# HBIM for Preventive Conservation

## An integrated approach through Building Information Modelling

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## Introduction

With the paradigm shift introduced by the publication of the **PAS198 Environmental Conditions for cultural collections**, Conservation Institutions are encouraged to develop environmental policies crafted for their collection care, avoiding fixed environmental set points and making decisions based on data collected from monitoring the collection environment, expected usage of collection items, the risk assessment and energy usage data.

Yet in order to define the best collection environment, scientists gather or generate an enormous amount of data from images, text to analytical measurements that may inform the risk management and decisions making.
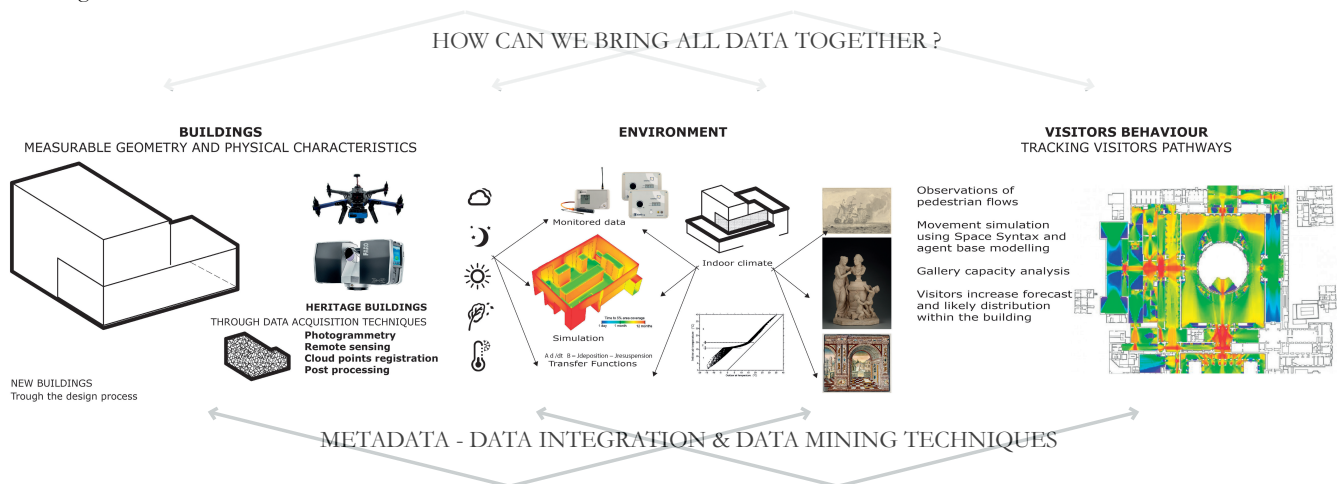
Therefore a way to integrate all the data needed for preventive conservation into a concise and accurate representation can lead to improvements in finding correlations and ultimately to new insights and discoveries.

## Aims and Objectives

The projects seeks to improve methods used to inform the Preventive Conservation decisions through development of a computer-assisted data integration tool using **Building Information Modelling and data mining capabilities** to process large amounts of information that will facilitate the **visualization, interpretation and extract new meaning** from data collected during the monitoring campaigns for **building, environmental and visitors impact modellin**g.

**RESEARCH QUESTION :**
**How can Historic Building Information Models be used to explore the relationship between buildings and their collections, environment and visitor behaviour ?**

HOW CAN WE BRING ALL DATA TOGETHER ?



**BUILDINGS**
MEASURABLE GEOMETRY AND PHYSICAL CHARACTERISTICS

**ENVIRONMENT**

**VISITORS BEHAVIOUR**
TRACKING VISITORS PATHWAYS

Monitored data

Indoor climate

Simulation

A.d /dt  B – δdeposition – Δresuspension
Transfer Functions

**HERITAGE BUILDINGS**
THROUGH DATA ACQUISITION TECHNIQUES
**Photogrammetry
Remote sensing
Cloud points registration
Post processing**

NEW BUILDINGS
Trough the design process

Observations of pedestrian flows

Movement simulation using Space Syntax and agent base modelling

Gallery capacity analysis

Visitors increase forecast and likely distribution within the building

METADATA - DATA INTEGRATION & DATA MINING TECHNIQUES

## Methods and Data Acquisition

- Define Workflow . Import existing **3D laser survey**, develop the architectural model using Autodesk BIM Solutions,
- Code using Python and Revit Api to **import** the monitored **data of deposition, T, RH and light incidence** into the 3D model and **associate** it with the monitoring **locations**.
- In parallel, T, RH and Sunlight Intensity Sensors will be linked to the BIM model through Arduino to **create a live monitoring system** for Hampton Court Palace.
- Explore through Sun studies the correlation with light incidence data on the tapestry surface;
- Explore relations between visitor movement and dust depositons through on-site monitoring, experimental work, CFD simulations and agent-based modelling strategies.
- Model&display future environments based on climate scenarios developed using transfer functions that relate outdoor conditions with the recorded indoor data.

**The data collected in historical buildings has specific characteristics not currently reflected in BIMs**

**Seamless interconnections to provide uniform access to heterogeneous & autonomous data sources**

**(.ifc to .crm)**

## Intended Outcomes

The project aims to develop a methodology to import and visualize the spatially-resolved and time-dependant environmental data into the HBIM Model as multiple layers with different parameters that allows changes over time to be visualised.

The target is to bring evidence that the post-processed data in a HBIM process would increase its relevance for preventive conservation.

A free and open source viewer and open source formats suitable for heritage institutions will be identified...