Digital Excavation Documentation – Objective and Sustainable (A Workshop Summary)[1]

Reiner Göldner[2] & David Bibby[3]

Abstract

Archaeologists discuss ways of making legacy fieldwork records amenable to today's use. Let's shift the time frame and discuss ways of making today's fieldwork records amenable to future use.

On archaeological excavations context information cannot be preserved in its original state. So it is important to build an objective* and sustainable* documentation which will provide all information gathered for future use. Some interesting aspects arise from combining the questions: Which digital methods best produce objective record of excavation facts and which of them produce sustainable information ready to be preserved over hundreds of years.

Within this subject area the workshop covered questions such as: Which digital methods are used for excavation documentation? Is there a trend from CAD to GIS? How useful are 3D scans? How might we achieve data sustainability? How can usability be preserved over hundreds of years? Which open standards are useful?

Today's practice often shows that digital methods are considered independent of preservation aspects. This workshop was a step toward changing this and setting up synergy effects combining both themes. It offered the possibility of exchanging hands-on experiences between archaeologists on the one hand and discussing prospects and starting points to future FOSS projects on the other hand.

The poster will give a short summary of the workshop „Digitale Grabungsdokumentation – objektiv und nachhaltig", which was held in February 2018 in Dresden. The Workshop was organized by the commission Archaeology and Information Systems of the Association of State Archaeologists in Germany due to increasing interest in sharing experiences on this topic. About one hundred archaeologists and excavation technicians from Germany and Switzerland came together, presented their ideas and discussed the above mentioned aspects. Detailed information is available from the website:

http://www.landesarchaeologen.de/verband/kommissionen/archaeologie-und-informationssysteme/projektearbeitsgruppen/workshop-digitale-grabungsdokumentation .

[* It is assumed that excavation documentation has to be "objective", that means comprehensible and independent from personal (subjective) and technological influence, as far as possible, as far as needed for scientific interpretation and as far as needed for "sustainable" preservation.]

Presentations

„Denkmalpflege hat die Aufgabe … - Gedanken zum Schutz und zur Erhaltung archäologischer Kulturdenkmale am Beispiel des Kirchplatzes in Lommatzsch" (M. Strobel, O. Spitzner | Landesamt für Archäologie Sachsen)

This presentation addressed general aims of heritage protection that cause documentation requirements. Preservation is preferred to excavation/documentation. For instance careful planning allowed the preservation of the church square in Lommatzsch.

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[2] Saxon Archaeological Heritage Office
[3] State Heritage Management Baden-Württemberg

„Paradigmenwechsel in der Digitalen Grabungsdokumentation im Landesamt für Denkmalpflege Baden-Württemberg: von CAD zum Open Source GIS" (D. Bibby | Landesamt für Denkmalpflege Baden-Württemberg)

Usually total stations are used to measure excavations. Therefore CAD was used so far. Because of cost concerns and methodological advantages (e.g. geo referencing, attribute use) a systematic change to GIS technologies was performed. "Survey2GIS", a basic tool for intelligent transformation of total station standard data to standard GIS data, was developed and is available as FOSS. Now excavation plans are geodata, easy to analyse and ready to archive.

„Neue Richtlinien braucht das Land! Konsequenzen der Neuausrichtung des Rettungsgrabungswesens für die digitale Dokumentation in Baden-Württemberg" (J. Bofinger, H. Junius | Landesamt für Denkmalpflege Baden-Württemberg)

Positive experiences with geodata from total station now led to a new excavation documentation policy that is consequently oriented towards GIS. But only results are regulated, acquisition methods stay free. Under special consideration are data formats and file structures to support discovery, analysis and archiving of archaeological information

„Verarbeitung digitaler Grabungsdaten beim Archäologischen Dienst Graubünden/Schweiz" (A. Zwicky, B. Heinzle, C. Walser, P. Wiemann | Archäologischen Dienst Graubünden)

This presentation is about short but intensive experience in using digital methods for excavation. There is a tradition of photo and find databases, but IT strategies didn't fit best to archaeological field services. Now digital excavation documentation is performed with ArchäoCAD and BricsCAD, sometimes with photogrammetry. Geodata is stored centralized with PostGIS, archiving is in focus.

FOSS (D. Bibby | Landesamt für Denkmalpflege Baden-Württemberg)

The principle of Free and Open Source Software (FOSS) provide the chance to develop user specific software with reasonable effort, if three aspects are regarded: standardization (→ sustainability), modularity (→ flexibility) and cooperation (→ cost reduction). It is the aim of the FOSS working group of the Association of State Archaeologists in Germany (VLA) to exchange experiences, pool competences and support cooperation.

„ExcaBook – Grabungsdatenbank des BLfD" (S. Jantos | Bayerisches Landesamt für Denkmalpflege)

Bavaria aims high with the draft „Denkmalschutz und Denkmalpflege in Bayern 2020". A contribution to that is the new excavation database ExcaBook. Based on a harmonized data model, ExcaBook provides on-site acquisition of excavation data and synchronization with the central information system. The University of München supported the project using the xBook framework.

„Zum Stand der digitalen Grabungsdokumentation in der Landesarchäologie Rheinland-Pfalz" (K. Wolters, C. Schuppert | Generaldirektion Kulturelles Erbe Rheinland-Pfalz).

Archaeologists of Rheinland-Pfalz initiated their digital era in the early 2000s with ArchäoCAD, SingulArch and Access databases. At the same time the archaeological information system PGIS was developed, based on database and GIS technology. Now new excavations start with total station, Survey2GIS and QGIS and legacy data is migrated into PGIS (pilot projects).

„Digitale Grabungsdokumentation in Sachsen aus grabungstechnischer Sicht" (C. Schubert | Landesamt für Archäologie Sachsen)

Almost all excavations are rescue excavations to document archaeological substance that is endangered by destruction. There are various kinds of excavations that require flexible documentation methods as hand drawing, total station / field book measurement (preferred), 2D and 3D photogrammetry and so on. Compared to traditional analogue methods modern digital methods obviously shift efforts from on-site to desk and the appropriate IT service becomes essential. Due to cost concerns a replacement of TachyCAD/AutoCAD is desired and there are tendencies to support a FOSS-GIS solution.

„TachyGIS – Eine Idee zur archäologischen Grabungsvermessung mit Tachymeter und GIS" (R. Göldner | Landesamt für Archäologie Sachsen)

Current challenges of geographic documentation are high software cost, insufficient attribute integration and low sustainability (archive demands), especially using field book measurement. These challenges can be mastered by a paradigm change from CAD to GIS, based on data standards and cooperative use of the FOSS principles. The basic idea is to connect GIS and total station via TachyGIS software and directly import coordinates from total station into GIS editing process. Geodata follows Simple Features Access and contains only core attributes like excavation code, object

type, object ID, … TachyGIS consists of three core components: total station interface, control interface with attribute input and visualization in 3D.

„Von CAD zu GIS" (J. Räther | Archäologisches Museum Hamburg, Bodendenkmalpflege)

After the introduction of the excavation database ArchaeoDox several years ago, the AMH now prepares the change from CAD to GIS. Archaeological geodata is defined in concept "NormA" and should be generated directly into GIS with a total station interface, comparable with the TachyGIS idea. Based on experiences from Survey2GIS a first prototype evaluation was successful, total station measurements could be used to edit 3D geodata in QGIS. The project follows FOSS principles, cooperation would be helpful.

„Keller und Gruben in 3D - Über Sinn und Unsinn der Grabungsdokumentation mit SfM am Beispiel der Stadtgrabung Pforzheim" (M. Lehmann | Landesamt für Denkmalpflege Baden-Württemberg)

Are photo based 3D models (SfM) able to replace total station measurements? The presentation clearly answers yes. Benefits are: touchless measurement, 3D information, archaeological features in global context, colour and texture information, GIS friendly data. The major challenge is the photo quality. SfM requires well skilled staff and appropriate computing power. With pressure of time SfM results are better than total station measurements.

„3D-Scandaten, Metadaten und Langezeitarchivierung – Langzeitnutzung möglich oder Datenmüll?" (T. Reuter | Landesamt für Archäologie Sachsen)

There is 15 years' experience of 3D object scanning in Saxon LfA. Most 3D scanning systems are very complex, non-standard and high grade proprietary. Raw data, stored in complex directory structures, are almost useless without the original software. Calculated 3D models can be used and exchanged more comfortably and there is some hope of preserving them. 3D data should be sufficiently characterized by metadata to support retrieval.

„Archivgrundsätze und Erhaltungsstrategien zur Archivierung digitaler (archäologischer) Daten" (R. Göldner | Landesamt für Archäologie Sachsen)

The aim of digital archiving is to permanently preserve digital content and digital function of archive material and to provide access to it. This presentation is first about archival value (does material has ageless, steady value to society?) and suitability for archiving (does material meet formal technical requirements of preservation?). A second aspect refers to preservation strategies that give an idea on how to preserve content and function of archive material while systems are changing over time. These preservation strategies are the heart of every digital archive, because they guarantee the survival of the archive material. Only few material types can be preserved with the usual format based approach. "Archiving" differentiates from "storing" by having sufficient preservation strategies (resp. preservation planning). From this perspective preservation strategies are the most important aspect of archiving.

Working Groups

Excavation Database (input of attribute data)
- There is an actual need of cheap or free software.
- Important requirements are mentioned: data safety, multi user capability, plausibility-/error check.
- Appropriate thesauri are necessary (→ standards), but also free text attributes.
- Different kinds of excavation (rescue ~ … large scale ~) require different versions of excavation database.
- Time efficiency during excavation is very important. It is hard to imagine spending more time on post processing (e.g. to prepare archiving).

Tachy&GIS (paradigm change from CAD to GIS and geodata input with total station and GIS)
- In praxis excavation measurement is mostly done by total station.
- There are two methods in use: code based measurement (without visualization) and field book measurement (with visualization on screen)
- GIS is broadly accepted as target for geodata from measurement, because it provides generic links to attributive data, promises archiving options and is cost freely available as FOSS.
- An appropriate system combining total station and GIS (Tachy&GIS) is considered a good idea.
- Such Tachy&GIS should allow simple and stable workflows.
- Regarding current state of evaluation the major challenge is 3D visualization, this aspect has high priority.

Quo Vadis 3D (capture of 3D geodata with laser scan or structure from motion)
- Technical options to capture excavation measurements are e.g.: laser scan, Structure from Motion (SfM), structured/strip light scanner, sonar, geophysical measurement, CT.
- Laser scans are vivid, high quality and very objective, but still quite elaborate and expensive.
- SfM is also vivid, good quality, objective and less elaborate and expensive, but completely depending on appropriate photos (only verifiable after processing).
- An interesting question is: Will SfM replace laser scans (effort, expense, quality)?
- 3D scans map excavation reality quite objectively. They are rather raw data than standard (interpretative) documentation.
- 3D scans support interpretation, but they normally do not replace field work.
- But: 3D scans are better than poor field work (possible subsequent interpretation at the desk).
- 3D scans don't replace attributive description, interpretation and drawing.
- Often 3D scans are interpreted in 2D. A very interesting question is: How might we perform this archaeological interpretation in 3D?

Standards (for access and exchange)
- Minimum standards are essential to be able to evaluate the excavation documentation.
- Even "digitizing" analogue forms may be problematic.
- Important application fields of standards are data structure and vocabulary (thesaurus).
- Standards must be thoroughly communicated and trained.
- Unified, homogeneous formats and structures are coming, but vocabularies (thesauri) are regarded somewhat sceptically.
- Standards (and digitizing) don't replace experience, expertise and skill of the excavation team.

Sustainability (suitability for archiving and preservation strategies)
- There is uncertainty regarding future use of excavation documentation (e.g. about the role data functionality or about the relevance of retrospective interpretation).
- The necessity of active preservation (migration) is broadly accepted, but practice suffers from insufficient resources.
- A differentiation over time might organize preservation: 1. phase: complete data, 2. phase: data ready for functional and interpretative use, 3. phase: basic core data.
- Selection of material has chances and risks, careful selection is needed.
- To know a localization is more important than a direct access to all functions of geodata.
- Descriptive Metadata about data structures is more important than readymade technical access.

Résumé

The workshop combined aspects of objective documentation with aspects of sustainability. This is essential if archaeological information is to be preserved for future generations. And of course this is a contribution to „digitization". Thirteen presentations were given that touched themes from heritage management through excavation practice to preservation strategies. They initiated an exchange of experience. This was continued with inspired and constructive discussions at five workgroup stations. Everyone could pass remarks, there were many ideas, possible cooperation and even solution oriented approaches.

The workshop started with some thesis. What was the response? The thesis "Digital excavation documentation is real archaeological everyday life" was overwhelmingly accepted. But only few accepted "Paper is not necessary in excavation documentation".

So we are on the road to digitization. We like to use helpful digital tools, but if problems arise we like to fall back to traditional methods. To our mind the potential of digital methods in archaeology is not exhausted yet. But digitization always means investing in digital methods and results will depend on the amount of resources available. Hence we want to point to chances of cooperation in the field of Free and Open Source Software (FOSS): standards achieve sustainability, modularity causes flexibility and cooperation leads to cost reduction – a clear vote in favour of the FOSS principle.

The feedback to the workshop was positive across the board, so a continuation with more workshops in the same vein is definitely not ruled out!