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Contenus et Interactions 2013-2017

MONUMENTUM: Digital 3D modeling and data management for the conservation of decorated stone buildings

L. De Luca[1], J.-M. Vallet[2], P. Bromblet[2], M. Pierrot-Deseilligny[3], X. Brunetaud[4], F. Dubois[5], M. Bagnéris[1], M. Al Mukhtar[4], F. Cherblanc[5], O. Guillon[2], J. Tugas[6]

➢ *MONUMENTUM on-going research project (2013-2017)*

The investigations that are made on a building for conservation purposes need an important work that is transcribed in a lot of kind of numerical and printed data: surveying data and scientific imagery, damage mapping, photographic collections, historical archives, physical and chemical data etc. Given the difficulty to collect, compare, analyze and validate data prior to restoration, the presented approach aims to mobilize various disciplines (architecture, conservation, mechanics, and computer sciences) to define a novel information processing chain including metric surveys, analysis of surfaces, geometric models of structures, heterogeneous documentary sources management, temporal data, etc.

➢ *Objective*

- **Designing and development of an open and extensible web platform for the capitalization and the management of knowledge needed for the understanding and analysis of degradation phenomena affecting historic buildings.**
- **It requires the definition of a common and continuous process that establish a technological and conceptual interconnection between the stages of 3D digitization, semantic annotation and structuring of the geometric model (including multi-layers analysis of surfaces), characterization of the state of the building and management of restoration actions.**
- **it concerns the image-based-modeling of architectural heritage, the development of a 3D information system for the management of conservation data and also a numerical modeling tool (FEM-DEM) for the physical and structural analysis.**

➢ *Sites*

3 French cases studies that present conservation issues on:

- ***stones*** **, Castle of Chambord and Caromb's church,**
- ***wall paintings*****, Notre-Dame des Fontaines' chapel**

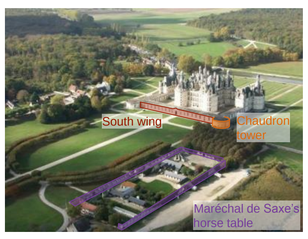


Image: PRISME

Images et scans: MAP – E. Gattet & T. Messaoudi

Fusion of multi-band imaging

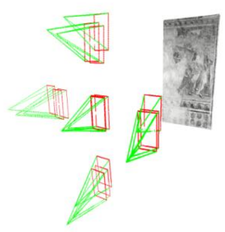
⇒ Images of each spectral range have many similarities details

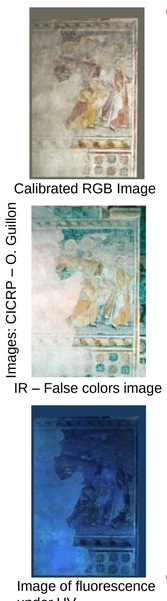
⇒ Images can be repositioned perfectly against a master image, wherever it is

⇒ Images reprojected on the 3D model

AND/OR

(direct) spatial referencing using photogrammetry



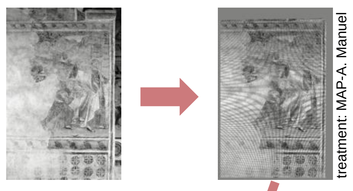


Calibrated RGB Image

Images: CICRP – O. Guillon

IR – False colors image

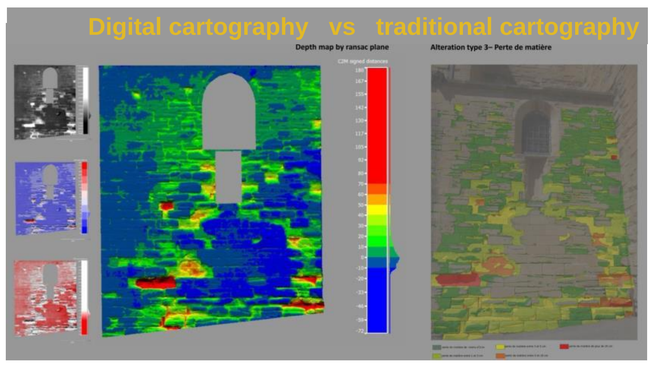
Image of fluorescence under UV



treatment: MAP-A. Manuel

Images et scan: MAP – E. Gattet & T. Messaoudi

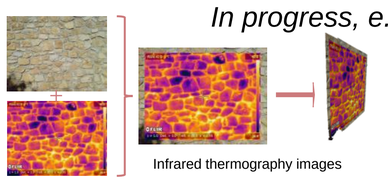
Use of thesaurii as:



Modeling – MAP, univ. Polytech. Delle Marche R. Nespeca

Mapping – CICRP, A. Benard

In progress, e. g.



Infrared thermography images

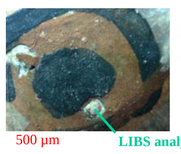
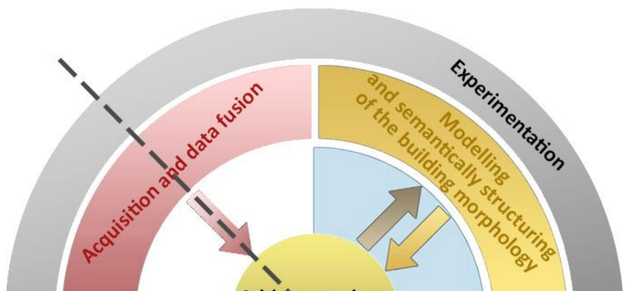
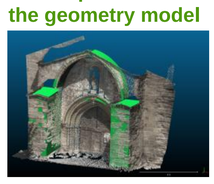


Image : CICRP-S. Boularand



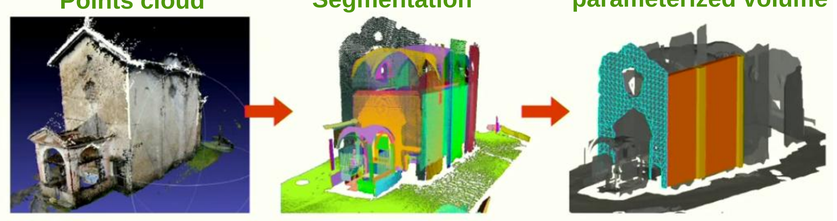
From the points cloud to the geometry model



On progress "Monumentum tool": "AIOLI"

MAP-A. Manuel (including PhD work)

Points cloud | **Segmentation** | **Construction of parameterized volume**



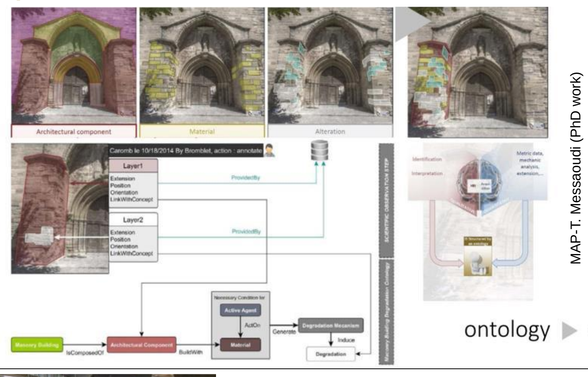
MAP-M. Bagnéris & F. Guéna LMGC- F. Cherblanc et T. Dubois

⇒ *Parametric model in development*

➢ *Results*

- **Scientific advances:** **Identification of a continuum of spatial information structured around a domain ontology, new protocols to acquire spatialized data, to analyze them**
- **Technical advances:** **3D scanning using images, data fusion, 3D information system for cultural heritage.**
- **On-going computer platform:** **Cloud service; some calculation moduli already inserted, web interfaces concerning the interaction 2D/3D, 2nd beta testing cycle in progress**

Towards an ontology for annotating degradation phenomena



MAP-T. Messaoudi (PhD work)

2017: finalization of the computer platform dedicated to conservation scientists, conservators and sites managers

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