

DEFINING THE FUTURE OF ARCHITECTURAL PHOTOGRAMMETRY

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ABSTRACT:

In classic times of architectural photogrammetry we have been limited to special cameras, special instruments and special cases. Nowadays, photogrammetry is possible nearly with any camera, it uses more general instruments and it is more flexible. Photogrammetry is going to be extended up to a real-time videogrammetry. Professional precision photogrammetry needs more professionalism than before, but it is also more powerful than before owing to the potential of electronic data processing. Ground-(=object-) control can be reduced to a great extent by combined data adjustment. Cheaper cameras and simpler photogrammetric systems are in use and will be further developed. Powerful data bases are waiting for the data, their exchange, use and revision. It is time to redefine the future of architectural photogrammetry as the most powerful tool to collect cultural and metric information about the architectural heritage, but not only of two percent of it within hundred years as before, in future we have to speed it up by a factor of 250 to get the job properly done, hopefully in time, i.e. within the next generation.

KEY WORDS: Cultural heritage documentation, simple methods, international cooperation, CIPA

THE CHANGED TECHNICAL SITUATION

Since the last renaissance of architectural photogrammetry in the nineteen-sixties and -seventies the methodology of terrestrial photogrammetry has changed significantly. It is not limited to special cameras any more. New, more universal and cheap cameras and simple photogrammetric systems for restitution are available and in use, and will be further developed. The "normal case" is still economical and guarantees stereoscopy. But there has not been enough demand any more for fixed base stereocameras, and thus they are not being produced any more. In practice, we use instead medium and small format, semimetric or even non-metric cameras. Instead of strictly normal case we use the nearly normal and the convergent case, but with better base-distance-ratios. Additional oblique and diagonal or cross shots form stable and accurate bundle blocks (Schlögelhofer, 1989). Restitution with analytical plotters after bundle block adjustment allows for a maximum of flexibility and reliability. Ground-(=object-) control can be reduced considerably, it is partly replaced by combined data adjustment. We have learnt to reduce object control to a reliable minimum (Kotowski et al., 1988, 1989; Waldhäusl/Peipe, 1990) and to arrange photography in such a way that the interior orientation can be determined simultaneously with bundle block adjustment without any singularities (Wester-Ebbinghaus, 1986). Analytical photogrammetry doesn't work from image to map any more, but rather from image to the monitor screen where the final editing is done prior to storage in data bases and/or output on plotter. And plotting is not done any more at a pre-determined scale, only, but at various scales as preferred for the practical tasks. The precision of measurement has to be adapted to the requirements rather than to a plotting scale. During the last years, digital photogrammetry has been further developed. The digital orthophoto is becoming daily practice (Ecker, 1991), multiphoto image matching (Baltsavias, 1991) and new digital cameras, scanners and a photoraster plotter (Ecker/Jansa, 1989) promise a rather quick end of the photographic age. Summarizing we see that photogrammetry and digital image processing have been and will be further developed and that we have at our disposal a much more powerful technology than ten or twenty years ago.

Similarly, we recognize changes in the methodology of the architects. They also work with computer graphics and ask for the portability of data. Some architects learnt to use photogrammetry by themselves, especially with simplified technology as Rolleimetric or Elcovision, and further systems will intensify this trend (Benning, 1992). As protection of environment has become one

of the main issues in the public, the architects have to present, more and more, exact perspective simulations of their projects prior to contracting, a task, which is relatively new on the market.

The computerized photogrammetrical technology of today needs more professionalism than the rather simple and specialized technology used in architectural photogrammetry in the past. In architectural photogrammetry this higher professionalism is not yet generally available. Something must happen.

THE UNCHANGED DEMAND FOR ARCHITECTURAL PHOTOGRAMMETRY

The "Convention for the Protection of Cultural Property in Case of Armed Conflict" was a resolution of the General Conference of UNESCO in The Hague in 1954. Already in 1954 it was signed by fifty states and since then by many more. The Convention was much too late to protect the Indian architecture of the Americas during the time after Columbus. It was also too late for Warsaw, Le Havre, Dresden, and Hiroshima, towns, our ancestors have built once with great effort for many more generations to come. Iraq has signed the Convention and, in spite of that, Kermanshah and Kuwait have been destroyed. Yugoslavia has signed the Convention as one of the first countries. Article 132 of the Yugoslavian Penal Code stipulates that any person who orders or who carries out the destruction of cultural property or historical monuments, buildings or institutions dedicated to science, art, or education or to humanitarian aims ... shall be liable to imprisonment. In spite of that, Dubrovnik, Sarajevo, Osijek, and Mostar and many other places with ancient architecture have been destroyed recently, in order to tear out the cultural roots of the political enemy. - We still remember that in Romania the caterpillars have destroyed many of the old villages, where generations have felt at home, and replaced them by prefabricated mass silos. In Syria, 80 % of the Byzantine architecture, which has been registered still in 1910, disappeared until 1980; the old palaces, churches and villas have been used as quarries, where the poor - they have my sympathy - as well as the rich took the stones to build up simple shelters and rather primitive houses. In Vienna, Austria, and the same in many European towns, the passion for the modern as well as pure pursuit of profit destroyed more than the Second World War did. The only difference: no general massacres in these cases.

Other threats for the inherited architecture are earth quakes, land slides, inundations, storms, conflagrations, avalanches. Such events occur without prior notice. We should be prepared for such events.

Since Meydenbauer came up with the idea to set up archives for photogrammetric documentation, more than 100 years ago, many thousands of buildings and monuments have been photogrammetrically recorded. But striking the balance after more than hundred years of architectural photogrammetry, we must admit that photogrammetry has failed. Or the responsible ones. Who are the responsible ones? In our opinion the architects. But we hear from them the contrary, of course. In fact, we only have a few percent documented. And we have nearly nothing done to collect photogrammetric documents of the architecture in the so-called third world. In many of the poor countries, people's main interest is concentrated on overcoming starvation, diseases and unemployment, much more urgent problems. We have to understand that architectural photogrammetry is simply of no importance to them.

Reading today's newspapers it seems easy to me to predict that things will not change basically in the near future. But something must happen.

CULTURAL HERITAGE - CULTURAL ENVIRONMENT - CULTURAL FUTURE

Presence is just a moment, we live between past and future. Man is a distinguished creature with a free will, created and destined to be responsible for the whole natural *environment*, where he lives *together* with plants and animals, small and big. We ought to be thankful for being allowed and privileged to live *with* science and art, e.g. music and architecture, hence at the same time we are responsible for the cultural *environment*. Our free will allows us to decide for noise or music, for war or peace, for conservation of the cultural heritage or for its destruction and decay. The more we inherit from our ancestors, the richer our children will be, rich not merely in the materialistic sense, but rich in culture and heart.

No tree can exist without roots. Nor should our children live without the cultural roots which nourish and stabilize all of us. The inherited as well as today's great and beautiful architecture - selected and evaluated, of course - is and should remain an important part of our cultural environment. If we had the money spent for bombs and arms, all our architecture could be great and beautiful. The minimum we photogrammetrists can do, is to help to collect metric knowledge and image-documents of any monument, which might be used to restore or rebuild it in case of damage or to remind others of its excellence. Future generations shall know about appearance, condition and artistic impression of today's architecture in general and of every building in particular.

The question is what photogrammetry's contribution should be to the preservation of the cultural heritage in the future, especially what we can do in CIPA and Commission V.

TASKS OF ARCHITECTURAL PHOTOGRAMMETRY

Task 1: Quick and worldwide photogrammetric documentation of the architectural heritage.

In order to accomplish such a big job within a reasonable time of, say, 25 years i.e. within one generation, fast and simple methods of documentation as well as for restitution have to be used besides the professional methods, (whose instruments are much too expensive). That means we have to speed up the documentation of architecture 250 times! In the majority of cases, the inventory, historical analysis and restoration demand such high accuracy as offered by professional photogrammetry (Almagro, 1991). Semi-metric or non-metric

cameras, reduced format plotters and/or digitizer tables, personal computers and commercial drum plotters are sufficient. Object control should be reduced to "simple control" (Waldhäusl/Peipe, 1990). In many practical cases, plotting is required of independent models, only. With some additional, but simple control information, bundle block adjustment yields reliable results. This method is efficient, usable and cheap as far as collection of photography is concerned, but a bit more expensive than professional terrestrial photogrammetry and a bit less accurate as far as restitution and further data processing are concerned.

World-wide there are many and highly intelligent people producing and collecting excellent architectural photography, capable to easily learn the but few and simple rules to be applied for metric documentation. If the job really has to be done within one generation's life time, it is advisable to motivate them to help us. We have to teach them some simple rules (Waldhäusl/Brunner, 1988), which we called the 3x3-rules. Three geometrical, three photographic and three organizational rules which are well known to any professional: How to prepare control information, how to provide for multiple coverage by all-around photography and how to get stereo-partners for stereo restitution. The inner orientation has to be kept fixed, the illumination should be homogenous, the camera should be stable and of the largest available format. How to make proper sketches, how to write the protocol and how to check up the results finally. Each of these nine rules is explained in detail.

CIPA should study, improve, approve and publish these rules properly. Then these rules should be distributed among interested groups. At the same time, a collection of documentations has to be organized. Photogrammetrists and architects could gain a new field of activity, i.e. to inspect, approve and collect these documentations and to manage an archiving system, communicating world-widely. Leaving the mass documentation to others, they could dedicate their efforts to the surveying of the more complex and more difficult objects, like cathedrals and castles.

Besides non-metric and professional photographic cameras, also (still-) video cameras are widely used, nowadays. The 3x3-rules should be extended also to these videogrammetric cameras. We should try to get into contact to one or another TV-station and to motivate them to collect proper videos. The big advantage of "amateur-documentation" is the fact that the many expert tourists could collect many, many objects also out of and for developing countries.

Task 2: The analytical methods of restitution should be further developed and further propagated.

The simplifications of the very complex and universal combined adjustment software systems are not yet simple enough. Non-photogrammetrists run into difficulties quite often. On the other hand, there are also many photogrammetric experts who are not yet acquainted with all the possibilities of combined bundle adjustment. And many practising and photogrammetric institutes have not even started to use bundle adjustment or non-metric photography.

In Europe, more than ten university institutes have started to compare their skills in the restitution of non-metric photography using ORIENT (Kager, 1991). A test object has been selected, a small but beautiful building in Vienna (Waldhäusl, 1991). The aim of this international cooperation is to convince the users of architectural photogrammetry that non-metric and semi-metric cameras render sufficiently good results for many practical purposes. Another goal is to provide all the members of

the project with more experience in gross error detection and camera calibrations on the job.

Task 3: Data bases are to be developed for national and international cooperation in the various fields of cultural resource information management.

The data on monuments and sites including the photogrammetric documents should be properly managed. This includes systematic updating in the event of renovation or decay, regular inspection of the sites, cooperation with the owners, handling of contracts, management of financial supports, ability to find plans, literature, correspondence etc. Furtheron, all existing photographs should be digitized in order to manage the mass of images as well as to protect colour films against fading. The data should also include XY-coordinates; only then area search and mapping with symbols are possible.

Any documentation made of a monument of another country and brought home by some travelling expert should be collected and registered and/or stored like those of national monuments, but information should be made available to the other country. Cooperation is needed also in the cases of the world heritage, for which both, the Parisian ICOMOS-Data Base and the national data base, are competent.

The problem of national and international data bases for architectural photogrammetry will be treated at a symposium in Quebec City immediately after the ISPRS Congress in 1992 (R. Letellier, Hull). Much work is waiting for ICOMOS and CIPA to solve all the problems of standardization for international data exchange. It is interesting to note that many national or regional data bases exist for technical data, social information, finances, land register (cadaster), natural resources and others, but nearly none for the cultural environment and, if any, more likely for archaeological sites or finds than for architectural monuments.

Task 4: Digital photogrammetry and digital image processing are to be further developed.

Rectification of digital images (digital orthophotos) as well as digital developments produced from general perspectives, real-time photogrammetry with an after multi-image matching, artificial shading and shadow changes, color corrections and color transformations, project simulations and automatic change detection, painting studies (colour compositions). These are only some subjects to be treated out of the wide field of practical application of digital image processing in architectural photogrammetry.

Task 5: Public relations

In fact, architect and photogrammetrist are competitors up to a certain extent for building surveys. Both get their contracts from the owner of the object or from its administration. Architectural photogrammetry has and is sometimes the better solution for a surveying problem, but might have no chance to get the contract due to ridiculous anti-propaganda. It seems advisable therefore to show photogrammetric performance in videos and by results also to many others. Excellent materials suited for this purpose could be exchanged internationally. Without such efforts, photogrammetry could continuously lose in the market. The same videos may be used also for training purposes.

In this respect, any extended publication of CIPA activities planned in the CIPA objectives for the coming years is most welcome, but it must be clearly expressed that activities are the prerequisite for any publication.

Task 6: Promotion of activities of National Delegates. Cooperation with other committees and organizations.

Frank exchange of experience and results, permanent contact by fax and phone, mutual information and assistance, a visiting programme to strengthen personal relations, definition of common goals and programmes, mutual respect and own activities, these are some recommendations for proper motivation of National Delegates. An important task for the National Delegates is to contact colleagues of other committees. Important committees with possible relations to architectural photogrammetry are e.g.: Vernacular Architecture, Cultural Tourism, Historic Gardens and Sites, Historic Towns, Rock Art, Archaeological Management. But also other groups are in fact interested in architectural photogrammetry, e.g. archaeologists, early historians, historians, ethnographers, city researchers, architects and civil engineers, photographers, regional planners, tourism managers, Lord Mayors, Board of Works, house owners ... It is a main task of all National Delegates to keep contact also to the neighbouring and interested groups. Reports on such contacts can be of great interest also to the delegates of other countries.

Task 7: Promotion of cooperation with the military and with local fire brigades.

During armed conflicts, the military has to protect the country and the architectural heritage. In the future, we should involve it much more. The military has to learn about the convention and it can, at first, assist in and later execute photogrammetric documentation according to the 3x3-rules. The method is very useful for the military because it may be used for the documentation of other objects, too, as e.g. for traffic accidents, or for an avalanche disaster. At the same time, the military learns about value and beauty of many important monuments. Education and delegation of responsibility are important means towards protection of monuments. In the same manner it is also advisable to cooperate with local fire brigades.

Task 8: Cultivation of macrophotogrammetry. Cadastre of small monuments and museal photogrammetry.

The cultural heritage to be "protected" or assisted by photogrammetry is not only architecture. Many smaller monuments in towns and villages, in the midst of the landscape or in the cemeteries, are witnesses of the past, have been erected to explain something to us and to our children. The cadaster of small monuments should contain also photogrammetric documents in many cases. Another "class" of cultural heritage objects we find in the different museums: Globes (Kraus, 1992), statues, music instruments, pieces of fine art, coins and medals, rare crystals and minerals, archaeological finds. Stereo-photogrammetric documents - in future digitally - are helpful means for science, after theft, fire, disasters, against falsifications and for reproductions.

Summarizing we see that architectural photogrammetry has a wide working area, is technically interesting, never boring, with many open questions. And we see that plenty of work still has to be done by Commission V as well as by CIPA in the coming years.

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