

INTERNATIONAL STEREOVIEWS TO SAVE THE WORLD'S CULTURAL HERITAGE

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ABSTRACT

This paper is on the promotion of international Cultural Heritage Stereoviews to benefit the recording, the 3D documentation, the protection and the reconstruction of monuments.

In an introduction this paper presents samples of masterpieces of existing historic as well as of modern international Heritage Stereoviews, to give an idea of its brilliance and outstanding documentary value.

These masterpieces represent a huge amount of international collections of Heritage Stereoviews, too. Therefore this paper also deals with information on International archives of importance for Heritage Stereoviews.

Historic Heritage Stereoviews are one key to “the spatial past”, a real treasure, still waiting for a rediscovery!

The 2nd chapter is on gaining new stereoviews to save the World’s Cultural Heritage. As a matter of fact, in most cases Cultural Heritage stereoviews can be obtained with single lens cameras.

For this purpose receipts and samples are stated, including close range earth born and balloon aerial photography.

The following chapter is on applying Cultural Heritage stereoviews for protection and reconstruction purposes.

In this context are demonstrated, e. g.,

- the general improvement of a 3D model in comparison with a 2D image, due to the still underestimated gain of a complete additional dimension and
- advantages of 3D visualization for the enhancement of spatial structures in particular (e.g., relief enhancement), as well as
- pointing to the extremely high detail resolution of about 1mm pixel size and even better(!), which so far is superior to any other 3D plain surveying method.

Also part of this chapter is the calculation of 3D coordinate values from geometric analysis of Heritage stereoviews.

In a final outlook the authors, who chair the RecorDIM task Group on “Collecting, Compiling and Sharing International Heritage stereoviews”, like to point to their non-commercial website 3dsite.icomos.org. As another future aspect, Heritage stereoviews will be presented by the Felix Solid state 3D screen, which promises a great future not only for Heritage stereoviews, but possibly even for a new 3D- instead of 2D-PC (screen) generation.

1. STIMULATING THE INTEREST IN INTERNATIONAL HERITAGE STEREOVIEWS

This contribution is on the promotion of international Cultural Heritage stereoviews to benefit the recording, the 3D documentation, the protection and the reconstruction of monuments.

Historic Heritage stereoviews are one key to “the spatial past”, a real treasure, still waiting for a rediscovery!

The masterpieces of international Heritage stereoviews as shown in Figure 1.2 until Figure 1.8 give an idea of its brilliance and outstanding documentary value and stimulate the interest in Heritage stereoviews.

These masterpieces represent a huge amount of international collections of Heritage stereoviews, too, e.g., Figure 1.2 until Figure 1.5 present masterpieces of Heritage stereoviews of the American Keystone-Mast Collection of the UCR/CMP, see figure 1.1, while Figure 1.6 until Figure 1.8 deal with Italian 3D views of different international collections of Heritage stereo views. To be mentioned as archives of international Stereoviews to save the world’s cultural Heritage 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 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 Marriott 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 govern-

mental, 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. Currently these are mainly still analog photographs, showing a low digitization rate.

However, due to different reasons, like restrictions by the owner, lack of information, critical conditions of the analogue originals etc., beside archives with free access, there are archives of Heritage Stereoviews with no or limited access only.



Figure 1.1: Steve Thomas, Head of the UCR/CMP Keystone-Mast collection (left picture) by Francois LeBlanc (GCI) and viewing through stereoscopes at the CMP (right picture)



Figure 1.2: Keystone No. 23581 T inscribed: "Highly decorated interior of the Church of San Francisco, Puebla, MEXICO"



Figure 1.6: Early stereo view masterpiece of the bridge of sigh's, Venice (ITALY), unknown artist



Figure 1.3: Underwood & Underwood No. 32: Statues and fountains in the summer Palace in St. Petersburg (RUSSIA)



Figure 1.7: TORINO (Italy): Sala d'Arme



Figure 1.4: Keystone No. W 23932 T: The great Wall near Hankow pass (CHINA)



Figure 1.8: Broso collection No.9680 Recordo Nazionale TORINO (Italy)



Figure 1.5: H.C.White (CMP) Masterpiece: "A great stone camel famous arrangement of stone animals, North CHINA"

2. GAINING NEW STEREOVIEWS TO SAVE THE WORLD'S CULTURAL HERITAGE

There is a great demand for new digital high resolution Heritage stereoviews for different purposes, like documentation, virtual museum etc..

As a matter of fact, in most cases Cultural Heritage stereoviews can be obtained with single lens cameras.

In an international context there should be a systematic imaging of "all" (!) real museum exhibition samples, to gain Heritage Stereoviews, using digital cameras with different (more than one!) baselines of different length and estimated parallel camera axis directions, see figure 3.3 but also figure 1.5, in order to have a real and optimized choice of a proper stereo pair for Cultural Heritage purposes,



Fig. 2.1 Gaining high resolution digital close range aerial stereoviews of antique sites in PATARA (Turkey) with a single lens staff Canon Powershot camera (approx. 10 m altitude)



Fig. 2.2 Sample of a high resolution digital close range aerial stereoview of remains of the antique houses of parliament in PATARA(Turkey) (Canon Powershot single lens staff camera, approx. 10 m altitude)



Fig. 2.3 Stefan Kiel of the University of Applied Sciences in Magdeburg presenting the digital Helucam I (Sony Cybershot)

Camera, as integrated in a Helium balloon platform, with

remote control, including image control, showing panorama and (single lens) stereo ability

Obtaining recent Heritage Stereoviews is also important for “on the site samples”, like buildings, facades and ruins (see figure 1.2 and 1.6 until 1.8). The well known 3 by 3 rules for sufficient simple photogrammetric object documentation at least should be improved by the consequent requirement of stereoviews instead of 2D imagery, see Waldhaeusl, P. and Ogleby, C. (1994).

Gaining new stereoviews to save the world’s cultural Heritage in particular is “a must” for Rock-Arts (sample see figure 3.4) and Underwater Heritage (like in figure 1.5) etc.. In addition to these kind of terrestrial Heritage stereo photography the Faculty of Civil Engineering of the University of Applied Sciences in Magdeburg (Germany) promotes the staff camera for high resolution ground based close range single lens aerial stereo photography, in particular for Archaeological sites, see figure 2.1 and 2.2.

Recently here the development of a helium balloon platform with the adaptation of a digital single lens camera, to gain Heritage Stereoviews for more synoptically purposes with relaxed resolution began, see figure 2.3 until 2.5.



Fig.2.4 The Helium Balloon used as platform for a digital single lens camera at the Campus area of the University of Applied Sciences in Magdeburg



Figure 2.5 Rectified and mosaiced aerial balloon views of the antique houses of Parliament at the archaeological site of PATARA (Turkey), as carried out by B. Luebbehusen

3. APPLYING CULTURAL HERITAGE STEREOVIEWS FOR PROTECTION AND RECONSTRUCTION PURPOSES

Independent of special applications for Heritage purposes, stereoviews show a general benefit, like, e. g.,

- the general improvement of a 3D model in comparison with a 2D image, due to the still underestimated gain of a complete additional dimension and
- advantages of the 3D visualization for the **enhancement of spatial structures** in particular (e.g., **relief enhancement**), see Figure 3.2 and 4.1 (!) as well as
- pointing to the **extremely high detail resolution** of about 1mm pixel size and even better(!), see Figure 3.3, which so far is **superior to any other 3D surface surveying method**.
- furthermore stereoviews allow the calculation of 3D coordinate values from geometric analysis, see figure 3.6 for the photogrammetric normal case.

As a matter of fact there exist different reliable photogrammetric systems, like Photomodeler, ERDAS etc., which even work for the general photogrammetric case and even though ground control is missing or poor.

In order to speed up the 3D evaluation of new Heritage Stereoviews, in addition to the stereoview documentation, aimed Moiré imagery is highly recommended. Here the Moiré effects are gained by the projection of parallel lines over the Heritage objects and by imaging this line pattern with a digital single lens camera. Under special constraints the resulting Moiré lines are nearly contour lines. Of course this Moiré method is also useable for still accessible objects, imaged on historic Heritage stereoviews, showing no or minor change compared with today's situation.

Nevertheless the rapid geometric evaluation of existing Heritage stereoviews is still a matter of research. Recently developments in this field, as based on the so called "i-Grammetry" of the Canadian Company Geoiconics, as introduced at the ISPRS Congress 2004 in Istanbul, promises a great future.

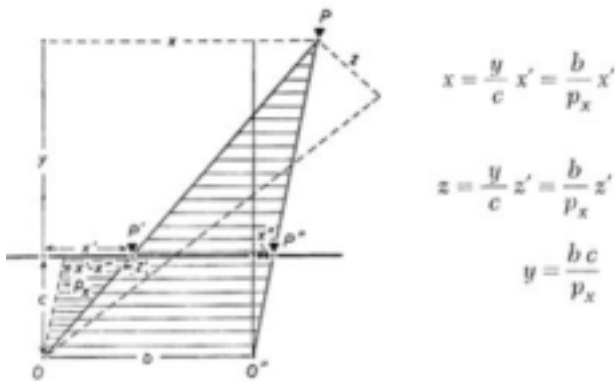


Figure 3.6 Basic geometric equations for Stereoviews

In case, baseline b and the focal length c are unknown, relative space information is obtained from

$$y_i/y_o = p_{x0}/p_{xi}$$

with x, y, z = object coordinates, x', x'', z' = image coordinates (of image 1, image 2 respectively)

$p_x = x'' - x'$ = horizontal parallax

c = principal distance = approx. focal length

Beside others the following applications of cultural

Heritage Stereoviews have been dealt with:

3.1 Replacing traditional sketches of archaeologists by Heritage Stereoviews and by close range large scale photomaps.

A real obstacle for a broad application of Stereoviews in Archaeology is the anachronistic competition between objective photographic documentation and subjective Archaeological interpretation.

As a matter of fact the typical today's surveying results of Archaeologists are still manual sketches in the scale 1:20, where details are roughly measured and even estimated within a 4 x 4m grid! But state of the art results of the surveying of the ground situation of objects showing partly plain surfaces are image maps based on extremely low aerial photography, imaging object parts together with sufficient corresponding ground control.

Of course, in addition gaining Heritage Stereoviews should be obligate, also partly stereo Photogrammetry can be required.

The authors like to point out, more than 175 years after the invention of photography by Niepce, manual sketches, even though claimed to be based on so called "expert interpretation", due to its subjective nature, should not be longer a result of serious research, see also Figure 3.1. In particular in our digital age of cheap computers, software and high resolution digital cameras, the authors cannot excuse the sticking to the "tradition of pencil and paper", ignoring any progress in documentation.



Figure 3.1 "Classical" comparison of a manual sketch (left) and a photography (right) of the same(?) stele in Peru (modified sample according to CERAM (1949))

Surveyors should refuse, promoting manual sketches of any kind, as they are not state of the art. It is liked to emphasize, the alleged superior of manual sketches, supposed to be proofed by the comparison of detailed sketches with poor photographs, is completely nonsense and has nothing to do with the today's ability of photographic techniques, see Figure 3.1.

3.2 The authors soon expect great progress in Heritage stereoviews from a systematic gaining of Rock-Art Stereoviews, for example see figure 3.2, but also in particular from underwater Heritage Stereoviews.

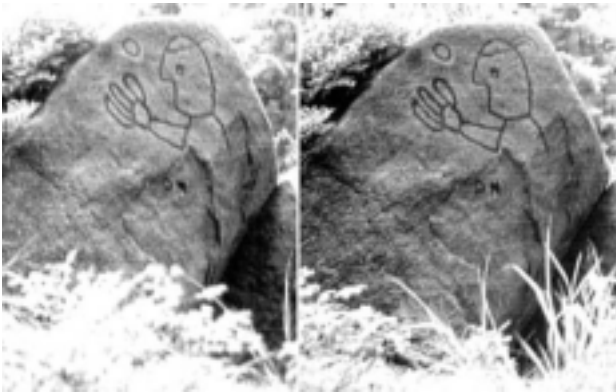


Figure 3.2 Rock-Art stereoview of a so called “Venetian stone” (identified as a road mark to treasures) in the Harz mountain in Germany

3.3 Applying new Heritage Stereoviews for

- a systematic documentation of museum exhibition samples, see Figure 3.3 and
- using Heritage Stereoviews as a virtual 3D (museum) data base, see figure 3.4

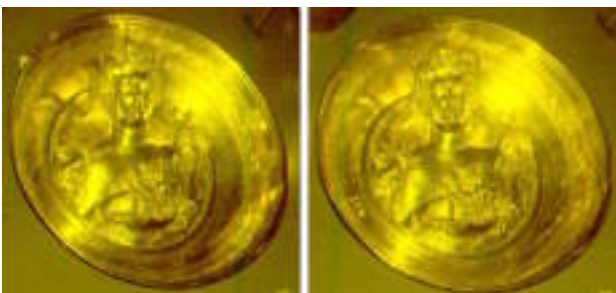


Figure 3.3 Heritage stereoview of the golden Cleopatra dish of the Boscoreale treasure (Louvre, Paris)



Figure 3.4 Recent stereoview of the large stone Buddha of Sichuan (China) (on top), a principal source of EON's 3D ICUBE virtual Museum (below)

3.5 Applying Heritage Stereoviews for reconstruction purposes, see figure 3.5



Figure 3.5 A surviving miniature of a great Buddha of Bamiyan, (Afghanistan) (left) and a historic Keystone stereo mate (middle) in comparison with a recent photography of the SPIEGEL journal (right), compare also with Gruen, A. & Remondino, F. (2005)

4. FUTURE OUTLOOK OF ACTIVITIES CONCERNING INTERNATIONAL HERITAGE STEREOVIEWS

It is liked to emphasise, the authors, who chair the **RecorDIM** task Group on “**Collecting, Compiling and Sharing International Heritage stereoviews**”, like to point to their non-commercial website **3dsite.icomos.org** as carried out by KIM, Seung Sun, see Figure 4.1.



Figure 4.1 The website address of the RecorDIM task group on “Collecting, Compiling and Sharing Heritage Stereoviews” as carried out by KIM, Seung Sun is **3dsite.icomos.org**

As another future aspect, like in the very first days of 2D photography, today we are witnesses of early developments of 3D Heritage presentations fixed in crystal, showing very low radiometric resolution, so far, see Fig. 4.2. Heritage stereoviews of the near future will be presented by flexible Felix Solid state type 3D screens, which promises a great future not only for Heritage stereoviews, but possibly even for a new 3D- instead of 2D-PC (screen) generation.



Figure 4.2. Like in the very first days of 2D photography, currently we are witnesses of the early developments of 3D presentations in crystal,

5. REFERENCES

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