in the business and IT communities.
- *James P. Allen*, Wilbour Professor of Egyptology, Department of Egyptology & Ancient Western Asian Studies, Brown University (http://research.brown.edu/research/profile.php?id=1170774357). As one of the most distinguished Egyptologists in the world and president of the International Association of Egyptologists, Prof. Allen is superbly qualified to critique the scholarly applications of our work. His seminal work in Egyptian hieroglyphic grammar and Old Kingdom mortuary literature and religion put him in an excellent position to advise us on our Egyptological content.
- *John Baines*, Professor of Egyptology; Fellow of The Queen's College, University of Oxford (http://www.orinst.ox.ac.uk/staff/eanes/jbaines.html). Like Prof. Allen at Brown, Prof. Baines is one of the foremost Egyptologists in the world and has written extensively on Egyptian visual and written culture. Managing the Online Egyptological Bibliography at Oxford, he has an unparalleled perspective on the organization of massive amounts of scholarly archival information. We expect his expertise to aid us in modifications to Egyptological search functions.
- *Florence Friedman*, Visiting Scholar, Department of Egyptology & Ancient Western Asian Studies, Brown University, and Curator Emerita, Museum of Art, Rhode Island School of Design. Dr. Friedman has been studying Giza royal iconography, particularly the finds from the Menkaure Pyramid Complex. She will contribute her expertise on three-dimensional sculpture, iconography, and Old Kingdom art history to our 3D modeling efforts and data organization.
- *Jeffrey Schnapp*, Professor of Romance Languages and Literature, Graduate School of Design, Harvard University; Director of the Berkman Center for Internet and Society, and Director of metaLAB (http://metalab.harvard.edu, http://cyber.law.harvard.edu/people/jschnapp). Prof. Schnapp is a cultural historian with research interests extending from Roman antiquity to the present. He oversees and supports a number of innovative digital initiatives that are making serious contributions to humanities scholarship and research. He will guide us in our visualization efforts, and suggest ways to keep pace with developing trends in online academia.
- *Jeff Steward*, Director of Department of Digital Infrastructure and Emerging Technologies, Harvard Art Museums. Mr. Steward formerly worked for the Museum of Fine Arts, Boston, when the Giza Project was initiated there. He thus designed a number of tools to improve the TMS database and web performance of the Project. He will advise us on integration of our 3D modeling assets into TMS, as well as assist with eventual construction of JSON apps to allow our database to seamlessly connect with our forthcoming revised Giza website.