USAGE FOR LASERSCANNING TECHNOLOGY FOR COMPLEX ACQUISITION OF DOCUMENTATION IN CULTURAL HERITAGE

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Abstract: *In this contribution we are trying to summarize our existing experience with using the laserscanning technology for old cultural heritage documentation – from the point of view of submitter and user who uses the final outputs and also from the supplier´s point of view for whom working with cultural heritage is just a narrow business segment. We presume, there are missing some information on the both sides of this relation. Therefore, our aim was to resume basic methodological hypothesis that could lead to optimal usage of laserscanning technology for purposes of surveys and building heritage documentation. This necessity came out naturally from long-terms cooperation between supplier companies and the processors of historical structures´ surveys and also from the reflection of consultation services during placing the order by the Institutional subjects of historical monuments care in the Czech Republic. This contribution is partially a message about the stadium of usage of this fast evolving technology in the field of surveys and the Czech cultural heritage field. We have divided the whole process into 4 parts: scanning, data processing, generalization and usage of outputs. Submitter and supplier can keep themselves informed about all the stages – about technology selection, its usefulness and also about the way of processing outputs and, retroactively, also about usage and effect of the outputs. Thanks to fast evolution the technology is changing and fundamentally influences the quality and usage of the outputs. We are the witnesses of static scanner accuracy rising and also the development of other technologies different from laser basis. Also the software tools are in fast progress. The elaboration area lies, at least in the Czech conditions, mainly in the field of suppliers´ companies and it will become quite crucial to improve the situation on the side of users. One of the most important problems, which usually lead to misunderstanding, is accurate specification of outputs required – or more precisely different understanding of their completeness, punctuality and also their informational extraction. Inexperienced submitter is enchanted with the clouds that seems to be the true imprint of reality, but could be disappointed after receiving the generalized 2D outputs, which do not allow more detailed description of the object. And it is the specialized capability of description, coupled with knowledge of historic structures and technologies what makes this technology in the field of cultural heritage meaningful. On the other hand, adequate usage requires higher functional literacy and technological equipment of the user. It is also essential to further developed methods of documentation, which use dimensionality scan and yet remain a practical tool in the process of cognition, restoration and presentation. Therefore the bilateral cooperation is necessary at all stages of the process as well as effective and open communication between the two discourses.*

1. INTRODUCTION

Technologies of 3D scanning present undoubtedly great contribution to cultural heritage documentation. They are not only the way for metrical documentation, but they bring unsuspected possibilities in process of description, analysis and presentation.

But what is the reality in Czech Republic really like and how is the technology used in everyday practices? We assume, that the situation could be described as „stagnant".

2. CASE PROJECTS – PROBLEMATICS IN THE CZECH REPUBLIC

New possibilities are coming up, but their number is not markedly rising.

Suppliers do not see a lucrative background in the field of cultural heritage documentation and people from historical monument care do not really see the purpose of it, because for them there are just insurmountable difficulties.

The problem lies somewhere in the middle – our opinion is that both sides are lack of the unnecessary information. We see the sense of the term „complex documentation" in the headline of this report as equivalent to methodologically settled forms of surveys of historical buildings in Czech Republic.

We try to summarize our existing experience with laser scanning usage at the moment of their creation, especially from the submitter and end-user view and also from the view of supplier, for whom working with cultural heritage is just a narrow business segment.

In this field we exploit our knowledge of the consulting activities during order-placing by different institutionalized subjects of historical monuments care in Czech Republic.

This paper is partially a message about the stadium of usage of this fast evolving technology in the field of surveys and the Czech cultural heritage field.
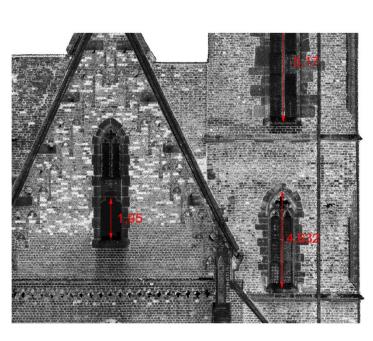

Figure 1: Orthoview of front side of Holy Spirit Cathedral in Hradec Králové (by ILRIS scanner)

How do both sides of this relation differ? Suppliers – technological universities' graduates - definitely predominate in knowledge of technological aspects of the process and the access to hardware and software tools.

Methodologically they are anchored in the fields of geodesy, technical and natural sciences. Part of them specialized in cultural heritage segment (i.e. The Laboratory of Photogrammetry at Department of Mapping and Cartography of the Czech Technical University in Prague) especially in the scope of documentation.

By contrast, submitters/users from historical monuments' care are forced to extend their primary subject field with practices and further education into poly-disciplinary fusion. They work in the intersection of technological (field of building) and humanities (art history, constructive cultural events, history) discursus.

Figure 2: Head in the King´s hall of Holy Spirit Cathedral in Hradec Králové
(by ZScanner scanner)

They differ in ability of analysis and interpretation of the building work.

And these specific abilities should be exploited during cooperation in development of laser scanning usage and others methods. Why this does not happen, or not satisfyingly? Let us go through single stages of whole process.

At the beginning there is the process of decision-making of investor, building administrator, documentator, metrical documentation reconnoitrer.

But how could this person define the demand while not knowing detailed technology parameters and having just indefinite idea of results. Where does he experience laser scanning? Experience of majority of the experts surveyed is based almost solely on viewing the presentations owners´ know-how - usually teams of specialized universities, who are forced, for good assessment of their work, to create partially „marketing" presentation products for conference tourism.

But they do not say under which conditions it is possible to conduct similar documentations and analysis on a purely commercial basis (time, price, usage of technological background, etc.) and often remain only in narrow corridor of technical discursus.
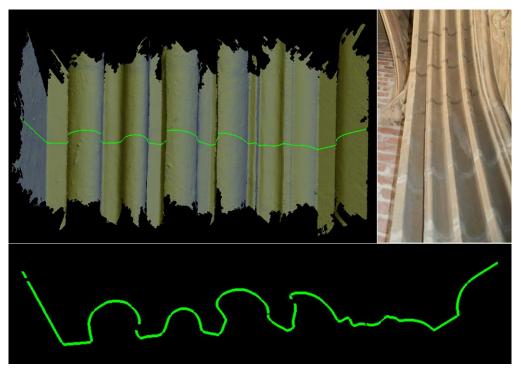
Figure 3: Portal profiling in Holy Spirit Cathedral in Hradec Králové
(by ZScanner scanner)

Apart from presentations of different types (outputs from grants, presentation of supply companies etc.) there are not many opportunities to extend our knowledge concerning the 3D scanning product use and therefore not many abilities to enter our services well (besides CIPA ☺).

Methodological development is staying in the field of technical sciences but in the field of knowledge, protection and presentation of immovable cultural heritage these issues are (apart from a few exceptions) still postpone into the background. However, thanks to global technological boom it is possible to reflect and receive completed methodological framework and then use it in educational process at colleges focusing on management, knowledge and protection of cultural heritage and it is also possible to increase skills of employees working for conservation institutions. The situation in the Czech Republic is in both considerations pathetic.

Correct formulation of an order expects setting the goal well. Therefore the use of laser scanning products differs. There is a difference between an authority who understands point clouds as archiving, preservation of a real state in a certain time or only as an intermediate step for creation of 2D drawing and a more knowledgeable user who understands the products as a base for documentation, exploration, analysis and presentation and is able to work with them. It is obvious that this phase is a crucial moment which decides whether the finance was effectively spent and benefits obtained.
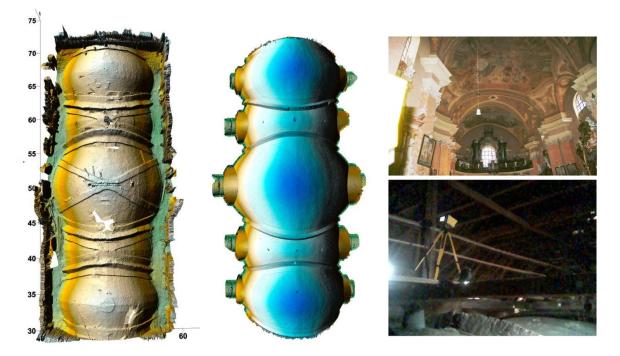
Figure 4: Back and front side of a Vault in Monastic church of paulans in Nová Paka
(by ILRIS scanner)

Scanning process and data processing is based on experience of few leading suppliers in the Czech Republic at the standard level. However, technology thanks to rapid development is variable and fundamentally influences the quality and usability of outputs. We witness the improvement of laser scanning accuracy and development of other technologies not concerning a laser base (method of optical correlation). In this respect it is necessary to inform the authority plausibly about recent standards and more progressive technologies. The same is meant for quick developing software instruments.

Far greater problem is a phase of generalization and output creation. There occurs interpretation of raw data and at this time also the highest influence of documents usability during their use. And this is, as it has been written above already, the field of the main interest of a user/authority. One of the basic problems often leading to misunderstanding is an accurate enter of outputs, or often different understanding of completeness and detail. Incorrigible authority is enchanted by clouds which seem to be a true imprint of reality and can be disappointed after receiving generalized 2D outputs which do allow not even detailed object description. As a small example we can show different idea of a supplier and an authority during creation of a plan cross-section:
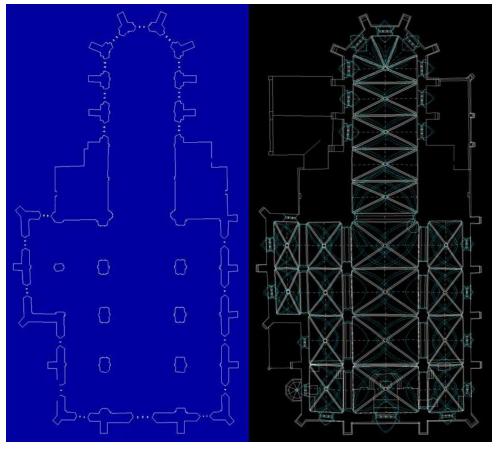
Figure 5: Comparison of initial and final cross-sections

It is apparent that in this stage a user/authority should fundamentally enter into the process and either to be a supervisor of an output creation or should these outputs produce on his own. This has quite a few crucial obstacles: lower information literacy, limits of user´s hardware and software equipment which are very difficult to remove due to sustained prices. It is necessary to find such instruments which will these obstacles eliminate and at the same time will lead to more precise output formulation during actual input.

So how should an ideal communication look like during an input of such a contract? We advise a detailed analysis of an authority´s requirements and a detailed explanation of the whole process concerning scanning, modification, processing, and generalization up to output creation. The best way how to do it is to make a brief manual which should be a structured base for such a communication. Its content would provide a brief list of limited factors. As an example can be used this sample:

Scanning	Data processing
Selection of technology	Aligning
-Technology development	Smoothing
-Detail option	Point reduction, Subsampling
-Effectiveness	Error points
-Technology limits	Polygon models
Range option	Holes in pointclouds
-Location limits of scan positions	
-Suitability	
-Range influence on data amount and time	
Generalization	**Usage**
Experience in work with point clouds	Outputs options - possibilities
Knowledge of historical constructions	Hardware and Software equipment
Errors by measurement and processing	Functional literacy
Generalization and formulation of outputs	Rules for additional outputs
Definition of 2D and 3D data relation,…	Rules for data archiving
	Copyrights,...

Table 1: Sample of limited factors

3. CONCLUSION

As it was said before – specialized descriptive and interpretative abilities is everything what makes sense to use this technology in the field of cultural heritage. On the other hand, for fully use it is necessary to have higher functional literacy and user´s technological equipment. It is also absolutely necessary to keep elaborating on communication methods which use scan dimensionality yet at the same time they stay practical equipment during process of knowledge, restoration and presentation. It is necessity of a bilateral cooperation in all process stages and more open communication between both sides.