

The First Emperor Of China's Ancient World Uncovered: From Xian To Your Electronic Screen

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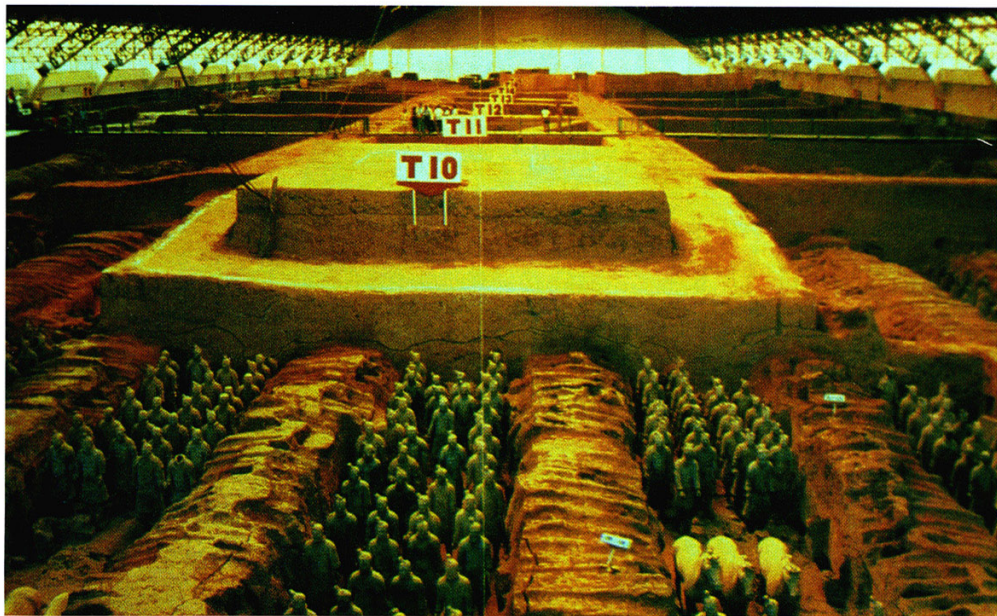


FIGURE 1: Overview of the Emperor Qin Shih Huang Di dig site.

To say that we live in an interesting time understates the uniqueness of the moment! The computer power, storage technology, and software currently available provide us with limitless opportunities for innovative experimentation in education, training, research, and development—all at affordable costs. While these new information technology tools have been taken somewhat for granted for years by researchers and professionals in the fields of science, technology, and medicine, they were not as well known nor as well received by specialists in the humanities and social sciences. Though many reasons can be attributed to the hesitation, reluctance, and occasional suspicion exhibited by humanists when their gazes turn to the new information technology, the failure of existing technology

to fulfill the essential needs of the humanists, the absence of adequate funding support for technology applications, and limited exposure to the capabilities of the new information technology are the main reasons for the humanists' skepticism.

Recently, we began to witness the change of both attitude and practice in accepting these tools to enhance education and research among humanities specialists. Humanities scholars are becoming aware of the possibilities that computing offers for their own work. Take *Academic Computing* as an example, exciting projects have been reported in several recent issues. Another major research and development project, and possibly one of the earliest ones (originating in 1984), PROJECT EMPEROR-I, is marrying high tech and humanities subjects to-

gether with something "old," something "new," and something "borrowed":

1) The Old: PROJECT EMPEROR-I deals with an old subject, 秦始皇帝, the First Emperor of China, his imperial past and his incredible terra-cotta army of warriors and horses excavated in 1973 near the ancient capital of China, Xian. (Figure 1)

2) The New: The project uses cutting-edge hybrid videodisc and micro-computer technologies to store 108,000 frames of visual images and one-hour audio information on each videodisc and provides end users with multimedia information on the subject by accessing media-mix information sources interactively via microcomputers.

3) The Borrowed: In addition to the primary source materials gathered

and created by the project staff, the Ministry of Culture of the People's Republic of China also provided us with invaluable original archival materials and film footage of this most spectacular excavation, otherwise unobtainable through any other means.

PROJECT EMPEROR-I

"PROJECT EMPEROR-I: China's Treasure Revealed via Videodisc Technology" is supported by the Humanities Project in Libraries, U.S. National Endowment for the Humanities (NEH). It applies the latest in hybrid microcomputer and videodisc technologies in presenting and interpreting one of the most important and early historical/archaeological periods in China.

The site and artifacts recorded and presented are from the period of the First Emperor of China, about 2,200 years ago. As the Roman Empire was expanding in the West, the First Emperor of China was conquering other warring states to create the Chinese nation. History knows this victor as Qin Shi Huang Di, 秦始皇帝. During his brief fifteen-year reign, his accomplishments included the implementation of a unified written script, the connection of strategic portions of the Great Wall, the unification of the various warring states, the standardization of weights and measures, the development of an extensive transportation system, and the building of his magnificent tomb at Mount Li near Xian. The tomb site has long been known, but it has not been excavated. In 1973, less than a mile from this mound, 7,000 plus life-size terra-cotta figures of warriors and horses were discovered. This spectacular discovery is considered one of the most magnificent and significant archaeological finds in this century, and it has captured the imaginations of thousands and thousands of people all over the world.

Project Objectives

PROJECT EMPEROR-I is intended

to bridge the gap between the East and the West, the past and the present, humanities and high tech, and scholarship and applications. New information technologies have the capability to deliver large amounts of multimedia information quickly, easily, and differently from those available from more traditional sources. Because of this, PROJECT EMPEROR-I demonstrates convincingly that new technology can indeed be used to promote better general understanding and appreciation of the humanities. It also introduces a new interactive educational and learning model. This enables teachers, professors, and researchers to create innovative humanities programs which achieve a new mode of public programming, education, and research in exciting and unexplored areas of the humanities. It provides students and the general public alike with the opportunity to gain subject knowledge through accessing, enjoying, and digesting the online electronic multimedia information at their own pace and choice, and at the point of need.

PROJECT EMPEROR-I illustrates how new information technologies can effectively present and interpret a stunning art history subject, can provide immediate information access on a difficult topic despite the various barriers such as time and geographical distance, and can permit the free and immediate exploration of the fascinating ancient treasures which otherwise could only be viewed on site. Although this project is related to an art history and archaeological subject, the experience gained from the project in terms of an integrated use of technology for information related problem solving and from the implementation process are transferable to all subject fields including science, technology, and medicine.

Since the completion of "The First Emperor of China" videodiscs in the summer of 1985, PROJECT EMPEROR-I has attracted widespread interest and curiosity across disciplinary lines and target groups—general pub-

lic and specialists, young and old, etc. This article, however, stresses the use of computer-based technology for the enhancement of the learning and research process in academic settings.

Information Problems And Project Considerations

Since PROJECT EMPEROR-I is a research and development project, in order to fulfill the project objectives, we deliberately chose to work on a popular art history and archaeology topic with the expectation that we would encounter considerable difficulties. These include the following:

For the subject specialists and information seekers

1) Although there are large volumes of available information sources on the First Emperor of China, there are relatively few on the Emperor's terra-cotta army because of the recency of this archaeological find.

2) Of the limited number of available information sources on the terra-cotta army, most are Chinese official publications. Most are written in Chinese and their print quality is relatively poor. The photographs in these publications generally are neither in color nor in acceptable quality for high-level research and study purposes.

3) There are no adequate bibliographical control tools for ready identification and location of available sources on the subject. Even in China, most relevant information sources are scattered among subject specialists and museums with no centralized location list of these sources.

4) The world's most renowned Qin specialists reside in China and are not generally accessible to the Western specialists and students.

5) Because of the recency of the archaeological find, few visual image sources of high quality on the subject are available in the Western world. Archival footage and images of the excavation are generally not available outside China. They are scattered in several Chinese governmental organi-

zations and major museums, specifically those in Lintong and Xian.

Thus, for both teaching and research purposes, information seeking on this topic can be a very frustrating and fruitless process. For those few college professors who are teaching in this subject area in the Western universities and colleges, heavy reliance on available printed sources is a given, and the use of visual materials can be limited, at best, to the use of only a few slides and/or film segments gathered from both formal and informal sources. Heavy lecture format is used, supplemented with a detailed course outline consisting mainly of readings of printed materials.

**For project staff:
a logistic, technological,
and pedagogical challenge**

1) Since we are information specialists rather than art historians or archaeologists, we started the project with only simple lay knowledge of the subject and with no relevant information sources—no articles, no slides, and no films. In order for us to complete the project and meet the highest standard of research and scholarship, we needed not only go through a very intensive learning process, but we also had to establish very strict quality control measures. We solicited invaluable assistance from our three key subject consultants—Professors K. C. Chang and Robin D. S. Yates of Harvard University and Mr. Wu Tung, Curator of Asiatic Arts, of the Boston Museum of Fine Arts. Extensive and detailed planning was a must to enable us to start data collection from both Chinese and Western sources.

2) In order to gain access to most of the valuable sources, including the archival footage of the excavation not available outside China, to obtain permission to gather relevant information from major Chinese museums, to interview Chinese archaeological experts on the subject identified by our consultants, and to film and videotape relevant Qin artifacts in major Chinese museums, complex negotia-

tions with the Ministry of Culture of the People's Republic of China and provincial authorities had to be initiated and conducted. These were not easy tasks!

3) Conceptually, we needed to balance the subject contents with the intended utility for computer-based instruction in supporting education, research, and public programming with multimedia information delivery. Technologically, we needed to be able to deliver a product which would integrate all media information sources in one comprehensive and electronic format and would be functionally user friendly to those users with little computer expertise.

4) We needed to know how to benefit from the continuous and dynamic technological development to expand both the scope and the horizon of our project activities.

5) Pedagogically, we needed to rethink how subject matters can and should be taught better through the use of the available electronic tools for computer-based instruction.

Why Videodisc For PROJECT EMPEROR-I?

Optical videodisc technology holds great promise for information storage and retrieval because of its high density storage capacity (108,000 frames of visual images for a two-sided analog disc with one-hour dual sound tracks) and quick random access of stored information (about 1.5 to 3 seconds to search any one of the 54,000 frames of images on each side of the disc). However, for PROJECT EMPEROR-I, in addition to these features, videodisc is also an ideal medium to enable us to capture and present the magnificent site of the archaeological find and related artifacts in multimedia formats, both visual and audio, and with broadcast quality resolution of color and graphic presentations. Furthermore, it is a perfect archival medium which enables us to create the most comprehensive electronic multimedia information bank

on the subject in the world. Last but not least, it lets us create innovative and interactive courseware and programs with microcomputers, achieving a new mode of education and research in fascinating areas of humanities. It is worthwhile to add that because of the enormous number of color images in our project, it became unfeasible for us to consider the use of digital optical media in 1985 since each digitized image consumes a substantial amount of storage, on the order of at least 250 KBs to over 10 MBs per image depending on the image resolution.

PROJECT EMPEROR-I's Major Products And Activities

Initial product

PROJECT EMPEROR-I's initial product is a set of two 12" NTSC CAV videodiscs, entitled "The First Emperor of China: Qin Shi Huang Di, 秦始皇帝," and completed nine months after the start of the project in June 1985. Our ability to deliver our first product under such a timeline is considered by many as remarkable.

Each two-sided videodisc contains 108,000 frames of visual images, one hour of audio track with narration and/or interviews in both English and Chinese, and authentic musical interludes. The first disc includes over 200 segments of motion video from films and videotapes and about 5,000 still frame slides. This visual information, together with matching narrations in both English and Chinese, is generally arranged in "chapters," as in an electronic book. Each chapter deals with an identifiable topic; for example, Introduction to the First Emperor of China, The Great Wall, and the Excavation of the Qin terracotta Warriors and Horses. The visual and audio information is programmed to be retrieved quickly by either chapter or frame search. The second disc essentially is an oral history disc, including interviews with ten of the world's top-most experts on the subject. Both visual and audio informa-

tion are arranged again in chapters by historically researched questions asked of each expert.

While the discs are not intended to be stand-alone products, they do contain short stand-alone pieces which can be accessed either linearly as with most video productions or interactively selected from the displayed menus in the microcomputer system through the use of the developed coursewares.

Integration of technologies and the value-added products

Since the production of our videodiscs in 1985, there have been dynamic developments on every front of new information technology. Many powerful, flexible, and user-friendly computer hardware and software tools and techniques have become available in areas such as interactive course authoring, hypertext information delivery, image database construction, high-resolution electronic imaging, large-scale information conversion, and optical character recognition. All of them have direct implications for PROJECT EMPEROR-I and have enabled us to expand the research and development scope of the project.

Since 1985, the project has also entered into the dissemination and evaluation phases. It has been most enthusiastically received by a wide variety of groups in all subject disciplines as well as by the general public in over twenty countries. The feedback and comments received during these phases have proved to be invaluable in reshaping the directions of our project development and in helping us understand better pedagogically how our products are and should be expected to be used by the end users. We are forced to rethink the educational process, redefine the "book," reformulate information organization patterns, redesign an integrated approach, and repackage the end delivery of information. The widespread popularity of the project has generated substantial support from many hardware and software companies whose products we have chosen care-

fully. It has also proved to be invaluable in permitting us to produce the value-added products listed below:

Interactive courseware development

Several prototype computer-assisted instructional and self-paced interactive videodisc courses were developed for both Digital Equipment Corporation's IVIS and IBM XT or IBM AT compatible systems in 1986 and 1987. Each interactive courseware disc consists of two levels—general information for the lay public and interactive research for serious students and researchers. These enable the information seeker to pursue his or her subject of interest in an interactive mode. The key words here are simultaneity and interruptibility. By using computer

***...the system user is
intimately involved in the
viewing/learning process,
rather than merely being a
passive observer or listener.***

programs, a system user may retrieve any of the visual and audio information contained on the analog disc and the text and database information on the connected computer. Thus, the system user is intimately involved in the viewing/learning process, rather than merely being a passive observer or listener.

The interactive videodisc system exemplifies the successful union of the computer with the audio, text, and visual information of the videodisc. The disc's allowance for easy access permits the development of a range of courseware with user-friendly, menu-driven choices. Each system user can select the specific information which he or she wishes to pursue from the displayed menu and/or submenu on a microcomputer monitor. This applies to either the "general" or "interactive research" level of sophistication. Furthermore, the main menu of the interactive research level

also permits one to select "topics," "explorations," "references," or "messages," each of which provides the users with more specific information. For example, under "topics," a system user can choose any one of the multiple topics with further sub-area selections under each selected topic. When a topic is chosen, relevant video with commentary in either English or Chinese will be shown on the screen; and further reading text materials and/or additional visual information can be selected. A system user can interrupt the selection and return to the main menu at any time. When "explorations" is selected, one is able to explore all the multidimensional images and videos stored on the videodisc. One is also able to easily browse the slide collection stored on the videodisc. Browsing capabilities and the ability to scan the images and associated database information forward and backward along with a zoom-in/zoom-out feature are also available.

Hypermedia information delivery

The interactive course developments described above were our earlier attempts to deliver multimedia information. However, the real blessing came in the third quarter of 1987 when Apple Computer, Inc., introduced its *HyperCard*, Bill Atkinson's version of a hypermedia information delivery tool. *HyperCard* is an extraordinary accomplishment! It is a flexible integrated text/graphic software application that enables users to create linkages among files without having to know too much about the programming language. It is easy to use and is designed for fast retrieval of multimedia information. Thus, it is ideal for PROJECT EMPEROR-I.

With the hardware support both from Apple's Multimedia Group and its New England Regional Office, we were able to begin our developmental work in using *HyperTalk* in the *HyperCard* environment on Mac II in the summer of 1988. In a short two-month period, our hypermedia application modeled after an extensive two-semester graduate study course outline pre-



FIGURE 2: The Main Menu in both English and Chinese versions.

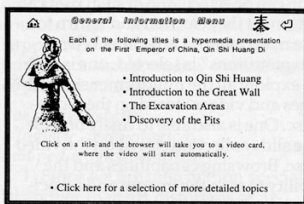


FIGURE 3: The General Information Screen for lay users in both English and Chinese versions.

pared by our consultant, Professor Yates of Harvard University, had its debut at the MacWorld Exhibition in Boston in August 1988. It was very well received. For the first time, PROJECT EMPEROR-I was able to deliver any of the chosen multi-media information—still picture, moving video, audio in dual English and Chinese languages, music, descriptive text, expert commentary, database information, printed source material—at speeds not previously possible. Here was a true seamless environment where a system user could gather and link in-

formation easily from different storage media and sources to obtain his or her own desired information package.

With the donation from the Apple's International Education and Training Division, we also were able to use Apple's *ChineseTalk* to develop the Chinese version of our hypermedia application. Thus, a system user is able to switch any menu and text information on the monitor screen back and forth from one language to the other at his or her choice. Figure 2 shows the Main Menu of the First Emperor of China's VideoDisc Guide in both English and Chinese versions. Although brief descriptive information is given to each icon on the menu, new system users can also benefit from the instructions provided with "Help" information by clicking the "Help" button on the Main Index card.

As shown in Figure 2, the PROJECT EMPEROR-I's hypermedia application consists of five modules and three sample resource files which can be expanded to include every type of information source. The modules include:

- 1) The Videodisc Controller which

enables one to retrieve both video and individual image from the videodisc easily through chapter and frame searches. The language sound track can be switched instantly with a simple click of the mouse.

2) The General Information courses are designed for the general public. Figure 3 shows the menu for general information in both English and Chinese. When a topic is chosen, the relevant video will start immediately on the video monitor along with the audio of the selected language, and the accompanying text information will also appear on the computer monitor. Additional interviews with subject experts on the chosen topic, slides, and text information can also be obtained by clicking the appropriate icons on the videocard. In addition, the resources icons enable the system user to interrupt the on-going program at any time by getting into Map, Dictionary, and Bibliography resource stacks to obtain desired information. For example, when the Map icon is clicked, information on the general location of the archaeological site in relation to the Ancient Capital of China, Xian, as shown in Figure 4, can be obtained. When the Bibliography icon is clicked, not only bibliographical citations of relevant literature are available for browsing, but full text of the desired item can also be retrieved and/or printed easily.

3) The Interactive Research course provides a student with more detailed subject treatment on a chosen topic. Figure 5 shows the Interactive Research Menu, in dual language, with each subject topical area further broken down to sub- and sub-sub-divisions. Each specific topic is presented with one, two, or all of the three types of information sources—text information in either published or unpublished format(s), slides, and interview(s) with subject expert(s). The system user is free to explore these multimedia information sources.

- 4) The Visual Exploration module
- (Continued on page 54)

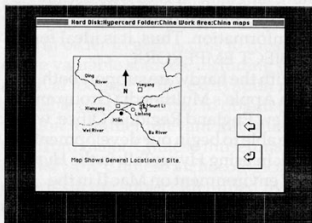


FIGURE 4: Geographical information is provided in the "Map" stacks.

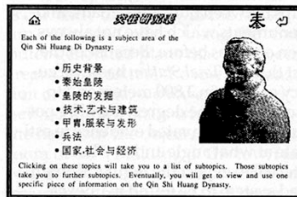


FIGURE 5: The Interactive Research Menu showing subject selections in both English and Chinese for more in depth study.

First Emperor of China (continued from page 14)

provides similar but more sophisticated functions as those described for the DEC interactive courses.

5) The Index module enables one to find visual images and to locate associated text information via many different ways—by subject, date, location, sources of information, format, types of images, etc. The Subject Index essentially maps out the hierarchical structure of the entire subject. Each subject concept can be further subdivided and/or described by a “modifier” or “descriptor.” For example, the close-up and front view of a terra-cotta head is certainly not the same as the back view of a terra-cotta warrior, of which the head is only a part of the entire body.

Converting Bilingual Textual Information In The HyperCard Environment

In addition to the hypermedia information delivery applications described above, we are also experimenting with the conversion of bilingual text information sources in the HyperCard environment by using Apple's *ChineseTalk*. For example, the online dictionary and bibliography can be designed in such a way that both Chinese and English can be accommodated. Thus, instead of a monolingual dictionary, a bilingual dictionary becomes a reality. Similarly, a bibliography or an article can

include information in both English and Chinese, and this is particularly essential when a Chinese character, name, or publication is being referred to. Furthermore, certain Chinese classical texts are essential to the understanding of this subject. For example, the *Records of the Grand Historian of China* is a must for every student and researcher in the field of Chinese studies. A bilingual presentation of this important historical text with appropriate punctuation, as shown in Figure 6, should be incredibly valuable for both researchers and students alike as they pursue mastery of Chinese studies and the Chinese language.



FIGURE 6: When the "Records of the Grand Historian" is selected, one sees the actual text in bilingual format with icons on both side panels for additional or supplementary information.

Electronic Image Databases

We have already discussed at length the image database in the HyperCard environment as part of

our hypermedia application. In this section, a description of the electronic image databases constructed for non-Macintosh system configurations is undertaken.

For the IBM systems, *C-Quest* from Image Concepts, Inc., has been used to index our images since early 1987. Because pictures are not word-based and each is likely to contain many concepts, different meanings of the same image may result as a consequence of how an individual views it in a given context. Most of the current manual image/picture indexing and cataloging methods organize images as if they are printed sources, and most use keyword approaches. Thus, they are not adequate and effective retrieval tools for nontextual data. For PROJECT EMPEROR-I, we have selected *C-Quest* for its flexibility, its synonym capability, and its knowledge-based system governed by hierarchically-structured synonym thesauruses, allowing users to search subject matter using familiar terms. With *C-Quest*, each image is cataloged and accessed with as many subject terms (not keywords) as necessary. Each term can further be coupled with "modifiers." Our experience with *C-Quest* has greatly influenced our design of a viable image database for Mac's using HyperTalk for the HyperCard applications.

Since 1988, our research and development work in this area also includes the following:

- 1) The cooperative experimental work with SOPHIA/TEC of Sophia Antipolis, France, under the sponsorship of Centre National de la Cinematographie (CNC) to port our data to SOPHIA/DOC in developing a multimedia image database for IBM XT and AT compatibles. It is expected that SOPHIA/DOC will be available for UNIX-based systems such as Sun 3 and Sun 4 families in the near future.

- 2) The cooperative experimental work with Project Athena of the Massachusetts Institute of Technology in creating prototype multimedia image

database in using the proprietary *MUSE* software for the DEC's Micro-VAX and IBM RTs. Figure 7 shows how multiple views of a terra-cotta archer with associated database descriptive information is shown on the same screen of an Athena workstation.

Image Digitization And Electronic Imaging

In the area of humanistic research, quality of images is a major issue. To many art historians and archaeologists, the images on videodisc, with broadcast quality resolution, simply are not satisfactory. Currently, with a hardware grant, a Sun 3-160 minicomputer from Sun Microsystems, Inc., and a software grant from Image Understanding Systems, Inc., of Alameda, California, PROJECT EMPEROR-I is able to explore the use of high-resolution image digitization and electronic imaging.

Image Capture And Pre-processing

Images for PROJECT EMPEROR-I are generated from various digitizing devices. For example, the few shown in Figure 8 are sample high-resolution digitized images captured using a Sun Workstation and an Eikonix Model 850 Digitizing Camera on the Sharp JX-450 color scanner. *Imagetool*, a software package developed at Sun, was used to control the scanner and to provide the necessary image manipulation and storage functions. It provides a straightforward SunView-based user interface. SunView, the window-based programming library provided in the Sun operating system, permits us to utilize and modify the powerful image processing software, OASIS, developed by Imaging Understanding System. These 24-bit images were scanned at varying resolutions up to 4,096 by 4,096 (or 4K by 4K) pixels depending on the image processing needs. Other digitizing devices include the Eikonix CDC Array Camera and the Targa Video Digitizer.

Electronic Image Analysis And Manipulation

The OASIS system has been developed on the Sun 3 family to take advantage of the high performance hardware design and powerful growth paths that are available with the Sun system. The open architecture of the Sun system allows each user to configure the system to meet the exact needs of the specific organization. The primary difficulty with high-resolution electronic imaging is the "storage" capacity of the system. For example, our Sun 3-160 has 327-MB hard disk drive. This seemingly large capacity can actually hold very few high-resolution images. For example, even a 24-bit, 1K by 1K, color image in a compressed color mode would require at least 8 MBs. With a further image compression, even at a

very high compression ratio of 10:1, each image will consume almost 1 MB. Thus, a 4K by 4K color image, at the final image compression level, will consume anywhere between 12 to 50 MBs. Therefore, system upgrade options and enhancements are essential in order to ensure that the system will evolve in response to future applications.

From this discussion, it is clear that high-resolution electronic imaging is not intended for all images such as those 108,000 stored on our videodiscs. It makes sense only for those few "star" images that researchers and scholars would like to study in depth, making use of every little bit of digital data. Thus, for PROJECT EMPEROR-I, we digitized only a few "star" images, and we will analyze and manipulate them

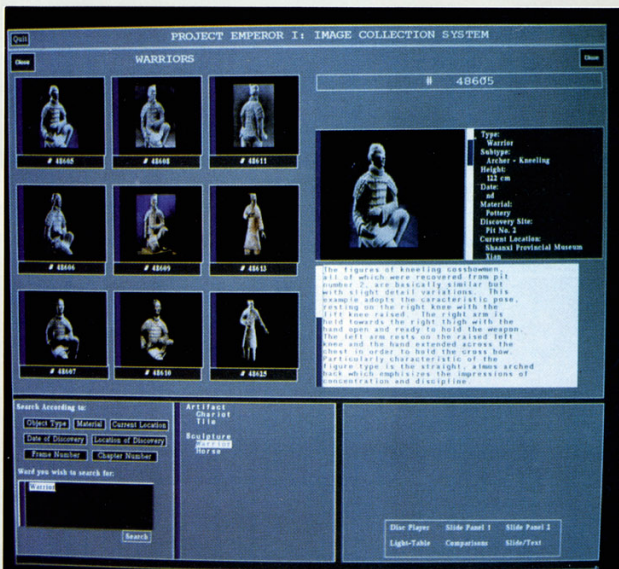


FIGURE 7: Different views of terra-cotta archer with associated database and descriptive information showing on an Athena Workstation.

in ways that include the following:

- 1) Zooming in on any part of the image to study the details;
- 2) Scrolling the image. For example,

we can take a system user to the site of the archaeological find and actually permit him or her to scroll the whole area since the computer monitor

screen can display only a small portion of a large digitized image;

- 3) Comparing images generated from a segment of a larger image, such as shown in Figure 9; and,
- 4) Color and image restoration.

This is a major contribution to the study of art history and archaeology! For example, the 7,000 plus terra-cotta figures are now all in "mud" color after having lost the original bright metallic colors. It is possible for us to restore our digitized images of terra-cotta figures to their supposedly original colors. These capabilities can have profound implications for scholarly research, education, and training. For example, instead of imagining the effects of the colors on the terra-cotta figures, researchers and students, for the first time, are able to visually explore the diversified results by manipulating and analyzing the images electronically and thus enhance their learning and research.

In addition to Sun 3-160, we have recently acquired Sun's 386i Workstation which runs UNIX and MS-DOS under UNIX. Thus, it would be possible for us to connect the 386i with our 3-160 through Ethernet. This also enables us to run our existing applications originally developed for IBM system configurations on the Sun 386i.



FIGURE 8 : High-resolution digitized images using an Eikonix 850 on a Sun Workstation.



FIGURE 9: Comparing images with OASIS on a Sun Workstation.

Image Digitization, OCR, And The Conversion Of Text Materials

In addition to the research and development activities in high-resolution image digitization, PROJECT EMPEROR-I is also involved in converting a large volume of printed text materials to machine readable forms. These are to be linked with the hypermedia applications. With the hardware support from Microtek Lab, Inc., of Gardena, California, and the software support from INOVATIC of Arlington, Virginia, Microtek MSF-300G flatbed image scanner is used for image capture. The 300G model is a flatbed high-resolution (up to 300 dpi for every linear inch of the origi-

nal document) and high speed optical page digitizer which can be used with either Mac IIs or IBM compatibles. Once the text image is digitized, INOVATIC's ReadStar II Plus, a powerful optical character recognition software program, is used to convert the digitized image from the Microtek's scanner to ASCII codes for word processing and/or desktop publishing by using many popular software packages such as PageMaker, Microsoft Word, MacWrite, WordStar, etc. ReadStar II Plus uses an expert system to read and learn simultaneously, training the system for a new font. Once trained, the system recognizes characters rather quickly and accurately, thus saving us an enormous amount of effort in the actual keying of the text documents.

The Future

PROJECT EMPEROR-I's integrated use of new information technology has provided researchers, students, and the general public with a dynamic system for immediate access to multimedia information. Pedagogically, we are sure that the use of multimedia technology both in and out of the classroom can increase the effectiveness of the educational curriculum. For the instructors, direct access to quality still and video pictures can bring new life to subjects that are generally difficult to teach. In addition, the diversified and broad range of subject areas available can encourage the analysis of single situations from many different perspectives, particularly when different views are expressed by subject experts through either interviews or their publications.

Many of the project's current activities and products were not even included in the original proposal submitted to NEH in 1983. This is because we are dealing with cutting edge technologies which are indeed moving targets. Standing on a fast moving sidewalk, we see new technological tools come and go swiftly. Thus, technologies are not really important. The overriding concern

should be whether we are able to utilize the available new technological tools effectively to enhance information access. PROJECT EMPEROR-I has demonstrated that every individual's information need, regardless whether that of researcher, scholar, student, or layman, is important and deserves our consideration. Thus, we have developed various research and development products to meet the diversified needs of information seekers. In order to maximize the potential use of these products, they have been developed for multiple delivery platforms.

PROJECT EMPEROR-I illustrates that one can develop a project which can stand the test of time without the danger of obsolescence. With the rich source materials—stored either on videodiscs, in machine readable forms on computer tapes or hard disks, or in hardcopy formats—we shall continue to build on what we have now and expand the scope beyond it. Undoubtedly, we shall utilize new evolving technologies and techniques in order to broaden our horizon. Thus, in a very confused and exciting technological environment, we view the future with great enthusiasm. The future holds great promise for information professionals!

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HUMANITIES

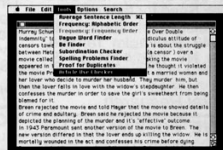
Software
for the
Macintosh



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