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CODEX 2022: COLOGNE DIGITAL EXCAVATION PROTOCOL

Latest Advances and future Objectives

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Objectives

While most parts of archaeological work undergo a transformation towards digitalization, this is rarely done for excavation recording (e.g. Berggren et al. 2015, Tripcevich & Wernke 2010). Here, we present an approach, which was developed for digital on-site recording and post-processing under the restriction of heritage management guidelines. Efforts were made to transform the documentation system at the *Magdalenian* open-air site of Bad Kösen-Lengefeld (Richter et al. 2021) to a fully digital version.

The main objectives of the transformation were:

- Improve error rates (transcription errors)
- Speeding-up documentation process
- Improvement of documentation quality

Previous Stages of Development

2008–2015	Fully analogue documentation
2016–2017	Word & Metashape based system
2018–2019	Transfer to a relational database
since 2021	GIS and Metashape system

The Cologne Digital Excavation Protocol

In general, the protocol uses georeferenced orthophotos as a background for digital object drawing in a GIS environment (Fig. 1). Georeferenced orthophotos are generated using simple structure-from-motion (SFM) models generated in Agisoft Metashape software. Referencing is achieved by total station measurements of coded reference markers. These are used in Metashape to automatically reference the mode grid.

Orthophotos are used in QGIS as a drawing backdrop to create point, line and polygon features associated with different attribute values (such as Object Type, time of creation). Objects are drawn with a stylus pen on Tablet -PCs.

Versions of the CoDEx Protocol

2021

- Data is stored in individual geopackage files and associated with individual QGIS project files
- Decentralised processing of SFM-Models (on tablet)

2022

- Introduction of a PostGIS database system
- Centralised processing of SFM-Models
- DSLR photos for processing

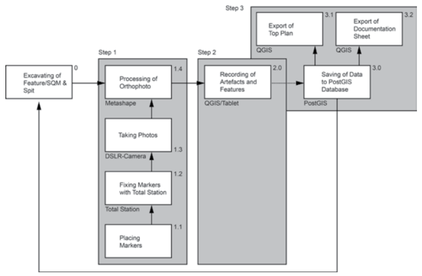


Fig. 1 Processing workflow of the digital recording protocoll.

Experiences 2022

The protocol focused on an increase in recorded data on site, a reduction of errors such as transcription errors. Also, it was developed to reduce post-processing time.

By introducing a PostGIS-database, data storage was improved substantially. Since all tablets access and write to the same datasource, issues with duplicates and data versions were eliminated. Also, checking the data was simplified, since all data is stored in a single location.

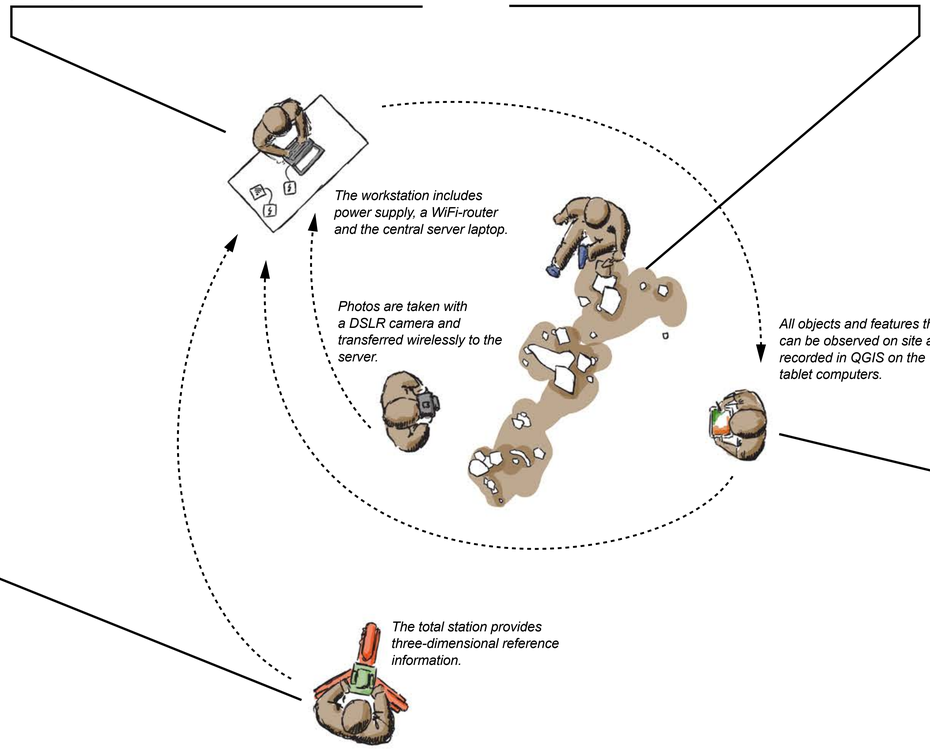
Postprocessing the data and finalizing the excavation reoprt with all (n > 300) individual mapsheets was sped-up substantially. An automated output of all data in a pre-set QGIS-system allowed for a quick export of all data. This took c. 3 minutes.

For SFM-processing, all photos were taken with a DSLR-camera and processed on the central server laptop. This increased both the speed of processing and the quality of the final orthophoto.

Step 1.2 (cf. Fig. 1): All marker positions are fixed by total station measurements.

Step 1.4, Step 3 (cf. Fig. 1): An outdoor laptop is used as a central processing unit and data server.

Step 1.1 (cf. Fig. 1): Markers are placed in the excavation area to allow for automated referencing of SFM models.



The climatic conditions during the field school in summer 2022 posed difficulties to the system. The extreme heat resulted in performance issues of the tablets. The tablets in use are Microsoft Surface tablets, which are not produced for extended outdoor-use. The tools had to be shielded from the sun even under the tent covering the excavation area.

Improvements in 2023

Due to the issues with outside temperature. Outdoor tablets will be introduced to the excavation in 2023. They are designed to cope with higher outside temperatures and display brightness is higher. This likely will improve on-site work with the tablet-PCs.

One of the major bottlenecks in documentation in 2022 proved to be the SFM processing of orthophotos. For this, a python-script was devised. It allows for the full automatization of this step and will increase processing speed substantially.

Step 2.0 (cf. Fig. 1): All objects are drawn in the digital environment using QGIS as the software for data handling.

Berggren, Å., Dell'Unto, N., Forte, M., Haddow, S., Hodder, I., Issavi, J., et al. (2015). Revisiting reflexive archaeology at Çatalhöyük: integrating digital and 3D technologies at the trowel's edge. Antiquity, 89(344), 433-448.

Richter, J., Uthmeier, T., & Maier, A. (Eds.). (2021). Der Magdalénien-Fundplatz Bad Kösen-Lengefeld an der Saale (Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt - Landesmuseum für Vorgeschichte, Vol. 82). Halle (Saale): Verlag Beier & Beran.

Tripcevich, N., & Wernke, S. A. (2010). On-site Recording of Excavation Data Using Mobile GIS. Journal of Field Archaeology, 35(4), 380-397.

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