ROLE OF INTERDISCIPLINARY COOPERATION IN PROCESS OF DOCUMENTATION OF CULTURAL HERITAGE

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Abstract:

This paper is focused on presentation of results of long-term interdisciplinary cooperation in a process of documentation of Cultural Heritage. There are two sides joined in this cooperation. The first side is a „submitter" - in our case it means architect-historian (Mr. Rykl). The second side is a „contractor" - in our case it means surveyor-photogrammetrist (Mr. Hodač and his students). We are cooperating mostly on projects of metrical documentation of Culture Heritage buildings and sites. Our cooperation is realizing mainly in bachelor's/master's projects. Other opportunity for our collaboration is our course [1]. We are offering this course to students of two faculties/specializations (surveyors + architects). Beside the wide range of real results (2D drawings, 3D models, photomaps etc.) we also collected quite a lot of experience with process of collaboration itself. Joint cooperation and communication of submitter and contactor are playing key roles for successful project. It is possible to generally expect that submitter will give the „task" and contractor will try to find proper technology to solve it. The process of communication should be permanent because new circumstances and findings are arising all the time. It is very important for all together to find common language across specializations to understand each other. Surveyors are „slightly pressed" to get more knowledge about historical building constructions. Architects-historians should get basic awareness about various recent technologies for metrical documentation and its „pros and cons".

1. INTRODUCTION

The projects we are cooperating on are mostly practically oriented. Course of our typical project evolved during period of our collaboration into a stable form. This form is showed in Appendix 1. Each side involved has a specific role in the project. What is different from common submitter – contractor relationship is very narrow and intensive cooperation before, during and also after the project. Both sides are highly motivated and they are following the same aim. Contractors/students are softly dragged into process of building-historical research (BHR). Finally they clearly know what they are working on and what the purpose is. This situation helps them to activate their creativity and also their ability to manage with emerging questions is gradually growing.

1.1 Cooperation – main characteristics

Submitter is defining each task within the project with regard to the specific goal of the BHR. We (submitter+contractor) are then trying to find appropriate way of record to meet the goal. This process of clarifying the form and content is continuous. In some cases it leads to usage of very complex technologies (e.g. laser scanning, optical correlation systems etc.) and in other cases only very simple methods are used (e.g. image rectification). Wide range of technologies is available today. From technological point of view nearly „all is possible". Our approach in this technological area is quite pragmatic. It means we are searching

for technologies that are as simple and yet fully solve the task. Effectiveness of means used in projects is one of important parameters we are following. Our most common approach is a combination of various documentation methods.

Our communication has often a form of dialog. Submitter is making a goal-oriented probe into the subject of research and based on that he is defining clear questions to contractor. Dialog leads us through project step by step. Partial outputs of project help submitter to ,,understand deeply" during process of BHR and then to define tasks for next step. From this point of view the whole process is alive, variable, trial-error oriented but following main goal of the project.

Understanding each other is key point of communication. Specializations involved have their own terminology, own language. First essential step is to find the same level of conversation which is clear for both sides. Crossing of borders of specializations is really necessary as well as ability of attentive listening and patient explaining. Only under these conditions of mutual interaction we can achieve the state when submitter is able to specify ,,what he really needs" and contractor is able to find and simply explain ,,how to do it".

The above described type of relationship should reduce or even remove some kind of impatience to new technologies on the historian's side and kind of blind fascination to same technologies on the surveyor's side. Cultivation of the ability to have a ,,health distance" from own specialization is useful ingredient in this process.

1.2 Cooperation – types of projects

Projects we are collaborating on can be divided into four basic types. Each type has its own specifics. Various kinds of activities are usually blending in a project but one of them is always dominant. The main activity is in a direct relation with the main goal of the project. The first type of our projects is ,,RESEARCH". It covers projects which are purely focused on research in the area of BHR. Most of them have a form of dialog and documentation results are innovative. The second type is ,,SUPPORT". This includes projects that are focused on a creation of metrical documentation as a support of standard BHR process. Results of these projects are common types of metrical documentation. The third type is ,,EMERGENCY". Such projects are focused on emergency documentation of details or complex of buildings and sites. The fourth type of our projects is ,,PRESENTATION". The main purpose of these projects is presentation of the BHR results. All these types will be discussed in more detail in the following chapters.

2. RESEARCH PROJECTS

This type of projects is mainly focused on verifying of hypotheses about building/site development. Hypotheses are defined by submitter during a process of BHR. Topic of project can be e.g. reconstruction of geometric shape of parts of buildings which were destroyed during ages. This reconstruction is then created on the base of precise metrical documentation of their rests. Various methods are used for documentation in this case and most common output has a form of 3D model. Second type of topics is focused on precise documentation of parts of buildings which exist in original state but their shape and its geometry is not precisely known. Research targeted on geometry of vaults is example of this type of project. Communication submitter-contractor in these projects is the most intensive. The course of projects is continuously modified based on the partial outputs.

The main features of this type of projects are summarized in Table 1.

Table 1: Research projects - main features

project	goals	verify hypotheses on building development
	technologies	combination, whole range, unconventional approaches
	results	mostly 3D
cooperation	specifics	intensive dialogue between specializations
		changes in course of project .. step by step
	benefits	new findings about development of object
		new findings about technologies
		deeper understanding across specializations

2.1 Example 1 – geometry of existing vault

This project was focused on verification of hypothesis about construction of vault of Gothic hall in a small fortress in Central Bohemia [2]. Laser scanning technology was used as a main documentation method. Various types of outputs were created in near cooperation with submitter or directly on his demand. Construction process of this vault was finally clarified by submitter with the help of documentation results. This project was presented in conference of BHR in form of a dialog between submitter and contractor (questions-answers). Various types of results are presented on Figures 1 and 2.

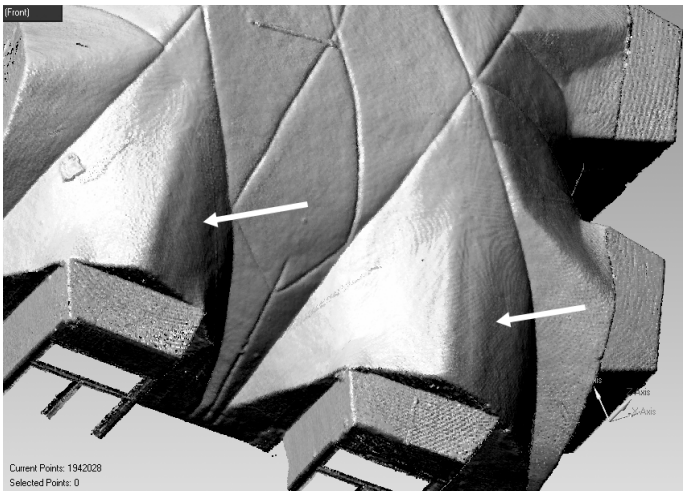

Figure 1: analysis of vault – 3D model

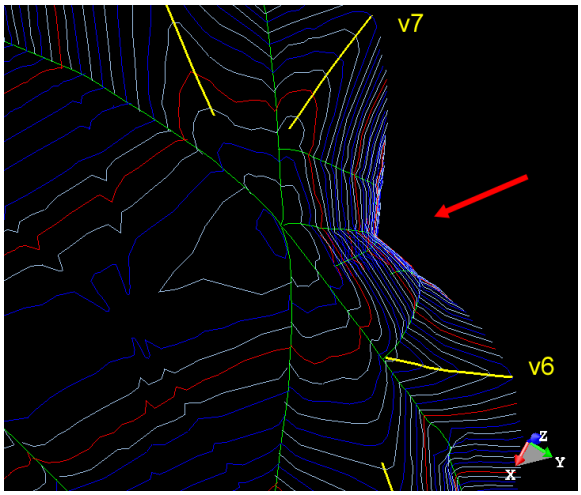

Figure 2: analysis of vault – contour lines

2.2 Example 2 – geometry of destroyed vault

These two projects were focused on verification of hypothesis about geometric shape of vaults which were not preserved. Vault of scullery in a Gothic fortress in Southern Bohemia was topic of the first project and vault of a pulpit of a Romanesque church in Western Bohemia was the second topic. Combination of methods was used in both projects. Stereophotogrammetry and optical correlation system were used as main methods for precise documentation of rests of vaults. Reconstruction of hypothetic shape of vault was created in narrow cooperation and with great help of submitter and enriched our knowledge about historical development of these buildings. Results of projects are shown on Figures 3 and 4.

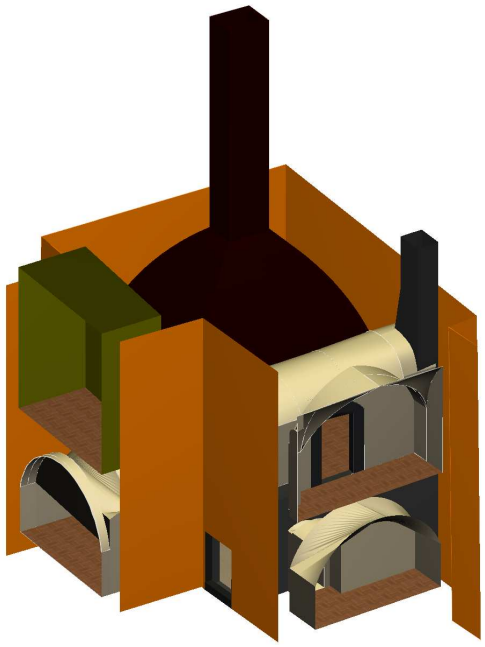

Figure 3: reconstruction of scullery vault

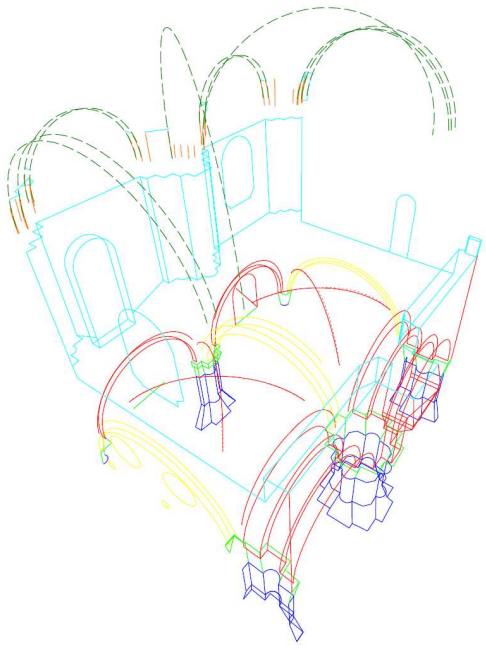

Figure 4: reconstruction of vault of church pulpit

3. SUPPORT OF BHR PROJECTS

This type of projects is mainly focused on creation of a quality-fundament for BHR process. Parameters and forms of outputs are clarified during submitter-contractor discussions. This type of communication can continue throughout the whole course of a project and it is leading to results which are highly customized to the submitter's needs. Results are almost immediately used for BHR done by submitter. Combinations of various methods are used for documentation in this case and the most common output has a form of 2D data (e.g. photomap). Methods used are mostly more simple then in other types of projects. Processing of results is sometimes done partly by contractor with help of submitter, it means, that both sides are slightly pushed to cross rigid borders of their specializations.

The main features of this type of projects are summarized in Table 2.

Table 2: Support projects - main features

project	goals	creation of quality base for BHR
	technologies	combination, simpler methods preferred
	results	mostly 2D
cooperation	specifics	search for appropriate parameters and forms of output
		crossing boundaries between specializations
	benefits	customized high quality documentation
		traditional result with added information

3.1 Example 1 – photomap and its interpretation

This project was focused on a creation of photomaps of part of facades of a small fortress in Central Bohemia [3]. Standard workflow of single image photogrammetry was used and photomaps were created. The second step of project was building historical interpretation of the content of photomaps. Intensive submitter-contractor cooperation was necessary during early parts of this period. Quality check done by submitter was the final step. Example of a result is shown on Figure 5.

Figure 5: interpretation of photomap

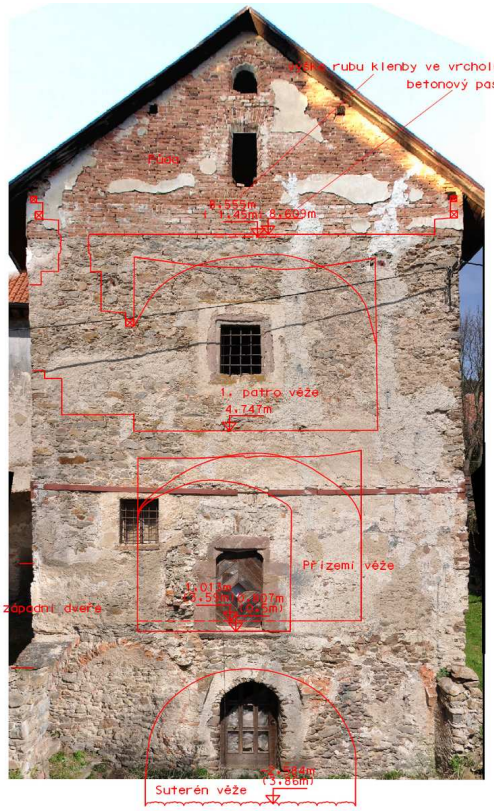

Figure 6: photomap with cross-section

3.2 Example 2 – photomap with cross-section

This project had similar assignment as the project presented above. Building of interest and methods used were also the same. The second step was different. Introjections of cross-section into photomap were demanded by submitter to understand more deeply spatial composition of the selected parts. Key communication submitter-contractor was done during period of fieldwork when parameters of cross-section were clarified in situ. Standard surveying methods were used for cross-section documentation. Example of a result is shown on Figure 6.

4. EMERGENCY DOCUMENTATION PROJECTS

This type of projects is mainly focused on emergency documentation of buildings/sites and its parts at risk. Time, work safety and technical conditions on site play key roles in these projects. Demand for documentation is formulated by submitter. It is really necessary to discuss and brightly identify priorities of project and parameters of results. Technologies for quick collection of maximum data are commonly used because of circumstances of such projects. Laser scanning and optical correlation systems are widely used and results are in a form of 3D model. Conditions during data collection process are often difficult (not much space, not much light, time press etc.). It has some influence on data quality but mostly it is not possible to wait for better conditions in field (e.g. archeological prospecting with excavator above head). Close submitter-contractor cooperation is necessary in a process of search for effective technology of documentation. High end technologies as e.g. laser scanning are not available and also not convenient at every time for various reasons (budget etc.).

The main features of this type of projects are summarized in Table 3.

Table 3: Emergency projects - main features

project	goals	emergency documentation of sites at risk
	technologies	combination, whole range, quick data collection
	results	mostly 3D
cooperation	specifics	clarification of priorities for documentation
		time, safety and technical conditions
	benefits	data recorded for future
		search for effective technologies of documentation

4.1 Example 1 – stucco decoration of vault

This project was focused on emergency documentation of the most valuable parts of stucco decoration (putti) of a baroque vault in a castle near Prague. Optical correlation system was used as a main documentation technology. Very detailed 3D models of putties were created and also complex model (not so detailed) of the whole vault was another result. Slow destruction of the vault and its decorations were discovered during the course of the project. Partial results of processing were discussed and high emphasis on punctuality of documentation from side of submitter opened necessity of next phases of fieldwork. This process of continuous regimentation led to very high quality outputs. Example of a result is shown on Figure 7.

4.2 Example 2 – archeological site

This project was focused on emergency documentation of archeological site in the centre of Prague [4]. Laser scanner technology was not available, just optical correlation technology was used similarly as in the first project. Huge amount of image data was collected and they are still processed step by step. Conditions during fieldwork were not ideal (time press, light problems) but detailed 3D model of part of the site was already created in a high quality. Close cooperation, help and patience was necessary mainly during the onsite work (many people in small space etc.). Documented ruins were destroyed few days after last fieldwork. Collected data are from this point of view very valuable source of information for the future. Example of a partial result is shown on Figure 8.

Figure 7: textured 3D model of putti

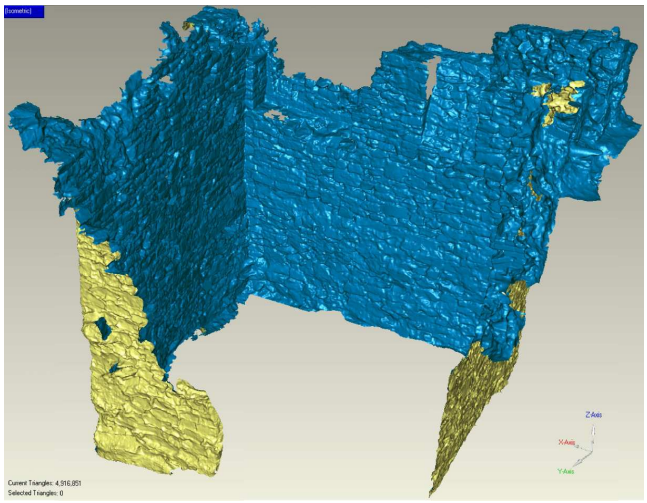

Figure 8: 3D model of part of Matthew tower

5. PRESENTATION PROJECTS

This type of projects is mainly focused on illustrative presentation of research outputs. Standard graphic form of BHR outputs is two dimensional (drawings, schemes etc.). Visualization (3D model) of findings gives better idea about spatial relationship of different parts of building/sites. Submitter defines the main task of visualization. Subsequent discussion with contractor leads to proposal of technology, parameters and forms of results. Existing data sources are mostly combined with supplemental measurement (different simple methods) in situ. Submitter is fully involved in the process of creation of final results. These results in some cases reveal the necessity of partial BHP improvement.

The main features of this type of projects are summarized in Table 4.

Table 4: Presentation projects - main features

project	goals	presentation of collected research outputs
	technologies	combination, use of existing data
	results	mostly 3D, visualization, animation
cooperation	specifics	working with various data sources
		working with results of research - explanation/understanding
	benefits	search for optimal methods of presentation
		suggestions for improving of research

5.1 Example 1 – reconstruction of historical appearance of a fortress

This project presented results of BHR of a part of a small Gothic fortress in Southern Bohemia [5]. 3D model was created using existing 2D drawings (earlier metrical documentation), results of BHR and simple measurement in building. Measurement by tape was performed in order to improve the above mentioned 2D drawings. Detailed photo-documentation was also taken. 3D model displays a hypothetic state of the building during researched historical period. Results of project were presented together with other results of BHR on a specialized seminar. Example of a result is shown on Figure 9.

5.2 Example 2 – development of ramparts

This project presented results of BHR of ramparts of a Gothic fortress in Central Bohemia [5]. Intersection photogrammetry was used as a method of documentation. The output was a 3D model of actual state of the area of interest. This model was combined with 2D drawings (BHR outputs). Projection of these drawings to the 3D model was done in a narrow cooperation between submitter and contractor. Final 3D model allows better understanding of building development. Created model became one of important sources for reconstruction of appearance of the fortress in various historical eras. These reconstructions were done by submitter consequently. Example of a result is shown on Figure 10.

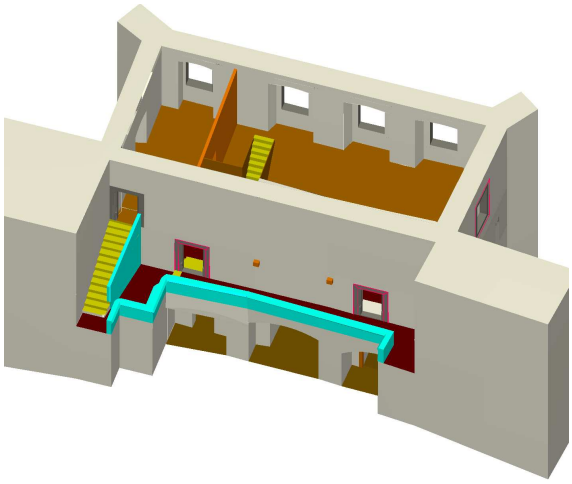

Figure 9: reconstruction of a part of a fortress

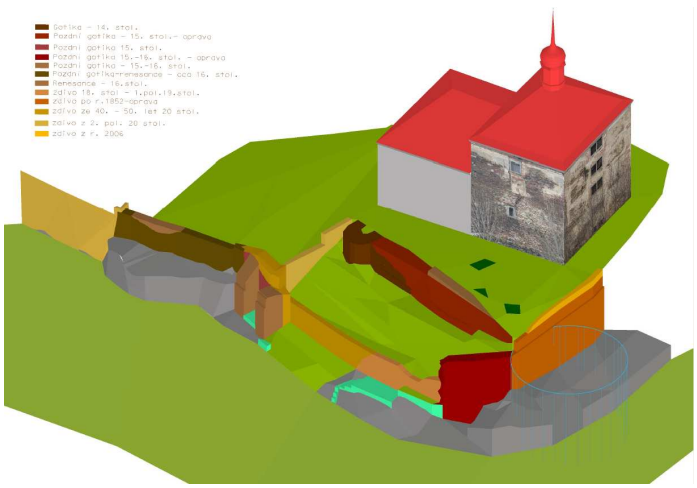

Figure 10: historical development of ramparts

6. CONCLUSION

We can say that described type of cooperation is leading to results of a very good-quality. Yes, it is true, that it is quite time demanding for all, but specialists from both sides are enriched and finally they are very satisfied with the project and its results. We cannot expect that in a real life the course of the projects will always run as ideally as we are practicing. We are trying to show to our students the way how to do it, what is important in the process and last but not least how to make interdisciplinary collaboration successful.

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APPENDIX

Appendix 1: Course of typical project

activities during project	S	C	ST
defined goal of project = purpose			
cooperation			
introductory meeting			
- study of basic groundwork/documentation			AS
- first draft of type of results			AS
- first draft of convenient technology			AS
- agreement on time frame of project			
meantime			
- obtaining additional documentation		SU	
- study of documentation		SU	
- study of previous projects of simillar type (technology)		SU	
fieldwork			
- specification of task in situ			AS
- specification of technology in situ			AS
- data collecting + continuous consultation with submitter			
processing			
- preprocessing of data		SU	
- first results - analysis and discussion			
- refinement of technology of processing and form of results			
> interactive process .. next meetings			
- final results - discussion			
conclusion - reflexion			
- benefits to submitter			
- benefits to contractor			
- new knowledge of technologies used			
- publication and use of outputs			
rem.: ***S*** *- submitter,* ***C*** *- contractor,* ***ST*** *- student,* ***SU*** *- supervision,* ***AS*** *- assistance*			

Activities of all parties involved are displayed on right side of table.