

The proposal for a COSCH study should typically include:

1. Title of the proposed case study:

**TOWARDS A MORE EFFICIENT USE OF SPECTRAL TECHNIQUES IN THE
ATTRIBUTION OF EASEL PAINTING.**

**The icon of Archangel Gabriel in the National Museum of Belgrade – a case
study**

2. Duration/dates:

The experimental part will take place in Belgrade, in the period 13th – 28th of April 2015.

The data assessment and the visualization will be implemented apart, collaborating via net. A first detailed report will be presented not later than the beginning of June 2015.

3. Description and image of the subject (object/site), its significance and suitability for the proposed case study:



Archangel Gabriel, National Museum Belgrade,
15th or/and 19th century, tempera on wood,
L=24.60 cm; H=33.40 cm; S=1.50 cm.

The icon, painted on a plain wooden panel without frame, is almost illegible due to the

strongly darkened and altered varnish. As far as can be seen from the photo, it represents the winged archangel Gabriel, in red *hiton* and green *hymation*, holding a sphere (mirror) in the right and praying with the left, in half figure, the head bended down: a position typical for the iconography of the Archangel's Deisis, usually located on the principal (*despotic*) range of the Russian *iconostasis*. The aureole is gilded, for the rest of the background this is not certain. The monumental shape of the figure, its proportions, the stylistic particularities as well as the articulated design denote an exclusively fine work in tempera, of high class and of typical Russian and not Greek inspiration. This evidence suggests that the icon could be work of one of the most prominent Russian iconographic centres of the end of the 15th century or the beginning of the 16th. Moscow or Novgorod. The painting doesn't have much parallels as original icon works from this early epoch are very rare (for example Rublev's archangel Mikhail in the Tretyakov Gallery) and of exclusive historic and artistic value. An early attribution is in conformity also with the plastic construction of the incarnate and of the garments, but it is not absolutely proven as master pieces from the Russian 15th and 16th centuries have been object of numerous, skilfully prepared copies and fakes – commercial and professional – since the second half of the 19th century. Doubts remain also on behalf of the atypical thickness of the panel, its original framing and, naturally, on all the surprises the discovering of the painting actually hidden by the wrinkled blackish varnish could bring forward.

The icon represents several kinds of damage concerning as the protective layer as the underlying paint and the support. In circumscribed areas in the left part – the most damaged – the paint has been lost. A profound cleft crosses the table from the left to the right border at the eyes' level, evidencing the bad conservation status of the *gesso* layer there and the eminent detachment and fall of the painting also in this area. The horizontal position of this fissure is very strange and its causes need to be cleared, as usually such deep cracks in the paint layer appear vertically, in correspondence to the junction of the planks constituting the support. To the symptoms denoting the critical conservation status of the icon must be added also the losses of the wooden support, visible left on the lower border, that could have extensions also within the support, threatening its integrity and the adhesion to the *gesso* and the paint layer . Nothing is known about the vicissitudes of this work. For example the blackish colour of the varnish and its clearer circular alterations in the left part are most probably due to candlesticks hold before the icon, indicating that for long time it has been hosted in an officiated church.

4. The rationale for and the purpose of proposed case study:

The question if this is an original work or a later copy, to which master or art school production it belongs, and if it has been subject to later interventions by principle can not be unequivocally answered basing on historic sources only. Moreover, the traditionally intense relationships between the South Balkans and Russia accredit both the hypothesis.

The multi decennial tradition in the scientific study of icon art in the most prominent centres (in Russia) has demonstrated that the only reliable method for correct dating and attribution represents the complex approach. It includes together with the iconographic and stylistic also non-, less- and even micro destructive techniques – if necessary for to solve definitively existing doubts. For this reason, as well as considering the specific objectives of COSCH, the proposed case study will be concentrated on the more efficient use of spectral techniques in the study of icons as a particular category of historic easel painting. The complete investigations on the Archangel Gabriel icon will be implemented however in the frame of other projects and related to other icons of the Belgrade National Museum, of Galerija Matica Srpska in Novi Sad and, eventually, of other collections in Russia, Serbia, and Italy.

The experimental part in Belgrade will consist of investigations concerning the wooden support, the preparative *gesso* layer, the paint layers, and the varnish. They will be carried out contemporary, confronting the data produced by the different, typically used for painting non contact techniques: surface analysis under microscope, VIS/raking light, UVR and UVL, IR (with monochromatic filtering at 715, 830 and 1000 nm), and X-ray, applying also computer tomography (CT). This selection has been suggested by former experience and is also imposed by the real possibilities of the Belgrade museum that has to face the postwar consequences in the preservation of the national art heritage in an extremely difficult economic situation. It is also founded on the practical needs of an extended group of non specialized end users, private and public, located mostly in Eastern Europe, but not only, of more easily accessible and efficient tools for instant monitoring of the conservation status, for authenticity certification and scientific documentation of easel painting.

The improvements in the production of devices for specific, non contact examination of art works in the reality favour mainly specialized end users (public or private), of a determined welfare status. The greatest part of owners and administrators of icon and easel paintings collections practically do not have access to these commodities or are not trained in their correct use. Particular difficulties raise – both to specialists and non – the interpretation of the results and the access to specific, sufficiently rich referential material. On this background, the agreement for information exchange and scientific collaboration with Russian experts in the field of icon art conservation results of fundamental importance for the success of the project.

The proposers' purpose is to demonstrate that the conditions for such authenticity controls that use more common technological base exist, and that they can be realized at an enough competitively level with minimal costs, simply making better use of already accumulated experience. That's why the case study will focus on the recognition – interpretation phase of the ND documentation and investigation. Its main these is that tools for efficient non contact investigation of artefacts are not exclusively the optical techniques and the utilized instruments for themselves. For to transform in real knowledge the information they produce,

its mass storage and interactive art historical, technical and technological assessment is of fundamental importance.

An other aim of this case study is to introduce in scientific use a more clear and articulated distinction between original and secondary works, between the different types of these last, on base of determined material characteristics. This is necessary for to strengthen the scientific-technological rigour and to assure the reliability of publications on historic painting in general, advertising “hard” scientists but also art historians about the broad extension of non professional restorations and fakes even in renown museums, and the necessity to consider them with the due attention.

It should be remembered with the occasion that detailed authenticity investigation and art technical and technological assessment must be obligatory carried out before any sampling for in-lab experiments not only on Russian and orthodox artefacts, but on every kind of historic art works in general. The practical experience and the historic documents demonstrate that easel painting often underwent renewals and only a minimal part of what has survived to our days is 100% original. Instead, in too much cases concerning historic artefacts, sampling yet follows the protocols for quality control in contemporary industrial production, without taking into consideration the specific alterations that could have been introduced not only by natural and ambient factors, but also by human hands. This makes unreliable the interpretations of the lab issues in most of the peer reviewed publications on physiochemical analyses and hyper spectral measuring of historic artefacts, discrediting their scientific character and value.

Finally, with the occasion the proposers will emphasize again and again the importance of the preservation of the original such as it is, avoiding any kind of interventions justified by mere reasons of aesthetic visibility or optical “integrity” as they not only falsify its character and documentary value, but make impossible the correct attribution and further in-depth studies.

5. Contribution to the objectives of a particular COSCH Working Group, or Groups, and generally, to the COSCH Knowledge Representation schema.

The proposed case study will generate useful information concerning mainly the objectives of COSCH WG4, applying surface analysis and spectral techniques in the investigation of the

- support type and to the eventual presence of living worms.
- ground composition and structure.
- pigment's composition (of white, red, blue and yellow mineral pigments).
- presence of over paintings with natural pigments.
- characteristics of the protective layer.
- eventual mycological presence in the ground and the paint layer.
- stratigraphic structure of the ground and paint layer.

Furthermore, it will

i) test the possibilities for the individualization of:

- the chemical composition of the materials on base of their recorded in previous ND experiments IR or X-ray characteristics;

- otherwise "invisible" elements like over paintings in natural dyes or inks of vegetable origin, through monochromatic filtering in Vis and IR at determined wave lengths;

ii) elaborate detailed references for the interpretation of crackles in the dating/authenticity certification of paintings, in the frame of joint spectral-radiological investigations;

iii) contribute to increase the efficiency of basic ND (spectral and radiological) surveys for the attribution of icon painting, benefiting from the most recent research on its technique, technology and regional phenomena, and exploring modalities to extend the application of the results to other sectors (to easel painting in general);

iv) ascertain the reliability of CT as spatial and archaeometric technique;

The planned elaboration of *stratigrama* and of the fragmentation schema, the mapping of the conservation status as well as the schematic presentation of the data obtained during the microscopic and spectral/radiological analysis concern the objectives of WG5, but they will be carried out apart, via net collaboration. It is expected that these will contribute to reconstruct virtually the vicissitudes of the icon and to produce referential standards for optical recognition useful as archaeometric/authenticity certification tools.

It is also expected that the problematic focused here will be of interest for COSCH WG1 (as subject and end-user), concretely for the need of a specific calibration of spectroscopic devices and measurement conditions; storing, analysis and visualisation of the acquired datasets.

The experiments will be aimed at fostering better exploitation of existing knowledge and technical potential, introducing or recommending innovative technologies and policies in collecting and proceeding of data resources, hence they could be of interest also for all the other COSCH Wgs.

6. Target users and their needs:

(Please name the user groups likely to benefit from the proposed case study and list likely research questions they may ask, e.g. Museum curators: can the proposed method support the authentication of the object under study?)

Target users categories: restorers, conservation scientists, art experts, museum curators, art historians, scientist engaged with lab analysis of easel (tempera and oil) paintings. They could require further referential standards, atlases with examples, dedicated publications,

best guides or software for fast ND recognition of fakes or of non professional restorations, interactive videos, etc.. that benefit new scholarship, research and developments in interpretation.

7. Proposer: (name, position, affiliation, contact details)

Dr. Magdalena Stoyanova,
art expert, restorer

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8. Other collaborators: (names, positions, affiliations, contact details; a letter of intent should be appended for each contributor)

- MSci Milica Marić Stojanović, chemist, National Museum – Belgrade (supervisor, technical consultant)

https://www.researchgate.net/profile/Milica_Maric-Stojanovic

- Ma. Branka Ivanić, senior adviser and curator, National Museum – Belgrade (general coordinator)

- Prof. Krstić (responsible for the X-ray and CT acquisitions),
University of Belgrade, Faculty of Veterinary, Lab for radiography.

- Prof. Selma Risvić, Faculty of Electrical Engineering, Sarajevo (for the digitalization and visualization of the data obtained during the case study).

For the retrieval of specific referential material and solution of technical questions will collaborate.

- Dr. Anna Mazina, chemist, vice-head of the section for chemical analyses of the Grabar Art Conservation Centre, Moscow;

- Dr. Irina Provorova, biologist, lecturer at the Russian Humanitarian University and at the Surikov Art Institute, Moscow;

- Dr. Galina Maximova, restorer, manager of the Lab for Restoration of the Surikov Art Institute, Moscow.

9. Description, techniques and schedule of the work to be carried out:

DESCRIPTION

The main purposes of the surface analysis and of the examinations in VIS, UV, IR, and X-ray/CT

will be.

- checking if the indicated icon is an original or secondary work, of which type;
- verifying the hypothesis about its early date and high artistic class;
- collecting elements that allow to ascribe it to the production of a determined master/school/epoch;
- mapping of its compromised status of conservation;
- understanding the origin of the damages and selecting the most adopted strategy for further preservation (restoration);
- establishing the most probable date(s) when the entire work or its single fragments were created and fixing the proposed dates/epochs in a graphic scheme (fragmentation).

The data obtained during the investigations will be confronted with the rich and most updated databases on Russian icon painting thanks to the scientific collaboration of highly qualified Russian specialists in art conservation and restoration. This agreement for mutual exchange of information will be surely an excellent occasion to introduce the W European specialists to some little known pilot achievements in the non destructive investigation of easel painting that significantly enhance its efficiency. We hope that the planned experiments will produce the necessary conditions for the definitive identification of the icon.

Moreover, if the hypothesis of an early 15th-16th century non restored original should be confirmed, the really rare occasion to study a unique historically important document will open.

Particularly challenging for the authentication certification is to succeed to establish the velocity with which concrete alterations and damage have occurred, while for the preservation – the tracing and reconstruction of the metamorphosis the entire work has underwent in the course of its historic vicissitudes (here we conventionally call the first 4D imaging and the second –5D).

TECHNIQUES.

I. MICROSCOPIC ANALYSIS IN VIS/RAKING LIGHT

Main purposes.

I. Establishing.

- the status of conservation,
- the presence of inscriptions and how they were signed, of overpaintings and changes of the original colours resulting in reliefs.

II. Orientative dating based on.

- the painting materials,
- the type of gesso application,
- the artefacts's build up.

III. Individualization of the technological characteristics that allow to classify the work as original or second secondary; of which type.

II. INVESTIGATIONS IN THE UV REGISTER

Main interest in the UV imaging of paintings represent the intensity, color, density, homogeneity; the presence of dark areas as sign of posterior interventions; deposits or missing protective layer. Our experiments aim to study the reaction of gesso, paint and varnish layers together as well as separately to UV radiation and to.

- individualize data of archaeometric value as, for example, presence of glues, egg, old Pb white, cinnabar or madder;
- collect information about the status of conservation (about losses and restorations);
- reconstruct faded inscriptions made with iron-gall inks or with Hg, Pb, Cr and Fe containing pigments;
- ascertain the position in-depth of the inscriptions (under the varnish, between two layers of varnish, over them or on their place; over restored parts).

The screening will be performed in UVR and UVL mode and documented on monochromatic (possibly also on colored) film. Its purpose is to explore the dependence between the chemical nature of the materials considering also their age and the response they give to UV rays (at determined lengths).

III. THE INVESTIGATIONS IN THE IR REGISTER

IR screening is a facility in discovering of restorations on the surface or in-depth, of inscriptions or autographs, and is also a reliable tool in the reconstruction of those made with carbon-containing substances.

Varnish, deposits and subtle paint layers result transparent for IR radiation, while soot, carbon, graphite pencil, china ink and other carbon containing materials are well recognizable. The most important information it offers regards however the preparatory design.

The investigation in the IR register, in conformity with the applied wave length, allows to see the underlying layers of the painting, eventual modifications in the composition or *pentimenti*; to recognize the preparatory design, a hidden element, of particular importance in the attribution and dating.

While in W European painting a free design with corrections and modifications normally is considered authentic, and a rigid one, with delineations of shapes and *chiaroscuro* borders or, sometimes, presence of grille, is sign of a secondary work., in icon art the criteria are completely different and the correct reading of icons' IR imaging and acquisitions requires detailed knowledge on the technical and technological particularities of the various iconographical schools. Their capturing and confrontation with referential material will be one of the basic tools in the solution of the question concerning the authorship and the dating of the discussed icon

IV. THE RADIOLOGICAL INVESTIGATIONS

The recently developed computer tomography (CT) and bifocal raking radiography have assumed the role of a kind of spatial ND techniques in the investigation of art objects. In difference to traditional X-ray, CT gives information on the spatial position of details up to 0,5 mm, in sections of 1 to 12 mm and allows to measure with great precision the density (ρ) of the wooden support, capturing even less pronounced differences. This enables the qualitative esteem of the radiological properties of the different elements (fresh or mature, core or peripheral part, etc.) the type of section and its orientation, and – considering the specific material characteristics – the dating of the support. Icons, thanks to the lack of Pb containing substances in the preparative (gesso) layer, offer good possibility to study not only the wooden support but also the gesso layer, to note eventual presence of canvas, to ascertain their integrity or to individualize interventions carried out over crackled surface. CT and raking X-rays can also reveal important facts regarding renewals of the paint layer, particularly with Pb, Zn, Hg containing pigments.

V. SURFACE ANALYSIS

The rationale for the surface analysis in the context of the radiological investigation is to optimize the correct recognition and interpretation of the data, particularly for to answer the question about the authenticity, date of origine and appurtenance to a known master/school/epoch production. Investigations will be carried out on macrophotos and under microscope for to establish.

- the status of conservation and collect data for its precise mapping;
- the characteristics of the author's manner and their identity with the connotations of determined masters/school;
- the methods and sequence in the realization of the work;
- the painting technique(s) and materials;
- the relation between support, gesso layer, paint and protective layers;
- the technical methods, the consistence of the paints, the configuration of the brushes; type(s) of crackles, particularities of employed materials

VI. INTERPRETATION OF THE RESULTS ON BASE OF REFERENTIAL MATERIAL

Conclusive documentation and integration of the all the working phases, elaboration of the final version of the entire investigation and subdivision of the tasks for the written report.

10. Description of the main results expected, explaining potential benefits for users and how their needs are likely to be attended and solved.

Results regard the authenticity expertise, the conservation status, the supposed data, place and/or authorship, technique (s) of elaboration, presence of restorative interventions. View the

massive presence of Russian icon art not only in great museums and galleries all over the world, but also on the private antiquity market, and the high prizes it realises, the results of this study will be of potential interest for both the public and private sector, as scientific publications on the topic are very limited, mainly in Russian (with few exceptions in German), and not accessible and understandable to non professionals. An idea about the economic importance of art expertises and authenticity certification could maybe give the fact that Russian antiquarian annual turnover is estimated about \$ 1-1,5 milliards while that of the international art market – about \$ 200 circa. Notwithstanding the policy of EU towards disciplining of all the market sectors with respect to consumers' rights, the art market together with all the intellectual, non material production related to it, remains a very risky sector, out of control as for the lack of cheap, non contact automated methods for certification as well as for the delay in the mass storage and assessment of the relative data.

11. Review of earlier relevant research, projects and literature.

Renewal for commercial purposes as well as falsifying of artefacts has secularly history. In the last decades, several cases have been unmasked in W Europe with the help of non contact analytical and technical methods. One of the most important was the project of the Rijksmuseum dedicated to Rembrants' works, whose purpose was properly to distinguish between originals, copies, replica, fakes (See also: Robert Oertel, *Die Frühzeit der italienischen Malerei*, Stuttgart 1966, S. 43, Abb.26.).

Concretely on what concerns Russian icon art, this study bases on the rich, multi decennial experience and publications of the Russian museum's restorers in discovering of fakes and non professional restoration, and in establishing the exact methods applied to these purposes in the past.

Craquelée typology, status of conservation, presence of non original interventions, art-technical and art-technological characteristics of icons (on wood, on canvas and on wood covered with canvas) have been object of decennial studies by Olga Lelekova (Moscow Central Lab for Restoration, see Olga Lelekova. "Naturwissenschaftliche Methoden zur Aufdeckung von Ikonenfälschungen" In: *Ikonen. Restaurierung und naturwissenschaftliche Erforschung. Beiträge des internationalen Kolloquiums in Recklinghausen 1994*. Herausgeber Ivan Bentschev und Eva Haustein-Bartsch. München (Editio Maris) 1997, 35-43) by UV-VIS luminescence, high resolution microscope, raking light, professional photography; X-ray imaging. It has been used for authenticity certification, non destructive diagnostic of the conservation status, elaboration of archaeometric references and deterrents against fakes.

With general, complex art -technical and technological investigation of easel painting (on canvas and on wood, on wood covered with canvas) deals the recent *Technology and ND techniques for the investigation of monumental and easel paintings* (in Russian: **Технология и**

исследование произведений станковой и настенной живописи. госниир - м., 2000), a kind of best practice for the ND investigation of paintings that is obligatory for all the museum property in Russia, as a part of the complex technical and technological study of the artefacts. The guide updates on the possibilities of the actually used techniques (High resolution microscope, photographic, SP (monochromatic filtering of Vis light); UV-Vis luminescence, coloured imaging of NUV and LUV; UVR, NIR, database referred monochromatic IR, SWIR, Mid-IR, LWIR; recognition by electronic-optical transformers (RTI), IRR; TV-IR systems; IRL; X-ray, OCT) considering the results obtained through assessment of enormous data collected in the multi decennial praxis and informing on the specific instruments and materials of national production.

Together with these most important sources for the present case study, also several art historic and technical publications in Russian will be considered for to clear single aspects. they will be listed in the report.

12. Potential interdisciplinary value of research carried out and any other comments.

- a) revision of publications and attributions on Eastern European and Occidental painting from early modern and new times;
- b) elaboration of correct strategies in conservation and for restorative interventions,
- c) authenticity certification for legal purposes,
- d) criminology,
- e) material characterisation,
- f) improvement of technical devises for ND acquisition;
- g) software programming;
- h) production of materials (for restoration or painting).

13. Detailed schedule of proposed work with explanation how each phase is to be funded.

The experimental part will take place in the National Museum of Belgrade, under the coordination and supervision of Ma. Branca Ivanic, senior adviser and curator, and of MSci M. Stojanovic, that will put at disposition the facilities for microscopic, photographic, UV and IR investigation, as well as the useful referential information at disposition. X-ray and computer tomography acquisitions will be performed at the University of Belgrade by prof. Krstic (Faculty of Veterinary, Lab for radiography). All the art-technical, historic and technological investigations and analyses, as well as bibliographic overviews and confrontations will be performed collaborating via net, under the coordination and responsibility of dr. M. Stoyanova.

The realization of the experiments (instrumental base, infrastructures, referential material) will be assured by the National Museum of Belgrade. Possible other funding from Russian and Italian sponsors. Of great benefit will be the informational exchange with Russian specialized institutions.

Work plan of the case study*

*** Only the experimental part will take place in Belgrade;
the data assessment and the visualization will be elaborated collaborating
via net**

day N/ object	VIS/Raking light, monochromatic filtering	UV(R and L), wl 365 nm	IR at wl 715-1000, with monochromatic filters for 715, 850, and 1000 nm	X-Ray/CT (-1000)-725 A° at 500 kV: soft waves)	Surface analysis
1.-2. support	type of wood species, constructive particularities, general status of conservation	faded inscriptions, traces of glue		wood specie(s), density and age; presence of living worms, water infiltrations, wood oxydation, metal particles.	status of conservation, characteristics of the author's manner and their identity with the cosmotations typical for determined masters/school;
3.-4. gesso layer	type, status (in the discovered areas)	the integral and/or separated reflectance (luminescence) of gesso, paint layer and varnish, eventual losses and posterious	presence of preliminary design, <i>pentimenti</i>	presence of Pb, of quecksilver (in the bolus for gilding), of gesso integrations.	methods and sequence in the realization of the work; the painting technique(s) and
5.-6. paint layers	older integrations, overpaintings with different colours, the ductus and originality of the inscriptions	interventions/integrations; faded inscriptions and signatures made with iron-gall inks (checking the depth of their position); mercury and iron or zinc-containing	distinction between carbon, iron, copper, and cadmium containing yellow and red pigments	mycological presence, pigments containing Pb, Zn, Fe, Hg; renewals on crackled surface	materials; the relation between support, gesso layer, paint and protective layers; the technical methods, the consistence of the paints, the configuration of the brushes; type(s) of crackles, particularities of employed materials
7.-8. varnish	type (olifa, gum lack, coloured transparent or artificially aged), status	presence of oil in the varnish	if based on oil or shell lack		
9.-10. fragmentation	Photographic micro e macro acquisitous, mapping of the conservation status of every layer, orientative dating and classification of the entire	Analysis and comparative interpretation of the acquisitions on base of their colour, density, intensity, homogeneity of the	Analysis and comparative interpretation of the acquisitions. Documentation of the measurings, mapping and definitive solution of the doubts regarding origin and author/school or individualization of problems to clear with further tests.		
11.-12. attribution	work or of single areas.	luminescence and presence of dark areas. Orientative dating and attribution and/or elaboration of investigative hypothesis.			

