Adapting Databases: Problems and Solutions

Implementing Best Practices in Database Applications for Assyrian Palace Cultural Management

Sarah SCOTT
Wagner College, Art Department, Staten Island, New York, USA

Abstract: This paper presents an analysis of a pre-existing database used to document objects from excavations at Nimrud of the Assyrian Central Palaces in order to determine whether it would be useful in a new project: documenting Sennacherib's palace at Nineveh. By collecting known data from excavations we can make the information available to scholars, students, and the public. The time and effort expended on creating such databases is immense. By using a pre-existing database program, time and effort can be saved. But how do we determine if pre-existing database structures are useful for newer projects? During the summer of 2008 data related to Sennacherib's palace at Nineveh, in the form of photographs, drawings, and archeological data, was collected at the British Museum. This data will be examined to determine if it fits into the pre-existing Central Palace database structure. It is expected a list of problems will arise, regarding the breadth of object type to be documented. This list will be assessed and presented at the conference, along with a series of possible solutions. The goal is to encourage discussion regarding streamlining data-entry, and expediting data-collection, analysis, and digital archiving with respect to historical archaeological excavations.

Keywords: Assyria, data, Nineveh, archive, palace.

Introduction

Scholars who work with database applications are often themselves not trained in computer technologies. However, many scholars who work in the Humanities find them useful for data-based projects. Art History is one such field; particularly when the objects involved are from the ancient periods and come from archaeological contexts. Scholars specializing in Ancient Near Eastern materials live at an academic crossroad where art history, Assyriology, archaeology, museum studies and semiotics intersect. These disciplines all have need for using database applications. Art Historians commonly use database applications as a tool for visual and iconographical analysis, and so look for database applications designed for these purposes. For non-computer specialists who take interest in using such applications, it is essential to gain an understanding of best practices in database application design so that these scholars can more constructively interact with the applications, and ultimately have a say in the design process.

In this paper, I want to look at a pre-existing database application, and examine the pros and cons of using it for a new project. The new project, Sennacherib's 'Palace without Rival' at Nineveh: Digital, Virtual, and Actual Interactive Reconstruction, is an ambitious endeavor seeking to record, analyze,

store and present to scholars and the public the Assyrian palace (Southwest Palace) constructed by Sennacherib at the site of Nineveh.[1] The database and associated applications will have to perform a variety of functions, and as we all know the creation of such suites is time-consuming and costly. An earlier project, spearheaded by Prof. Paley and Dr. Sanders, relied on a database application to record and analyze similar archaeological materials from another Assyrian Palace (Central Palace) at Nimrud. One hope of the new project was to use some form of this existing database application for the new Southwest Palace project.

At the time of the presentation of this paper, the existing database was not accessible for practical use. Therefore this study will not look at the actual use of the new data in the old database application, but will look more generally at the goals of the new project, identify how the old database might be adaptable, and what areas would have to be modified. The second section of this paper will look more specifically at existing projects that could serve as models for the new Southwest Palace project.

The Southwest Palace project

The goal is to record, reconstruct, and analyze multiple types of artifact, objects, and records relating to Sennacherib’s Southwest Palace at Nineveh. The database itself will thus need to store data, but will also need to interact with various applications to allow for the analysis of this data. Many attributes need to be recorded within the database application. These include:

Uniquely identified object number

Artifact type: This includes various types of artifacts such as wall reliefs, architectural fragments, ivory furniture fragments, inscribed tablets, cylinder seals.

Artifact details: This varies from one artifact type to another; certain objects have only certain qualities. Take, for instance, the wall reliefs: the initial excavator assigned numbers to each of the slabs. So one type of artifact detail we will need to track is the specific number of each slab.

Date/Period: Obviously an important attribute for most archeological objects.

Findspot: Where were objects found? In a room, in a foundation, in fill? Is there information on the stratigraphic location of the object? The findspot will itself need its own attributes.

Excavator: Nineveh has been explored and excavated by multiple parties. It will be necessary to record who excavated the object.

Date of excavation: When was the object found?

Excavation number: The excavation number can vary from one excavator to another, so this will have to be considered.

Current location: Is it in a museum, private collection? Is it still on-site?

Accession Number: These vary from one institution to another, and some include letters not only numbers.

Material: Is the object made of mosul marble, ivory, lapis?

Object Measurements: These will have to be as detailed as possible in order to generate reconstruction, with CAD programming, a major component of the analytical aspect of the database.

Architecture/Context Measuremen: Measurement of the foundations, walls, etc.

Bibliography: Of various source types; It is likely this data will not be stired in the same database, but it should be linked to other bibliography programming, such as EndNote or Zotero. Also, related to this category, there is even more data to record, such as the catalogue number within a publication (for the reliefs).

Photographs: Archival photos of objects, but also new photos as part of the analytical project.

Drawings: These are very important; particularly for the wall reliefs, as they often record sculptural detail that is not easy to detect from the photos

Inscriptions: Photos and transcriptions of the actual inscription, transliteration, translation of the actual text.

High Resolution Images: High-resolution 3D scans of objects, provided by Factum Arte of Madrid; these scans will be used in reconstructions but also need to be accessible through the database.

Spatial data: The database will need to store the necessary spatial data, grids, and point clouds to generate the reconstructions

Once the archeological data is recorded, there are various analytical functions the database and associated application will need to perform. These include:

Architectural analysis: Various floor plans, 3D models, and animated sequences will all need to be relational to each other within an architectural context.

Object context: Objects' location within the rooms, their function within their original setting. Was this object part of the actual structural architecture? Or was it a mobile object? It will be necessary to relate the architectural context from the above analysis to the objects.

Iconographic/Art Historical analysis: Iconographic analysis of each object should be possible. For instance with the wall reliefs, identification of theme (military scene, ritual scene, etc.)

Reconstructions: Learning Sites Inc. will be using specialized high-end modeling software, to generate reconstructions of the palace.

Animations: From these reconstructions, animated sequences will be generated based on images in the reliefs. These should be included in the application suite as well.

Comperanda: From other sites, of various types.

The existing database application was designed by Samuel Paley in conjunction with Learning Sites, Inc. to record information about the Central Palace at Nimrud, with one of the end goals being the creation of virtual reconstructions of that structure. It was based on the objects themselves, designed to be flexible and extensible. Analytical features include the identification of relief themes and determination of architectural function. It was also meant to serve as an interactive catalogue of the

individual finds from the excavations (Layard to Meuszynski), to be used by scholar and students. The schema, according to Paley and colleagues, was designed to store hierarchical data in a way that would make searching easier. The front-end is generated dynamically from information stored in the database (PALEY 2004).

The Central Palace database application records the following object attributes, as identified by viewing the front end of the application: Inventory ID, Object Name, Object Description, Created Date, Discovered Date. The Central Palace Database has functional components allowing the following attributes to be searched according to a hierarchical model: Object type (architectural feature, box, brick, coin…), Object Attributes (material, shape, decoration, preservation), Object Depictions (representation, figure, object, etc.).

In a comparison of what the Central Palace database has to what is necessary for the Southwest Palace project, there are a number of attributes that are missing. This includes spatial data, which will be essential for the generation of reconstructions. Other attributes include: findspot, excavator, excavation number, current location, accession number, material, measurements, bibliography, photographs, drawings, inscriptions, and high resolution images.

In addition, the new database application should allow for front-end display of virtual reconstructions, manipulation of high-resolution imagery including 3D scans, animations, analysis of bibliographic materials, and comperanda. This will certainly require ample modification of the front-end, and the addition of appropriate applications and much programming. These will be substantial modifications and additions. Simply stated, the current schema of the Central Palace database, considering this analysis of the front-end, is not adequate to perform the functions for the new project.

Models

A number of database applications and suites of applications currently exist which can serve as models for the Southwest Palace project, and as models for the broader fields of archeology, art history, and cultural management. Topics of database application innovation that appear relevant for this project include global standards, discipline-specific standards, archival and photographic analysis, and integration of 3D data.

In the consideration of global standards database it is helpful to examine applications accessible not only to the researching public, but also to other institutions that comprise our research community. This includes museums, archives, and excavations.

Specifically, for the Southwest Palace project, one goal is to work with the Digital Nineveh Archives project sponsored by the University of California, Berkeley (www.digitalnineveharchives.org *Not available*). The DNA website provides a web-based location for collection and display of data from various research projects conducted over the years at Nineveh and the vicinity. One type of data housed at the site includes imagery from GIS-based projects. It plans to expand its site in a number of ways, particularly through using open source software. A goal of the DNA project is to give researchers autonomy of content, so they would be able to edit the metadata while still having it displayed through DNA.

The Southwest Palace project would strive to make its database application accessible through DNA, so that the searchable and interactive database could be linked to their spatial displays. In order to share, the Southwest Palace project will need to work closely with DNA, first and foremost, modifying the existing database so it will be compatible with the current format. Essentially, the Southwest Palace project seeks to link up the database application with a larger database application seeking to house multiple smaller projects. This concept of sharing among database application projects is only possible with adherence to global standards.

A number of database applications exist that are capable of storing information in a central database from various excavation projects. Many of these have been designed so that the basic database structure is indirectly modified so each archaeologist can manipulate it for their own needs, but all the while the structure of the central database is maintained (KARAMALIS 2008). The Open Context Database (www.opencontext.org) developed by the Alexandria Archive Institute (KANSA 2008), and the 3DMURALE project (www.dea.brunel.ac.uk/project/murale/database.html *Not available*), hosted by Brunel University (JOSEPH 2003) appear to be excellent models. Ultimately, such models can improve the collaboration between archaeologists, and improve the capability of sharing among various parties.

A second model in the discipline applicable to the Southwest Palace project is a series of standards established within Cultural Resource Management (CRM). Museums must deal with information of various types, recorded in various ways, and the need of access to the objects and records by various types of people and institutions. A number of CRM institutions have managed to successfully develop database systems to allow for this variability. One is the Museum of London whose large and complex collection is managed by a relational database application provided by commercial software which also links with other archaeological databases within the Museum's fieldwork units (www.museumoflondonarchaeology.org.uk). The Ashmolean Museum’s system (www.ashmolean.org) is another illustrative example. However, unlike most CRM databases which are relational, the Ashmolean's is a hybrid between what they call a ‘free-text system’ and relational (LOCK 2003).

Both the Museum of London’s collection management system and the Ashmolean must adhere to certain standards within the realm of CRM. Within the UK, there are various bodies that oversee the process of documentation of cultural heritage. In particular the government body: Resource: The Council for Museums, Archives, and Libraries (www.mda.org.uk/spectrum.htm). The standards they set are based on compliance in computer file formats, data structure, and computer documentation, known as SPECTRUM (LOCK 2003). As scholars and programmers consider excavation databases, and databases of collections of groups of artifacts and information about those artifacts, such as the Southwest Palace Project, it imperative they strive to meet similar such standards.

As global standards are implemented in archaeology, it is also necessary to implement similar standards within related sub-disciplines. For the Southwest Palace project, this would mean investigating other databases dealing with Assyrian art and determining what standards of nomenclature, if any, exist. Databases exist that store art objects in general. One model is the web

interface at the British Museum. The public can conduct a keyword search for ‘Sennacherib’: (www.britishmuseum.org) and then refine the search within those results based on date and location. Without actually seeing the schemas of the database, it is not possible to tell whether there is a standard nomenclature for searching. A more advanced search interface, with the inclusion of standardized search terms, rather than a simple keyword search, as identified by archaeological and art historical analysis, would be helpful to the general public and scholars.

Another example of a searchable database where nomenclature is not clearly defined is the Cuneiform Digital Libraries Initiative (CDLI) (www.cdli.ucla.edu). There are good instructions for searching: for example, the query fields provide examples of search terms, but does not provide a drop down list. The CDLI would be better if it provided a thesaurus of search terms to aid the user. If Assyriologists and programmers could work together to create such a list, and make this list public, as well as present it as a model, this would help both the general public, advanced scholars, and other programmers. Collaboration of this sort would move toward establishing standards within our various fields.

One successful example where nomenclature has been used as the backbone of database design is the Scottish Thesaurus of Monument Types (STMT) (BAINES 2006) (www.rcehms.gov.uk). A thesaurus for the identification of Neolithic and Bronze Age archaeological monuments in Scotland was successfully applied in the construction of a database used by the National Historical Monuments of Scotland. The Canmore database within this site (www.rcahms.gov.uk/search.html#canmore) provides public access to historical and archaeological monuments in Scotland (ASMUS 2003).

Another example of a database that takes advantage of standardized vocabulary within its discipline is IMAREAL's Digital Image-Server (www.imareal.oeaw.ac.at/realonline/ *Not available*). REALonline is a searchable image and text database storing photos of objects from central European medieval provenance. It stores the photos and text about the photos. Not only does it house identifying elements regarding the cataloguing of the photos, it also houses iconographic data regarding the description of the image.

One of the redeeming qualities of the existing Central Palace database is the inclusion of a thesaurus for architectural and iconographic features, also based on hierarchical organization. One recommendation is that this be expanded and linked to the DNA project as a larger discipline-base nomenclature standard. These vocabularies could serve as a thesaurus for objects of Assyrian art and archeology across multiple projects.

In returning to the comparison of the needs for the Southwest Palace project application to the existing structure of the Central Palace Database, one conclusion is the necessity to look for ways to standardize. One intent is to combine this project with the Digital Nineveh archive. In moving forward with this endeavor it is necessary to ensure compatibility with theirs. And the entire project, as a repository for all archaeological data from Nineveh, would be compatible with other existing, or future projects relating to Assyrian culture. It would be ideal also ensure it would be compatible with other museum and national databases, so that information and data could be shared between all Assyrian data collection projects and other institutions seeking to record, analyze and educate the public about

cultural heritage. By adhering to global standards scholars and the general public will be better served in their use of databases as a resource for educational purposes.

Two other areas the Central Palace database needs modification are photographic and archival analysis. One project at the British Museum that has successfully and ingeniously analyzed archival photography in a database, using SPECTRUM standards, is the Pictorial Collection of the British Museum's Department of Africa Oceania and the Americas (ROMANEK 2008). This database application was used to analyze data to determine semiotic functions of archival imagery. It addresses how the digitally archived artifact is received by the public, and the role such 'objects' play in the construction of historical memory. It is a nice example of advanced scholarship in the semiotics of digitally stored artifacts, and a model of what can be done by scholars in our fields once standards in data management have been implemented. Many projects currently underway record and analyze textual archival data in the form of old excavation records. The use of OCR (Optical Character Recognition) can aid in recording this type of information, and can also aid in the coding of ontological structure to study the historiography of such texts (HOLMEN 2003).

The incorporation of global and discipline specific standards with regards to the objects themselves will be essential for the success of the Southwest Palace database application. But it is also necessary to store and allow for the analysis of archival photographs, drawings, and excavation reports. This data can be treated as raw data linked to the object analysis, but these archival objects should also be analyzed in their own right, and so the two models above serve as useful examples.

The final area warranting attention is the storage and analysis of 3D scans of the objects. An exemplary project in this regard is the E-curator project in progress since October 2007 at University College London (UCL), Department of Museums and Collections (www.museums.ucl.ac.uk/research/ecurator/). It is an interdisciplinary project drawing on UCL's expertise both in curatorship and in e-Science that successfully stores and makes accessible 3D color scans stored in a relational database management system. The project supports the management and collaborative (and controlled) sharing, publication, replication, transfer, and preservation of the collections. A web-based interface is developed to allow users to access the 3D images (HESS 2008).

The existing Central Palace Database is certainly useful for the new Southwest Palace project. As a relational database it fits in well in overall structure with many other examples in related fields. The hierarchical nature of the front-end searches is useful. However, more fields must be added, others expanded, and multiple applications need to be added to the front-end to enable the suite to function as we need. The front-end and data-entry displays also need substantial modification. Only then will we be able to share with the DNA project, perform more advanced iconographic analyses, create and move through virtual reconstructions, explore the location and function of objects within their architectural context, and search and analyze archival data, as well as make these components accessible and attractive to a wider audience.

The preliminary planning process of examination of data types and analysis needs is important for strategic planning in a large cultural heritage management project. This process of closely examining data sets and analysis needs prior to implementing tools cannot be understated. I would therefore suggest that all professionals, before beginning such projects, do ample research before choosing their tools. There is a phrase in world of home improvement that is appropriate: “measure twice, cut once.”

Finally, I’d like to urge all professionals to consider the issues of transparency and responsibility. We need to construct our tools so that they can comprehensively analyze our data; this means cooperation and collaboration between disciplines and professions. We cannot all be everything; Art Historians are not usually computer programmers, but Art Historians should be able to use computers as tools. One specialist should feel comfortable relying upon another. Similarly, as we hold each other responsible as scholars, we must also hold ourselves responsible to the public. Many of our projects are designed to educate the public; we must consider how our projects will be used, and do our best to design them so that some component of our project is engaging and functional for the informed public. If we only educate ourselves, then we are not reaching as high as we should be.

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[1] Currently underway, this project is being spearheaded by Professor Sarah Scott of Wagner College in Staten Island, Professor Samuel Paley of the State University of Buffalo, and Dr. Donald Sanders of Learning Sites, Inc. Massachusetts.