

Cross-Disciplinary Synergy: Research Outcomes and Teaching Applications

Exploring the Toro Farnese: A Use-Case from Scientific Analysis to Interactive 3D Workshops

Motivation and Introduction

One of the central tasks of 'Archaeoinformatics' is the appropriate communication between the disciplines of archaeology and computer science. Archaeoinformatics is not an objective but should rather support the answering of scientific questions in archaeology and the interpretation of data.

As part of the joint research project 'Toro Farnese', various scientific questions are discussed, and the available technical solutions are examined and discussed. The aim is not to give computer science the task of answering these questions. Rather, the aim is to support archaeologists in such a way that they can answer the questions themselves using all technical devices and applications.

Project Background

Around 1895/96, the Museum of Antiquities at the University of Leipzig purchased a plaster cast of the 'Toro Farnese' (Farnese Bull) for its archaeological study collection. With almost 4 m in height, the marble original, now in the Archaeological Museum of Naples, is the largest sculpture known from antiquity. This Roman copy of a famous Hellenistic original was found in the Baths of Caracalla in Rome in the 16th century and was most likely made for this display context in the early 3rd century CE (Kunze, 1998). The Leipzig cast survived WWII but was disassembled into its over 50 separate parts during the GDR period. Subsequently, unfavourable storage conditions heavily damaged the plaster fragments. Since 2022, a research project deals with the restoration and reconstruction of the historical object. Due to the lack of space to physically rebuild the sculpture, the project aims to digitally reassemble it in a 3D model. This shall serve as the basis for further conservational and archaeological research both on the historical plaster cast and the Hellenistic original of the Toro Farnese. During the project, the individual parts of the cast were restored and digitized using a handheld structured-light 3D scanner. The next step is to calculate the missing parts and print them in 3D for a possible physical reconstruction of the statue. The models of the missing parts will be obtained by comparing the model created from the digitally reassembled segments of the Leipzig Toro Farnese with a 3D model of the complete group.

The plaster cast collection of the Freie Universität in Berlin owns such a plaster copy of the complete sculpture which was cast from the same forms as the Leipzig Toro Farnese at the Berlin Gipsformerei in the 1980's.

From Scientific Questions to Interactive Workshops

As part of the "Research and Development" course at the HTW Dresden, media computer scientists among others are introduced to scientific projects and learn about interdisciplinary exchange with other scientific disciplines. The 'Toro Farnese' project was selected as a use case for the creation of

interactive workshops. The approach is to be seen as an iterative process, starting with the pure immersion of all participants in the project and the discussion of the resulting scientific questions. These specific questions in this project include, for example: Which elements or fragments of the 'Toro Farnese', which lies as a puzzle in the Museum of Antiquities in Leipzig, are missing? To what extent do plaster casts taken at a great distance in time from one and the same negative differ? What might the original 'Toro Farnese' have looked like?

In the second part, various technical methods were examined, and the results discussed. For example, a 3D scanner and videogrammetry (Block-Berlitz, 2024) were used to reconstruct artifacts and complex sculptures. Based on the results and the subsequent tasks, such as the addition or manipulation of 3D models or the analysis of missing elements, various software solutions were examined regarding feasibility, costs and usability.

The result is three interactive workshops using Microsoft PowerPoint based on the Toro Farnese as use case, which describe the relevant objectives for the user when using and handling Blender¹ or CloudCompare² and should thus also enable other archaeologists to answer similar questions.

Conclusions and Future Work

This article is not only intended to support focused communication between archaeologists and computer scientists. The resulting workshops show a concrete path from scientific question to technical solution. These workshops are made freely accessible, are intended to open the way for further courses and offer concrete solutions to comparable questions.

References

- Block-Berlitz, M. (2024). *Innovations in Digital 3D Documentations of Artifacts and Archaeological Sites - Practical Guidelines to Photo and Video Campaigns Using Cameras, Multicopters, and Mini-Submarines*. 1st Edition, Berlin, Germany: vividus Wissenschaftsverlag
- Kunze, C. (1998). *Der Farnesische Stier und die Dirkegruppe des Apollonios und Tauriskos*. Berlin, W. de Gruyter

¹ <https://www.blender.org>

² <https://www.cloudcompare.org>