



## Call for PhD applications

**Title:** Development of technological mediation tools for creating augmented heritage objects

**Grant:** Fondation des Sciences du Patrimoine

### Context

This PhD project is funded by the Fondation des Sciences du Patrimoine (FSP), which provides governance for the Patrima LabEx (laboratory of excellence) and the Patrimex EquipEx (equipment of excellence), and which supports collaborative and transdisciplinary research projects on tangible cultural heritage. FSP is also the coordinator of the EquipEx+ project ESPADON, launched this year, whose objective is the creation of an advanced instrumental platform for the study of tangible heritage objects, associated with a digital platform that ensures the interoperability and efficient management of the data produced by instruments and by the studies on the objects, throughout their life cycle.

One of the central goals of ESPADON is the creation of the *augmented heritage object* (AHO), which associates to the material object all the data produced during studies on this object: descriptive data, data from instrumental analysis, spatialization, about transformations, etc., but also data specific to various application fields: art, conservation-restoration, historical studies, cultural mediation, etc., data which continuously enriches the knowledge on the object and the possibilities of multi-aspect study.

The creation of the AHO implies the design of common, modular data models, and of specific methods for producing, integrating, preserving, enriching, sharing and consulting this data, as well as the realization of efficient and intuitive systems implementing these methods.

These elements contribute to the elaboration of a technological mediation model dedicated to the creation of the AHO, addressing all the actors of the heritage sciences.

This PhD is a first step in this direction, relying, in the elaboration of these models and methods, on work already initiated by the community and on a dialogue with the different actors of the project, representative of the diversity of the heritage sciences. In particular, the work will be based on a corpus including from the beginning 4 objects of different natures, to cover a significant diversity of aspects:

1. The Issenheim Altarpiece by Mathias Grünewald (painted panels) and Nicolas de Haguenau (sculpted elements), early 16th century, Musée Unterlinden, Colmar;
2. The Carthusian monastery of Villeneuve-lez-Avignon and in particular the frescoed chapel with paintings by Matteo Giovanetti;
3. The bronzes of Bavay (which have the advantage of being linked to an archaeological site);
4. A book/manuscript (to be determined) that is emblematic from a historical and material point of view and that allows us to join other analytical techniques and other approaches of the human and social sciences.

### Objectives

The main scientific objectives of this PhD project are as follows:

- The design of a data model for the augmented heritage object, using an ontology-based approach using CIDOC-CRM [2] and the various specific models already proposed by the community [1][3][6], by developing modular, flexible approaches, adaptable to the great diversity of objects and characteristics. Special attention will be paid to the representation of changes and the dynamics of knowledge creation.
- The definition of a data production [4] and management protocol using this model, respecting the FAIR principles throughout the AHO life cycle.

- The design of a model and of techniques for the distributed integration of data from various sources, around the AHO model, with a particular focus on the interoperability of existing information sources in the community. We will build on data integration approaches using ontologies, such as [1] [7] [9].
- The design of automatic methods for semantic enrichment of data, whether for knowledge extraction from unstructured data [8] or for the deduction of semantic, spatial or temporal links [7] between concepts.
- The implementation of efficient algorithms for the mentioned methods, combined with the integration of already developed software modules, to realize a first version of the ESPADON information system, with a special emphasis on an intuitive access to the knowledge about AHOs, accessible to various categories of users.

The most important challenges raised by these scientific issues in the context of the ESPADON project concern:

- the great heterogeneity of objects types, of analysis techniques, of studied problems, of users, of already proposed approaches, to be made interoperable;
- the very large volume of data to be managed, distributed over several sites;
- the multimodality of the data to be analyzed for semantic enrichment;
- the articulation of data spatialization with visualization and the possibility of exploiting it in the multi-instrument and multi-scale analysis of objects;
- the modeling and management of the dynamics of knowledge creation.

## References

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3. Carboni, N. et De Luca, L., 2019. An Ontological Approach to the Description of Visual and Iconographical Representations. In : *Heritage*. juin 2019. Vol. 2, n° 2, p. 1191-1210. DOI 10.3390/heritage2020078.
4. Dudek, I. et Blaise, J., 2017. What Comes before a Digital Output? Eliciting and Documenting Cultural Heritage Research Processes. 2017. DOI 10.18178/IJCH.2017.3.1.083.
5. Manuel, A., Alaoui M'Darhri, A., Abergel, V., Rozar, F., et De Luca, L., 2018. A semi-automatic 2D/3D annotation framework for the geometric analysis of heritage artefacts. In : *3rd Digital Heritage International Congress (Digital Heritage) held jointly with 2018 24th International Conference on Virtual Systems & Multimedia (VSMM 2018)* [en ligne]. San Francisco, United States : s.n. octobre 2018.
6. Messaoudi, T., Véron, P., Halin, G. et De Luca, L., 2018. An ontological model for the reality-based 3D annotation of heritage building conservation state. In : *Journal of Cultural Heritage*. 2018. Vol. 29, p. 100-112. DOI 10.1016/j.culher.2017.05.017.
7. M. Koutraki, N. Preda, D. Vodislav. Online Relation Alignment for Linked Datasets. ESWC 2017, Portoroz, Slovenia. European Semantic Web Conference, May 28- June 1st, Proceedings, Part I, pp.152 - 168, 2017
8. M. Koutraki, D. Vodislav, N. Preda. Deriving Intensional Descriptions for Web Services. ACM International Conference on Information and Knowledge Management, CIKM 2015, pp 971-980, 2015
9. S. Cebiric, F. Goasdoué, H. Kondylakis, D. Kotzinos, I. Manolescu, G. Troullinou, M. Zneika: Summarizing semantic graphs: a survey. VLDB J. 28(3): 295-327 (2019)

**Candidate profile**

As this is a research topic in the field of information systems, data and knowledge management, but with strong interdisciplinary openings, applications are expected from several disciplinary sectors of Information and Communication Sciences and Technologies with, if possible, experiences in digital applications to heritage documentation.

**PhD supervision**

Dan Vodislav, ETIS, CY Cergy Paris Université, <http://depinfo.cyu.fr/~vodislav>

Livio De Luca, MAP, CNRS/Ministère de la Culture, <http://www.map.cnrs.fr/ldl>

**Doctoral school:** EM2PSI, CY Cergy Paris Université

**Work place**

Paris region (Ile de France)

**Remuneration:** around 1800 € net / month

**Application procedure**

To apply, send a PDF document (a single file) including:

- + Detailed Curriculum Vitae
- + Cover letter
- + Diploma (giving access to a PhD thesis registration) and Master's grades (M2)
- + Recommendation letter(s)

to the supervision team:

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**Application deadline:** October 15, 2021

**Start date of the PhD:** as soon as possible