Chapter 13
Concluding Remarks – Coordinates for the Future of Digitalised Archaeology

Marco Hostettler, Anja Buhlke, Clara Drummer, Lea Emmenegger, Johannes Reich, and Corinne Stäheli

Abstract The diverse contributions in this book show that the main challenges for the field are a lack of standardisation, interoperability and open-source solutions, as well as of long-term archiving solutions. The contributions also show that efforts are being made to sustainably integrate 3D technologies into the field of archaeology. Within the broader context of digital archaeology, it is argued that, in addition to technical issues, attention must be paid to ethical considerations about the nature of technology, cultural heritage and accessibility. Finally, the entanglements of technology with violent contexts must also be critically assessed.

Keywords Digital humanities · Digital archaeology · 3D archaeology · Access · Interoperability · Long-term archiving · Ethics in archaeology

The aim of this book was to provide insight into current cutting-edge applications of 3D technology in archaeology, as well as to identify the most-pressing challenges

M. Hostettler (✉) · J. Reich
Prehistoric Archaeology, Institute of Archaeological Sciences, University of Bern, Bern, Switzerland

Oeschger Centre for Climate Change Research (OCCR), University of Bern, Bern, Switzerland
e-mail: marco.hostettler@unibe.ch; johannes.reich@unibe.ch

A. Buhlke
Excavation Technician, Freelancer, Berlin, Germany
e-mail: info@anjabuhlke.de

C. Drummer
Orthodrone GmbH, Kiel, Germany
e-mail: info@archaeologie-drummer.de

L. Emmenegger · C. Stäheli
Prehistoric Archaeology, Institute of Archaeological Sciences, University of Bern, Bern, Switzerland

M. Hostettler et al. (eds.), *The 3 Dimensions of Digitalised Archaeology*,
https://doi.org/10.1007/978-3-031-53032-6_13

that still need to be overcome. 3D archaeology is part of the vast subdiscipline of digital archaeology, whereby the focus lies on the digital capture, reconstruction and/or display of real-world objects in a 3D digital environment. The individual chapters that make up this book testify to the wide array of possible applications subsumed under the notion of '3D archaeology', and even these do capture its full potential. Chapter 2 (Pendić and Molloy) gave a brief overview of the history of this method, emphasising the importance of FAIR data principles for future developments. Chapter 4 (Brünenberg, Rummel and Trümper) and Chap. 12 (Kruse and Schönenberger) presented case studies which mainly relate to the documentation of archaeological contexts and the study of features. The study presented in Chap. 5 (Fouriaux) combines the documentation of archaeological contexts with the 3D documentation of artefacts, focusing on the complex relationships between objects in a 3D space, while basically adopting a 3D GIS approach. As highlighted in Chap. 3 (Innerhofer, Reuter and Coburger), the use of 3D archaeology helps in the study of surface features of objects, such as use traces or decorations. This is briefly mentioned in Chap. 12, but it is the focus of Chap. 6 (Horn et al.), which shows how 3D technology is transforming the study of rock art. In Chap. 7 (Trinkl et al.), several approaches to data collection, automated retrieval from databases and 3D feature analyses were presented, including a novel approach to unwrapping, while preserving the geometries of the unwrapped features. Analyses of spatial relationships and volumetric measurements, as well as surface analysis under exclusion of texture, which can only be done with difficulty when using traditional documentation techniques, can be conveniently carried out using digital 3D techniques.

In Chap. 8 (Opgenhaffen, Jeffra, Hilditch), a database to study the technology behind Aegean pottery was presented. It was created as a reference collection of 3D objects for both specialists and the general public. However, 3D objects cannot easily be displayed, as they require specialised viewers that often facing restrictions in upload quality. Similar challenges arose in the case study presented in Chap. 9 (Pendić et al.). Here, a collection of human remains was made publicly available. In addition to technical challenges, ethical considerations also need to be taken into account when determining the extent of access. The authors of Chap. 8 (Opgenhaffen, Jeffra, Hilditch) heavily stressed the importance of contextual information, which must be attached to any 3D object. Preserving the context is of critical importance for archaeological collections, and robust protocols must be used to ensure this. The challenges involved in providing access to the general public and specialist audiences were taken up on an overarching level in Chap. 10 (Fernie), where pressing problems, such as a lack of metadata, standardisation and interoperability, became apparent. Novel approaches to the multi-modal retrieval of different kinds of digital archaeological objects were presented in Chap. 7 (Trinkl et al.), while the relevance of long-term archiving was particularly emphasised in Chap. 10 (Fernie) and Chap. 12 (Kruse and Schönenberger).

In Chap. 12, the aim was to establish a smooth and sustainable workflow for the archiving of 3D datasets generated in everyday (rescue) archaeological work. Here, the capacity for the long-term archiving of digital 3D datasets is understood as the precondition for fully incorporating the methods into everyday workflows. This

broad spectrum of topics and approaches is reflected in the results of the survey on the application of 3D technology in archaeology presented in Chap. 11 (Hostettler et al.). Among other observations, the survey revealed that female practitioners are apparently underrepresented in the field of 3D archaeology.

Despite intensified efforts on various levels and within large-scale projects to tackle challenges such as a lack of open-source applications, interoperability and solutions for long-term archiving, most of these issues remain unresolved. These problems are pressing and lie at the heart of responsible research in archaeology. Despite growing talk of 'de-collecting' (Hofmann et al. 2016), it is important to acknowledge that archaeological practice destroys its own primary sources. It is the context of retrieved archaeological objects that, in essence, gives value to what are otherwise merely old things. Just as the most precise radiocarbon date loses its value when its context is unclear, archaeological 3D objects become worthless when their context is lost. Thus, as Kruse & Schönenberger put it in Chap. 12, if 3D technology is to be considered as established in archaeology, long-term archiving needs to be ensured.

As Bridle (2018) and Kucklick (2015) have argued, the digital age can be characterised by the fundamental idea that everything can be quantified. Computers are the most important tool of this era, but their use gives rise to other, deeper challenges.

In the introduction to his book *Die granulare Gesellschaft,* Kucklick gives the example of a child with a grave illness (diabetes) who has the possibility to receive a tailored therapy thanks to the comprehensive data collection that can be performed on their body using highly sensitive electronic devices. From there, Kucklick develops the idea of a granular society (*granulare Gesellschaft*), in which high-resolution datasets replace the dominance of mean and average values – such as the monitoring of diabetes via mean blood sugar values – in our understanding of the world. In *New Dark Age,* Bridle (2018) notes that there is an increasing lack of understanding in our society concerning the growing amount of information that is widely available and that continues to be produced on an unprecedented scale. He also observes growing complexity and a growing dependence on large-scale infrastructure. Moreover, while the digital manifests itself within material objects and a physical realm (e.g. computers, drones, server farms, etc.), its contents increasingly seem to lack spatiality. Spatiality again is an essential property of what we understand as the physical world, and its absence thus lies completely beyond our experience as biological subjects.

As can be seen from many examples presented in this book, these notions are inherently true for the use of 3D technology in archaeology: when 3D models are produced, more data on the objects under study is generated, which can lead to new results. Moreover, another dimension of these new possibilities is the ability of the digital object to be accessible beyond geographical boundaries (once the infrastructure has been put in place). These properties once again underline the fundamental importance of context being preserved and strategies being formulated to structure the new masses of data in meaningful ways. Approaches that go in this direction have been presented in this book.

That said, technology and infrastructure are also implicated in problematic and violent contexts. Access to much of the needed infrastructure is regulated by (economic) power relations. The infrastructure itself is built using materials that are often mined in exploitative contexts by imperialistic agents. This violence inherent in modern technology should not be ignored, either on the societal level or in archaeology. The entanglement of modern technology with warfare and exploitation has been underlined in a polemical way by Hutchings (2014), who sharply attacks the uncritical embrace of technology by the organisers of a public event on digital archaeology. This entanglement may also be exemplified by Bridle (2012), whose artwork depicts the outlines of military drones on public grounds and thus tries to bridge the uncanny gap between their destructive purpose and their base of operation.

However, it is not only technology that is entangled in violence and warfare, but also archaeology as a discipline. The deliberate destruction of cultural heritage during the civil war in Syria garnered widespread public attention, and it was argued that the attacks explicitly targeted the 'West' and its institutions. Although 3D technology was feted as a countermeasure to the large-scale destruction in Palmyra, it failed to address the suffering of the civilian populations involved (for a discussion and further literature, see the debate carried out in *Archaeological Dialogues* in 2020: Meskell 2020; Rico 2020; Stobiecka 2020a, b). However, this debate also revealed a deeper history of violence surrounding Palmyra: the city was cleared of its inhabitants in the early twentieth century to enable the archaeological study of its ancient remains (Meskell 2020). A broad discussion of ethics in digital archaeology is still missing, although some efforts have been made (Khunti 2018; Dennis 2020).

In light of these ethical failures, it seems necessary not just to 'absorb' (Morgan 2022, p. 224) new technologies into common practice, but also to adopt a much more critical approach towards digital archaeology, one that considers the broader societal implications of technology (see also Caraher 2019). As Morgan (2022), p. 225, puts it: 'Digital work within archaeology must move beyond skeuomorphic submission and replication of previous structural inequalities to foment new archaeological imaginaries.' In a digital world, it is of fundamental importance to maintain awareness of these issues, as the violence is not readily visible or displayable (e.g. in the case of drones). Accessibility also goes beyond digital barriers, and access to digital infrastructure cannot be taken for granted. This is true not only in a geopolitical sense, but also with regard to future generations. The accessibility of our common heritage, to which archaeological objects inherently belong, must be guaranteed in a global and sustainable way. Infrastructure is of fundamental importance here, and archaeology must inform political decision-making in this regard.

Finally, the computational nature of digital 3D objects must be acknowledged. These objects represent the translation of the archaeological record into high-resolution datasets. This data might allow completely new narratives and understandings of the past that move beyond sweeping trends or rough classifications. As was attempted in this book and as is demonstrated by its authors, 3D archaeology can augment the ontological and analytical toolset available in the field. Moreover, we are currently working on strategies to ensure the preservation of the digital record in the long term. Where this might lead us and whether we are able to develop

and pursue a sustainable and ethical digital archaeology remains to be discussed in the years to come. Large-scale databases structuring different kinds of archaeological data (e.g. radiocarbon, 3D objects, palaeoecological datasets) and new computational ways of understanding them seem to represent only the first steps towards revolutionising archaeology.

References

Bridle J (2012) Drone shadow 001–009. https://jamesbridle.com/works/category:drone
Bridle J (2018) New dark age. Technology and the end of the future. Verso, London/Brooklyn
Caraher W (2019) Slow archaeology, punk archaeology, and the 'archaeology of care'. Eur J Archaeol 22:372–385. https://doi.org/10.1017/eaa.2019.15
Dennis LM (2020) Digital archaeological ethics: successes and failures in disciplinary attention. J Comput Appl Archaeol 3:210–218. https://doi.org/10.5334/jcaa.24
Hofmann KP, Meier T, Mölders D, Schreiber S (eds) (2016) Massendinghaltung in der Archäologie: der material turn und die Ur- und Frühgeschichte. Sidestone Press, Leiden
Hutchings R (2014) Weapons of mass destruction: UBC archaeology day, digital technology, and the rapidly spiraling scientification of humanity. Inst Crit Herit Tour Bull 2014
Khunti R (2018) The problem with printing Palmyra: exploring the ethics of using 3D printing technology to reconstruct heritage. Stud Digit Herit 2:1–12. https://doi.org/10.14434/sdh.v2i1.24590
Kucklick C (2015) Die granulare Gesellschaft: wie das Digitale unsere Wirklichkeit auflöst. 2. Aufl. Ullstein, Berlin
Meskell L (2020) Hijacking ISIS. Digital imperialism and salvage politics. Archaeol Dialogues 27:126–128. https://doi.org/10.1017/S1380203820000252
Morgan C (2022) Current digital archaeology. Annu Rev Anthropol 51:213–231. https://doi.org/10.1146/annurev-anthro-041320-114101
Rico T (2020) The second coming of Palmyra. A technological prison. Archaeol Dialogues 27:125–126. https://doi.org/10.1017/S1380203820000240
Stobiecka M (2020a) Archaeological heritage in the age of digital colonialism. Archaeol Dialogues 27:113–125. https://doi.org/10.1017/S1380203820000239
Stobiecka M (2020b) 'Violent care'? A response to Lynn Meskell and Trinidad Rico. Archaeol Dialogues 27:128–134. https://doi.org/10.1017/S1380203820000264