STSM Abstract

Designing an application ontology for computer-based 3D visualisation – Research on key concepts and definitions of visualisation based on digital 3D documentation and digital 3D reconstruction as well as the descriptive metadata integrating both kinds of data processing

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Abstract

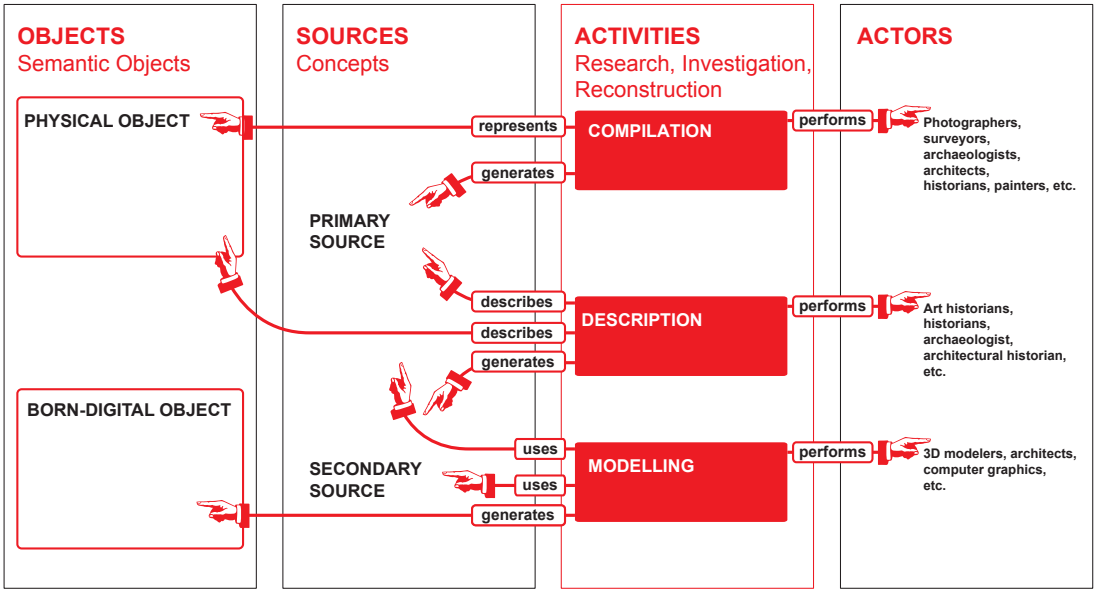
The STSM contributes to the still unsolved questions of e-documentation within the computer-based visualisation of Cultural Heritage (CH) in the light of the upcoming Semantic Web technologies. The focus lies on so called digital (hypothetical) 3D reconstruction of destroyed and/or never existing tangible CH (through digital 3D modelling), namely the art and architecture. According to the scientific issue the STSM strongly refers to the expertise at King`s Visualisation Lab and the guidelines of the London Charter to discuss the design of an application ontology. The STSM is dedicated to introduce and discuss an application ontology embedded in a Virtual Research Environment for collaborative documentation of a comprehensive 3D visualisation. The main task is to explore the digital (hypothetical) 3D reconstruction, the data processing and methodology as well as the state-of-the-art in project documentation, visualisation of CH objects and dissemination. The investigation of CH definition in the light of the digital revolution and the comparison with more advanced concepts in the research field of digital 3D documentation refers to the subjects and keywords of the COSCH WG 5 within the 5th Call for STSM 2015: *Key concepts and definitions of CH visualisation (e.g. as recording, documentation, dissemination)*. The work includes a comparison with more advanced concepts in the research field of digital 3D documentation. Looking forward to reveal common issues and to integrate data processing of both digital 3D representations in a knowledge-base.

The STSM is based on the visit at the King's Collage and the conceptual discussions with colleagues on the digital 3D preservation (e.g. via mass-digitisation of the museum objects) and digital hypothetical 3D reconstruction (computer-aided design 3D models), inter alia at the British Museum London and the *i3mainz* Institute of the University of Applied Sciences Mainz. The STSM reveals a general introduction on the contemporary CH definition and the semantic web technologies. The work explains the differences between the process of a 3D preservation (e.g. 3D point cloud from a laser scan) and the 3D reconstruction (e.g. modelled by a human-being using sources and computer-aided design techniques). Clarifying the machine-driven process on the one hand, and the human-driven (interpretative) process on the other hand. Subsequently the STSM compares the »CARARE 2.0« metadata schema, designed in general for documentation and delivery of 3D digitised objects (digital preservation) with the »Cultural Heritage Markup Language« (CHML) metadata schema customised for the purposes of the digital (hypothetical) 3D reconstruction.

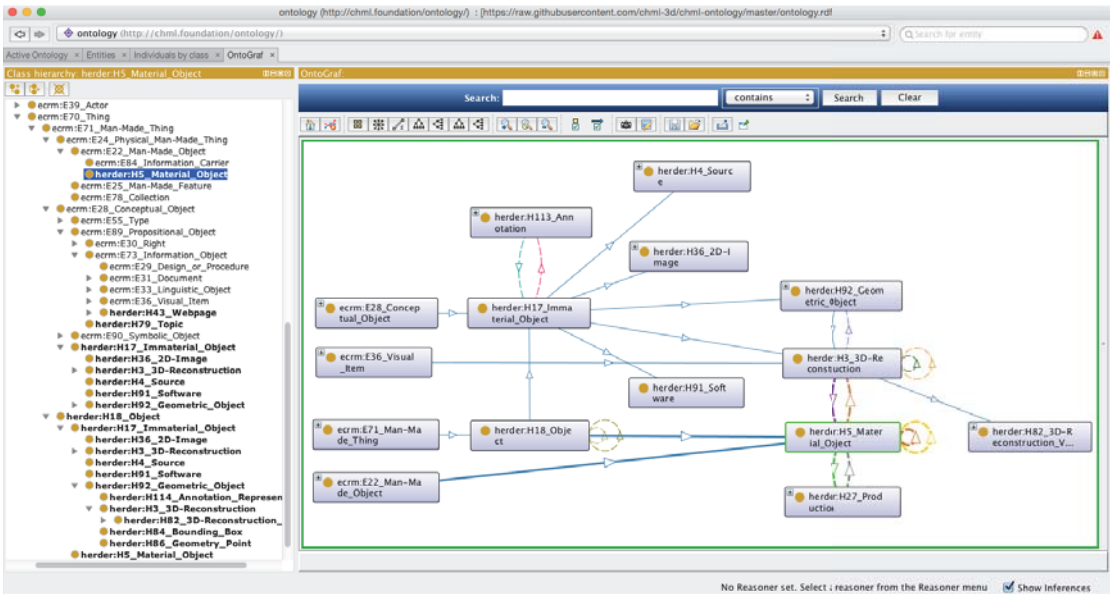
Finally the concept of a CIDOC CRM referred application ontology under development in the ongoing project »Digital 3D Reconstructions in Virtual Research Environments«, coordinated by the Herder Institute, is presented. The semantic data model embedded in a collaborative Virtual Research Environment (VRE) integrates digital 3D documentation and 3D visualisation, constitutes recommendation to CIDOC CRM extensions and to the implementation of appropriate controlled vocabularies.

The STSM demonstrates a strategy for the design of documentation within a VRE according to the semantic web technologies and the prior CH reference ontology CIDOC CRM (ISO 21127:2006). The comparison between the CARARE 2.0 and CHML presents differences in the documentation and dissemination of 3D data content form »3D preservation« (e.g. digitised objects) and »3D reconstruction« (CAD models) projects. The excursus into the VRE under construction (patrimonium.net) reveals the potential of collaborative web-based environment for data acquisition, data process, documentation and visualisation of 3D content. The integration of 3D point clouds and 3D hand-made models offers first impression of a powerful environment to facilitate comprehensive information in the context of Digital Heritage (produced by 3D digitisation and 3D reconstruction). The labelling system (TYPE) and the TYPE editor offer a flexible and promising concept for disambiguation and Linked Data connection of the acquired data within the VRE. The STSM contributes to the COSCH^{KR} revealing the challenges of documentation (Knowledge Representation) and proposing a VRE for CAD models (3D reconstruction), complementary to digitised tangible CH objects (3D preservation).

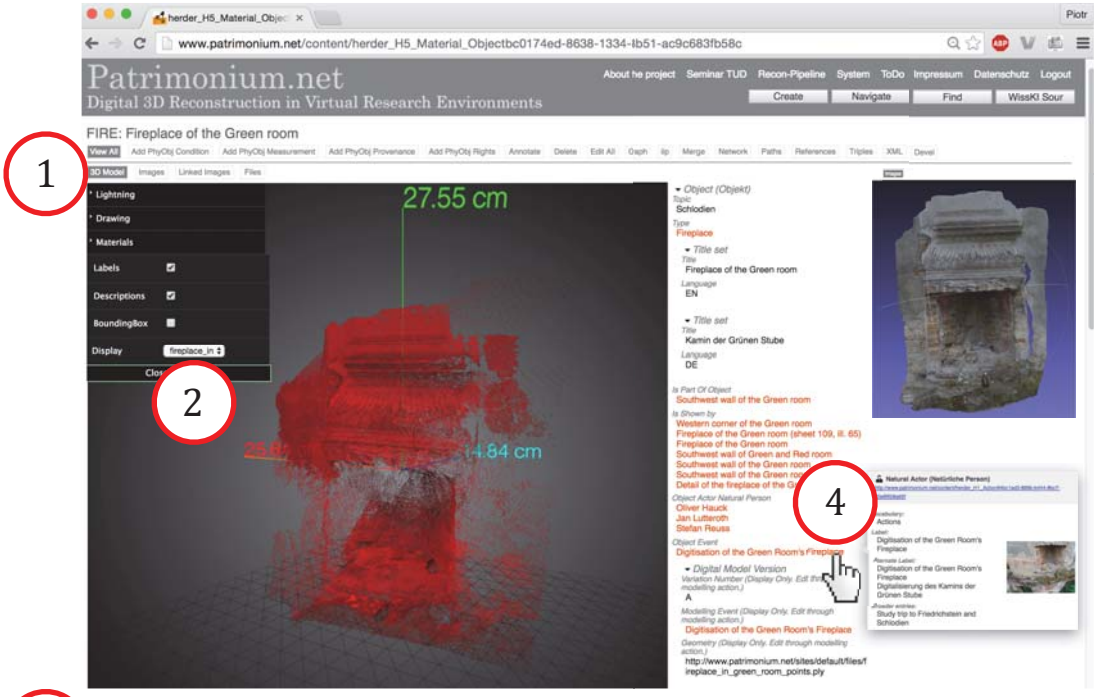
In the next step the integration of both procedures within a VRE has to be discussed. The VRE for the documentation (data acquisition, data processing) and visualisation for the different approaches in machine-driven 3D preservation and the human-driven (hand-modelled) 3D reconstruction has to be developed. Both processes are complementary in the object-orientated research, in particular in the humanities (e.g. urban history, art history, architecture, archaeology). Integrated solutions have to be clarified. An extension and adjustment of the presented application ontology and the VRE facilitating the requirements of both approaches (3D visualisation included) is a feasible challenge.



Data model for mapping the digital 3D Reconstruction workflow within four main themes of CHML



Class hierarchy of the "H5_Material_Object" within the ontology editor (protégé)



Object view within the Virtual Research Environment (patrimonium.net):

(1) The user can switch between the tabs. The 3D model tab opens the control windows for WebGL functionalities.

(2) The user can switch between the different Variants or Versions of the 3D model representing the object (e.g. the point cloud from SfM).

(3) The user can observe interactive the computer-aided design 3D model (3D reconstruction)

(4) Using the mouse-over functionality the user can explore deeper the metadata. Clicking on the Object Event of the Digitisation the user can immerse into the activity record.