

# OntSciDoc3D – Ontology for Scientific Documentation of source-based 3D reconstruction of architecture

Piotr Kuroczyński, Hochschule Mainz – University of Applied Sciences, Germany

Peggy Große, Hochschule Mainz – University of Applied Sciences, Germany

**Keywords:** *“Knowledge representation”, “Data model”, “digital 3D reconstruction”, “art and architecture history*

The digital/virtual 3D reconstruction of architecture, especially of de-destroyed or modified architecture, is an obvious way to approach the object of interest in disciplines, like archeology, art and architecture history. The hypothetical reconstruction and computer-based visualization has been used increasingly in the scientific community since the beginning of 1990s<sup>1</sup>. In the beginnings of the new millennium the scientific community recognized the need of documentation of the decisions made during the re-search activity of source-based 3D reconstruction<sup>2</sup>.

The challenge in using computer-aided visualization techniques in research remains to ensure the traceability and sustainability of the results, in particular the source on which decisions have been made and the hypothesis and interpretations of the scientists as well as the findings expressed through and in the 3D models. The question of sustainability and interoperability of digital research data based on adequate data model in the object-oriented research projects arises. In the following, a knowledge representation will be presented which documents the research activities of the 3D reconstruction, scientists involved, the sources used in this process in order to make the interpretative and hypothetical part of the results as transparent and comprehensible as possible for human and machine.

The formalization of knowledge in structured data models (ontologies), the networking of digital resources (Linked Data) and web-based interactive visualization of 3D data sets as a result of WebGL technology is a forward-looking technology in this context<sup>3</sup>. The computer-suitable way of formalizing and structuring knowledge enables the operationalization of data and promotes computer-based knowledge acquisition and web-based knowledge networking.

The presented data model therefore pursues two goals: 1) To record the research activity of 3D reconstruction, persons engaged, source acquisition and interpretation in as standardized way as possible and 2) to link them to the corresponding digital 3D models, their versions and variants, in

---

<sup>1</sup> Messemer, H.: The Beginnings of Digital Visualization of Historical Architecture in the Academic Field. In: Hoppe, S., Breitling, S. (eds.) *Virtual Palaces, Part II – Lost Palaces and their Afterlife. Virtual Reconstruction between Science and Media*, PALATIUM e-Publications. Heidelberg: arthistoricum.net (2016)

<sup>2</sup> Bentkowska-Kafel, A., Denard, H., Baker, D.: *Paradata and Transparency in Virtual Heritage*. Ashgate (2012).

<sup>3</sup> Kuroczyński, P., Hauck, O., Dworak, D: 3D Models on Triple Paths - New Pathways for Documenting and Visualizing Virtual Reconstructions. In: Münster, S., Pfarr-Harfst, M., Kuroczyński, P., Ioannides, M. (eds.) *3D Research Challenges in Cultural Heritage II*. Cham: Springer International Publishing, 149–72 (2016).

a com-prehensible way<sup>4</sup>. Furthermore, the collected digital research data should be readable and usable for man and machine in the long term. In result the application ontology OntSciDoc3D based on the ISO standard CIDOC CRM will be introduced.

The data schema maps the procedure of the source-based 3D reconstruction, which is understood as an activity (class E7 Activity). Accordingly, a 3D reconstruction is primarily an activity that ends with an immaterial prod-uct, the digital 3D model (class E73 Information Object). The performer re-constructs on the basis of the available sources, which he documents ac-cordingly and to which reference is made. This makes it possible to present the interpretative or hypothetical part, which is always present in a recon-struction, in a transparent way. Since the content of the sources and not the physical medium (e.g. painting, photo, etc.) is relevant for the recon-struc-tion, all sources of any genre are considered to be instances of the class E31 Document. Thus, the possibly very het-erogeneous material can be recorded homogeneously and in a standardized way. The 3D model as a digital repre-sentation of a destroyed or altered building is naturally related to the former phys-ical building it represents. All information related to the building is recorded as instances of the class E22 Man/Human-Made Object. The re-sulting digital model is thus mapped as the result of a creative process in a network of source, experience and object-based information.

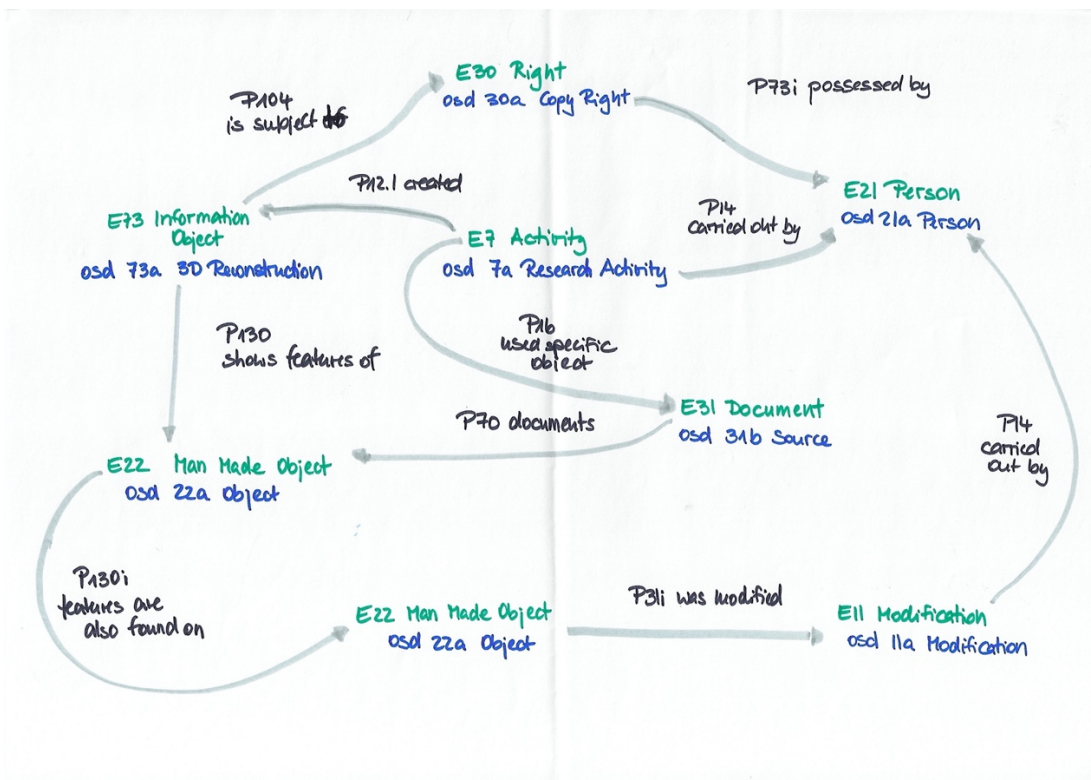


Fig. 1. Draft of the OntSciDoc3D data model scheme (© 2020, AI MAINZ)

<sup>4</sup> Kuroczyński, P., Brandt, J., Jara, K., Große, P.: Historic Building Information Mode-ling (hBIM) und Linked Data – Neue Zugänge zum Forschungsgegenstand objektori-entierter Fächer“. In: Sahle, P. (ed.) Proceedings of DHd2019, Digital Humanities: multimedial & multimodal, pp. 138–141. Mainz/Frankfurt (2019).

## References

- Messemer, H. (2016): The Beginnings of Digital Visualization of Historical Architecture in the Academic Field. In: Hoppe, S., Breitling, S. (eds.) *Virtual Palaces, Part II – Lost Palaces and their Afterlife. Virtual Reconstruction between Science and Media*, PALATIUM e-Publications. Heidelberg: arthistoricum.net
- Bentkowska-Kafel, A., Denard, H., Baker, D. (2012): *Paradata and Transparency in Virtual Heritage*. Ashgate.
- Kuroczyński, P., Hauck, O., Dworak, D (2016): 3D Models on Triple Paths - New Pathways for Documenting and Visualizing Virtual Reconstructions. In: Münster, S., Pfarr-Harfst, M., Kuroczyński, P., Ioannides, M. (eds.) *3D Research Challenges in Cultural Heritage II*. Cham: Springer International Publishing, 149–72.
- Kuroczyński, P., Brandt, J., Jara, K., Große, P. (2019): Historic Building Information Modeling (hBIM) und Linked Data – Neue Zugänge zum Forschungsgegenstand objektorientierter Fächer“. In: Sahle, P. (ed.) *Proceedings of DHd2019, Digital Humanities: multimedial & multimodal*, pp. 138–141. Mainz/Frankfurt.