Introduction: Digital Methods and Experiential Approaches to the Past

Giacomo Landeschi and Eleanor Betts

Abstract In this chapter, the authors introduce the theme of computational/digital methods in the realm of sensory archaeologies. To this purpose, the concept of sensoriality and its relevance for the archaeological discourse is rediscussed. Key concepts such as perception of material culture help us in better defining possible modalities through which archaeologists can benefit from the use of formal methods to answer questions related to the relationship between ancient space and its original inhabitants. In this context, recent advances in the field of computational methods can now provide a significant contribution to the development of 'digitally mediated' sensory archaeologies.

Keywords Sensory archaeologies · Digital archaeology · Perception · Material culture · Phenomenology

Is it possible to combine computational methods with the study of sensory archaeologies? To answer this question, it is important to reflect on what lies behind the concept of 'sensoriality' and its relevance for archaeological discourse. A sensory-informed approach to the analysis of landscape was sought long before any statistical inferential method was in use within the discipline. When thinking about the definition of archaeology as the discipline dealing with 'thought transmuted into things' (Frothingham 1911), it is quite apparent that the material manifestation of past human existence can inform us about the mindset of peoples of the past.

What an archaeology of the senses can allow us to do is perhaps to define new modalities through which we can engage with 'the Past'. It is therefore crucial to reinforce the concept of perception as a pivotal element in linking the world to our

G. Landeschi (✉)
Department of Archaeology and Ancient History, Lund University, Lund, Sweden
e-mail: giacomo.landeschi@ark.lu.se

E. Betts
School of Arts and Humanities, Faculty of Arts and Social Sciences, The Open University, Milton Keynes, UK
e-mail: eleanor.betts@open.ac.uk

knowledge about the world: to put it simply, perception can be understood as the relationship between sensation and cognition (Frieman and Gillings 2007). In this respect, as stated by Pollock (1967), 'the data of all our senses are combined in perception to make us aware of the entire object at once'. If we take perception as an essential part of our process of understanding the world, then the experience, intended as the synesthetic sum of multiple perceptual stimuli through which we gain knowledge about the external reality, becomes the key point for us to interpret and infer also about a past reality.

When it comes to the definition of experiential or phenomenological approaches, there is still the problem of replicating and verifying what has been found, which is typically the result of a single researcher's personal observation (Day 2013).

For us as modern people, the main challenge is to define possible workflows to reach as close as possible to a plausible insight into the world of the past or to quote Lock (1995:13) 'to make coherent and meaningful statements of it'. To fulfil this scope, archaeology typically combines the study of material culture with the examination of multiple sources. When it comes to the definition of methods applicable to the study of material culture, it is possible to identify at least two macro-categories: the autoptic, individual examination of the objects under scrutiny and the formal examination conducted through inferential, quantitative methods.

Autoptic examination is conducted by the archaeologist who typically approaches any form of material culture (artefacts, buildings, landscapes) and raises hypotheses and interpretations about their significance or cultural value based solely on his/her own observation. Phenomenological, experiential approaches have been widely applied throughout the last 30 years (Tilley 1994; Fleming 1999; Brück 2005; Hamilton et al. 2006; Skeates 2010; Johnson 2012; Hamilton and Whitehouse 2020) with embodiment representing an important aspect reflecting the role of body as a metaphor (Meskell 1996; Hamilakis et al. 2002; Joyce 2005; Crossland 2010) through which our modern selves get in touch with our past predecessors. One of the main limitations with this approach is the bias of the individual experience that can hardly be generalised to allow us to get plausible conclusions on past humans' behaviours and their relationship with the landscape (Fleming 2006; Tringham 2013).

1 The Role of GIS-based Visual Studies/Space Syntax Analysis

A way to cope with the 'subjectivity' inducted by most of the traditional phenomenological studies is to introduce formal methods of enquiry. Early attempts to investigate the archaeological landscape through quantitative/statistical methods are described by Lake et al. (1998) who refer to works conducted by a few scholars during the 1980s and termed 'non-GIS visibility studies'. Although these methods were not based on computational approaches, the idea to adopt formal procedures to test assumptions and formulate hypotheses around the perception of sites or monuments based on

their relational (visual) structure with the surrounding landscape laid the foundation for a more digitally informed post-processual archaeology that developed during the 1990s (Gaffney and Stančić 1991; Wheatley 1995; Llobera 1996, 2003; van Leusen 1999; Lock et al. 2014). That approach was characterised by the attempt to include an understanding of the symbolic dimension of past space based on the theoretical strands raised by processual cognitive archaeology (Renfrew 1994). Prehistoric monuments, mounds, cairns and other prominent features in the landscape became the target of such studies, where the visual impact, but also the movement (Van Leusen 1999; Verhagen and Jeneson 2012; Herzog 2013), was assessed in order to find possible patterns connected to the way prehistoric peoples lived and interacted with their surrounding landscape.

On a similar note, Space Syntax methods, first introduced by Hillier and Hanson (1984), developed with the goal of generating insights into the architectural configuration of ancient buildings, relying on concepts intimately related to a perceptual dimension of the space, such as accessibility, movement and exposure/concealment (Banning and Byrd 1989; Van Dyke 1999; Chatford Clark 2007; Stöger 2015).

In this context, and partially as a consequence of the 'phenomenological turn', Gillings and Goodrick (1996) questioned the role of GIS and its very static nature as a tool not really capable of grasping the complexity of the social aspects of ancient space. The main points of criticism focussed on the significant limitations imposed by computational capabilities and traditional map visualisation standards, which reflected on the impossibility of providing a detailed representation of the palaeolandscape. For this reason they introduced the notion of a sensuous GIS, where the simulation of the past reality becomes a pivotal element. Indeed, it was essential to explore alternative ways to data representation and to find a suitable option to integrate multi-dimensional contents in order to cope with the complexity of an experiential approach to the past landscapes. The authors proposed VR as a possible means to provide a more 'humanised' perspective of the (pre)historic space and subsequently VRML as a standard computing language for representing VR contents.

2 VR-based Applications

It is thus partly due to the dramatic advances in computer graphics and partly to the discussion of the role of more dynamic landscape representations raised in the frame of post-processual archaeology (Ingold 1993; Tilley 1994; Llobera 1996) that more scholars started to focus their interest on digitally oriented (multi)sensory approaches to the investigation of archaeological or ancient space. This included some of the first experiments with sound analysis of prehistoric monuments (Watson and Keating 1999; Watson 2001). In the Iron Age site of Danebury, Earl (1999) presents an analytic use of VRML in combination with CAD software for creating controlled viewpoints in a digital landscape where a rendered view is derived and first-person view associated to each viewpoint. This visually based simulation provided some insights into

the original functions associated with the hillfort and allowed archaeologists to question the defensive scope of that space (Earl 1999). The role of senses in relation to the development of a digital ecosystem capable of providing the user with an experience similar (but not equal) to the one lived by the original inhabitant of a prehistoric space is then discussed by Forte (2003), drawing upon Barcelo's idea of developing models to reproduce complex behaviours of agents (human and non-human) interacting with the landscape (Barceló 2001). The main challenge at this point was to move on to an interpretative use of 3D modelling in archaeology (Earl and Wheatley 2002), in which multi-dimensionality and sensory-enriched virtual reconstructions could have provided the users with a formal set of tools for evaluating the experiential qualities of a landscape.

In the attempt to overcome limitations due to the 2–2.5-D visualisation of digital landscapes, texture viewshed was presented as a possible analytical tool to be applied in combination with 3D modelling software to perform visibility analysis in a virtually reconstructed built space of a Roman villa (Earl 2005), where visual prominence, impact and control were measured as a way to understand the sensory-mediated meaning of the social space in an ancient building. In this respect, a more comprehensive and systematic work for interpreting the architectural and iconographic apparatus within the Minoan palace of Akrotiri along with their agency in the frame of liturgical processions is conducted by Paliou (2011), who integrates 3D modelling and GIS functions to perform the analysis. On a related note, Paliou also tried to combine visual and acoustic analysis to explore the sensory dimension of Byzantine churches (Paliou and Kinight 2013).

Additional efforts were made in the attempt to cope with the issue of natural and artificial illumination, an aspect often neglected in most VR-based reconstructions but that has an important agency in affecting the actual perception of an object in the space (Papadopoulos and Earl 2009; Earl et al. 2013).

To further improve the reliability of the visual assessment for ancient or prehistoric monuments, simulated through VR application, Opitz (2017) proposed an assessment based on the evaluation of visual acuity and the capability of the human eye to discern details in an object's view. Richards-Rissetto (2017) explored instead multisensory modalities of analysis for the Mayan site of Copan by combining well-established GIS-based spatial analysis techniques with VR-oriented solutions for increasing the experiential value of the experiment.

3   Where Are We Now?

Throughout its chapters, organised according to a chronological order of the different case studies presented, this volume provides an insight into state-of-the-art research on digital methods and sensory-based studies of the past and the contribution they can bring to the discipline.

In Chap. 2, Eve and Gillings invite the reader to overcome the traditional reliance on representation and analysis of sensory modalities, to explore affects

and invitations-to-act engendered by such sensory encounters. To demonstrate this, the authors present a case study in which a combination of GIS-based mapping and analysis plus virtual, mixed, augmented reality approaches are employed to evoke affects.

A special role in sensory-based investigation of the ancient space is played by the study of sacred or ritual space. In this respect, Sullivan in Chap. 3 explores the sacred space of an Egyptian necropolis by combining multiple sources including textual, art historical and archaeological evidence, with 3D GIS-based technology for answering questions related to the way ancient people create a physical and emotional sense of specialness or distinction in their ritual places.

Concerning the role of Virtual Reality and sensory immersion for archaeological enquiry, in Chap. 4, Sciuto et al. introduce and examine a few case studies where VR was used, respectively, (a) to support the interpretation process in a Mesolithic site in northern Sweden, (b) to capture the intangible art of Roman pantomime in the virtually reconstructed theatre of Pompeii and (c) to study through an immersive approach the photogrammetric models of mediaeval rock-cut settlement and to assess VR Google Earth as an educational students learning ancient topography.

In Chap. 5, Dunn introduces some reflections on the role of digitisation as a freeze-frame process to represent natural movement. Drawing upon a selection of case studies, the author explores and compares the possibilities provided by digital tools to cope with the problem of representing a dynamic phenomenon such as movement in order to improve our understanding of past landscapes and their inhabitants.

Visibility and acoustic analyses represent an important tool also for increasing our understanding of ancient architecture and the original structure of Roman theatres. In Chap. 6, Manzetti introduces an analytical approach to hypothesise the original architecture of Roman theatres in Crete. Her analysis is based on the combination of multiple data source, including 'legacy' data that form the basis for 3D reconstructions that were further analysed in 3D GIS.

A synesthetic investigation of a Mayan urban landscape is presented by Rissetto et al. in Chap. 7. The authors take advantage of GIS, 3D and acoustic tools to create multisensory experiences in VR with spatial sound using an immersive headset and touch controllers for movement. Interestingly, the authors explore the role of landscape in facilitating movement, sending messages and influencing social interaction.

Concerning the possibilities for artefact study and dissemination offered by sensory-oriented digital tools, in Chap. 8, Bozia presents a research project focussed on possibilities for natural interaction, physicality and contextualisation of digitally acquired artefacts and the opportunities provided by 3D printing for hands-on study and experience of the artefacts.

In Chap. 9, Pasquinucci and Landeschi illustrate the contribution that integrated sources can provide to reconstruct a narrative of the past based on a sensory account of a few coastal landscapes in Northwestern Etruria as they were perceived and described by ancient authors. The study of these passages is compared with the output of recent integrated research in the same districts described by the ancient authors.

In Chap. 10, Piccoli discusses about the use of 3D digital reconstructions for providing users with visual cues to increase their perception and so their understanding of historical places by relying on a transparent and philological process of digital anastylosis based on heterogeneous data set which includes the surviving architecture of a room in a seventeenth-century Dutch home.

Misharina and Betts, in Chap. 11, present a methodology for recording sensory data in an urban landscape and consider how the results of such sensory surveys might enable multisensory mapping of ancient urban spaces. This work draws upon Lefebvre's philosophy of social space, according to which it is impossible to make a single map of a city without overlapping temporal, monumental, social and sensory spaces.

References

Banning, E.B. and Byrd, B.F., 1989. Alternative approaches for exploring Levantine Neolithic architecture. Paléorient, pp. 154–160.

Barceló, J.A., 2001. Virtual reality for archaeological explanation. Beyond "picturesque" reconstruction. Archeologia e calcolatori, (XII), pp. 221–244.

Brück, J., 2005. Experiencing the past? The development of a phenomenological archaeology in British prehistory. Archaeological dialogues, 12(1), pp. 45–72.

Chatford Clark, D.L., 2007. Viewing the liturgy: a space syntax study of changing visibility and accessibility in the development of the Byzantine church in Jordan. World Archaeology, 39(1), pp. 84–104.

Crossland, Z., 2010. Materiality and embodiment. The Oxford handbook of material culture studies.

Day, J. ed., 2013. Making senses of the past: toward a sensory archaeology. SIU Press.

Earl, G., Porcelli, V., Papadopoulos, C., Beale, G., Harrison, M., Pagi, H. and Keay, S. (2013) Formal and informal analysis of rendered space: the Basilica Portuense. In, Bevan, Andrew and Lake, Mark (eds.) Computational Approaches to Archaeological Spaces. Walnut Creek, US. Left Coast Press/Routledge, pp. 265–305.

Earl, G.P. 1999. Visualising Danebury: Modelled Approaches to Spatial Theory, in: Dingwall, L., S. Exon, V. Gaffney, S. Laflin and M. van Leusen (eds.) Archaeology in the Age of the Internet. CAA97. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 25th Anniversary Conference, University of Birmingham, April 1997 (BAR International Series 750). Archaeopress, Oxford, pp. 259–264.

Earl, Graeme and Wheatley, David (2002) Virtual reconstruction and the interpretative process: a case-study from Avebury. In, Wheatley, David, Earl, Graeme and Poppy, Sarah (eds.) Contemporary Themes in Archaeological Computing. Oxford, UK. Oxbow Books, pp. 5–15.

Earl, G. 2005. *Wandering the house of the birds: reconstruction and perception at roman italica.* In (Fellner, D.W. and Spencer, S.N. eds.) VAST 2005: The 6th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage, Incorporating 3rd EUROGRAPHICS Workshop on Graphics and Cultural Heritage, ISTI-CNR, Pisa, Italy, November 8–11, 2005 : Short and Project Papers Proceedings

Fleming, A. 1999. Phenomenology and the megaliths of Wales: a dreaming too far?. Oxford journal of archaeology, 18(2), pp.119–125.

Fleming, A., 2006. Post-processual landscape archaeology: a critique. Cambridge Archaeological Journal, 16(3), pp. 267–280.

Forte, M. 2003. "Mindscape: Ecological Thinking, Cyber-Anthropology and Virtual Archaeological Landscapes." BAR International Series 1151: 95–108.

Frieman, C. and Gillings, M., 2007. Seeing is perceiving?. World Archaeology, 39(1), pp. 4–16.

Frothingham, A.L., 1911. Where Archaeology Comes in an Open Sesame. The North American Review, 194(671), pp. 576–588.

Gaffney, V. and Stančić, Z. 1991 GIS Approaches to Regional Analysis: A Case Study of the Island of Hvar. Ljubljana.

Gillings, M., and G. T. Goodrick. 1996. "Sensuous and Reflexive GIS: Exploring Visualisation and VRML." Internet Archaeology 1 (1).

Hamilakis, Y., Pluciennik, M. and Tarlow, S., 2002. Introduction: Thinking Through the Body. In, Hamilakis, Yannis, Pluciennik, Mark and Tarlow, Sarah (eds.) Thinking Through the Body: Archaeologies of Corporeality. London; New York. Kluwer Academic/Plenum, pp. 1–21.

Hamilton, S., Whitehouse, R., Brown, K., Combes, P., Herring, E. and Thomas, M.S., 2006. Phenomenology in practice: Towards a methodology for a 'subjective' approach. European Journal of Archaeology, 9(1), pp. 31–71.

Hamilton, S. and R. Whitehouse, eds. 2020. Neolithic Spaces: Social and sensory landscapes of the first farmers of Italy, Vols 1 and 2. London: Accordia.

Herzog I. 2013, Theory and practice of cost functions, in F. Contreras, M. Farjas, F.J. Melero (eds.), Fusion of Cultures. Proceedings of the 38th Annual Conference on Computer Applications and Quantitative Methods in Archaeology (Granada, Spain 2010), BAR International Series 2494, Oxford, Archaeopress, 375–382.

Hillier, B. and Hanson, J., 1984. The social logic of space. Cambridge university press.

Ingold, T. 1993 'The temporality of the landscape', World Archaeology 25(2), 152–75.

Johnson, M.H., 2012. Phenomenological approaches in landscape archaeology. Annual Review of Anthropology, 41, pp. 269–284.

Joyce, R.A., 2005. Archaeology of the body. Annu. Rev. Anthropol., 34, pp. 139–158.

Lake, M. W., P. E. Woodman, and S. J. Mithen. 1998. "Tailoring GIS Software for Archaeological Applications: An Example Concerning Viewshed Analysis." Journal of Archaeological Science 25 (1): 27–38.

Llobera, M. 1996. "Exploring the Topography of Mind: GIS, Social Space and Archaeology." Antiquity 70 (269): 612–622.

Llobera, M. 2003 'Extending GIS-based visual analysis: the concept of visualscapes', International Journal of Geographical Information Science 17(1), 25–48.

Lock, G. 1995. Archaeological Computing, Archaeological Theory, and Moves towards Contextualism, in: Huggett, J. and N. Ryan (eds.), CAA94. Computer Applications and Quantitative Methods in Archaeology 1994 (BAR International Series 600). Tempus Reparatum, Oxford, pp. 12–18.

Lock, G., M. Kormann, and J. Pouncett. 2014. "Visibility and Movement: Towards a GIS-based Integrated Approach." In Computational Approaches to the Study of Movement in Archaeology: Theory, Practice and Interpretation of Factors and Effects of Long Term Landscape Formation and Transformation, edited by S. Polla and P. Verhagen, 23–42. Boston, MA: De Gruyter.

Meskell, L., 1996. The somatization of archaeology: institutions, discourses, corporeality. Norwegian archaeological review, 29(1), pp. 1–16.

Opitz, R., 2017. An experiment in using visual attention metrics to think about experience and design choices in past places. Journal of Archaeological Method and Theory, 24(4), pp. 1203–1226.

Paliou, E. 2011. "The Communicative Potential of Theran Murals in Late Bronze Age Akrotiri: Applying Viewshed Analysis in 3D Townscapes." Oxford Journal of Archaeology 30 (3): 247–272.

Paliou, E., and D. J. Knight. 2013. "Mapping the Senses: Perceptual and Social Aspects of Late Antique Liturgy in San Vitale, Ravenna." In the Proceedings of CAA 2010, Computer Applications and Quantitative methods in Archaeology, International Conference, Granada 6–9 April, 2010, pp. 229–236.

Papadopoulos, C. and Earl, G.P., 2009, September. Structural and lighting models for the Minoan cemetery at Phourni, Crete. In Proceedings of the 10th International conference on Virtual Reality, Archaeology and Cultural Heritage (pp. 57–64).

Pollock, J.L., 1967. Criteria and our knowledge of the material world. The Philosophical Review, 76(1), pp. 28–60.

Renfrew, C. 1994 'Towards a cognitive archaeology', in C. Renfrew and E.B.W. Zubrow (eds) The Ancient Mind, Cambridge, 3–12.

Richards-Rissetto, H., 2017. What can GIS+ 3D mean for landscape archaeology?. Journal of Archaeological Science, 84, pp. 10–21.

Skeates, R. 2010. An archaeology of the senses: prehistoric Malta. Oxford University Press.

Stöger, J.J., 2015. Roman neighbourhoods by the numbers: A space syntax view on ancient city quarters and their social life. The Journal of Space Syntax, 6(1), pp. 61–80.

Tilley, C. 1994. A Phenomenology of Landscape: Places, Paths, and Monuments. Vol. 10. Oxford: Berg.

Tringham, R. 2013. A sense of touch–the full-body experience–in the past and present of Çatalhöyük, Turkey. Making senses of the past: Toward a sensory archaeology, pp.177–195

Van Dyke, R.M., 1999. Space syntax analysis at the Chacoan outlier of Guadalupe. American Antiquity, 64(3), pp. 461–473.

Van Leusen, M. 1999. "Viewshed and Cost Surface Analysis Using GIS (Cartographic Modelling in a Cell-Based GIS II)." BAR International Series 757: 215–224.

Verhagen, P. and Jeneson, K., 2012. A Roman puzzle. Trying to find the Via Belgica with GIS. Thinking beyond the tool. Archaeological computing and the interpretive process, pp. 123–130.

Watson, A. and Keating, D., 1999. Architecture and sound: an acoustic analysis of megalithic monuments in prehistoric Britain. Antiquity, 73(280), pp. 325–336.

Watson, A., 2001. Composing avebury. World archaeology, 33(2), pp. 296–314.

Wheatley, D. 1995. "Cumulative Viewshed Analysis: A GIS-based Method for Investigating Intervisibility, and Its Archaeological Application." In Archaeology and Geographical Information Systems: A European Perspective, edited by G. Lock and Z. Stancic, 171–185. London: Taylor & Francis.