ANR project ReSeed
Semantic reverse-engineering of digital heritage objects

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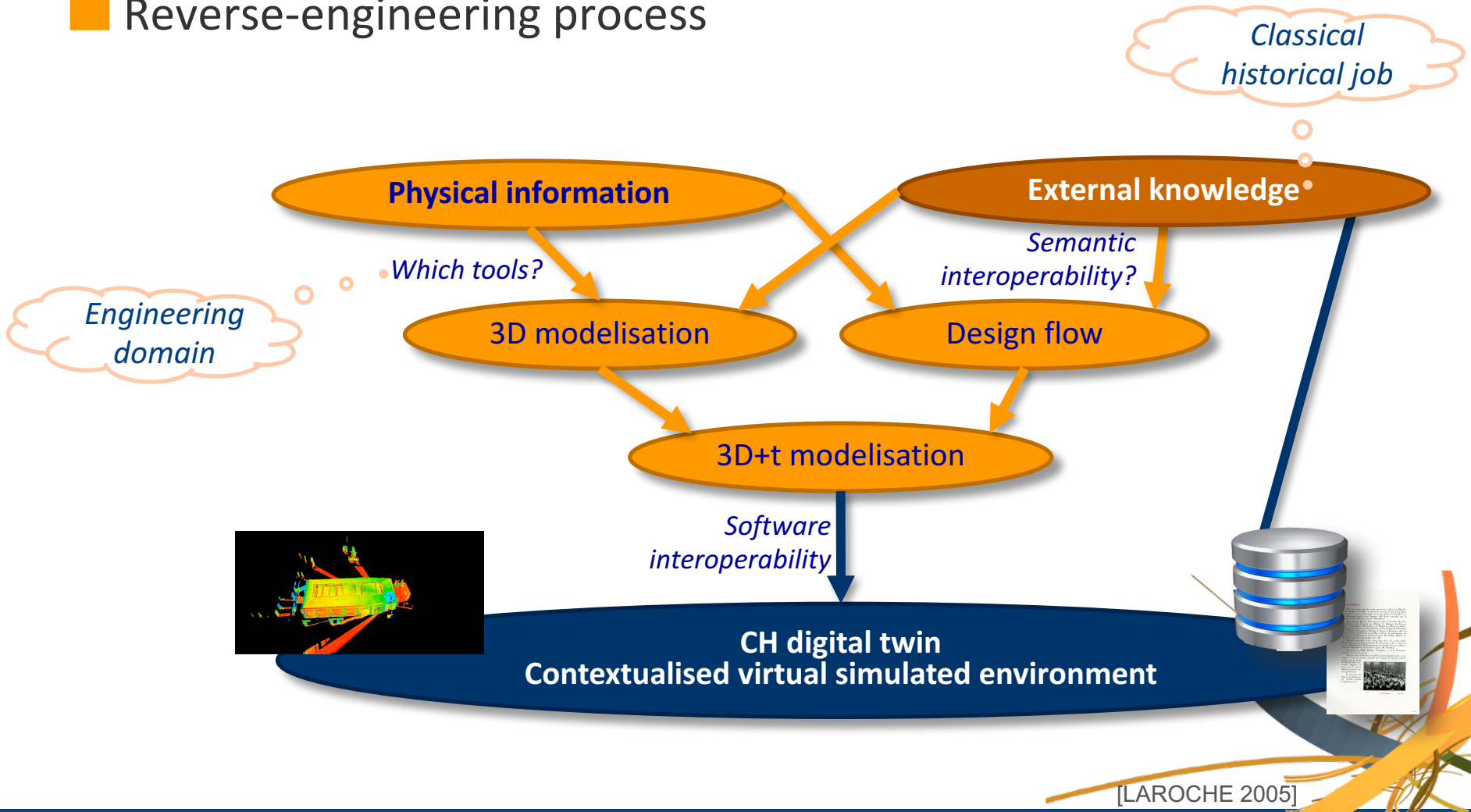
Centrale Nantes

IRCCyN UMR CNRS 6597

Case study

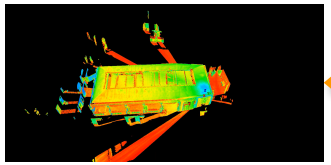
How to open and deal with this &#'§!ç big 3D file and only focus on the information we have on the cathedral?

Reverse-engineering process



[LAROCHE 2005]

Problematic



3D digitalisation

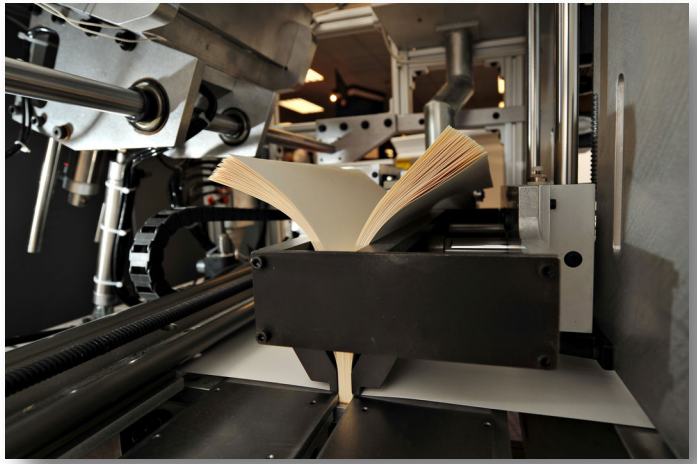
Link ?

Historical documents

- RéSeed is part of the heritage process for conserving ancient objects:
  1. **Capture** traces of the object: digitize and store (3D elements, documentation, analyses, archives ...) → **digitizing** the object and **capitalizing knowledge** associated
  2. Numerical **modelisation** of the object for creating a "knowledge silo" (linking documentation and archives, geometry, dynamics)
  3. Data **Conservation** and **enhancement** : transmission and mediation

- Issues:
  - Standard practices = "one shot" without reusability of the approaches and tools
  - Requires a methodology for sustainable conservation and scientific valorisation of the heritage

Scientific challenges



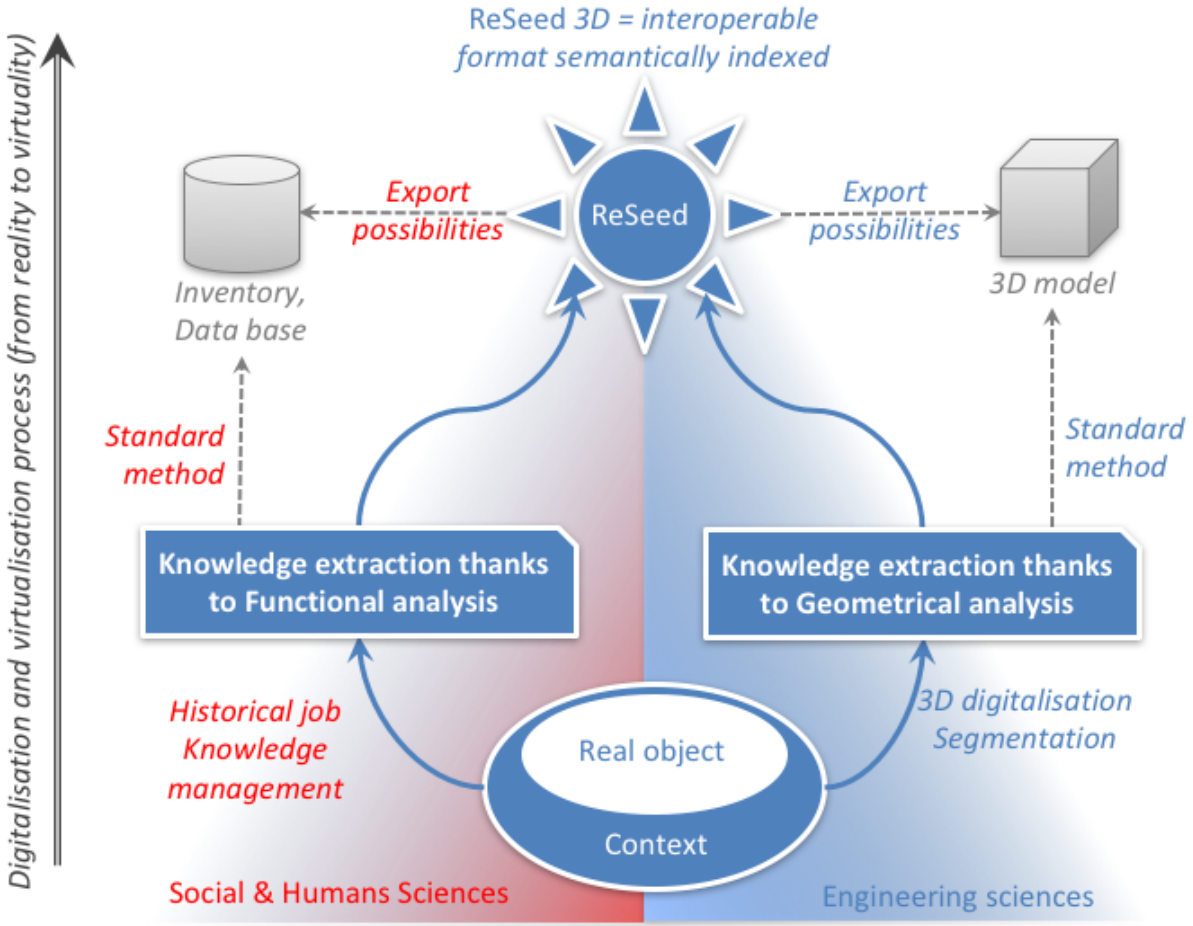
1. Main scientific challenge = **interoperability of the 3 phases** (often segregated): capitalisation → modelling → valorisation

Definition of a semantic model of the object on which 3D data will be attached = a digital surrounding skin with a real meaning on which a 3D virtual representation is attached if it exists (mix of functional view and geometrical view).

2. Second scientific challenge = **indicators for qualifying digitized heritage objects**

UNESCO criteria's: Integrity of the digital object? Qualitative and -not only- quantitative indicators: authenticity and uniqueness guaranteeing the validity of both the process and the digital format.

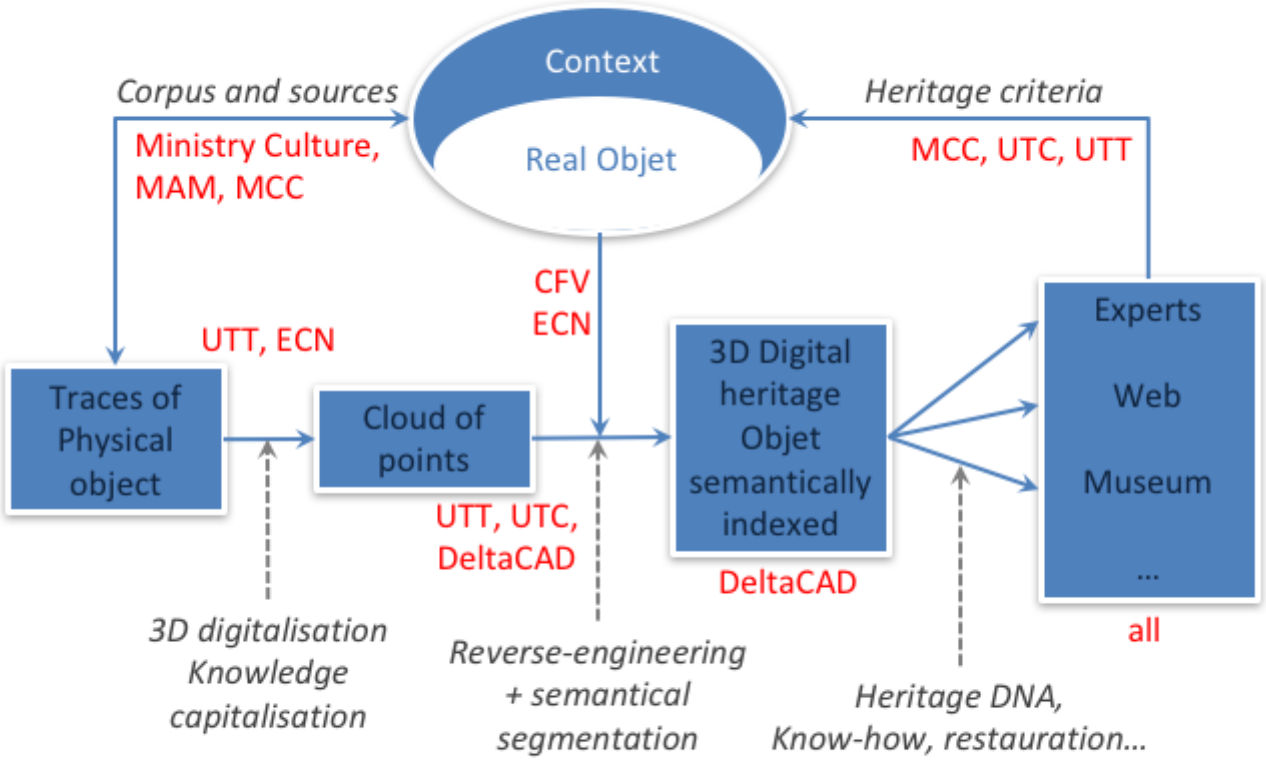
Scientific proposal



1. Create a **structured model** for accessing heritage knowledge coming from the 3D digitalization
2. A new but necessary **interoperable tool** for accessing semantically segmented 3D information
3. A **new format** for defining a tool dedicated to experts. It would help them solving the heritage paradigm: knowledge, protection, restoration, valorisation.

Scientific methodology and problematic to be solved

1. For Social Sciences → Methodological answer with the semantic indexation of 3D models
2. For Engineering Sciences → Switch from hybrid digital model to structured 3D models thanks to the automatic semantic recognition of forms in a cloud of points



Project management by case studies (WP5)

- WP5.3 = collection of technical objects (Musée des Arts et Métiers)
  - Representative corpus
  - Industrial period 19-20th century (steam engines, gas engines ...)
  - Process to be carried out by students
  - Experimentation: year 2019
  - Exhibition: january-april 2020

Partners	HR funded
ECN	36 months PhD
CFV	6 months post-doc
UTC	36 months PhD
UTT	6 months post-doc
MCC Héritage	12 h.m engineer
DeltaCAD	30 h.m engineer
MAM	6 h.m engineer
MIGPC	

Human resources funding by French government

Sum up and resources

- Aims:
  - Development of a new technology: a **tool** and an interoperable **format** for the digitization of both semantic and physical data
  - A « new profession » !
- Tested on industrial heritage → if successful: set up for the industry 4.0
- Multiple impacts: economical, scientific, technological, methodological, ethical
- Support from TGIR Huma-Num (Consortium 3D)
- The pluri-disciplinary consortium:

Partner	Name of the lab	Domain
Ecole Centrale de Nantes (ECN)	IRCCyN	Engineering
Université de Nantes (UN)	Centre François Viète (CFV)	Human Sciences
Université de Technologie de Compiègne (UTC)	Roberval	Engineering
Université de Technologie de Troyes (UTT)	LASMIS	Engineering
MCC Héritage		Human Sciences
DeltaCAD		Engineering
Arts-et-Métiers Museum (MAM)		Human Sciences
French Ministry of culture (MIGPC)		Human Sciences

Project Identity

Acronym	*RéSeed*
Titre	*Rétro-conception SémantiquE d'objEts patrimoniaux Digitaux*
Title	*Semantic reverse-engineering of digital heritage objects*
Funding	*French National Research Agency (DEFI 7 - Axe 1)* *Information society and communication* The Digital Revolution: link between Knowledge and Culture
Time	*42 months*
Partners	*4 university labs, 2 private firms, the Ministry of Culture and a public museum*
Human Resources	132 h.m
Budget	998086 € global 656259 € granted

A testimony…

Jean-François Moreau ANR ReSeed 5 octobre 2016 à 17:25

Rép : [Theuth] Offre de thèse en Patrimoine Numérique

À : Florent Laroche

Cher collègue,
Je vous félicite d'avoir initié ce projet. Je suis trop vieux pour me lancer dans une telle aventure mais j'espère qu'elle fera de nombreux émules. Historien de l'imagerie médicale et thuriféraire d'un projet de musée de la radiologie, je déplore l'absence de conservation intelligente du matériel produit en 120 ans! Il faudra un jour s'atteler à la reconstruction 3-D des appareils et des outils satellites mais à partir de quoi? A-t-on gardé les plans chez les industriels? Les photos suffiront-elles?
Bien à vous,

Dr Jean-François Moreau, AIHP, Hy FACR
Professeur honoraire, Université Paris Descartes
Radiologiste honoraire de l'hôpital Necker

Président-Fondateur
ACSATIM - Académie des Sciences, Arts et Technologies de l'Imagerie Médicale

Dear Colleague, Congratulations for initiating this project. I am too old to join you on such an adventure but I hope many will join you. Historian of Medical Imagery and strongly in favor of a museum of radiology, I deplore the absence of intelligent conservation of the material produced over 120 years! One day, we will have to 3-D reconstruct our devices and tools, but based on what? Has the industry kept all the plans? Will the photographs be sufficient?
Truly yours,

www.reseed.fr

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