COMPUTER LABORATORY

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INTRODUCTION

During its second year of operation the Oriental Institute Computer Laboratory expanded its services to include a diversity of projects. Besides addressing daily issues of computer operations or malfunctions of every imaginable sort, there has been a steady flow of graphics production for archaeological publications, as well as programming and applications development. Not least in significance was the compilation of a document describing the evolution of computer use at the Oriental Institute.

As Institute sections and projects acquire new computers, the laboratory is consulted on the shuffling and reassigning of older computers to where they are most needed or best suited. This often involves upgrading the machines with more memory and/or higher capacity hard disk drives. With the rising demand for computers, few, if any, remain unused.

INSTITUTE COMPUTER NETWORK

The computer network provides a means for all Institute personnel to communicate by electronic mail, or to send messages to colleagues in other institutions that are also connected to the world-wide computer network. This same process also allows computer files or documents to be transferred between individuals over the network, a definite improvement in speed and ease of communication among scholars. The network also provides access from a desktop computer to the University of Chicago On-Line Library Catalogue, as well as more than 300 other library catalogs around the world. Access to laser printers by all Institute faculty, staff, students is also available over the network, which improves the quality of computer documents that must be printed.

After only a year and a half, the Institute's computer network seems to have reached a very important point in its life. Given the comments and general state of anticipation that pervades the halls during its not too frequent "down time," it appears that the computer network has developed the capacity to inflict Institute personnel with the "how did we manage without it" syndrome. Use of electronic mail as the preferred means of intra-building communications amongst the Institute's faculty and staff has steadily

increased, and in some sections of the Institute, such as the Research Archives, electronic mail and use of the Institute's fax machine has virtually replaced the voice telephone for communications outside the building.

Practically all of the Institute's computers are connected to the building's computer network: sixty-three of sixty-seven Apple Macintosh computers are connected to the AppleTalk network, with two of the remaining four Apple Macintosh computers directly connected to the Ethernet network; six of fourteen IBM PC compatible computers are likewise connected to the AppleTalk network. And the Institute's Sun SPARCstation computer located in the Computer Laboratory is connected to the Ethernet network. Similarly, eight of ten laser printers in the Institute are connected to the building's AppleTalk network.

LABORATORY PROJECTS

Considering the volume of drawings produced by the Computer Laboratory, whether printed or plotted images for publication, or slide images for lectures, the assistance and graphic skills of Peggy Sanders is gratefully acknowledged. Ms. Sanders, who has been the artist for the Nippur Expedition since 1977, maintains a relationship with the Oriental Institute as an independent contractor with Archaeological Graphic Services. Her work is divided between manual and computer-aided drawing, both of which have their place in various projects at the Institute.

The Computer Laboratory staff assisted several research projects and Institute sections during the past year. The following discussions briefly summarize our work, the methods employed, and their results.

The Nippur Expedition

Although the Gulf War caused a distressing interruption to excavations at Nippur, a small consolation is increased time to spend preparing publication maps, plans, pottery, and object drawings from several seasons of excavation at Nippur. The list includes the operations in areas:

WC-1, an area of Kassite buildings and surface graves

WC-2, an area of seventh and sixth century B.C. houses

WC-3, Nippur city wall excavations from several periods

WF, a small stratigraphic exposure of continually rebuilt houses from the Early Dynastic through the Ur III period, as well as Kassite and first millennium B.C. remains

WG, an area of Parthian through Sasanian buildings

Umm al Hafriyat (a site 20 km to the east of Nippur)

With regard to area WG and the site of Umm al Hafriyat, the work involved simply digitizing, or transferring, original field drawings (pencil on

paper) to computer files in preparation for future editing. Once in the computer, drawing files can be edited and re-edited in accordance with the excavation's corresponding field notes and publication manuscripts.

In the case of the area WC-1 report, whose primary author is Richard Zettler, numerous drafts of the individual level plans and sections were produced during the course of editing over the past year. The final, publication-ready, ink-on-mylar versions of these drawings were plotted and given to the Oriental Institute Publications Office, along with the completed manuscript. The volume, entitled *Nippur III: Kassite Buildings in Area WC-1*, will be published about the same time as this *Annual Report.*

Drawings of area WF, which will illustrate the dissertation of Augusta McMahon, have gone through a similar metamorphosis and will be plotted a final time during the coming year. James Armstrong is reworking, for publication, his dissertation on excavations in area WC-2. During the past year the Computer Laboratory added to these plans some important details which were brought to light in his 1987 excavation of the same area.

Drawings such as those described above, whether produced on a computer or by more traditional means, have been for years and continue to be a routine part of any excavation report. The Computer Laboratory staff, however, in conjunction with Nippur Expedition members, is utilizing the graphic capabilities of our computers to produce three-dimensional visualizations of the site of Nippur and its environs. For many years each excavation report from Nippur has relied solely on a topographic plan to orient the reader. Two years ago that original two-dimensional contour plan was transformed into a three-dimensional surface terrain model of the site. With this computer model it is possible to "fly around" as if in a helicopter and to view the site in three-dimensions from any angle or height you choose. This type of imaging enhances one's ability to understand the topography of Nippur and to locate features and excavation areas at the site. Examples of several such images became part of the Interactive Computer Display in the Oriental Institute Museum's Centennial Exhibit, "Sifting the Sands of Time." Photographs produced from these computer images will appear in future Nippur Expedition publications, in the same manner as color slides that are now being used to illustrate lectures given by members of the Nippur staff.

During this past year the three-dimensional surface terrain model of Nippur was enlarged to include an 11 × 23 km area surrounding the site. This expansion of the model is a direct result of collaboration with Tony Wilkinson, the Institute's geomorphologist, who has spent many hours in the field studying this region around Nippur. In the future, coverage will be expanded further as the necessary topographic data is acquired and can be verified by ground survey.

Giza Plateau Mapping Project

In the spring of 1991 public television station WGBH, in Boston, contacted Assistant Professor Mark Lehner, the Institute's Egyptian archaeologist, with an idea for a show that investigated the construction of the Giza pyramid complex to be broadcast in their NOVA series. One part of the show was to be an animated "fly-over" of the Giza Plateau as it might have looked at the time the pyramids were being constructed.

Mentioned briefly in last year's *Annual Report*, a computer model of the entire plateau and its architectural components had to be created from existing maps, and published survey and excavation reports. Lehner supplied the Computer Laboratory with a one-meter contour map showing the topography of the Giza Plateau. The original Giza map was broken down into twenty-five 500 × 500 meter squares. The contour lines in each square were "digitized" into drawing files using the AutoCAD graphics program on an IBM AT computer. Once all twenty-five squares were completed these files were processed to extract the X, Y, Z coordinates for every line segment of each contour, producing a data file of just over 100,000 point proveniences for a 3.5 × 4 km area of the Giza Plateau. This file of point proveniences was then used to generate a three-dimensional surface terrain model of the Giza Plateau using the ARRIS graphics program and an add-on module called Topographer, from Aritek Systems, Inc., on a Sun SPARCstation 1+ computer.

We would like to thank Mr. Al Hart and Mr. Dan Moore of Aritek Systems for their assistance in this project. The need to process over 100,000 data points to generate a single surface model required modifications to the Topographer program itself, changes which they graciously undertook at no charge and which have now been incorporated into the latest release of the Topographer program. We could not have produced the Giza Plateau model for the NOVA production without their help and that of the entire Aritek Systems staff.

In addition to the Giza surface terrain model, the Computer Laboratory constructed basic three-dimensional volume models of the architectural monuments on the Giza Plateau. These building components were added to the surface terrain model in their appropriate locations.

With the computer model of the Giza Plateau completed, the use of animation software will permit one to "fly" into, around, and through the model and to record what one sees on videotape. Because the Computer Laboratory does not yet have the animation software necessary to accomplish this, a copy of the Giza Plateau computer model was shipped to an architectural firm in Venice, California, The Jerde Partnership, who assisted Lehner with his computer mapping of the Sphinx during the 1980s. With Lehner's assistance, Tom Jaegers, the firm's computer specialist, merged their

surface model of the Sphinx with the Giza Plateau surface model, decided on the path of the "fly-over," added a sky backdrop, and produced the forty-five second video sequence that was seen in the NOVA special entitled "This Old Pyramid," which was broadcast on November 4, 1992.

Beyond this "popular" use for the Giza Plateau database, future enhancements to the basic computer model are already underway that will greatly increase its use and potential for analytical and educational studies. One by one, each of the architectural volume models will be replaced with more accurate and detailed three-dimensional reconstructions of the architectural constructions on the plateau. Construction of the first two detailed models, that of the Sphinx Temple and the Khufu Pyramid itself, are nearly completed. These particular structures were chosen because of the needs of a second project Lehner is involved in, the publication of a new survey of the Egyptian pyramids by Thames and Hudson.

Additional work in "re-contouring" the plateau's surface is also planned, in order to produce four separate computer models of the Giza Plateau in accordance with Lehner's reconstructions of the different stages of the plateau's development: before any construction was undertaken, and after each of the pyramids of Khufu, Chephron, and Mycerinus were built.

Tal-e Malyan Project

William Sumner asked the Computer Laboratory to prepare a number of pottery and lithic plates for a forthcoming publication of his excavations at Tal-e Malyan in Iran. The work involved the final hand inking and page layout of pottery profiles and lithic illustrations, most of which were originally drawn years ago by other members of the excavation staff.

Paper on Oriental Institute Computer Usage and History

During the first half of 1992, Charles Jones, the Institute's Research Archivist, and John Sanders collaborated on a paper describing the various uses of computers at the Oriental Institute. Entitled "The Oriental Institute: Computer Usage and Applications Development," it also contains a brief history of how the incorporation of computers into the research projects of Institute faculty and staff has evolved from the early 1960s. It is our intention to update this document as events and projects change over time. We foresee several uses for this paper, either in part or in its entirety:

1. To provide general, background information on the types of research projects and methodologies undertaken at the Oriental Institute
2. To provide more detailed information on the use of technology by these research projects

Copies of this paper are available from either the Oriental Institute Computer Laboratory or the Research Archives.

Publications Office Accounts Receivable Database System

During the past year we helped the Publications Office staff assess their computer software for accounts receivable and shipping of books to their clients. After discussions with the University Computing Organizations' staff, it was decided that the Computer Laboratory would write a new prototype database system on an IBM compatible computer using the dBASE III+ programming language. When the programming is completed and fully tested the dBASE code will then be "ported," or moved, to the Apple Macintosh computers used by the Publications Office. The new Accounts Receivable system should be operational by the summer of 1993.

Rewrite Field Mapping and Recording Software

The Nippur Expedition has used a Hewlett-Packard hand-held computer, the HP-71B, for on-site mapping of field excavations since 1985. John Sanders developed and wrote the computer database programs used at Nippur in the mid-1980s, when the HP-71B was the only affordable hand-held computer with the requisite power, speed, and durability. In writing the mapping and recording software he took advantage of specific features built into the HP-71B computer. When Hewlett-Packard announced in 1988 that it would stop manufacturing the computer immediately, and stop supporting the HP-71B in five years, our continued use of this computer system was called into question.

It was decided this past year to take advantage of the interruption in field operations at Nippur and to start a rewrite of the entire set of recording and mapping programs using a more general-purpose programming language and to remove any computer-specific code that limits the types of machines the programs will operate on. Such changes are advantageous now because the number of hand-held computers we can choose from to replace the HP-71B has increased dramatically in the past year. At present, half of the primary recording program has been rewritten in the dBASE III+ programming language. The entire process, including the addition of several new features that enhance the overall capabilities of the software, should be completed by next fall.

Integrated Computer Database

Discussions continue concerning the development of a single, integrated computer database that would link the various Oriental Institute collections: Research Archives, Photographic Archives, Museum Registration, Museum Conservation, Cuneiform Tablet Collection, and the Epigraphic Survey Archives. This integrated database would incorporate not only textual information from each collection but also images of artifacts and photographs where appropriate. The integration of these related collections would greatly enhance their analytic potential for faculty and staff, as well as scholars

outside the Institute, and provide for very efficient management of these collections.

During the past year and a half three companies have demonstrated their Museum Management and/or Text and Image Management computer programs to representatives of the various Institute collections mentioned above. Several more commercial programs will be evaluated during the coming year. Throughout this process the Institute's original requirements for this type of integrated database are assessed, and adjustments are made as new technologies and methods of achieving our goals are developed and made available.

LABORATORY EQUIPMENT / RESOURCES

In the last *Annual Report* we mentioned that several of the Institute's archaeologists, McGuire Gibson and William Sumner, in particular, had expressed an interest in the use of satellite imaging for their respective projects and in developing a capability within the Institute to process and analyze satellite image data obtained from government and private sources. After discussions with Dr. Raymond Pierrehumbert, Director of the Computer Laboratory in the Geophysical Science Department, the University of Chicago, and Dr. Robert Beck, Director of the Center for Imaging Science, the University of Chicago, it was decided that the Institute should take a two-fold approach to this new technology: first, continue to build on our relationship with these two local resources for image processing and satellite data analysis; and second, to obtain the Spyglass software for the Institute and to start training selective faculty, staff, and students in the use of the programs to view, process, and analyze satellite images and other remote sensing data. The Computer Laboratory has purchased and installed the Spyglass series of software on its Apple Macintosh IIfx. We have also obtained a tape containing SPOT satellite image data covering an area of Iraq to the north of Nippur. This is the image data that will be used as a teaching aid as faculty, staff, and students learn to master this new technology in the coming year.

SPOT Image Corporation is a commercial remote sensing resource owned and operated by the Centre National d'Études Spatiales (CNES), the French space agency. Along with the National Aeronautics and Space Administration and the EOSAT Corporation, these are the primary sources through which the Institute will obtain further satellite data of the Middle East.