APIS - ARCHITECTURAL PHOTOGRAMMETRY INFORMATION SYSTEM

Ulrike Herbig, Peter Waldhäusl
Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Vienna, Austria
Email: pw@ipf.tuwien.ac.at

ABSTRACT :

In 1988 Martin Brunner defined in his diploma thesis the "3 x 3 Minimum Rules for Photogrammetry". The aim was to create a possibility for everyone to use his own camera for amateur photogrammetric stereo block documentation which even can be used for restitution if needed later on. Several tests, like the Vienna Otto Wagner Pavilion Test of CIPA in 1993, have proven that amateur images allow photogrammetric results sufficiently good for the majority of needs. The use of the many amateur cameras in the world seems to be the only realistic possibility for a more or less complete and permanently updated documentation of the enormous quantity of architectural and other cultural objects within a reasonably short time.

In 1996, "Austria Nostra", a partner organisation of "Europa Nostra", used the 3 x 3 - Rules for a school project in Austria. Its aim is to involve the scholars into the task to preserve the cultural heritage of their school's neighbourhood.

Such a country-wide project creates a big amount of data with information about the objects collected by the scholars, and - as a consequence - a data base is needed to clearly re-identify any object again, to learn about its history, about the availability of plans or images, etc. The data needs to be administrated on a central file server and should be accessible for everyone by internet. As the information on the object contains also the location were the photographs are being kept, the working title for this kind of information system has been chosen "APIS - Architectural Photogrammetry Information System".

In the future such a database will be a valuable tool in the event of destruction of an object. It will be easy to search for information on the object, to find either existing plans or at least photographs having the capability to create new plans. There will be various further applications feasible such as time related studies to find environmental effects on certain objects, to detect changes, to compare old and new for judgement of the development. There will be great capabilities for tourism, for historians, for insurance companies. But the main aim is civil protection, preservation of knowledge about the cultural objects documented.

The paper shows the structure of APIS and examples of photogrammetric documentation and restitution.

1. INTRODUCTION

For more than 100 years photogrammetry has been done by specialists who took pictures with special metric cameras. But these specialists and their cameras are rare, so the percentage of properly documented architectural heritage is still very small. The need of usable documentation we can see nearly every week. Think of the last architectural catastrophes, like the fire at Windsor Castle, in the cathedral of Turin, in the Galleria degli Uffizi di Firenze, in the Hofburg of Vienna,

Burning Hofburg, Vienna (Kurier,1992)

in the Palais de Challiot, Paris, and consider all the destroyed jewels of cultural heritage in former Yugoslavia.

In cases like these we think of all the thousands and millions of pictures tourists take every year which can't be used for renovation or reconstruction of destroyed objects. The aim is to use the power of those people who are interested in history and heritage to help to build an extensive collection of pictures which are taken in a way that they can be used for photogrammetric restitution. In 1988 Martin Brunner already defined the "3 x 3 Minimum Rules for Expedition-Photogrammetry" to allow any traveller interested in the preservation of cultural heritage to do his part for the documentation of architecture. Of course, these rules may also be applied at home. The following years were used to prove the usability of non-metric cameras for photogrammetric documentation.

The "CIPA - Test Karlsplatz, Vienna " showed that the restitution of small-format non-metric cameras brings results with an accuracy which is good enough for most architectural needs, at least for all the emergency cases. The photogrammetric institutes participating in the "CIPA – Test Karlsplatz, Vienna" increased their knowledge on handling pictures taken by non-metric cameras. Now their know how can be used for the upcoming tasks of creating a fundamental collection of architectural documentation with the help of everyone interested in the preserving of cultural heritage using

the "3 x 3 Minimum Rules for Photogrammetry". These rules are surveyed in the first part of this paper.

Following this preparations it is our aim to build the bridge between those institutes of photogrammetry where restitution of non-metric pictures can well be done, and the communities, societies and schools as well as the thousands of people, who are actually collecting such non-metric photography. Most of them who are interested in preserving cultural heritage want to take their pictures not only for holiday memories but also for practical or scientific purposes for the benefit of further generations. Such a bridge should be APIS, the Architectural Photogrammetry Information System, which is subject of the second part of this paper.

2. DATA COLLECTION

2.1 The 3 x 3 Rules for everyone

The first step to mass photo collection by people who don't have any knowledge about photogrammetry was to set up some rules in such a way that everyone can understand it, who wishes to produce photographic documents useable for photogrammetric restitution.
These rules have been written down in 3 chapters with 3 sub-chapters each, therefore called 3 x 3 Rules:

3 geometrical rules describe
- the preparation of control information (One distance and one plumb-line on each side of the object);
- the geometrical arrangement of photography (Normal, diagonal and traversing shots in intervals specially explained as app. 1/10 of the distance);
- the geometry of stereo-photography (Normal case, exceptionally also convergent case).

3 photographical rules explain
- that the "inner orientation" has to be constant (No zoom, distance to indefinite or fixed);
- that the illumination should be soft (No hard shadows);
- that any film may be used with more or less advantage, but carefully cut and treated as the real document.

3 organisational rules mention
- that proper sketches are necessary (Ground plan and elevations);
- that a protocol should report about action and object;
- that care and final checks are required, on site as well as prior to archiving.

2.2 Simplification of the 3 x 3 Rules

The rules as they were defined in the beginning were simple in terms of people working with photogrammetry or related disciplines. The next task therefore was to make them understandable for everyone. At first the sequence of working steps has been tested practically and how such photogrammetric documentation with the 3 x 3 Rules can be realised for example by people on holidays.

On a trip through Asia the rules were tested in four different countries at four quite different sites. The objects chosen were:
- the temple of Changu Narayan close to Kathmandu, Nepal,
- the temple Kandhariya Mahadev at Khajuraho, India,
- the tomb of Jehangir at Lahore, Pakistan and
- the Ghara Khelisa, an old church at the Turkish border in Iran.

Temple Khandharya Mahadev, India. Test-object

The size of the objects varies between app. 10 x 10m to 80 x 80m. All of them were easily attainable and in each case it was possible to make pictures all around the object. These configurations were chosen to make the test relatively easy and to show that even more complex shaped objects can be documented. It took between 2 to 3 hours to prepare all sketches and control information and to take the pictures. As a result of the test a revision of the 3 x 3 Rules concerning the description of the planning of the pictures has been done. Other points have been cut to short, significant explanations. To create a complete manual for a photogrammetric documentation of an architectural object, the rules were extended with a step by step instruction.

In order to prepare the rules for a school project more detailed descriptions with sketches and self-explaining pictures have been added like the image below. An introducing overview about photogrammetry and a detailed description of the several steps of the 3 x 3 Rules for teachers complete the script for schools.

Planning of the photographs

Now both versions are available in form of booklets which can be used for the photogrammetric documentation and should be a guarantor for pictures which can be used for restitution.

Therewith the first tool for the collection of architectural photogrammetric documentation was created. Now it was necessary to find the people who will do the work.

One idea is to mobilise young generation motivated to look after the cultural heritage in the future, because it is their heritage. With the help of examples produced by pupils it should be just a small step to find interested groups, people who will take part at this conservation support project in communities, societies and so on.

A good access to schools was found on the occasion of a school project initiated by the society Austria Nostra.

2.3 The Austria Nostra school project

The society Austria Nostra was founded in 1973 as an exponent of Europa Nostra. Its function is the support of the preservation of the cultural and the natural heritage of Austria. Its activities lie in research, adult education, scientific and artistic instructions, documentation, publications, etc. for the protection and the care of the cultural as well as the natural heritage.

Austria Nostra has started a school project with the title "Das Alte erhalten - Die Zukunft gestalten", that means in English: "Preserve the old - shape the future". The idea of this project is, that pupils look for cultural or natural objects in the vicinity of their school which are worth to be preserved, possibly endangered in their existence. One of these objects should be documented and the historical meaning and importance for the environment should be investigated and evaluated.
300 schools participated in the project. The results are manifold and covered very different aspects of pre-servation. Examples are:
- the production of a CD-ROM about the 1000-year history of Austria's name or
- the mapping of the water quality of the local river or
- the documentation of a desolate baroque tower,
in all cases with an elaboration of suggestions for restoration, preservation and the further use.

One of the examples was a stereo-photogrammetric documentation of an old smith's-shop. Schoolgirls of an agricultural technical college took pictures of this house which is now used as a museum. The 3 x 3 Rules were applied, and support has been provided by staff of the Vienna University of Technology. To prove the quality of the pictures they were used for photogrammetric restitution by students of the Institute of Photogrammtry and Remote Sensing. The result showed that such photography can be used to get a plan, the accuracy of which is between 2 to 5 cm, good enough for many needs.
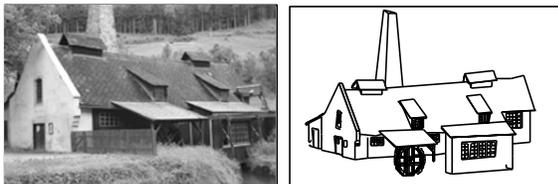
Object of a school project : An old Smith's-shop
in Lower Austria

The school received an award by the Ministry of Education and Arts which started the initiation of further activities in schools. The aim now is to co-ordinate the work and to collect the results of the different schools. This should be done by means of APIS, the Architectural Information System. Its administrators shall be the centre of all activities. Teachers will be supported by training - workshops and material they can use at their schools afterwards. Examples of incoming documentation will be controlled in order to be sure of the quality of the pictures and the information about the objects. Problems coming up with the system or questions concerning the 3 x 3 Rules have to be treated in co-operation with teachers and pupils. Everyone is invited to work on APIS to create an information system in such a way that also everyone is able to use it, i.e. to bring in new information or to gain information about cultural heritage.

3. APIS - THE ARCHITECTURAL PHOTOGRAMMETRY INFORMATION SYSTEM

3.1 The main tasks of the data base

The intention to create this Architectural Photo-grammetry Information System is to provide a tool for the practical organisation of useful information for the preservation of cultural heritage. The main task is to have a bridge between "amateurs" on the one side and those professionals who need and use photo-grammetric documentation in order to prepare materials for the renovation or restoration of objects.

At the beginning there were two major needs for an architectural photogrammetric information system: First the data have to be administrated. One needs to know which objects are documented and where the pictures are kept. Secondly everyone should easily be able to learn how to proceed and make a correct photo-grammetric documentation.

The problems are solved by APIS which is situated at the internet server at the Institute of Photogrammtry and Remote Sensing at the Vienna University of Technology. The homepage provides information about the 3 x 3 Rules for photogrammetric documentation of architecture and a detailed step by step description of the proper realisation of such documentation. Furthermore examples are shown, especially of already used photo-documents, and the purpose is explained why and what for they have been used. For these examples the results will be shown like plans of the object or of details restituted from the pictures.

APIS is accessible via internet and explains itself the use of the database.

So it will be really easy for everyone who wishes to do such documentation
- to copy the instruction,
- to ask for help information,
- to prepare for the documentation,
- to do it and
- to provide others with the information collected by data input to APIS. The latter is nothing but a systematic filling in of data sheets.

Due to the still very slow data transfer possibilities it would not be practicable to save the pictures themselves. Later on this might be changed. For the

moment just one overview picture should be presented per object. Of course, APIS has already today the capability for storing of many more pictures.

The main information stored in APIS concerns:
- the object with its address and its description,
- the address of the archives where the original pictures are kept,
- the description of the pictures and their contents and the respective technical data,
- the description of existing plans with the relevant technical data and source information,
- the architectural or art historical or local importance.

APIS also administers the addresses of all institutes and offices which are able to work with photos made according to the 3 x 3 Rules.

The database is administered by "Basis*plus"* a software product by IDI, Information Dimensions Inc., Dublin, Ohio, USA, specially designed and used for text document management. It is used also by the "Canadian Heritage Administration". Text search can be done in several languages, an important feature, which makes it possible to use APIS also for international data search, as an international information system.

Besides the overview pictures of each collected object, documents and books relating to the object can be fed into the database as well as already available plans. APIS is capable to handle the full text of informative books as for example the famous Dehio for the Austrian monuments.

3.2 The data lists

In the **object list** address and geo-reference are collected, the names of persons to contact if necessary, and all historical relevant information like the year of construction, the stile and involved artists. This list can be enlarged by either available digital documents or links to other net sites which are of interest in relation to the object. It is also planned to provide links to other databases which could contain relevant information. In co-operation with public authorities or special experts the objects will be classified according to importance, or place, or distance to other important places etc. A date will be added informing about the next advisable date for documentation. APIS will watch about these dates automatically and inform the authors.

Finally the object list contains information about the number of documents, photographs, plans already available, and each document leads to the protocol list which contains the detailed data about the document itself.

The **protocol list** provides the information about a part-document, e.g. about a series of amateur-photo-grammetric pictures, like the date of the shooting, the information about the camera and the films used, the description of the place wherefrom the photo has been taken and, most important, the name of the archives where the original pictures and where copies of them are kept.

Detailed information about the physical archives are collected in the **archives list** which contains the address of the archives and the information which authority has to be contacted, or which conditions have to be fulfilled to get copies or pictures. Depending on the kind of imagery APIS leads automatically to the photogrammetric institutions which have the capability to make restitution from the imagery.
Similarly the **plan list** contains details about existing plans, maps, etc. and the name of the respective archives where plans are available. The archives list also shows the relevant addresses and the conditions under which the plans or copies thereof can be provided.

3.3 Administration of APIS

It is not intended to establish a central archive for photogrammetric documentation. So the main task of APIS is to co-ordinate many local archives which are situated in schools, in communities or other places where societies or people are interested to participate in this preservation project. Everyone who makes a documentation shall feed the system with the information about it. This can be done either via internet or into a small local archive database whose contents will be handed over in practicable intervals.
All incoming material will be first checked automatically by the data management system. Results of this check have to be revised by a system administrator who is also responsible for the update of the homepage and all information which shall be provided in APIS besides the database.
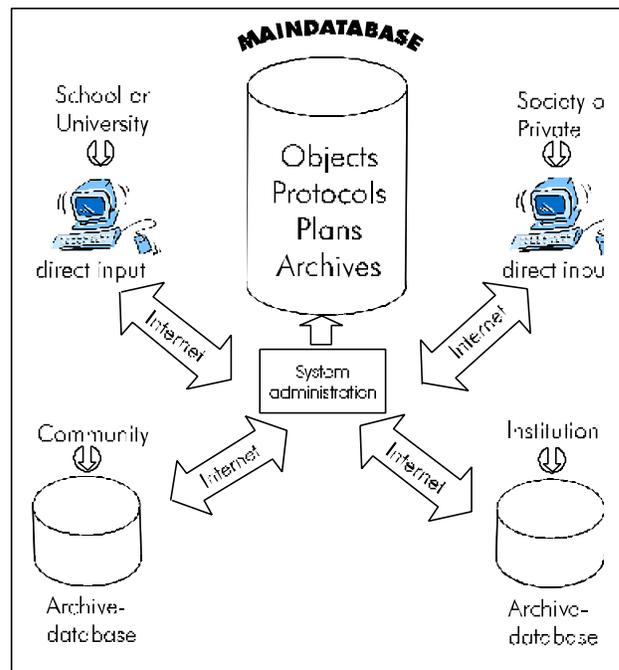
Database administration

3.4 How to use APIS

Let's assume someone wants to make a documentation about an object, so he looks into APIS to find out

whether this object is already enlisted. Then he may download the 3 x 3 Rules for assistance and plan the documentation. Coming home from the field-work he can already start to input the text data. Therefore he has two possibilities:
- input directly into the central data base APIS via internet or
- input into a local little ACCESS version of APIS, which we call client data base **apis**.

The database software for it can be downloaded from the main APIS. This guarantees that all client-apis have the same structure basically. The data can be transferred periodically to main APIS via internet or by means of disc etc.

If there is later on some need for pictures, plans, or descriptive information of this object, it can be found in or via APIS. Towns or big organisations have their own and professionally administrated information systems. But also for them it might be interesting to find additional information in APIS. Communities which have not yet started their own system will be happy later on about any digital information they can find already in APIS.

For safety, it is advisable to have the information stored in different places:
- First in the archives where the paper originals are kept and the original films.
- Second at the place where the client apis is run and where duplicates of the film should be kept and where the information is handled locally.
- Third in APIS where everybody can reach information about existing materials and about everything interesting generally.

But this should not be the only application. It will be possible to collect more than one, even a lot of photographic or photogrammetric documents about one and the same object at different times. This will give the possibility to make studies about changes and general trends as well. So the collected documentation may become a tool for communal and regional planning, also. The scholars can ask the politicians and ancestors why this or that has been done, omitted, neglected. It is their heritage, their capital for their future. To enable such trend control, APIS will inform the client-archive by email as soon as it is time to update the photography or everyone can see the advisable date for the next documentation at the object list.

4. FURTHER ACTIVITIES

The Ministry of Education and Arts supports the project to involve all schools of a region. Municipal administrators shall be involved to present APIS to groups which could be interested in taking part in this preservation project. At workshops people will get detailed information and training about the 3 x 3 Rules, how to make a photogrammetric documentation and how to use APIS. All co-operating people are invited to improve APIS in order to guarantee a system which can be used really by everyone. And the international, the CIPA community is invited to take part, to construct an APIS network with bee-like assiduity.

5. SUMMARY

Much too long the documentation of cultural heritage was the responsibility of some experts, only. Very much has been developed and changed during the last century. But it's also evident that during the last century too many valuable objects of our cultural identity have been destroyed. The nowadays workload for the few who have to deal with preservation of the cultural heritage is so enormous that they urgently need help from all private and professional sides. Amateur photogrammetry and APIS provide such valuable help and give even to the young generation the possibility to take part in an activity for the protection of their future heritage.

APIS can grow to a huge information collection about architectural as well as other cultural and natural objects, not only of a small area, but also for a whole country or international region. International co-operation with open information transfer was a dream for many years. Today the internet makes it possible. The young generation won't have to ask for permission to start such positive activity any more, it will simply do it. In situations of emergency like after fire, flooding, storm, revolution or war, documents and technical materials should be available for reconstruction, a firewall against ethnic cleansing and forgetting.

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