INTERACTIVE VIDEODISC TECHNOLOGY,
INFORMATION TRANSFER AND COMMUNICATION:
A Case Presentation on PROJECT EMPEROR-I

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Applications of optical storage and interactive information
technologies continue to be developed at an incredibly ac-
celerating pace. In the past two years, technology improve-
ments, implementation methodologies and cost-effectiveness
have continued to show great gains. Thus, the impact of new
interactive optical technologies has increasingly been recog-
nized by educators, researchers, librarians and publishers
alike. This paper intends to provide a quick introduction on
the interactive videodisc technology. Optical videodisc tech-
nology permits high-density storage of multi-media, multi-
formatted, and multi-dimensional information on a single disc,
thus possessing great potential for information organization,
storage, retrieval and transfer. However, with the demonstra-
tion of the spectacular interactive videodisc, entitled, "The
First Emperor of China", a product of PROJECT EMPEROR-I, it is
clear that the full impact of the videodisc is only realized
when the disc is wed with a computer in an interactive mode.
PROJECT EMPEROR-I: China's Treasure Revealed via Videodisc
Technology is funded by the Humanities Project in Libraries,
US National Endowment for the Humanities. Applying the most
recent videodisc technology, this project presents and inter-
prets a most significant historic/archaeological period of China's
past. The site and artifacts recorded are from the First Emperor
of China's lifetime. The terra-cotta figures of warriors and
horses, which were found near his tomb in Xian are included.
PROJECT EMPEROR-I demonstrates how interactive videodisc techno-
logy has been used to transfer information and to provide better
information access insensitive of time, distance, geography and
other boundaries. It thus promotes better communications among
people and better international relations among nations.

Since early 1985, tremendous progress has occurred in the applications of optical
and interactive information technologies in information services. Technological
improvements, implementation methodologies and cost-effectiveness have continued
to show great gains. Thus, significant milestones were reached in both the
variety and employment of these technologies, and the impact of these new inter-
active information technologies has increasingly been felt and recognized by
educators, researchers, librarians and publishers alike.

In line with the central theme of this FID Conference on information transfer,
communications, and technology, it is essential to expand on how the interactive
videodisc technology can and will continue to play a significant role in informa-
tion transfer and communications. It is important to note that although other
laser optical technology, such as CD-ROM technology, have also revolutionized
electronic publishing, libraries' mode of operations and services, as well as
information transfer and communication. This paper will deal with videodisc
technology only, in particular the analog one for interactive use.

INTRODUCTION

Much to many people's surprise, videodisc technology has been around longer
than microcomputers. Yet, throughout the 1970s and 1980s videodiscs were em-
ployed mainly for recreational purposes. It was not until recently that the
videodisc's role as a high-density, high-speed information storage and retrieval
tool was identified. The rapidly growing microcomputer industry is responsible
for the flamboyant and dynamic developments of interactive videodiscs. For
it is the marriage of the computer, especially the low-cost, high-performance
micros to the videodisc which provides infinite information transfer possibili-
ties. Divorced from the computer, the videodisc has restricted applications.
This is revealed by the extreme popularity of micro-based videodisc technology
in information services.(1)

An important role in this matchmaking was the promotion of information communi-
cations beyond alphanumerics. In the past, this has been a hindrance for appli-
cations involving visual images. With the coupling of videodisc technology to
computerized databases together with other significant advances in this tech-
nology, the possibilities for graphic image applications have mushroomed. Evi-
dence of this is the ease at which videodisc technology, with its capabilities
for large-scale information storage and retrieval, permits the quick and random
use of graphic images with accompanied text and numerical information.

To facilitate better discussion on this subject, the following introductory
information is abstracted from Chen (see reference 1).

Videodisc and Its Characteristics

Optical videodisc technology is unique in that it allows the union of various
types of information media into one continuous and simultaneous format. For
instance, still pictures, meaning slides and filmstrips or motion pictures,
meaning films and videotapes, as well as dual-sound stereo audio can all be
included in one videodisc.

A high-density storage medium, an analog videodisc can on a double-sided, 12-inch
disc store 108,000 images with high color resolution and one-half-hour audio.
This is comparable to 1,350 carousel trays, each possessing 80 slides; at
30-frame per second, video running for one-half hour. For a digital videodisc,
about 800 MB of data can be stored on a 12-inch double-sided digitized disc;
approximately 10,000 to 20,000 pages of text (varying with resolution fineness);
up to 75 hours of digital sound; or any combination of these.

An analog videodisc permits a single image or piece of a motion sequence to be
retrieved randomly in less than three seconds. In addition, one may retrieve
a combination of still images, motion sequences and audio. Digitized videodiscs
also allow information to be retrieved in seconds via the Boolean search and/or
the full text search by use of a specified software.

A laser is the mechanism by which optical videodisc technology records and/or
reads. The laser has the accuracy of one micro or one millionth degree of
a meter. Because of this accuracy, a 12-inch disc possesses information with
a phenomenally high-density inscription. Over 10-billion microscopic spiralling
pits compose each side of the videodisc's information surface. The disc spins
at a rate of 1800 revolutions per minute or 30 revolutions per second. As
it spins, the laser beam's reflected light focuses on the disc's surface and
a photo-detector collects it. When the beam hits a pit, its light is diffracted
away from the detector. The different lengths of the pits cause a variation
of light intensity. The formation of video and audio signals is the result.
Thus, the laser beam reads the information on each disc without actual content.
Furthermore, a protective layer of plastic on the videodisc's metallic surface
forms the protective cover, which yields the information burned on the disc

nearly industructable. It is one of the reasons why the videodisc has been
considered as an archival preservation or conservation medium.

The above summarizes the versatility of the videodisc, as revealed through the
following characteristics:
    - High storage capacity,
    - Multi-type information integration,
    - High resolution and sharp color images,
    - Ideal medium for archival and preservation purposes,
    - Fast random access, and
    - Interactive capability with computer systems.

The Interactive Videodisc

Though highly praised for all these traits, the videodisc's ultimate power is
only completely divulged in an interactive mode. What is an interactive video-
disc?

An interactive system is one in which both the user and the system enter into
a simultaneous and reciprocal interchange. An excellent example of such a
system is human conversation.

Simultaneity and *interruptability* are the significant qualities. As in our mode
of conversation, an interactive optical videodisc system allows a viewer to be
an intimate part of the system and to be actively involved in both the viewing
and learning processes. The coupling of the analog disc with a computer system,
most commonly a micro-based computer system yields this effect.

The ability to easily access information on a videodisc, together with the
availability of sophisticated authoring software, allows the development and/or
composition of computer programs on a variety of courseware. Thus, a user has
a convenient array of alternatives, via the selection from the supposedly user-
friendly, menu-driven screens on the system, to retrieve needed information,
found both on the disc and/or in the computer. To demonstrate both the charac-
teristics of an interactive videodisc and how this technology has been used to
provide information access insensitve of time, distance, geographical and other
boundaries, a product of PROJECT EMPEROR-I has been used.

PROJECT EMPEROR-I

PROJECT EMPEROR.I: China's Treasure Revealed via Videodisc Technology" is funded
by the Humanities Project in Libraries, US National Endowment for the Humanities.
This project applies the most recent in videodisc technology. Its aim is to not
only present, but also provide an interpretation of a difficult but most
interesting humanities-related subject -- a major historical and archaeological
find of China's past, the First Emperor of China's terra-cotta figures of
warriors and horses. During the Emperor's brief 15-year reign, the Qin Dynasty,
there were many significant achievements. For instance, the institution of
unified written scripts, the completion of the Great Wall, the unification of
warring states, and the construction of his magnificent tomb near Xian. This
most spectacular and archaeologically significant discovery, which includes the
7,000 life-size terra-cotta figures of warriors and horses found near the First
Emperor's grave, has captivated people throughout the world. Employing an
interactive videodisc, PROJECT EMPEROR-I captures and interprets these incredible
and most intricate subjects.

The Project Objectives

PROJECT EMPEROR-I illustrates the valuable role of videodiscs for information
storage, processing and retrieval. It also attempts to bond new communication
technologies with the transfer of humanities-related information most of which

is not easily accessible. This project is unique in its union of East with West, past with present, humanities with high technology, and scholarship with application. Thus, PROJECT EMPEROR-I goes beyond demonstrating how this and other related new technologies are able to supply users with more efficient and improved large-scale information processing, storage, access and delivery. It further promotes an increased understanding and appreciation for the humanities, and enhances international relationships.

Figure 1.   Qin Terra-Cotta Figures of Warriors and Horses
             (Courtesy of PROJECT EMPEROR-I)

Introducing a revolutionary interactive educational and learning tool, in addition to the provision of multi-media, multi-formatted and multi-dimensional, visual, audio, and textual information, PROJECT EMPEROR-I also offers interactive micro-based courseware to enable systems users to learn about the subject at their own pace and as desired.

PROJECT EMPEROR-I Products   .

1. "The First Emperor of China" Videodiscs

Two double-sided 12 inch NTSC CAV videodiscs, entitled "The First Emperor of China: Qin Shi Huang Di" are the primary products of PROJECT EMPEROR-I. Musical interludes and 108,000 frames of visual images make up each disc. Also, recorded in both Chinese and English is one full hour of narration and/or interviews.

In much the same format of an electronic book, the visual information is organized with reference to appropriate bilingual narrations, which are then classified into "chapters" each of which can be searched and retrieved just in the same way as any one frame of the visual images. While the videodiscs are not meant to be stand-alone discs, the first one does consist of a few stand-alone introductory programs, such as "The Introduction on the First Emperor of China", "The Great Wall", and "The Qin Terra-Cotta Museum of Warriors and Horses". In addition, the first disc contains also over 200 segments of motion video and over 4,000 still frame pictures.

An oral history presentation of videotaped interviews is located on the second double-sided disc. Segments from over 60 hours of videotapes consisting of interviews of the field's top experts were critically edited and reorganized into the format of questions asked of and responded to by each expert. To enhance quick retrieval, the answers provided by each expert to the questions asked are also arranged in chapters.

2. Electronic Database

For the visual images which are most significant, a detailed database is being developed on a micro-based system. Each database record consists of 12 fields, such as disc side number, frame number, type of object, date of object, date of discovery, size of object, material of object, site where discovered, current location of object, information source, publication sources, and comments. Almost all fields are expected to be retrievable for both visual and textual information.

3. Coursesware

A hardware grant from the Digital Equipment Corporation led to the employment of a DEC IVIS (Interactive Video and Information System), together with the videodisc to create a variety of computer-assisted instructional courseware. In hopes of meeting the needs of users with different levels of expertise in either Chinese art history and/or archaeology, three levels of courseware have been developed. The levels are the intelligent layman including school students, college students and researchers including graduate students in the field. For each level, computer assisted instructional lessons are being developed currently by using Videologic's authoring software, DIRECTOR.

Making selections on menus and sub-menus will be the method by which a system user will interactively choose options. In this manner the user will progress through each lesson or part of it. Simultaneously, the user will be able to select visual, audio and textual information in any desired combinations. The

main menu is composed of the following alternatives:
- Topical -- choices for various subject matters at different levels of
  sophistication. Sub-topical menus are also available (see Figure 2
  for the topical menu selection).
- Exploration -- choices to view three-dimensional pictures or to browse the
  slide collection by going forward, backward, zooming in, zooming out, etc.
- Reference -- selection for checking in the "glossary" file or for viewing
  the "bibliography" file. Some items included in the bibliography can
  also be retrieved and viewed in full-text form.
- Announcements or messages for the system user(s).

The intent is to make these courseware also compatible with IBM and IBM-compatible micro-based systems. Aside from the use of the DIRECTOR authoring software, options are open for experimenting with various other kinds of authoring software as well.

Figure 2:   A topical menu of a sample courseware

CONCLUSION

A key element in the success of the objectives of PROJECT EMPEROR-I is its humanities focus. This orientation permits laypersons and field specialists alike to grasp the benefits of this technology. Videodisc technology permits the simultaneous retrieval of the multi-media information sources and spectacular visual images of this magnificient Chinese treasure. Thus, many can view this find in an even grander fashion than if they were personally on site. It also brings to those who may never in their lifetime travel to China, a mouth-watering taste of this spectacular archaeological discovery. For it provides them with the opportunity to experience this thrilling period of Chinese history. PROJECT EMPEROR-I allows our technological advances in information technology to enhance our appreciation of something very ancient and far away. Its cross-cultural orientation promotes international information transfer and communications.

Just as importantly, PROJECT EMPEROR-I has revealed itself as a perfect research and development project. It spectacularly promotes the tremendously exciting opportunities which the interactive videodisc can provide in education, research and training.

Generally speaking, videodisc technology also can be a universal tool for all of us and should have a very positive influence in the future of information provision and communications. It can provide information access insensitive of time limitation, distance volume or complexity in a way not possible for us to contemplate before. This is the kind of dynamic and aggressive information provision which we as information professionals in this information age should develop and strive for.

PROJECT EMPEROR-I is one attempt to promote the development of a new frontier. A frontier which uses the most current information technology for information transfer and communications. While the process and tasks involved have been difficult and at times frustrating, the experience and results have been most exciting and gratifying.

REFERENCE *

1. Chen, Ching-chih. "Micro-based Optical Videodisc Applications". *Micro-computers for Information Management* 2(4):217-239(December 1985).

* This project has been widely covered in media, publications and conferences. For more information about the project and a complete and up-to-date listing of publications, contact: Dr. Ching-Chih Chen, Professor and Associate Dean, Principal Investigator and Project Director, PROJECT EMPEROR-I, Simmons College, 300 The Fenway, Boston, Massachusetts 02115, USA.