"DIGITAL TWIN:

A HBIM-BASED METHODOLOGY TO SUPPORT PREVENTIVE CONSERVATION OF HISTORIC ASSETS THROUGH HERITAGE SIGNIFICANCE AWARENESS"

PIERRE JOUAN & PIERRE HALLOT

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Data centralization & collaborative management in HBIM
Objectives of the methodology:

- Keep data "alive" and up-to-date to avoid its loss
- Provide site managers' with tailored information for the preservation of their assets
Digital Twin?
MONITORING

| Observation | Simulation | Analysis | Real-time data |

Digital replica

DIGITAL WORLD

IoT

Physical object

REAL-WORLD

Sensing devices
Digital Twin & preventive Conservation
DIGITAL TWIN
DIGITAL + PHYSICAL WORLD

HERITAGE SIGNIFICANCE-BASED HBIM PROCESS
DIGITAL WORLD

INTEROPERABLE STRUCTURED DATA

DATA MANAGEMENT PROCESS

HBIM
DIGITAL INFORMATION MODEL

DATA
BIM

INTEROPERABLE STRUCTURED DATA

As-BUILT model

KNOWLEDGE DATA BASES & REAL TIME DATA

RISK ASSESSMENT & PREVENTION

REAL-TIME DATA ANALYSIS

HAZARDS IDENTIFICATION

MULTI-CRITERIA EVALUATION

MONITORING

STRATEGIC PRESERVATION

DECISION MAKING

DEPRECIATION

INVENTORIES

REALIZATION

DESTRUCTION

DESTRUCTION

DESTRUCTION

DESTRUCTION

DESTRUCTION

INTERVENTION REQUIRED
Data structuration in HBIM models
Data structuration in HBIM models

- DIGITAL 3D MODEL
  - As-Surveyed
  - As-Built
- DATA
- PLANNING
- COST
- LAWS & NORMS
- OPERATION & MANAGEMENT

- SURVEY
- HISTORIC DATA
- RETROSPECTIVE
- PRESENT CONDITION
- LEGAL STATUS
- PREVENTIVE CONSERVATION

- SIGNIFICANCE

...
VALUES TYPOLOGIES

Fredheim and Khalaf's (2016) critical review and proposal of a new framework for value assessment

Values typologies "often fail to prompt the necessary questions to develop satisfactorily detailed understandings of heritage significance, resulting in decisions being based on implicit, rather than explicit, value assessments in practice".

"To summarise, a value typology should be short, yet inclusive, use accessible language, minimize overlap between values and provide a mechanism for reviewing and integrating past assessments of significance."

Heritage significance & value typologies?
### WHAT?

Identification and description of *features of significance*

- **Forms**
  (tangible & measurable)
- **Relationships**
  (identity, memories, spirituality, sense of the place, ...)
- **Practices**
  (traditions, activities, events)

### WHY?

In what sense are the identified features valuable?

- **Associative**
  (people, events, places, traditions, ...)
- **Sensory**
  (sensory pleasure)
- **Evidentiary**
  (provides evidence for smth)
- **Functional**
  (Heritage in use)

### HOW?

How valuable are the identified features?

- **Authenticity**
  (people, events, places, traditions, ...)
- **Rarity**
  (sensory pleasure)
- **Condition**
  (provides evidence for something)

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**New framework for identification of the interpretations of Heritage "site"**
• Fredheim and Khalaf's proposal to be used as model for prototyping data structuration in HBIM model

• **TAXONOMY in HBIM models:** Definition of categories, sub categories -> Inclusive, from specific to general to ensure adaptability of such process regardless of time-space context

• **Multi-scale process** to provide a complete understanding of the interpretations of Heritage assets
HERITAGE SIGNIFICANCE-BASED HBIM PROCESS

DIGITAL WORLD

DIGITAL TWIN

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DATA MANAGEMENT PROCESS

HBIM

DIGITAL INFORMATION MODEL

BIM

DIGITAL 3D MODEL

DATA

PLANNING

COST

LAW & REG.

OPERATION & MANAGEMENT

I N T E R O P E R A B L E  S T R U C T U R E D  D A T A

S E R V I C E S

PREVENTION

RISK ASSESSMENT & PREVENTION

H A Z A R D S  E X P O N E N T I A T I O N

R E A L - T I M E  D A T A  A N A L Y S I S

M O N I T O R I N G

M U L T I - C R I T E R I A  S H I L L I N G

D E C I S I O N  M A K I N G
Conclusions_
• Data structuration model for heritage significance

• Multi-criteria evaluation process in digital twin environment

• Interoperability Digital Twin - HBIM
AGILE

"LIVING LAB"
Pierre Jouan  |  pjouan@uliege.be

Pierre Hallot  |  p.hallot@uliege.be