

IMAGE PROCESSING AND DATABASE SYSTEM IN THE NATIONAL MUSEUM OF WESTERN ART; AN INTEGRATED SYSTEM FOR ART RESEARCH

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Abstract: A research group of a librarian, curators and a computer specialist, to which I take responsibility, has been developing an integrated system for art research on an experimental basis for four years from 1994. Image processing technologies using input and output devices and software for high definition digital data are applied to studying Western artwork of the museum collection and comparing ours with that of the other museums. According to this system, for example, we can see on the CRT monitor the image of the same size of the artwork itself.

On the other hand, the integrated database system will enable us to catalogue artwork, on the same screen, recognized, images and different application programs such as AAT, ULAN and Iconclass in the same system. We examine, for the academic research of Western art in Japan, the efficiency of the application to those machine-readable thesauruses and classification systems, which have been developed in Western countries using Western languages. The use of digitized microfiche images is also discussed.

Introduction

Many art museums in Japan have been experimenting with the creation of databases of collection catalogs and with the practical application of high-definition image presentation systems using high-vision techniques. In most cases, the trials aim mainly at the daily management of the collections, art education and diffusion for visitors. On the other hand, a number of curators in the museums are asking themselves if image processing and image database creation by computer are truly helping their jobs or contributing to their research activities. We have set up a research environment clearly different from an ordinary museum job environment, and have identified several research subjects (but not the general issue of image processing or image databasing). We are aiming to verify that a new computer system can be a support tool to solve such problems.

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1. Objectives of research

In art research images such as photos are essential and it is therefore necessary to collect and accumulate visual resources of various kinds. At the same time, effective means of retrieval and use must be established. In the field of Western art studies, European countries and the United States have a history of image study, and photo archives exist to support it. They have also established description and classification systems, and effective retrieval techniques¹. To our regret, we do not have a fully-fledged photo archive of Western art, and have not yet come to full understanding of the above-mentioned European and U.S. systems and techniques². In the fiscal year 1992 the National Museum of Western Art, Tokyo, bought some fundamental reference materials including the Marburger Index³, and in the following year, held a lecture meeting with Mr Jan van der Wateren, Chief Librarian of the National Art Library, Victoria and Albert Museum as speaker⁴. In 1993 a representative of the research group (myself) made a short visit to France to study image database systems, get information-related reference materials from French counterparts, and to set up co-operative relationships with them⁵. In addition, we are asking visiting researchers of fiscal years 1992 to 93 for advice and proposals on information processing systems. Furthermore, conventional comparative study of artworks had been pursued by comparison of photo negatives, and handwork such as reproduction and enlargement simulation of duplicated materials⁶. This way of study was accompanied by problems of precision, efficiency and effect. Many researchers concerned have been expecting a real-size research support system using image processing and database systems.

Through the image stocks (microfiches and photos) so far built up in Europe and the U.S., the first objective of our study is to discuss the efficiency of the ICONCLASS⁷-based classification and language control method applied to the actual research environment. The second is to clarify various conditions and problems for promotion of the study, to open a new aspect of use of electronic image information, and to produce a model of visual resources and image information to be presented to a future Western Art Information/Reference Materials Research Center. The third is to make a comparative study of the collections of our museum using image processing technology, and to make use of the image database in special exhibitions.

This kind of study has been conducted to a certain degree for Japanese and Eastern arts⁸. For Western art, however, there has been little systematic study in Japan. Our research is characterized by co-operative study by a group of experts in the fields of art history, documentation and information systems. At the same

time, this is the first full-scale trial to establish visual resources and image information specifically for the study of Western art. Researchers in our museum and in others have eagerly awaited a Western art information and materials system or center and our research is an essential basic step towards it.

In Japan, there have been some cases of artwork database creation for art including Western art but an overall image study system has not been created to cover photographic prints, microfiches, CD-ROMs, X-ray photos, infrared photos, etc.

In this respect, the efforts to improve study and to update systems are worthy of special mention; for example, the photographic materials retrieval system pursued by the Witt Library, Courtauld Institute of Art, University of London⁹; the painting and drawings database JOCONDE¹⁰ in the French Ministry of Culture, Thésaurus iconographique¹¹; AAT (Art & Architecture Thesaurus)¹²; the image classification system ICONCLASS developed by Leiden University; the image database related to scientific analysis image data NARCISSE¹³; and VASARI¹⁴.

The Japanese technical level of hardware for image databasing and image processing has acquired a high reputation in European countries and the U.S. How to make the most of it in the software field is the great problem now facing us. If the methods developed by Europe and the U.S. prove to be effective (or to have some limitations) through this research, a new step forward in the study will definitely be taken.

2. Organization of research team, and contents of research

To pursue this research, a team of five members from different job categories has been created. The role allotted to the members, and the contents of the research are as follows:

- A: Management of the study, analysis and evaluation of application tools (by the Author).
- B: Application of image processing in German art studies.
- C: Study of artwork collections through the use of computer image processing, and creation of checklists of paintings and drawings by Domenico Tintoretto.
- D: Database ("Einblattholzchnitt") of German Renaissance woodcuts.
- E: Creation and management of image processing databases and image processing systems

Member A specializes in library and information science and art documentation. Members B,C and D are specialists in art history. Member E is a systems engineer. In fiscal year 1994, the system was mainly operated by member A under technical assistance from member E. In fiscal year 1995, the emphasis of the research will be placed on research by members B, C and D, and in fiscal year 1997 (final year) the research will be submitted for analysis and general evaluation by member A.

3. Creation of system

In view of the team's budgetary and technical restrictions, we have selected personal computers as the mainstay of the system instead of a workstation. Initially there was a plan to connect the main system to the personal computers of co-operating researchers via a small-scale LAN. This plan, however, was abandoned for physical and fiscal reasons. Instead, the two main personal computers were connected peer-to-peer on Ethernet. In total, this system is composed of three components: image input/output system, image database system, and terminal system.

3.1 Image input/output system

On an IBM DOS/V machine, two types of scanners are attached so that the researchers can enter the image of their choice. One is a flat-bed scanner permitting entry of images whose sizes range from 4x5 inch positive film (standard size in art study) to reflective documents of up to A4 sizes. The other is a special scanner for 35 mm slides. Also provided is a CD-ROM drive incorporated in the personal computer so as to import images from CD-ROM, including Photo-CD. Also available is input from an analog videodisc player and videotape recorder. The devices used are compatible with NTSC as well as PAL and SECAM, the standards in England and European countries.

The image entered is sent to the PC via Ethernet, and then submitted for image processing. The software used is DENGADENGA. Once processed the image is output as hardcopy by PICTROGRAPHY 3000, using the advanced technology called "Silver Halide Photographic Process Combined with LD Exposure and Thermal Development and Transfer."

3.2 Image database system

DENGADENGA has a database facility, but this facility is not sufficient. Instead, an integrated database has been made using PARADOX. According to a basic plan, textual data can be entered while checking an image taken in from a magneto-optical (MO) disk, with reference to the existing application software

such as the image classification system ICONCLASS, Art & Architecture Thesaurus (AAT) and the Union List of Artist Names (ULAN)¹⁵⁾.

To avoid duplication between image processing input and output and image database input, an IBM DOS/V machine and MO device are included in the system (Fig. 1) so as to permit the latter job.

3.3 Terminal systems

On the terminal system the co-operating researchers enter mainly textual data. In most cases they use Macintosh machines for their principal purposes of research. The IBM machine was selected to match the requirements for WordPerfect, the most popular word-processing software in the U.S. and Europe. A card-type modem is also mounted to provide a telecommunication facility.

4. State as of March 1995

The first year of the research was aimed mainly at system creation and collection of reference materials. Although these have not been completed yet, the activities now underway can be summarized as follows:

4.1 Real-size image display facility

As one feature of the image processing facility, we have been developing software to permit real-size display of artwork. This system is designed to display, on full scale, artworks related to each other in some points (e.g. altarpieces, triptych, etc., serial works or works of different versions) and to make comparative simulation by juxtaposition, superimposition, reduction, enlargement, deformation, partial shift or change in colors. This system will make it possible to display images on a high-definition monitor with an error of about 0.2 mm.

4.2 Collection of microfiches and creation of image files

André Malraux says "For the past hundred years (if we except the activities of specialists), the history of art has been the history of that which can be photographed"¹⁶⁾. Research of artworks depends to a great extent on how to obtain high-quality art photos, as many as possible, in an efficient way. We have bought a collection of microfiches "Sixteenth Century Pamphlets in German and Latin" (about 2,900 sheets, 142,000 frames)¹⁷⁾ and "The Witt Library" (about 15,000 sheets, 1,470,000 frames)¹⁸⁾. In our research, the former collection was selected as a model for an image database. First, an image file was created as follows:

- 1) In a pamphlet consisting mainly of text pages, a page with a figure is selected and marked. At this time, selection is made between 200 dpi and 400 dpi according to the definition of the image.
- 2) Image data is entered by a subcontractor and is presented in TIFF format as an image file held on magneto-optical disk. The number of images amounts to 5,112. The data volume for an A4 image is about 500 Kbytes at 200 dpi; and, for an A3 image, about 4 Mbytes at 400 dpi. The data storage requirement reached five 5-inch MO disks (double sided).

4.3 Creation of database

The database is composed of two or more files having different data structures varying with the objectives of the research shared by the co-operating researchers. For "Sixteenth Century Pamphlets in German and Latin", data items are classified. This is because there are two bibliographic levels: for the individual figure and the pamphlet containing the figure. They are classified into two respective files and are linked with each other. In the data items, the subject (or category), key word and name of artist are taken from AAT, ICONCLASS and ULAN. The data is presented in the form of a book or floppy disk. Among the database systems, AAT and ICONCLASS have priority. AAT currently operates only on DOS; ICONCLASS can run on Windows.

5. Conclusion

Our system has now been completed up to a certain level of practical operation. Evaluation of the system, however, remains somewhat difficult at this time. The curators specializing in art history have difficulty with the operation because of the complicated procedures involved.

From the fiscal year 1995 onwards verification of the effectiveness of the system, data input, image processing, and application of an image database for research activities will continue to be pursued by the respective members.

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Figure 1: System configuration

