NEW PERSPECTIVES FOR SINGLE IMAGES IN CONSERVATION

by

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Abstract

New perspectives for Single Images in Conservation are permanently gained from dealing with the "4 point state of the art standards" for "taking", "processing", "applying" and "archiving" of images, including www access, as far as possible.
Consequently the chapters of this paper follow this "4 point program", opening particular new perspectives and practical advises for using Single Images in Conservation:
Chapter 1 deals with new perspectives for basics and for obtaining single images in conservation. It recommends a new definition for single images in conservation and deals with new historic aspects, like Hockneys' camera lucida and reports on experiences from using new sensors and platforms, like the Telescope Camera Light.
Chapter 2 is on new perspectives for "processing" single images in conservation, including projection theory and algorithms, and on promoting the distribution of software for image rectification and mosaiking for both, sophisticated and simple solutions.
Chapter 3 points to New Perspectives from using single images in conservation projects. It is reported on own experiences, offering new perspectives for the use of single images in archaeology but also on, e.g., the role of single images giving reference for judging on the laser scanning resolution.
Chapter 4 deals with New Perspectives for Archives for single images in conservation according to the truth, that an efficient application for single images in conservation will not work without a proper archive.

1. New Perspectives for Basics in Single Images in Conservation.

Cartography, Photogrammetry and Remote Sensing contribute to the inventory and to the Detection of monuments, as basis for further monument protection.
It shall be pointed out, valuable documents for this purpose are in particular imaged local indications (see Fig.1.1 and Fig. 1.2) historic maps and Photos, but handed down texts only with low priority.
In addition, "quasi photographs", which are precise historic paintings in particular, mainly dating back to "ancient times" (before the invention of the photography) still contain treasures for conservation purposes. Namely this historic paintings showing proper perspective projection are obviously based on "Hockney's" camera lucida or comparable projection devices, which of course also have their tradition in Photogrammetry, like the well known historic Aero-sketchmaster, which is nothing else than the camera Lucida, see fig. 1.3:

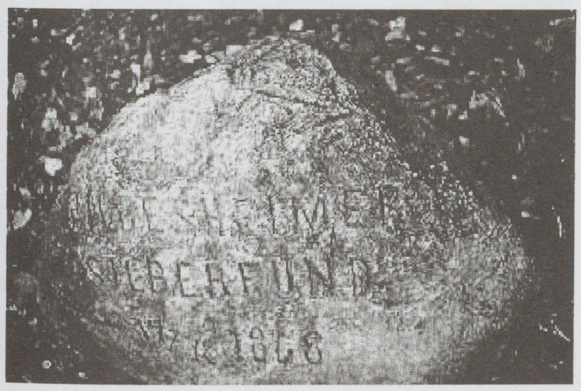

Fig.1.1 Local indication(arrow!) to the excavation place of the "largest ever" Roman Treasure in Hildesheim (Germany), see Fig. 1.2!

Fig. 1.2 The number one piece of the antic Roman Treasure place of Hildesheim, where about 70 pieces still might wait for discover in the soil!

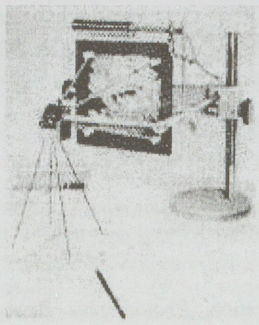

Fig. 1.3 The well known Aero-sketchmaster, based on the principle of "Hockney's" camera lucida!

This requires a new definition of "Single Images in Conservation". From modifying the conventional image definition a first suggestion for the term Single Images in Conservation is "Sources with Geometric and radiometric and/or pseudo radiometric Information with respect to the human culture", see figure 1.4

Fig. 1.4 A good sample, to test the new definition for Single Images in Conservation, even of the times before the camera Lucida: The eldest view of St. Nicholas' Patara (Turkey) as shown on the early global map of Ebsdorf, a source for reconstructions, dates back to 1350

There is no doubt, Single Images in Conservation must deal with historic paintings of ancient times as well as with modern types of photography.
At the University of Applied Sciences in Magdeburg exist some experiences with a new type of very low altitude aerial photography. It consists of a light metal telescope staff of in maximum 10 m length, which is the platform a conventional light digital remote camera. The range of applications is still extending as well as these "telescope camera light" technology is still improving. The system follows experiences as achieved by surveying the ancient houses of Parliaments in PATARA /Turkey) and nowadays it changing to additional applications, like in Fig. 1. 5. until fig.1.8 , which show this telescope camera light in action, as applied for mapping a Jewish Cemetery in the town of Magdeburg (Germany) and, as a first result, a part of a high resolution photomap (see fig. 1.9)

Fig. 1.5 Judging on very low altitude photography results by St.Mueller, M.Hoffmann and St.Voigt

Fig. 1.6 Taking very low altitude photography of a historic cemetery in Magdeburg (Germany)

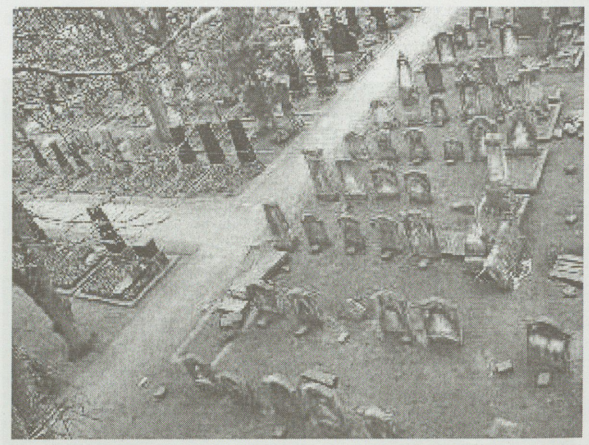

Fig. 1.7 Typical "tree penetrating" xxlow altitude photography of the historic part of a Jewish Cemetery in Magdeburg (Germany)

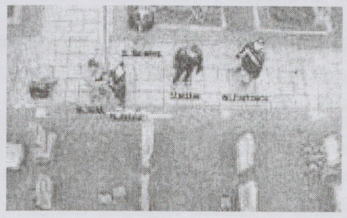

Fig. 1.8 Top view of the "very low altitude photography crew"

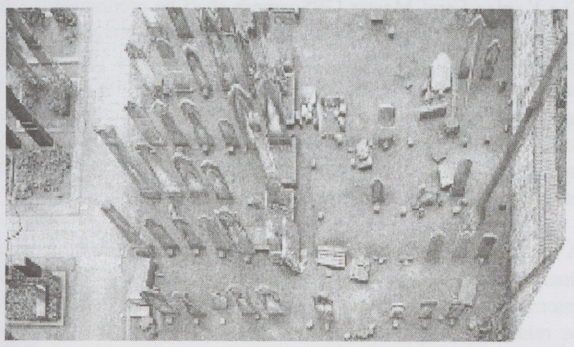

Fig. 1.9 Part of a 2D-Photomap of the historic site of the Jewish Cemetery in Magdeburg (Germany)

2. New Perspectives for Processing Single Images in Conservation.

It is liked to point out, the signalization of controlpoints partly can be replaced by (digital) photographs of the queue of ground survey points, when engaged with the reflectorstaff. These controlpoints, can be clearly interpreted on the snapshot and transferred to the corresponding synoptic photograph for, e.g., rectification purposes. It is also very important, clearly to assign the point number on the picture, at least by voice recording for moving sequences.

The use of single images in conservation can benefit from existing digital imageprocessing devices and suited software, as well as (still?) from analog rectification devices. For low attitude values the latter even could be overhead or slide projectors.

A new way to visualize the projection theory can be derived from the French facet method. The facet method has been used in France until about 1970 in an analogue manner, even for precisely cadastral mapping purposes. The characteristic terrain surface is adapted by multiple polyeder projection.

For a modern flexible application of a modified facet method, in particular to survey an Archaeological site, the "polyeder" can show a regularly (4 x 4m) grid as well as random edges, see Fig. 2.1

- The edges of these polyeder pattern are marked with wooden colored sticks.
- The object surface must be suited to be adapted by a polyeder pattern
- The three dimensional coordinates of the regular or non regular situated edges of the polyeder pattern are set out and/or determined using the conventional terrestrial polar surveying method.
- Extremely low altitude aerial photography, successive taken with a amateur camera from a telescope beam of approximately 10m height, must show the particular polyeder or grid plain of about 4 x 4 m in nature, as indicated by at least 4 corresponding marked points of the polyeder respectively of the grid.
- The exposure is verified from the ground using modern infrared control or ball exposure.
- Continuously the images, defining the polyeder, will be digitized and digitally rectified, based on at least 4 controlpoints, e.g., using the Rollei MSR rectification program.
  Of course an alternate method is analog optical rectification using a rectifier.
- Finally the rectified images are digitally or manually mosaiced to achieve the complete photomap of the archaeological site.

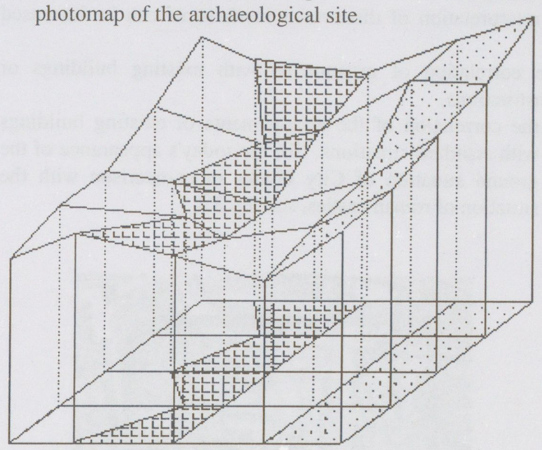

Fig. 2.1 Principle sketch of the modified facet method for obtaining a rectified photo mosaic by approximating the object surface with a regular and/or non regular grid pattern and successive processing of digital or analog image rectifications

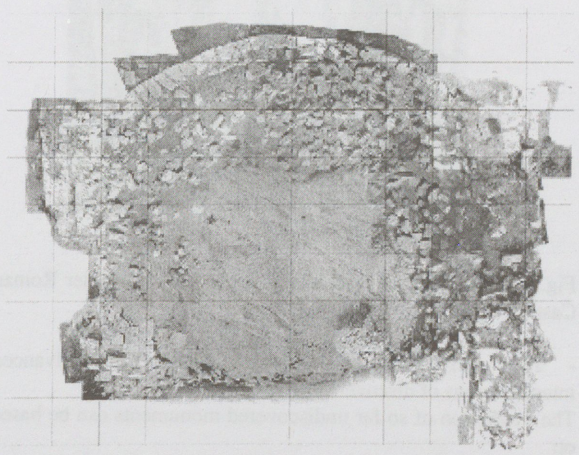

Fig. 2.2 Differentiell rectified Orthophoto of the excavating situation in 2001, based on the principle of the facet method (see fig. 2.1), as carried out by B. Luebbehusen, who mosaiced about 80 rectified single images showing a 4 x 4 m grid

3. New Perspectives from Using Single Images in Conservation.

In view of the increasing dilapidation of handed down monuments, Photogrammetry and Remote Sensing Techniques can support the protection of these monuments by
- permanent control of existing historic monuments, including the inventory,
- by advanced interpretation of discovered monuments,
- by (aerial) Prediction of so far undiscovered monuments and
- by the reconstruction of partly and/or even completely destroyed monuments.

For serious systematic investigations after the reasons for the increasing disintegration of monuments it is absolutely necessary, to start with an inventory, to document the recent conditions of the monuments (see Chapter 4).
In order to judge the success of, e.g., chemical monument protection, a futural permanent control of the monument condition, using suited photography, is definitely required.
The most suited way to verify this is a Monument Information System(MIS).
The interpretation of discovered monuments can be increased by
- the correlation of monuments with existing buildings or reconstructions,
- the correlation of the arrangements of existing buildings with standard situations, like the today's appearance of the ground situation of City blocks in comparison with the situation of roman castles, see fig. 3.1

Fig. 3.1. The City of Magdeburg (Germany), a former Roman Castle?

- The correlation of different objects for advanced interpretations of discovered monuments

The Prediction of so far undiscovered monuments can be based on
- traces of human activities,
- historic and recent maps and measurements, see Fig. 1.4.
- historic and recent photography

The quality of the interpretation of the situation of so far undiscovered monuments can only be judged by excavations or excavations substitutes.

4. New Perspectives for Archives for Single Images in Conservation

It is highly recommended, to digitize the available single imagery and to store it on CD-ROM. The combination with a data manager program has big advantages for a systematic data access. And for some applications the digital print of that photo might be sufficient, while the original is kept for exclusive operations.
Due to very high solution requirements, so far still conventional cameras are in use for documentation purposes in conservation.
CCD-Cameras, showing about 2000 x 2500 Pixels, nowadays can almost replace slide cameras. Their color and color truth is even superior.
The Konica Land Master GPScamera shall be recommended as the first public camera to be used for single imagery, which records additional frame information, including the position, the date and time and the imaging direction belonging to that particular photograph. The Konica Land Master GPScamera as introduced occasionally the ISPRS congress in Vienna in 1996 is linked to a data bank, screening the position and the direction of every single photography in a map.

A list containing the worldwide Photographic Archives is more than overdue. This proposed list should become a part of CIPAs internet presentation. At least these photographic Archives must be related to single images in conservation. Very important is the access to these Archives and even the searching for lost photographs, as very impressive reported by GERNSHEIM, used to become the owner of the first surviving photography, showing the private house of Niepce in 1827.
As an important sample for a state of the art Photography archive the Bill Gates archive with over 1 million images in particular shall be mentioned. The Bill Gates archive is an integrative part of the Corbis collection. Corbis claims to be the leading provider of photography and fine arts on the Internet and maintains one of the largest image collections in the world with 25 million historical, contemporary, celebrity and fine art images. More than 1.5 million of these images are available on-line, designed to offer a full range of visual solution.
To be mentioned are also the Ancient Greece Photographic archive in Indiana, USA, the Photographs-collection of the Civil war in the United States, the Photo Archive for buildings etc.,of the Carnegie Mellon University in Pittsburg, Philadelphia,USA and the Photo Archive - Buildings - of the Butler University in Indianapolis, USA.
Of great importance are also Archives with local character, like the Old Colorado City Photo Archives or the Photo archive of the Mariott Library of the University of Utah, USA, containing Aerial Photographs and Photographs showing Architecture, Buildings and Archeological sites.
As a typical situation in Germany, beside numerous governmental, company owned and private Archives, at least 16 governmental Archives for historic Photographs are maintained on a provincial level, containing collections of images for conservation purposes of that particular area. As the digitizing of this material has just started, currently these are mainly still analog photographs.

5. Conclusion

It has been clearly shown, New Perspectives for Single Images in Conservation are not only opened from very advanced Technology, like from the Laser Scanner Technology, but still gain surprising improvements in the traditional field of basic Photography, as well as in the field of Image analysis and Imageprocessing and finally, most important, in the field of image archiving.

The samples indicate, CIPA's role in particular for a systematic steering of the use of Single Images in conservation has even not yet really started. As a matter of fact there will be a great challenge for Single Images in Conservation in the next future, possible even on the commercial sector, hopefully not outside of CIPA.

The reported samples on the application of improved camera technology, like the applications of the telescope camera, the improvements in surveying by using the movie camera assisted tachymetry, in applying the facet method in a digital manner and in reporting on image Archives of the world wide web represents a huge spectrum for further research and practical work.

"Taking", "Processing", "Applying" and "Archiving" of images have just started!