

The integration of semantic knowledge graphs in virtual environments

The Use Cases of the Excavation of the archaic settlement Monte Iato (Sicily) and an Exhibition about the fate of women during the Cossacks Tragedy 1945 (Lienz)

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Introduction

The archaic settlement of Monte Iato in Sicily and the tragedy following the extradition of the Cossacks in Lienz at the end of World War 2 do not have much in common at first sight. However, the two projects being presented both have the similar ambition: to link a virtual environment - that of an excavation in the former case and that of a museum space in the latter - to a semantic information network modeled on the basis of CIDOC CRM (Bekiari et al., 2021) in order to allow visitors not only to learn more about the story, but also to decide whether to move through the environment, to follow a linear narrative path, or to click freely through the information in the network.

The Projects

In the following, a brief description of the projects is outlined first, so that the common goal of linking semantic networks and virtual environments can then be discussed in more detail.

The Virtual Exhibition „They Shared Their Destiny“

The original realization of the exhibition "They Shared Their Destiny. The Women and the Cossacks' Tragedy in Lienz 1945" was already presented as a poster at CHNT last year. The purpose of the exhibition was to illustrate the fate of women during the Cossack tragedy in Lienz, when about 4'500 of 22'500 Cossack soldiers and civilians were able to hide in the forest or as ultima ratio committed suicide (some with their children, other handed their children over to local inhabitants) to avoid their

extradition to the Russians by the British administration, contrary to the agreement. Due to the restrictions during the Covid-19 crisis, the exhibition had to be re-planned as a virtual exhibition on short notice.

A small follow-up project “Virtual Exhibition in All Dimensions” funded by the Research Center “Digital Humanities” of the University of Innsbruck, which is based on the data from this exhibition, has three main goals: a) to collect more information about people, artifacts, places and events, and link them into a semantic network; b) to integrate this network into the 3D model of the exhibition room and finally c) to increase the amount of information provided, the story-telling possibilities and the navigation options for visitors (Fig. 1) (Danthine et al., accepted).

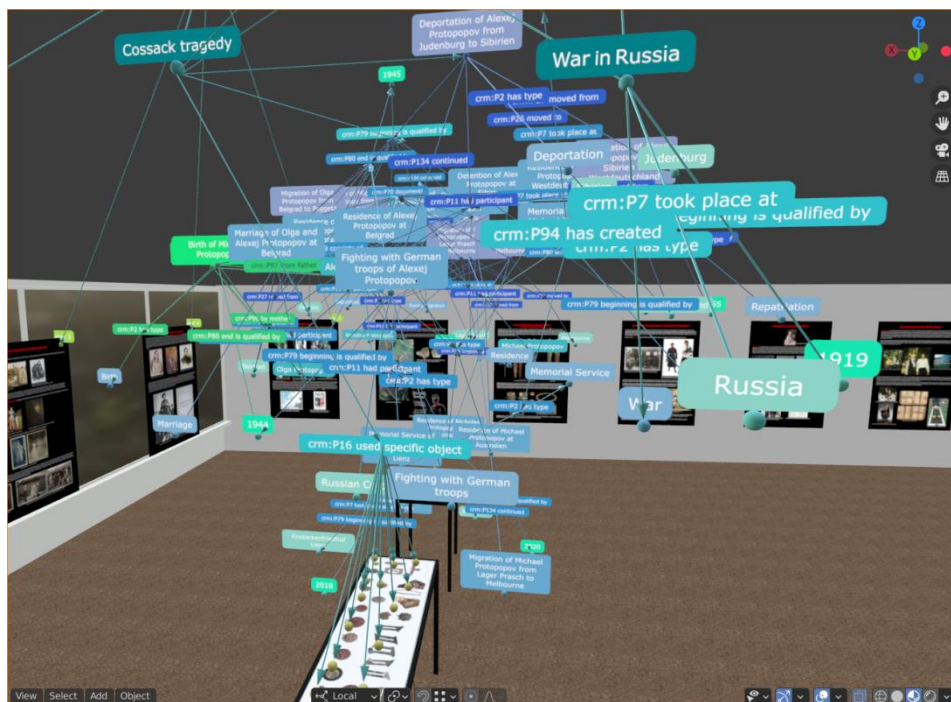


Fig. 1. Visual integration of semantic network into the 3D model of the exhibition room

The Project „Narrative Consumer Landscapes between Modernity and Traditionality“

The project, funded by the FWF as part of the Science Communication Program, intends to visualize the research and excavation results of the FWF projects "Between the Temple of Aphrodite and the Late Archaic House I-III" (Kistler et al., in press).

The focus of the Science Communication Program is the central cult site of the indigenous settlement at Monte Iato of the late 6th/first half of the 5th century. A period in which the migration of the Greeks and Phoenicians, who settled on the coast from the late 8th/7th century onwards, led to increasingly intensive cross-cultural contacts, which gave the local communities access to new and foreign goods, ideas and technologies. This entangled situation led to very different consumption practices within ritual feast that were held in the vicinity of the central cult building - the so-called Aphrodite-Temple and within a large banqueting house - the so-called Late Archaic House. While one consumer landscape was shaped by long-standing traditions, the other was characterized by the integration of modern elements.

The project objective is a) to visualize the archaeological sites, b) to model the information and interpretations of the artifacts signaling the different consumption landscapes at different zoom levels

and c) to connect the resulting semantic network with the 3-dimensional visualization of the Temple of Aphrodite and the Late Archaic House, that the viewers do not have to follow a linear story, but are offered different access points, whether it may be multiple story lines, different starting points, different zoom and knowledge levels or the virtual environment generated by the archaeological data (Fig. 2).

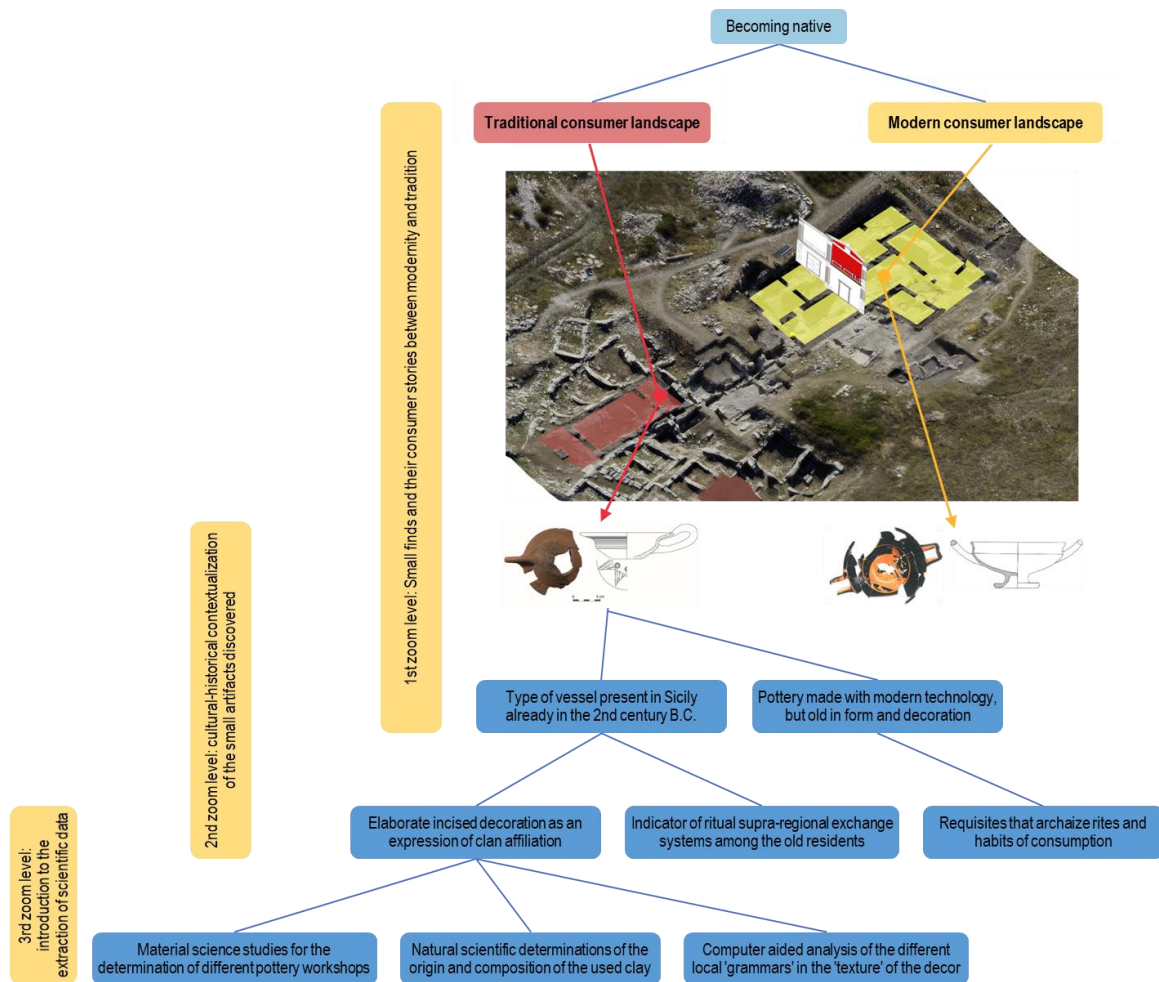


Fig. 2. The two consumer landscapes with the different zoom-levels of information

The integration of semantic knowledge graphs in virtual environments

Both projects have the integration of semantic networks into virtual 3D models in common and aim at creating a user interface that allows the navigation in both the semantic information space as well as the virtual 3D environment. For this purpose, on the one hand the virtual environments are created by different methods like modeling or photogrammetry and on the other hand all associated information about artifacts, findings, events, locations, peoples etc. are modeled according to the ontology of CIDOC CRM. The design of this event centric model contains the necessary elements to tell a story, which is the best way to convey a historical reality (Fig. 3).

CIDOC CRM is a formal ontology developed specifically for the cultural heritage domain, which has gained broad acceptance not only in the field of museum studies, but also in the entire cultural heritage sector and in Digital Humanities where one of the research questions often relates to the representation of a historic reality.



Fig. 3. The modelling of the virtual exhibition “They Shared their Destiny”

However, the projects should go one step further and not only provide the information processed in this way separately but integrate them directly into the exhibition and thus visualize them directly in the virtual museum, making them available to visitors.

While this has already been realized in the Cossack project on a small and non-nested basis, the goal of the Monte Iato project is now to 1) do it in a larger and more complicated virtual environment encompassing multiple contexts and archaeological layers, and 2) to semantically model and make the information accessible in a narrative work encompassing various zoom and knowledge levels.

This will need additional semantic information which is the one of the story that should be told gluing the interpretations of the historic reality together to one sequence of events which make the story. The technical realization of this in RDF has to use approaches like named graphs or RDF star which will be exploited in the course of the project.

Conclusion

The goal of the projects is to explore the possibilities to add (nested) semantic information to archaeological or museal virtual environments. Furthermore, aim of this work is to show how a semantic representation in an event-centric ontology could enable visitors of a virtual environment to experience the historical or archaeological reality beyond artifacts and information through different access points. For this purpose, various information and interpretations were acquired and mapped on the basis of the widely used CIDOC CRM ontology. This should enable the visitor not only to move within the virtual environment and visit it in a linear way, but also to “move” through the semantic network and thus follow the storylines they are interested in.

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Conflict of Interests Disclosure

The authors hereby confirm that there are no financial or personal relationships with any individuals or institutions that could influence this work.

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All contributions are listed in alphabetical order

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Formal Analysis:

Funding acquisition: Danthine, Hiebel, Kistler, Öhlinger, Stadler

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Methodology: Danthine, Hiebel, Kistler, Öhlinger, Posch, Stadler

Project Administration: Hiebel, Kistler, Öhlinger, Stadler

Resources: Kistler, Öhlinger, Stadler

Software:

Supervision: Hiebel, Kistler, Öhlinger, Stadler

Validation:

Visualization: Danthine

Writing – original draft: Danthine

Writing – review & editing: Danthine, Öhlinger, Hiebel

References

- Bekiari, C., Bruseker, G., Doerr, M., Ore, Ch.-E., Stead, St. and Velios, A. (2021). *Definition of the CIDOC Conceptual Reference Model v7.1.1*. Available at: http://www.cidoc-crm.org/sites/default/files/cidoc_crm_v7.1.1_0.pdf. (Accessed 30 July 2021)
- Danthine, B., Hiebel, G., Posch, C. and Stadler, H. (accepted). 'The Integration of Semantic Networks in Virtual Exhibitions', *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, accepted paper.
- Kistler E., Forstenpointner G. and Thanheiser U. (in press). 'Feasting at the Edge – Traditional vs. Modern Consumption-scapes at Archaic Monte Iato (Western Sicily)', in Morgan, C., Charalambidou, X. and Crielaard, J.P. (eds.) *Feasting with the Greeks: Towards a Social Archaeology of Ritual Consumption in the Greek World*. Oxford.