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Electronic keeping of the
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In the past few years the Municipal Archaeological Museum of Bologna in collaboration with the Planning Department of the City of Bologna has paid great attention to the use of new computer science technologies in the framework of the different activities which are carried out: management, information, education, cataloguing, restorations, scientific research, publishing etc. Indeed, it believes that these instruments are not simply useful but absolutely necessary to enhance the museum's cultural function.

Recent initiatives - the opening to the public of the computer section and the production of a CD-ROM, which contains an in-depth summary of the different projects which have been completed or which are still under way - confirm the museum staff's willingness to involve and interest visitors, students and scholars to carry out educational and scientific activities by proposing new learning paths and visits to the archaeological collections using the computer.

ELECTRONIC CATALOGUING OF THE NUMISMATIC COLLECTION

Among the different projects of the Museum the one concerning the digitalization of the Numismatic Collection constitutes the first example of integration between different technologies. It includes all the different phases: scientific cataloguing, acquisition of images and data processing for record keeping and publishing. The data is thus available to visitors and scholars thanks to a computer which has been installed.

The creation of a virtual Collection of Coins and Medals allows the problem of the absence of a numismatic collection expository route in the Archaeological Museum to be overcome. Indeed, it is possible by using the computer to consult the entire collection of coins and medals. It cannot of course replace the direct examination of the coins and medals but it is in any case an extraordinary and simple instrument for the knowledge of our heritage and can be used by both scholars and visitors.

The Numismatic Collection of Bologna, located entirely at the Municipal Archaeological Museum comprises approximately 100,000 specimens of coins, medals and minting dies. It is one of the richest and most significant historical collections of the institute and one of the most important numismatic collections in Italy. Since 1994 an important reorganization and check of the Collection has been carried out and the material has been arranged, classified and scientifically filed using computers. It has thus

been possible to overcome the difficulties linked to the nineteenth century organization of the Numismatic Collection which subdivided the specimens thematically and according to the collections of origin.

COMPUTERIZED FILING

At present the computerized archive of the Collection of Bologna includes more than 40,000 catalogue and inventory file-cards prepared using the File Maker Pro 3.0 software by Claris.

The catalogue file-card is subdivided into several sectors. Each sector contains different pieces of information: anagraphical identification, administrative, technical, chronological, cultural information etc. whereas each single sector contains specific information thus allowing a more rational use of the data bank and greater accuracy in the arrangement and research activities.

Special attention has been paid to the drawing up of the standards necessary to correctly fill in the file-cards. Uniform terminology and alphabetical indexes in filling in the file-cards have been introduced to help users consult the archive.

The database organization and structure of the more than 16,000 medals contained in the collection of Bologna is particularly interesting. The data bank of the scientific file-cards has been linked to two archives: the first contains the biographies of the people shown on the medals and the second contains information on the engravers and the medallists. The above enables different data to be brought together and helps ensure a better understanding and definition of the objects as well as allowing an articulated and cross-sectional management of the information obtained.

The inventory and catalogue data banks of the Numismatic Collections over and above constituting consultation archives for visitors, students and scholars are also fundamental instruments for museum staff for the management and arrangement of the specimens, the protection and control on the conservation, for the programming of cultural and expository events, for research and for the editing of scientific catalogues.

The Numismatic Collection project is the result of the collaboration between a museum institute and a private company, between the scientific personnel of the museum and a computer expert. It is the result of long and tiring experiments and long discussions which also considered the deep organizational and cultural transformations which exist and the need of equipping oneself with new professional profiles, the need to programme new services for the public to ensure a greater enhancement of our heritage and to obtain an instrument useful in museum organization and cultural planning.

DIGITAL IMAGE INPUT PROJECT

In 1998 the complete digitalization of all the images of the Numismatic Collection began with funds from the Municipal Archaeological Museum of Bologna and the Cultural Heritage Institute of the Emilia Romagna Region. The objective is that of obtaining 200,000 images concerning the obverse and reverse view of the coins, medals and minting dies and the creation of a digital archive of file-cards and images which can be consulted on the net of the Museum using a specially-conceived research interface.

The intervention will last twenty-four months from the beginning of digitalization. It applies technological solutions seeking to reduce to a minimum the time necessary to acquire a single image and introduce greater automation of the interventions for the storing of the single files (checking of the inventory code-number given to each single image file, chromatic calibration, compression and the putting into scale of the image).

The objective is that of extracting the greatest possible information in the shortest possible time. In our case, a systematic and in-depth shooting campaign of a very high number of small specimens was requested and therefore the direct acquisition of the images using a digital camera was necessary. This solution is recommended in those cases in which a high resolution of the image is not required and in which control in real time of the framing and shooting parameters as well as the utmost reduction in image acquisition and storing is necessary. The potential of the shooting means used guarantees the immediate live-video control on the screen of the shooting parameters and the positioning of each individual object, as well as a list of the recording and storing speed of each photogram. The low image acquisition resolution in the PAL format (768x576 pixels at 72 dpi) as compared to other shooting means such as the last generation digital cameras was sufficient to obtain prints of the object at 300/400 dpi on a 1:1 scale.

OPERATIONAL STRATEGIES

The programming of the entire operation if assessed in terms of envisaged execution time also required the optimization study of all the operations required after the acquisition to definitively store the data. The time necessary for the entire procedure concerning a single image must not exceed 36 seconds according to the mathematical calculation of the working seconds available in 24 months of activity divided by the overall number of images (400 working days with five full working hours daily).

The strategy adopted envisaged reducing manual intervention to a minimum and exploiting to the greatest possible extent the automation possibilities of the computer as far as the presetting of the record traces, the chromatic calibration, putting into scale and compression are concerned. The storing procedure was thus subdivided into two different operational phases: the preparation of the stations for manual interventions

with the manual placing of the specimens and the presetting of the software for the automation of the data post-processing phase.

The two stations are placed so as to guarantee the real time viewing on a screen of the positioning of each specimen by both operators. They comprise a stand with double lighting and a Handycam Sony camera connected to an Apple Power Macintosh G3 (96 Mb RAM-4 Gb HD) with a Miro 30 board for the acquisition of the video signal, (FIG. 1) The image storing system comprises a 2 Gb hard disk for temporary backup before the recording on the CD-ROM, a master and a 18 Gb hard disk for the definitive storing. When the object is positioned the first operator places on the shooting plane a reference bar subdivided into 4 one-centimetre segments indicating the basic RGB colours in addition to black. This reference is used for the chromatic calibration and later it shall be recognized by the viewing software allowing the image to be automatically put into scale. The second operator makes sure that the specimen is positioned correctly, saves the image by entering as the file name the inventory number plus the abbreviation for obverse or reverse. At the end of the working day the following operations are carried out automatically: procedures for chromatic correction, fine-tuning of the images (software Photoshop 4.0 in batch), image compression (Graphic Converter -> JPEG format) and a special software checks the inventory numbers associated to the names of the file.

The entire cycle requires several working days until the maximum number of images which can be stored on a CD-ROM is reached (approximately 6,000 images).

The system adopted reduces acquisition time to a minimum. Eight to nine images per minute can be stored in addition to the post-processing time. It was thus possible to store more than 85,000 images between the end of September 1998 and September 1999.

DISPLAY INTERFACE

In May 1999 at the time of the inauguration of the computer room of the museum, a computer was installed allowing visitors and scholars to consult the numismatic material which has been digitally stored.

The display system is based on a specially-conceived surfing interface connected to the network with the different File Maker Pro format archives, (FIG. 2) In this way it is possible to search for and surf among the information which is entered by the operators in charge of cataloguing. The software is connected with the image archive located in the acquisition laboratory and the digital photographs concerning the scientific file-cards can thus be recalled. Once an image is displayed, the interface executes several object analysis functions such as the recognition and measuring in real time of the metric bar (it is thus possible to view a coin on a 1:1 scale and carry out free measurements on the images); the zooming function

and viewing of the front and rear of the specimen. When the research functions within the individual fields are activated the result can be shown as miniatures on a page thus allowing the immediate iconographic contents analysis of the selection obtained.

The electronic cataloguing and filing of the Numismatic Collection is directed by Paola Giovetti (filing-card system and cataloguing) and by Antonio Gottarelli (electronic storing system) with the collaboration of Daniela Picchi and Massimo Bozzoli (data input operators).



FIG. 1 *The digital image acquisition laboratory*



FIG. 2 *The interface*