A Digital Art-Image Database Using Borland Paradox

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Abstract:

ArtBase, a digital art-image database for the presentation, processing, archiving and retrieval of art-works, has been developed. The platform of the system is Paradox® a commercially available general purpose, object oriented, relational data base package working under Windows 3.x on Novell networks. In cases where the tools provided by the package were found inadequate to the specific application, we developed our application by programming in C++ language. The application has the advantages of low cost, wide applicability and adaptability to individual needs.

The aim of the activity has been the development of a distributed computer system providing storage, processing and communication services required by the art community. Some special features of the system are: handling of multimedia information in a uniform way, fast access to images through the network, open image communication possibilities and the capability of image input and output from devices commercially available (CCD cameras, scanners, printers).

Given the limited resources of museums, galleries and educational institutions, this approach offers a simple, yet robust, PC based, imaging software that focuses on organisations of small to medium size. The system can also be used on education as a teaching tool in Art History and in variety of other applications requiring flexible, low cost multimedia type image database.

Introduction-Description of the Package

Computers [1] are making unprecedented aesthetic experiences possible and offer a revolutionary way to how art is conceived, perceived and taught. The profound impact of digital technology on the art during the last years and what it portends for the future, is only beginning to be appreciated.

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2 Paradox® is a trademark of Borland Inc.
Although enthusiastically welcomed by the film and broadcasting industries, computers have not been readily accepted by most of the art community. With their enormous potential as visualising tools, the reticence of the art community is somewhat perplexing. While it is certainly true that the liaison between art and technology has been an uneasy one for some art historians and art educators, their ideas and apprehensions are becoming outdated in the current context of computer knowledge regarding available machines and programs.

Today, the wide availability and portability of personal computers and very sophisticated programs invite art historians to work directly on their own computers, so that intermediaries are no longer required. However, there is still a need for art historians and teachers to work alongside programmers to improve the familiarity and the simplicity of the user interface towards the artistic and educational directions of art software. The reasons for this are:

- the new and unfamiliar are frequently received with discomfort and sometimes, rejection [2].
- for the present days, art historians and computers make up a rather unfamiliar terrain
- most museum visitors do not read properly the instructions and information cards for handling the computer systems [3].

ArtBase is a structured database and is suitable for museums, individual collectors and for educational purposes as well. Under modification it can also be used in any application requiring a flexible, low cost multimedia image-text databases, such as real estate, product catalogues, etc. It is designed to support basic documentation, a function provided by existing collection management systems. It can include information which constitutes the current knowledge about sets of paintings organised into collections. This information consists of multimedia data (images, audio, text, etc.) and is characterised by a degree of linking (mainly via key words), a variety of references, data for the management of the collection and tools for educational purposes.

Information in ArtBase is organised as a knowledge base according to a specifically developed, and quite simple, user interface. ArtBase's main window (Figure 1), an excerpt from the image window, includes pop-up menus for the management of the input and output data, as well as user interface elements like "buttons" for the presentation of related information.

It is of particular importance that ArtBase can be considered as an "open" system in the sense that it could be used as a software tool for multimedia composition. To use an analogy, ArtBase is to various media as a word processor is to text. It allows the user, having the access to do that, to easily add new material and to manipulate the old one as well. The tools for doing these are put in the pop up menus. The whole operation has nothing to do with programming languages. Furthermore, if the user is capable in programming, he/she can tailor the whole interface according his/her needs. ArtBase was developed with the goal of creating and tailoring the database and the interface according the specific application in which the user intends to use it.
The Object-Oriented Data Base Platform

Object-oriented database systems [4] distinguish themselves by the integration of conventional database functionality with object-oriented modelling concepts. A primary goal of databases is to isolate the presentation and management of data from the application programs which process these data and to enable a consistent use of data by several application programs running simultaneously. In conventional database systems the isolation of data and application programs is achieved by making the application independent of the internal representation of the data. The application programs are responsible for the consistent interpretation and manipulation of the data. The following essential restrictions of conventional database systems are overcome by an open, object-oriented database system:

- Structural representation. Objects will be complex structures stored in the database as a whole.

- Data processing. Application program are independent of the internal data representation as well as to a high degree - from the semantics implied by the data since the operations which are defined on the data are also provided by the database.

- Extensible, open model. The set of modelling primitives can be extended by modelling primitives which are especially designed to an application's needs.

Compared with conventional systems, object oriented database systems offer essential advantages with respect to specific application domains because of the higher
expressiveness of the object-oriented data model and the interaction of object-oriented concepts with conventional database systems. Many such prototypes have been developed in research centres and some of them have evolved into commercial systems all over the world during the last few years.

Borland Paradox for Windows 4.5 [5] is such a widely used truly relational database management system (RDBMS) which runs under the Microsoft Windows user interface platform. Access® is another similar product developed by Microsoft. We decided to use Paradox because we had more experience with it. It provides users with a powerful RDBMS able to handle relational tables with advanced data types such as Memos (large amounts of text), formatted text, images and BLOBS — meaning any kind of digital information such as sound and video. The package provides with a very intuitive and simple way of browsing tables, creating data entry forms and summary reports.

The user interface is designed in a fully object-oriented manner focusing towards objects and related identities and methods. Moreover it offers a visual way to construct full featured database windows applications, by simply drawing the windows and dialogue boxes that are to be used. Paradox offers an object oriented programming language called ObjectPAL which combines the flexibility of C++, along with the robustness of Pascal, thus providing programmers and developers with a unique development tool. (figure 2).

![Image](image.png)

*Figure 2: A typical Paradox developing session with the dialogue box and code widow for a specified UI object.*

General Information and System Requirements

The ArtBase project features a simple though robust approach — imposed by the relational model — in maintaining a database of paintings, artists and all related information. The

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3 Access® is a trademark of Microsoft Corporation.
program runs adequately on a 80386 based personal system — however an i486 is recommended — with an at least 800 x 600 true colour video card and display. It also requires at least 8MB of RAM memory in order for the database cache buffers to provide sufficient transfer speed. Since all multimedia functions have been programmed using the Windows MCI command interface, no specific sound card is required, providing that the card has been properly installed for use with Windows.

In order to improve the program’s speed and efficiency a large part of it has been written using the Borland C/C++ 4.0 Compiler, which produces 32 bit code taking full advantage of the 80386 and i486 processor’s capabilities. Moreover since Paradox supports data sharing on many networking environments, ArtBase is supposed to perform well on any of them and has been successfully tested on a Novel NetWare 386 v3.11 Network.

A major goal of the software and hardware platform used is portability. Furthermore the system is extensible since the Windows operating system and the Novell network support the integration of unlimited numbers of new devices (image sources and destinations), operators, and images (of various types). The speed of the information (images, related data) interchange depends mainly on the hardware.

**Internal Database Structure**

Data for ArtBase are kept in three different data tables joined together in a fashion that allows data lookup from one to the other. The main table contains the primary data for the paintings in the database, including name, artist, reference number, comments, exhibitions, references and sound. The second table contains additional images of paintings already stored in the database while the third one contains information about artists. The main table is always kept open while the others are consulted on demand.

**Features**

The program user interface is very intuitive, with most operations being available through push buttons and menu commands. The painting’s image can be seen in a variety of resolutions ranging from 100% (image as scanned) to 200% and 400% magnifications and 50% and 25% shrinking. A best fit option is also available allowing for the best possible image view taking into account image dimensions and window size. Vocal description and narration is also available using digital sound (WAVE format files) while MIDI music can be selected and heard in the background.

The user is allowed to sequentially move though entries in the database using a CD fashion set of buttons, while searching for and going to a specific record is done at a click.

ArtBase is also able to export data of both pictures and text. Pictorial data can be exported using the standard Windows 3.0 bitmap file format, while all textual information can be easily copied to the clipboard, or even written into a text file. In this, way ArtBase users can freely manipulate and process individual images of paintings from any other image processing software, such as PhotoStyler, PhotoShop or Corel PhotoPaint.

When it comes to selecting paintings and creating selection lists, the program also offers a browsing tool (figure 3) which allows users to make selection lists by querying the

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*PhotoStyler®, PhotoShop® and Corel PhotoPaint® are trademarks of U Load Systems Inc., Adobe Systems Inc, and Corel Corporation., respectively.*
database using the basic fields as search keys. Selections can then be stored on simple text files and saved for later use.

![Figure 3: ArtBase's query tool](image)

The system provides various operating modes. It can be used for administrative purposes or presentation (part or as a whole) of the collection of a museum or by individual collectors. It can also be used for publishing titles for CD-ROMs since the user interface includes tools for doing this. Since part of the image database and the associative data can be transferred to a portable computer, the system can be used for remote presentations. Furthermore, the tools which the system has been equipped, make it valuable for the teaching of History of Art.

All textual information is available in both Greek and English languages.

The cost of the project is estimated at the sum of money for the purchase of the Paradox platform (£110) and about six man-months of an experienced programmer.

Tools For Educational Use

ArtBase offers some functionality regarding the program's use from an educational point of view. Art history can be presented using ArtBase as a tool. With the addition of a friendly question & answer module we can use this program to teach Art History even in elementary schools. Selection lists can be easily stored in separate disk files for later retrieval. In that way results of joined queries can be combined in order to be used as later reference material. The program is also able to keep track of more than one version of the same painting (figure 4) or linking paintings, thus allowing users to have more than one view of the art element in question.

Since most information can be reached at a click with the use of fancy buttons and menus, ArtBase is ideal for use also by children who address the entire program with unexpected curiosity. The authors were very glad to experience this -- during the exhibition of the program in the INFO SYSTEM HI-TECH 94 Exhibition which took place in Thessaloniki,
EVA'95
A Bakalidis ~ C Chamzas ~ G Kekkeris ~ A Kouria

Greece from 30-9 till 5-10 1994. — many children used the program in order to find out more about art and related data.

Figure 4: Both version of a painting by N. Gizis.
Notice the difference in colour of the girl's dress

Future Developments

Future work will concern, among others, the following topics:

- Compression. At this time we store the images uncompressed, due to some peculiarities of Paradox. We are working into using various compression schemes [6], [7], [8]. Our priority is to use JPEG. We hope that by the day of presentation a suitable algorithm will be implemented so that the speed of file interchange will increase even more and scenes of video recordings and dynamic zoom will be added to the system as well.

- When a system consists of a large database, generally the response time becomes a very important factor. This is true in the art environment where the users do not wish to wait a long time for the high resolution images to be retrieved in the database server and appear on their screens. We plan to evaluate the response time of the multimedia database server working through an Ethernet LAN using TCP/IP [9], as seen from a remote station for various search queries and image retrieval requests and will work to (hopefully) find ways to improve it. The testing will be performed on our University
network and the Greek National Gallery-Athens where a version of the program (aimed at curatorial needs) will be installed.

- Continuing the development of the system we will add further capabilities in order to improve the linking of information, access through chains of references, expression of historical and cultural context and indication of conflicting information, along with the respective sources.

Conclusions

Seen as a whole, ArtBase is a low cost relatively simple program running on the average of today’s personal system offering however a number of capabilities including:

- Performance of tasks necessary to the art community in an effective and rapid manner
- It is easily learned i.e., the system doesn’t require learning time which slows its use by people who are not computer specialists
- It can be easily implemented at relatively low cost
- It is portable, extensible and can be considered as an “open” system
- It supports communications and file interchanges
- It can be selectively tailored to the requirements of an application
- The set of modelling primitives can be extended by modelling primitives which are especially designed to an application’s needs
- Allows publishing opportunities to be undertaken
- Provides tools for use in education

References


Company profile

IMAGE ANALYSIS AND MULTIMEDIA GROUP

The multimedia group of D.U.T.H. currently consists of three faculty members, eight graduate students and supporting technical personnel. Its members are teaching courses in the areas of Computer Networks, Data Compression, Digital Signal Processing, Digital Image Processing and Image Coding. Their current research interests are on image compression, pattern and optical character recognition, image communication, multimedia image data bases and digital signal processing.

They have been actively involved in the definition, design and implementation of the CCITT/ISO (JBIG, JPEG, MPEG etc.), standards for coding, storage and retrieval of images (colour & bilevel), where they have six international patents. They are interested in the implementation of multimedia techniques either with fast software or with special purpose devices. They are also working towards the design and implementation of an experimental computer network (based on UNIX/NOVEL), which will be used for the storage and transmission of multimedia University Documents and Images. The Image & Multimedia Laboratory of D.U.T.H. has recently invested over 30 kECU (from Stride - Hellas 8) in its multimedia infrastructure.

Curriculum vitae

Mr. Athanasios Bakalidis received the BSc degree in Computer Science from the University of Crete's Department of Computer Science in 1991 and has been a Ph.D. Student in the Democritus University of Thrace ever since. His areas of interest include multimedia databases design and implementation with use of image compression algorithms in order to improve database efficiency.

Dr. Gerassimos Kekkeris received the B. Sc. degree in Physics from the Aristotelion University of Thessaloniki and a Ph.D. degree in Control Engineering from D.U.T.H. in 1977 and 1990 respectively. He is currently a Lecturer at the Image Analysis and Multimedia Group. His research interests include Control Engineering, Signal Processing and Multimedia. Dr. Kekkeris is a member of IEEE.

Prof. Christos Chamzas, has extensive experience (10 years with AT&T Bell Laboratories, Visual Communications Research Laboratory) in digital signal processing, communication systems and image coding. He has been working on problems in the Submarine Lightwave Systems, adaptive echo cancellers, mobile phones and image data bases. He has designed and implemented a variety of special purpose communication boards for the above projects. Recently, he has been a major player in the definition, design and implementation of the CCITT/ISO (JBIG, JPEG, etc), standards for coding, storage and retrieval of images (colour & bilevel). He is currently interested in the implementation of the above algorithms either with fast software or with VLSI design.

Dr. Afrodithe Kouria has worked as curator at the National Gallery-Athens and has collaborated with Benaki Museum, The School of Fine Arts and the Peloponnesian Folklore Foundation in organising exhibitions. At present she is a research fellow at the Center for Modern Greek Studies (National Hellenic Research Foundation). She is the author of two books and has published several articles on Modern Greek Art and European Engraving.