

THE ORIENTAL INSTITUTE COMPUTER LABORATORY

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INTRODUCTION

Emerging computer technologies in the areas of information access and exchange are changing the way scholarly research is conducted on university campuses. Since the spring of 1991, when all offices in the Oriental Institute were connected to the University of Chicago's Ethernet network backbone, Institute faculty and staff have been able to choose from a variety of Wide Area Networks (WAN), such as the Internet, Bitnet, Gopher, Wide-Area Information Servers (WAIS), and World-Wide Web (WWW) networks as well as the Institute's own Local Area Network (LAN), and to use these resources to access and process an ever-increasing amount of digital information that is pertinent to the field of ancient Near Eastern studies. Over the next years we will witness the continued growth and expansion of such network computing, as both individual users and the entire university community expand their reach beyond the traditional boundaries of desktop, office, building, and campus.

The diversity of computer technologies available today is staggering compared to that of a few years ago. Computer-aided drafting, image processing, spatial analysis, text recognition, and database management techniques have become more sophisticated, and user demands are for integration and networking and always for more data. The coordination of these technologies is vital. They need to be managed and focused on the research goals of the Oriental Institute, forming the technology infrastructure upon which future research and scholarship by the Institute's faculty, staff, and students will be founded.

The Oriental Institute Computer Laboratory concentrated much of its efforts during the past year maintaining the Institute's leading role in ancient Near Eastern studies through the adoption of three specific computer technologies: the World-Wide Web Database, the Ancient Near East Mailing List, and the File Transfer Protocol File Server. The database, mailing list, and file server are intended to provide access to an ever-increasing amount of digital information stored on remote file servers around the world and to promote the electronic publication and further public dissemination of the work of the Institute's faculty, research projects, and the collections of the museum.

The establishment of these three electronic gateways at the Oriental Institute in such a short span of time emphasizes the commitment of the Computer Laboratory to promoting the most appropriate computer technologies in the furtherance of research by Institute faculty, staff, students, and visiting scholars. We would like to thank our collaborator in these ventures, Charles Jones, the Oriental Institute's Research Archivist; he has been most supportive of these efforts, and his suggestions and ideas concerning the best and most versatile solutions for accessing digital information over the Internet and his further willingness to take an active part in the day to day management of several of these databases have helped guide decisions and have contributed immensely to the final form of the Oriental Institute's first electronic doorway to the Internet.

Oriental Institute World-Wide Web Database

World-Wide Web is an international network of computer file servers and databases on the Internet that uses an information-retrieval system developed in 1989 by Tim Berners-Lee, a computer specialist at the CERN physics laboratory in Geneva, Switzerland. It allows researchers to exchange information through the use of a format known as "hypertext." With hypertext, highlighted key words and images in ordinary text documents are employed to point, or link, to related sources of information. These additional sources include text, image, video, and sound files that may reside on any server throughout the worldwide network. The underlying networking model of the database, called client-server computing, allows users at any personal computer or workstation connected to the Internet to request information from any World-Wide Web server. The easy access to an ever-growing number of database sources worldwide from software programs (such as Mosaic, which is a viewer program written by the National Center for Supercomputing Applications in Champaign, Illinois) is responsible for much of the movement toward electronic scholarship at universities around the world.

In February 1994 the Computer Laboratory began building the Institute's first Internet-accessible World-Wide Web database containing general information about the Oriental Institute, its museum, and research projects. Although still under development, our database is now available to the entire Internet community. At present this database resides on an Apple Macintosh computer in the University of Chicago's Department of Computer Science. We anticipate that at some future date the Oriental Institute will move the database to our own server in the building.

We had a single objective in creating this database: to have information about the Oriental Institute reach a worldwide audience through the medium of electronic publication, a new and exciting vehicle for the dissemination of scholarly informa-

tion that holds great promise for the Institute as we approach the twenty-first century. The use of this and other forms of electronic communication will provide faculty, staff, and the general public with ever-increasing access not only to the research materials of the Institute but also to similar databases residing at other institutions and universities throughout the world.

Although World-Wide Web databases already exist for classical studies, for example, the Classics and Mediterranean Archaeology server at the University of Michigan, the Oriental Institute is leading the way with the creation of this first World-Wide Web database centered on ancient Near Eastern archaeological and philological research. The fact that all major universities worldwide are connected to the Internet, coupled with the power and ease of electronic publishing formats, indicates that more scholarly research and communication using such institutional databases will take place over the Internet during the coming years. It is our hope that the Institute's database will set an example for others to follow.

We began compiling our database by focusing on three recent Institute publications: the Oriental Institute Museum's *Highlights from the Collection* and the *Oriental Institute Annual Reports* for the years 1991-92 and 1992-93.

The section of the database entitled *Highlights from the Collection*, which contains registration and descriptive information along with digital images of sixty-five artifacts from the Oriental Institute Museum, goes beyond the original pamphlet publication as it is also indexed according to subject matter, such as daily life, deities, warfare, etc. The artifacts highlighted in this electronic publication represent a cross-section of the cultural regions and historical periods covered by the museum's collection.

The other sections of the database include the entries in the 1991-92 and 1992-93 *Oriental Institute Annual Reports* for the museum, research projects, and the individual scholarship of faculty, research associates, and staff. These reports are arranged in the following categories: Oriental Institute Museum; Oriental Institute Research Projects: Archaeology, Philology, Individual Scholarship; Oriental Institute Departments; and Oriental Institute Faculty and Staff.

This type of hypertext database makes it possible to put the same textual and graphic information contained in several book publications into a convenient and easy to use electronic format, while at the same time grouping separate articles together according to their common theme.

In the future we plan to expand both components of the database. The *Highlights from the Collection* section will grow to include additional artifacts, offering a more complete picture of the museum's holdings and a fuller understanding of life in the ancient Near East. Development of further cross-reference materials for museum artifacts in the database is also under discussion. The section pertaining to the *Oriental Institute Annual Reports* will be updated on a yearly basis, and other types of Institute publications and research materials are being considered for inclusion in our World-Wide Web database.

Ancient Near East Mailing List

In July 1993 the Computer Laboratory and the Research Archives collaborated in the establishment of the Ancient Near East Mailing List discussion group, which is an electronic mailing list on the Internet that supports discussion on topics and issues of interest in ancient Near Eastern studies. The Computer Laboratory over-

sees the computer program, Majordomo, that automates the routine administration of Internet mailing lists and Charles Jones, the Institute's Research Archivist, administers the mailing list itself. List communications are electronic mail messages sent to each subscriber in either the standard format or in digest form that combines a series of separate contributions into a single electronic mail message to the user. At the present time the Majordomo software resides on the Institute's Sun SPARCstation 1 computer.

The Ancient Near East Mailing List and Digest currently have more than seven hundred subscribers worldwide, with a daily average of ten mailings to each subscriber and a peak output of thirty to forty messages. A wide range of topics are discussed on the list: new discoveries and publications in the field, public debate on controversial issues of policy and scholarship, job placement information, and other musings by subscribers.

Oriental Institute File Transfer Protocol File Server

As a complement to the Ancient Near East Mailing List, an anonymous File Transfer Protocol file server was established on the Institute's Sun SPARCstation 1 computer in the fall of 1993. The purpose of this file server is to provide easy computer access via the Internet to text, image files, and other types of computer documents and programs that are placed into the public domain by the Oriental Institute. In addition, the Chicago Society of the American Institute of Archaeology and the American Schools of Oriental Research are posting newsletters and other informational documents on our server. Virtually any user connected to the Internet can access our file server to obtain general information about the Institute, its museum and current activities, and its research projects and publications as well as those of non-Institute scholars.

ARCHAEOLOGY SYMPOSIUM

On November 6, 1993 John Sanders participated in a day long symposium at the Oriental Institute, "Archaeology for the 1990s and Beyond," sponsored by the Oriental Institute Museum Education Office and the Chicago Society of the American Institute of Archaeology. In a joint presentation, Prof. Mark Lehner and John Sanders gave a short overview of the development of the computer model of the Giza Plateau and its monuments during the past three years. The discussions centered on the notion that because archaeology destroys the very historic contexts being investigated it is the responsibility of each archaeologist to use every available means to document and record their excavations. Lehner and Sanders explained the surveying and computer technologies that have been used by the Giza Plateau Mapping Project and the Computer Laboratory to record and document the architecture and the topography of the plateau. They also discussed several emerging technologies, laser scanning, remote sensing/satellite image analysis, and hand-held photogrammetry, which promise to provide even better recording accuracy in less time and with minimal damage to the monuments.

LABORATORY PROJECTS

Giza Plateau Mapping Project

With Prof. Mark Lehner on leave this past year, work on the overall computer model of the Giza Plateau and its architectural monuments has slowed down tem-

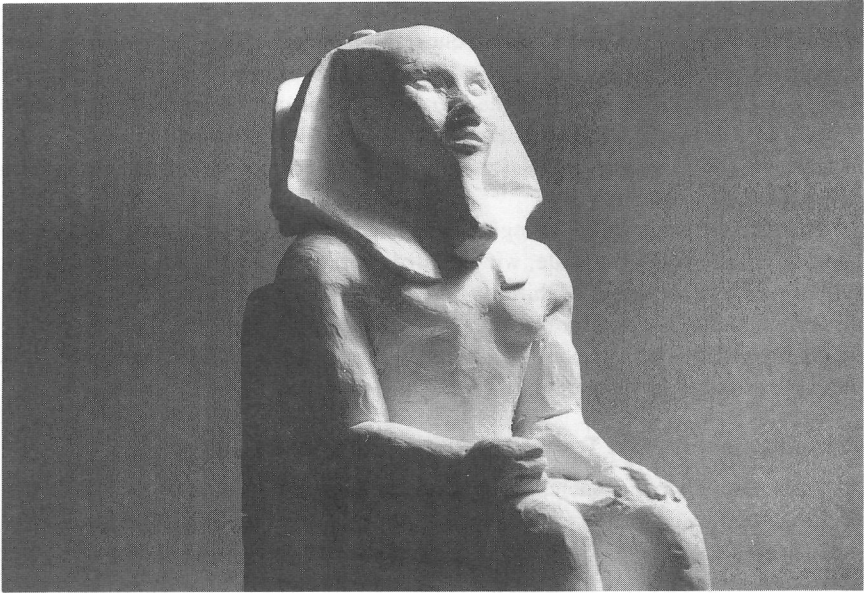


Figure 1. Clay model of Sphinx temple statue

porarily. One small piece of the puzzle, however, moved closer to completion when Peggy Sanders finished processing the surface geometry in our computer model of the seated pharaoh Khafre, which will be scaled and copied twelve times in the courtyard of our computer model of the Sphinx Temple at Giza.

In last year's *Annual Report* it was reported that Peggy Sanders had sculpted a clay model of the statue according to Lehner's reconstruction in the spring of 1993 (fig. 1). The foot high statue was then taken to the Biomedical Visualization Laboratory at the University of Illinois-Chicago campus, where with the help of Director Lewis Sadler and his staff a laser scan was made of the statue, resulting in a computer data file of some 70,000 discrete data points that precisely model its surface geometry. During the winter of 1993 we reduced this number by half, edited the remaining data points to reflect more accurately the figure, and finally applied ruled surfaces to the wireframe geometry using the AutoCAD graphics program. The drawing file was then transferred to the Computer Laboratory's ARRIS graphics program to render (or "solidify") the statue (fig. 2).

Besides these monuments from the Giza Plateau, work continues on the Computer Laboratory's three-dimensional model of the architectural complex at Saqqara, located to the south of Giza. To date, published plans and sections remain limited and offer little assistance in visualizing the labyrinth of chambers and passages under the famous step pyramid. These early publications did, however, supply the necessary information to create a new three-dimensional computer model of the Zoser pyramid complex.

While the initial motivation for this project was a future publication on pyramids by Lehner, another application for this model presented itself quite unexpectedly. Florence Friedman, Curator of Ancient Art at the Museum of Art, Rhode Island School of Design, asked Lehner if he knew of "better" plans of the subterranean chambers than were commonly available. Fortunately for her, our computer model of the Zoser complex was easily adapted to illustrate her forthcoming ar-

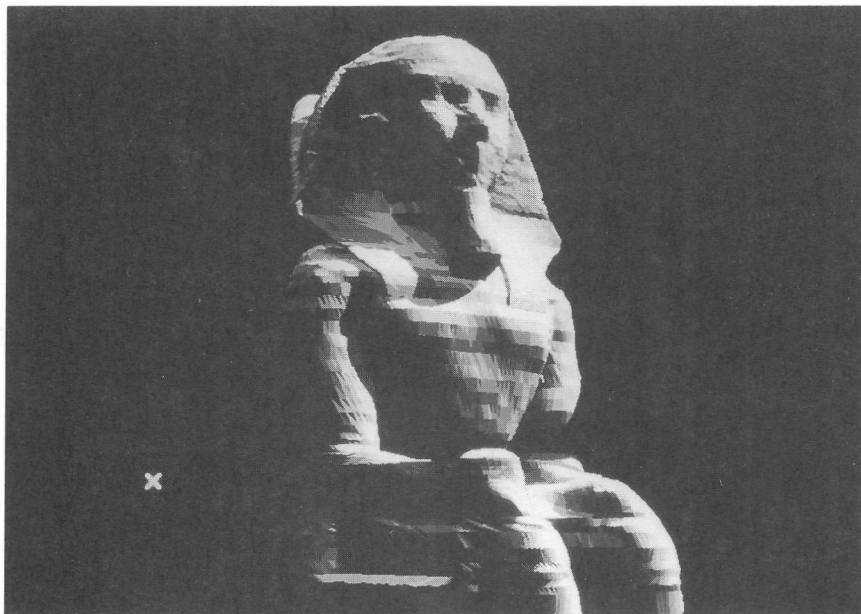


Figure 2. Computer model of Sphinx temple statue

ticle correlating the three stelae beneath the step pyramid and the three stelae associated with the southern tomb.

In January 1994 Lehner asked John Sanders to create a three-dimensional surface model for the entire Nile valley from Giza on the north to Dashur on the south, and from the current Nile River on the east to the plateau on the west. As with the Giza Plateau model, he provided thirty-four maps, each at 1:5000 meter scale containing one meter contours, spot elevations, and major architectural and cultural features in the landscape. Peggy Sanders spent the better part of two months digitizing the maps into AutoCAD drawing files and transferring this data into an ARRIS database on our Sun SPARCstation LX computer. Lehner was interested in using this computer database to look for topographic evidence of either the bed of the Nile River or a major canal off the Nile that lay at the base of the plateau during the time the pyramid complexes were constructed. To accomplish this we produced several versions of the surface terrain model, each with a different vertical exaggeration. With the valley floor exaggerated by a factor of 150, a well-articulated trough at the base of the plateau is evident from as far north as Abu Sir south to the Snefru pyramid complex. These are only preliminary results and much refinement of both the data and our construction techniques needs to be made during the coming year. These early results, however, are promising and encourage us in our efforts to develop computer models of archaeological sites.

Göltepe / Kestel Mine Project

Soon after joining the faculty in the fall of 1993, Aslıhan Yener came to the Computer Laboratory proposing to move all of her archaeological plans, drawings, and photographs of her work at Göltepe and the Kestel Mine area in Turkey into digital documents using the AutoCAD and ARRIS computer graphics programs. To this point three databases have been created from existing drawings:



Figure 3. Original inked drawing of Göltepe Area E, 1993

- Surface terrain and twenty meter topography map for a ten by twelve kilometer area around Göltepe and the Kestel Mine sites.
- Contour map of the Göltepe summit area, with site grid and all trenches from the 1990, 1991, and 1993 excavations.
- Detailed plan of Göltepe Area E after the 1993 excavations.

The original inked drawing of the Area E plan is shown in figure 3, whereas figure 4 shows a plot of its computer equivalent made on the Laboratory's new Hewlett-Packard DesignJet 650c plotter.

The Nippur Expedition

For the third consecutive year the interruption to excavations at Nippur has provided increased time for the investigation of new approaches and tools for archaeological analysis. During the past year our efforts concentrated on remote sensing capabilities, which were facilitated by the gift of a Sun SPARCstation computer for satellite image analysis by the Women's Board of the University of Chicago in the spring of 1993. In the fall of 1993 the Institute purchased fourteen Landsat multi-spectral satellite images of central and southern Iraq that were taken at various times during the past twenty years. With the help of two students, Michael Judin and Matthew Huber, the latter an assistant with Dr. Raymond Pierrehumbert, Department of Geophysical Sciences, Prof. McGuire Gibson, Tony Wilkinson, and John Sanders have begun to develop a strategy for interpreting the massive amounts of geomorphological and cultural data that these Landsat images contain. The pro-

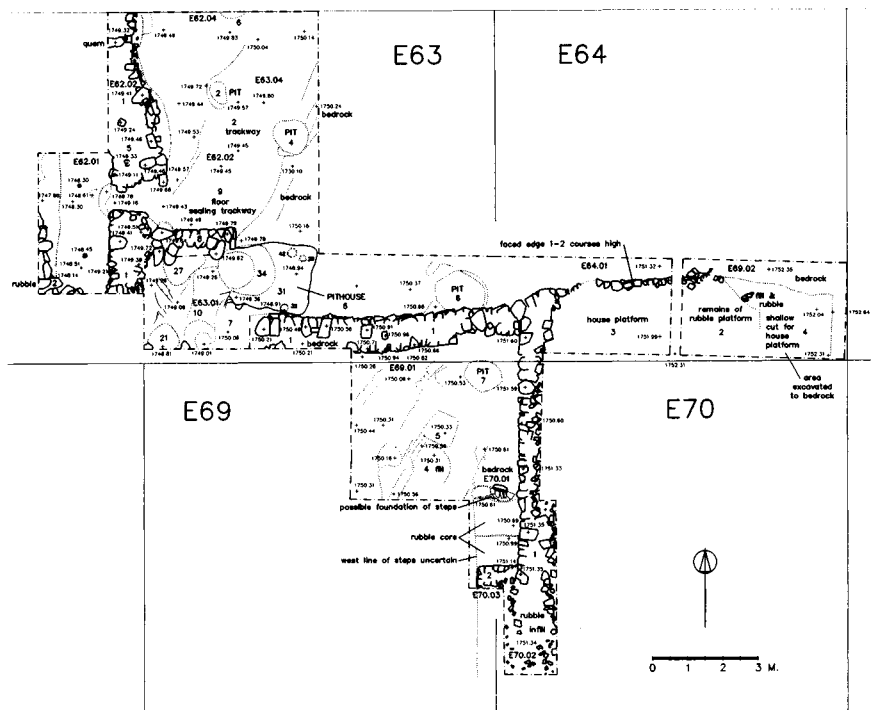


Figure 4. Computer drawing of Göltepe Area E, 1993

cess of becoming competent with a new computer technology is slow, but we are confident that we will have initial results to present in next year's *Annual Report*.

Publications Office Accounts Receivable Database System

The Computer Laboratory has written a new Accounts Receivable and Book Inventory system for the Institute's Publications Office. The first part of this process, writing the prototype system for the Laboratory's IBM computer using the dBASE III+ programming language was completed in May 1993. During the past year all these software programs were modified to run on the Macintosh computers in the Publications Office, using the Microsoft FoxPro 2.5 programming language, a more recent programming language that has evolved over the past ten years from its dBASE origins. What remains to be completed is the data entry of all the necessary support databases for inventory, stock, authors, customers, and prices. We hope to report on a fully operational system for the Publications Office in next year's *Annual Report*.

LABORATORY EQUIPMENT/RESOURCES

In the fall of 1993, Apple Computer, Inc., donated a Macintosh Quadra 610 computer and a portrait monitor to the Oriental Institute as part of a grant program with the University of Chicago; we would like to thank Mr. Gary Thompson of Apple Computer, Inc., for this generous gift. The computer has been installed in the Publications Office, where it is helping to further publication of the Institute's research and discoveries.

The Computer Laboratory purchased an Apple Macintosh Centris 650 computer, high resolution color monitor, 24-bit color scanner, and a 256 MByte optical disk drive in the fall of 1993, providing the Institute with a computer system dedicated to scanning both graphic images, drawings, photographs, as well as textual documents. This system resides in the Computer Laboratory and is accessible to all Institute faculty, staff, and students via the building's computer network.

In December 1993 the proceeds from the 1992–93 Annual Dinner, which benefited the Computer Laboratory, were used to purchase a Hewlett-Packard DesignJet 650c raster plotter for producing large-scale (up to 36" × 48") color graphics output on paper. The Women's Board of the University of Chicago had donated a Houston Instruments vector plotter to the Institute in 1988, and over the years this device produced many drawings that were used by faculty and staff for both analysis and the publication of archaeological reports. Computer technology, as well as the Laboratory's requirements, however, have advanced during the past six years, and the need for a raster plotter capable of printing the newly acquired Landsat satellite images purchased by the Institute meant we had to replace our vector plotter with a raster model. Because of a special offer by Hewlett-Packard, we were able to trade in the Houston Instruments plotter for a generous price reduction on the DesignJet 650c. This impressive machine is now the centerpiece of the Computer Laboratory and is connected to our IBM computer and to the three Sun SPARCstation computers in the Institute. We plan on purchasing the necessary hardware to connect the plotter to the Laboratory's Macintosh computers in the summer of 1994.

A CLOSING THOUGHT

Research organizations like the Oriental Institute depend on collecting, assembling, and extracting meaning from data. Consequently, its faculty, museum, and project staffs have increasingly come to rely on computers and a computer environment that makes information easily accessible and that promotes the flow of data both vertically within a research project or unit and horizontally among research projects or units across the entire Oriental Institute. Such a computer infrastructure would be foreign to James Henry Breasted. He would heartily concur, however, with its intended purpose, to help maintain the Oriental Institute as a leader in the field of ancient Near Eastern studies, combining research, teaching, and artifact collections with a regional and chronological focus that is virtually unparalleled throughout the world.

Although the Computer Laboratory is keeping abreast of the latest developments in computer information access, storage, and electronic publishing, the benefits of these technologies will only be realized when they are applied to the on-going work of the Institute's faculty, museum, research projects, and staff. Demonstration projects undertaken by the Computer Laboratory, such as the Institute's World-Wide Web database, are a necessary first step, but the measure of their success lies not with these projects themselves but rather with the integration of their technologies into the management of the Institute's collections and research projects.
