The Embodied GIS. Using Mixed Reality to explore multi-sensory archaeological landscapes.

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Introduction

Geographic Information System (GIS) approaches to landscape analysis in archaeology have traditionally been confined to the computer laboratory. Phenomenological analyses of archaeological landscapes are undertaken within the landscape itself: and rarely the twain do meet (Millican & Graves McEwan 2012). The experiential approach, that is, an exploration of landscape using phenomenological or body-centred techniques (e.g. Tilley 1994), allows us to explore all of the sensory dimensions (at least of the modern world) using our bodies and various in-built senses. Attempts to use an experiential approach to landscape within a computer environment have primarily focused on using Geographic Information Systems (GIS) to recreate elements of human perception (e.g. Llobera 1996; Witcher 1999; Llobera 2001; Lake & Woodman 2003; Van Hove 2004; Frieman & Gillings 2007; Gillings 2009). While these computer-based studies have produced interesting results, they are not without their critiques (mainly due to claims of environmental determinism [see Wheatley 1993]) and, in particular, beyond some notable exceptions (Mlekuz 2004; Frieman & Gillings 2007; Gillings 2009), they have tended to focus mainly on the visual aspect of perception rather than encompassing all of the senses (see Thomas 2008 for a critique exploring the wider problem of ocularcentrism in archaeology; Rennell 2009, pp.37-49 for further discussion).

As Mark Gillings says of the phenomenological turn, "...if the interpretation of landscape [lies] not in its measurement, abstraction and representation, but instead through immersion, movement and perceptual engagement, then how [are] archaeologists to go about recognising, gathering and interrogating this data" (2012, p.602).

This paper presents a method of bridging this gap by using Mixed Reality (MR). MR provides an opportunity to merge the real world with virtual elements of relevance to the past, including 3D models, soundscapes, smellscapes and other immersive data. In this way, the results of sophisticated desk-based GIS analyses can be experienced directly within the field and combined with a body-centred exploration of the landscape: creating an *embodied* GIS. In this paper I will first introduce the concept of Mixed Reality and discuss some previous archaeological applications, before going on to present my concept of an embodied GIS alongside a number of case studies undertaken in two prehistoric landscapes (Leskernick Hill, Cornwall and Moesgaard, Denmark) and a post-medieval cemetery in York, England.

Mixed Reality

Virtual Reality (the creation of entire virtual worlds that can be explored within a computer), has been used in archaeology for many years (see Renfrew 1997). However, the term Virtual Reality now really only covers one aspect of so-called virtuality. As technology has advanced, we are now able to merge computer-generated 'reality' with the real-world, creating a Mixed Reality (MR) (Ohta & Tamura 1999). This has lead to the creation of a scale of virtuality (the Reality-Virtuality continuum - see Figure 1) (Milgram & Colquhoun 1999),: the scale goes from the Real Environment (RE) through Augmented Reality (AR), Augmented Virtuality (AV) to a full Virtual Environment (VE).

The focus for this paper is the Augmented Reality (AR) section of the continuum. AR is a blend of the real world with some limited level of augmentation from the virtual world. AR "...allows a user to work in a real world environment while visually receiving additional computer-generated or modelled information to support the task at hand" (Schnabel et al. 2007, p.4). This normally involves overlaying the live video feed from a mobile device with virtual objects. It allows new objects to be created and inserted into the real world, but "still holds the real elements and analog conditions as an indispensable part of its nature" (Ma & Choi 2007, p.36). One implication for archaeologists, for example, is that it is now possible to visit an archaeological site with a tablet computer or mobile phone, hold up the device and view the site virtually reconstructed on the video feed, while exploring the site *in situ*.

ARCHEOGUIDE, released in 2001, is an early example of using an AR device to aid in a tourist's experience of an archaeological site. The user is given an AR Head-Mounted Display (HMD) and reconstructions of the ancient buildings are overlaid directly onto the real world. The more recent Cultural Heritage Experiences through Socio-personal interactions and Storytelling (CHESS) project takes a similar approach - users are led on a personalised tour through the new Acropolis Museum, with the AR content being delivered through a handheld tablet (Roussou et al. 2013). Christopher Witmore presents a slightly different approach, citing work by the artist Janet Cardiff, in which she supplies the user with a small video camera on which she has loaded a previously recorded tour of a site. The user then attempts "to synchronize their movements through the same locale with her prerecorded journey by maintaining their pace and carrying a small digital video camera as if they were filming the same sequence"(Witmore 2004, p.61).

George Papagiannakis *et al.* (2004; 2005; 2007) produced one of the best known cultural heritage AR applications, centred on the site of Pompeii. Using a tracked video-see-through Head Worn Device (googles) and dynamic modelling of the real and virtual world, Papagiannakis and his team were able to insert virtual characters into various buildings within Pompeii and enact a real-time storytelling scenario.

The Embodied GIS

Whilst some of the previous applications of AR in archaeology have been landscape-based they have been focused on the tourism, storytelling and reconstruction aspects of using AR in archaeology. No application has yet been produced that uses AR to expand our archaeological knowledge or use it as a tool for the investigation and exploration of ideas and the production of new interpretations of landscapes. Previous AR applications have been used solely for the presentation or explanation of existing ideas, creating an essentially passive experience. I argue that AR has greater potential than this and can be used in an active way as a means of investigation and to find out new things about the past, rather than just to consume existing knowledge. To address this, I here present a manifesto for the use of AR in archaeology, one that calls for a closer relationship between analysis and experience and harnesses the *in situ* nature of AR to the exploratory power of GIS analysis (Eve 2012; Eve 2014).

Peter Zwart (1993) coined the term 'embodied GIS' in 1993, but his vision was that GIS would be embedded in all software and hardware, and unnoticeable to the user. My vision for an embodied GIS is centred round the acceptance that GIS technology is simply a method to enable our evidence to be recorded and explored spatially. This 'space' is normally represented only within a computer environment and viewing it is limited to a screen, usually in an office. We need to move away from the office and use the GIS technology to give archaeological objects and concepts *a place* in physical space. We need to be able to explore and use the GIS data *within the space* that is being modelled. This is not an eschewing of GIS, instead it is the enablement of GIS technology to be explored in the way that it always should have been, naturally and *in situ*.

My concept of an embodied GIS, then, is simply this - the combination of traditional GIS technology and Augmented Reality technology - allowing the experience of the GIS data within the field and the ability to feed directly from the field into the GIS. All of the data held within the GIS should be readily accessible when actually visiting the archaeological site. This does not mean taking a laptop out into the field and sitting down with the GIS data, or even using a tablet version of the GIS software. Instead, the data need to be able to be visualised *as if they were directly there in the landscape* - overlaid on the hills, plains and rivers themselves, reacting, developing and changing as one moves through the space. One should be able to walk around the data, through the data and query and update the data. It is a step beyond the blinking red location dot of Google Maps or the entirely virtual world of VR - out of the abstraction of the flat plane digital map or the entirely falsely rendered 3D world, and into the real world. With the limited addition to the landscape of data from the GIS, the landscape itself is being used as a canvas (Eve 2012). The introduction of the virtual elements should be kept to a minimum and, in contrast, the landscape itself should provide the bulk of the experience - the way in which steep slopes tire you; the shelter gained from standing in the lee of a hill; the smells of the flowers; the sound of the birdsong; and the views and perspectives that open and close as you explore the landscape. Elements such as these are vital to the way humans experience space and what it means to them, and are vital to the experience of that specific landscape: but which are extremely challenging to recreate within traditional GIS.

The embodied GIS also encourages, perhaps even demands, the inclusion of other senses within the GIS dataset. For too long the use of GIS in archaeology has been only about vision (see Lake & Woodman 2003), and the AR interface offers the opportunity to use the other senses when exploring the landscape: the smells and sounds of animals in the landscape, the smells and sounds of the landscape itself, water, wind, trees and so on, the everyday things that would be experienced by everyone as they went about their lives. By enabling and demanding the inclusion of these extra senses, GIS users are encouraged to take account of the need for these extra data and to further integrate them into their GIS analyses (see Rennell 2009, chap.9). Without the addition of the other senses - or at least a move toward their integration - the AR experience will seem flat and lifeless, a pertinent reminder for traditional GIS users about the brevity and limitations of their hamstrung datasets (Eve 2014).

The embodied GIS should also always be part of a feedback loop (Figure 2), not merely another way of seeing the GIS data. In order to be an effective tool, the embodied GIS user should be able to make changes to the data from either the embodied interface or by using the more traditional GIS interface. Both need to interact with and use the same underlying data structure and datasets. A change made using the GIS interface should be directly updated and experienced within the embodied interface and *vice versa*. That way the strengths of both interfaces work together to refine and improve the underlying dataset. The embodied user should also be able to add or delete objects from the dataset. The embodied GIS, therefore, is another way into the GIS dataset and a different 'view' on the same data - one that is enriched and informed by the landscape under study itself, that raises questions and challenges the underlying data in the GIS model, and which allows the user to further refine that model and to experience it *in situ*.

The embodied GIS in action

The creation and deployment of the embodied GIS involves a number of steps. The technical details of the process have been documented in detail elsewhere (Eve 2012; Eve 2014), in short, a 3D model of the landscape is created within an iPad application which can then be loaded with data fed directly from a desktop GIS. This initial model can then be used for augmenting different senses, for example, the nature of the software allows this data to be overlaid on the landscape as 3D objects that appear with the correct perspective and scale on the video feed of the iPad (Figure 3). In the following sections I will discuss augmenting visual, aural and olfactory elements into modern archaeological landscapes.

Vision (*Leskernick Hill, Bodmin Moor, Cornwall. England)*

I first present an application of the embodied GIS undertaken within the Bronze Age landscape of Leskernick Hill, Bodmin Moor, Cornwall (Figure 4). Leskernick Hill nestles in the north-eastern part of Bodmin Moor in Cornwall. It is an unimposing hill, dwarfed, over-looked and virtually enclosed by a ring of surrounding hills. The advent of the Neolithic and Early Bronze Age in the UK brought the construction of various different types of ritual or ceremonial monuments, including long cairns, stone rows, stone circles and hill-top enclosures, many of which are found on Bodmin Moor and Leskernick Hill. As the late Neolithic transitions into the Bronze Age, we also begin to find widespread evidence of permanent and substantial domestic settlement areas, enclosures, fields and cultivation of the land (Tilley 1996, pp.167-168). This pattern continues through the Bronze Age, with approximately fifty round Bronze Age house circles in two distinct settlements on Leskernick Hill by the Middle Bronze Age into the Late Bronze Age (1500-1000 BC). During the mid- to late 1990s, the domestic and ritual setting of the fifty roundhouses and structures of Leskernick Hill were subjected to an intensive archaeological and phenomenological investigation (Bender et al. 1997; Bender et al. 2007). A wealth of data were collected (including survey, phenomenological, and excavation records) making it an ideal candidate for testing the embodied GIS.

As part of previous research I undertook a formal experiment to investigate the effectiveness of using visual augmentation in the embodied GIS to provide a feeling of *presence* in the landscape and to assess whether the embodied GIS aids in identifying the location, size and shape of the Bronze Age houses. The experiment is explored in full elsewhere (Eve 2014), and here I just present the results and a brief methodology.

A 'traditional' GIS model of the hill was created, with two viewing areas specified (Figure 5). These locations were chosen as they have different perspectives on the rest of the settlement. House 50 stands slightly apart and has a view up a slope to the rest of the houses. House 35 is part of cluster of houses, and was chosen to explore the feeling of being deep within the settlement. A series of tests were undertaken using different from both viewing areas, where the participants were asked to count the number of houses they thought the could perceive without augmentation; with augmentation using small white spheres; and finally with fully rendered Bronze Age house reconstructions being augmented via the iPad screen sized to fit the traces of the houses on the ground (Figure 6).

From both viewing areas, the number of houses seen when looking through the iPad (without any AR mediation) was less than the number of houses that can be seen without the iPad. The resolution of the iPad screen is clearly not as high as what can be seen with the naked eye, flagging up the issue that any mediation through an electronic device will affect what can be perceived (Mann 1998): even though the Augmented Reality interface augments the view, it also diminishes some areas of perception because it is necessary to look through a screen. However (and perhaps unsurprisingly), when the fully rendered houses were shown the participants were able to identify many more houses (even those that were partly occluded behind others). The associated participant comments confirmed that the use of fully-rendered house models added greatly to the feeling of a populated landscape and 'brought the landscape to life' (Eve 2014, pp.95-101).

In this example, the embodied GIS provided a perspective on the settlement that would not have been possible to investigate using either traditional GIS or phenomenological techniques alone. The AR view which included the 3D models of the houses gave a very different impression of the number of houses that were being perceived, and as such gave the participants a perspective on the layout of the settlement impossible with the naked eye alone. The size and shape of the houses are of great importance for both a feeling of presence, but also for the actual overall understanding in terms of crowding and the feelings of enclosure. As an example, the viewing area towards House 50 looked up the hill toward the settlement. These house platforms are extremely hard to discern without augmentation due to the jumbled nature of the archaeological remains on the skyline (Figure 7). When the white spheres were deployed at House 50, a number were hidden behind the rise of the hill, due to the small size of the spheres. However, when the house models were used the top of the roofs of a number of the houses could be seen, with the rest of the house being occluded by the real landscape or by other huts. Without the mediation of the AR device, the settlement on the skyline would simply not have been perceived.

The experiment as run did not engage with the palaeoenvironmental factors (i.e vegetation cover, but see Ghadirian & Bishop 2008 for a modern example) or the issues of the contemporaneity of the houses. Future experiments could be run that build in these factors, and the power of using the GIS model as the background to the AR application would mean these parameters could be easily varied dependent on the underlying archaeological evidence.

In addition, this experiment only investigated the use of the device at two locations (houses 35 and 50), however the ability to move around the site and view it from any angle or location dynamically means that it is possible to use the AR application when undertaking any type of fieldwork on the Hill or even beyond. For example, by using the application to view Leskernick Hill from the top of a nearby peak (Brown Willy) (Figure 8), the addition of the virtual houses immediately brings the settlement into focus and even though the forms of the houses themselves cannot be discerned, their presence breaks up the picture, suddenly creating a feeling of an inhabited landscape, just as would have been the case during the Bronze Age. The ability to move around and through this inhabited landscape also challenges certain assumptions made about the views from each individual house. Rather than looking out of your doorway to the wonderful landscape of Bodmin Moor, or to the nearest burial mound (as is so often assumed in both standard phenomenological and standard GIS analyses, see Eve 2014, chap.7) - many of the houses simply looked out at the back of other houses. The embodied GIS allows us to approach the 'real' view of the settlement from any location, rather than they reified view created within the binary GIS or the lofty phenomenological walk.

Sound (*York Municipal Cemetery, England)*

During the inaugural Heritage Jam (http://www.heritagejam.org), an annual cultural heritage 'hack-fest' I was a member of a group of archaeologists, historians and designers tasked with creating an application to explore the history of the York Municipal Cemetery. York cemetery was opened in 1837 and continued to be a place of active burial until 1966 (Murray 2008). It remains an open public space, with a number of important buildings (for instance, a grade II* listed chapel) and has been under the auspices of the York Cemetery Trust since 1987. The projects created during the 2014 Heritage Jam took many forms and covered many different topics including interactive fiction; 3D visualisations; and even cake-baking (Laino 2014). Our team decided to explore the use of sound in the cemetery and by creating a multi-layered soundscape aimed to see how that would affect a visitor to the cemetery and also investigate its power as a pedagogical tool enabling visitors to engage further with the history of the cemetery itself. The resulting application, entitled Voices/Recognition, was "designed to augment one's interaction with York Cemetery, its spaces and visible features, by giving a voice to the invisible features that represent the primary reason for the cemetery's existence: accommodation of the bodies buried underground" (Eve et al. 2014).

The soundscape has been explored in a historical context by a number of scholars, and in particular, amongst archaeologists as the study of archaeoacoustics (Blesser & Salter 2007; Reznikoff 2008; Fausti et al. 2003; Mills 2010). The majority of these studies attempt to recreate sounds, or to analyse places and spaces for their acoustic properties. However, a soundscape is inherently linked to the person experiencing the sound (Mlekuz 2004, para.2.2.1), the sound is in the ear of the beholder. Where we may be able to recreate the sounds of the historical past, we may not be able to recreate how these sounds came together to create the soundscape of a person existing in that past. The soundscape is a combination of the acoustic properties of sound, space and the individual. However, the acoustic nature of historical sounds *will* affect us as human beings and *will* evoke some kind of emotional/affective response - even if it could be argued that this response is not 'historically authentic' (Eve 2014, pp.113-114).

Voices/Recognition was partly inspired by previous work undertaken by the author and Shawn Graham (Graham & Eve 2013) - a mobile application which takes GPS-located Wikipedia entries, converts them to sound files and plays them through headphones when the user walks into a specified geographic radius. Using a text-to-speech algorithm the Wikipedia entries are whispered at different volumes using different voices, and if more than one entry coincides with the user's location all of the files are played on top of each other. This results in a cacophony of sound in areas where there are many Wikipedia entries, and due to the overlapping nature of the sounds the individual voices cannot be made out - it becomes almost white noise - and in some cases (due to deliberate manipulation of volume) becomes painful to listen to. However, in areas where there are not many entries (places with little recorded history) each individual entry can be easily discerned.

Voices/Recognition takes this basic premise and applies it to the data from the cemetery records. By geo-locating each grave and creating data about the grave occupant from the census records and the headstone it is possible to create a standard GIS database of each grave and its associated data. Many cemeteries already hold this data and it is used for many straight-forward queries, some as simple as finding the grave of one's relatives. However, when the database is used with the Voices/Recognition application this database can then be used to play each grave's 'story' as the user is walking around the cemetery. The resulting embodied GIS takes this seemingly prosaic database of grave details and transforms it into a 'live' database that can be explored and experienced *in-situ.*

The creation of the application and a video showing it in action can be seen below:

INSERT EMBEDDED HERITAGE JAM VIDEO HERE <https://www.youtube.com/watch?v=wAdbynt4gyw>

The use of this application has already raised many important issues about the cemetery that were not necessarily considered previously. For example, there are a vast number of unmarked burial pits within the cemetery itself, usually resulting from pauper's graves or alternatively bodies that have been moved to make way for new burials. The majority of these burial pits are located below the many paths that wind through the cemetery. A visitor to the cemetery may not be aware of these burials, as there is nothing to indicate them visually. However, when using Voices/Recognition the inhabitants of these unmarked burials are each given a voice. It is impossible to know how many actually burials are contained within each pit therefore they represented by a cacophony of different voices talking randomly. The areas of the cemetery that are visually empty are suddenly transformed into areas containing a vast number of voices of the dead. There is a common belief that it is bad luck or disrespectful to walk over somebody's grave, therefore the 'empty' paths that were previously seen as a 'safe' places to walk, suddenly become areas that are superstitiously liminal. The use of the embodied GIS in this case is causing the user to think very differently about the spaces they are moving through and challenges the user to re-examine their preconceptions about the cemetery itself.

Smell (*Moesgaard Archaeological Trail, Denmark*)

"*Smell, this most liminal of senses, carries a great subversive potential in its ability to violate boundaries, assault rationality, and evoke powerful emotions of disgust and attraction." (Fjellestad 2001, p. 650).*

As has been demonstrated, the technology for creating digital visual imagery and sound via a mobile device is well advanced and relatively easy to implement. However, the embodied GIS should not just be limited to those senses that are convenient. The everyday for people in the past was not simply experienced through what the could see or hear and smell clearly played a vital part in the sensorium of the past (see the papers in Bradley 2014).

Smell has been used previously in a number of museum settings to engage visitors with this past sensorium: the smell of the Tyrannosaurus Rex in London's Natural History Museum (BBC 2001); the Jorvik Centre in York (Walsh 1990); and the Metropolitan Museum of Art in New York (Ucar 2015). These explorations of smell are almost exclusively confined to *presenting* smells to the museum visitor for consumption, usually as a novelty. For example, at the Jorvik centre the visitors are moved through the recreation of a Viking town via a 'Time Car' on fixed rails (Sunderland 2014), they are moving through the smellscape which changes depending on how far along the ride they are. Without doubt the multi-sensory experience of Jorvik affects the way visitors think about the exhibits and Aggleton and Waskett (1999) have demonstrated that a visitors recall of the exhibit is better if they are exposed to similar smells at a later time, but due to the 'theme-park' style Time Cars there is little chance to independently explore the multi-sensory atmosphere.

The olfactory challenge for the archaeological embodied GIS is to enable these smells to be experienced *in situ* while investigating an archaeological site. The smells should be an integrated part of the GIS database, for instance, when dealing with Bronze Age roundhouses as in the vision section above, the smells and well as the appearance of these roundhouses should be experienced when using an embodied GIS. To enact this the olfaction triggers are simply linked to the GIS data in the same way as the size, shape and orientation of the 3D model for the roundhouse is or the audio files for the burials in York Cemetery.

To demonstrate how this is achieved, I will discuss my use of the Dead Man's Nose (DMN) project at Moesgaard Museum's archaeological trail. The archaeological trail at Moesgaard consists of a number of different sites at which there are a combination of reconstructions, excavated archaeological remains and standing buildings. These sites range in antiquity from the Neolithic to the Medieval period. The Dead Man's Nose is a device that uses an Arduino microcontroller, a number of small computer fans and a number of different scents. The work was initially undertaken as part of my PhD research, but was extended during the 2015 York University Heritage Jam. The video below explains the mechanics of the device and also shows it in action at Moesgaard Museum:

INSERT EMBEDDED VIDEO FROM 2015 HERITAGE JAM <https://www.youtube.com/watch?v=6yEy9rippJk>

As can be seen from the video, the Dead Man's Nose consists of an Arduino board, battery, a BluetoothLE chip, and four small fans contained within small boxes. The boxes contain small drawers in which a scent can be placed on a small piece of cotton wool, which is then dispersed when the fans blow. The fan boxes also have small pieces of velcro on the back, allowing them to be attached either to clothing or to a board that can be worn around the neck (as seen in the video). The device communicates with a mobile phone using BluetoothLE that reads the user's GPS position and (as with the sound example above) emits a smell, by turning one or more fans, when the user is within a specified radius of an archaeological feature.

The smells used are manufactured by Dale Air (Dale Air 2013), who offer a range of over 100 different smells, ranging from the simple smell of a rose to the more complex smell of decaying flesh in a cannibal's cave. The selection of the correct scent for each of the areas of interest is clearly limited by what is available, but the DMN has four different fans allowing a combination of smells to be emitted at any one time - enabling the creation of complex smellscapes. As with the aural example from York Cemetery the user is able to move around the archaeological site and experience either sustained smells or shorter 'whiffs' of a smell depending on the size of the smell radius as recorded in the GIS.

No formal testing has been undertaken so far with the DMN, but as can be seen from the user experience in the video above - it has the ability to evoke different emotions to a place - some of which are almost certainly at odds with the way that the site(s) are presented today. Smell plays a powerful role in memory recall and can also have a direct impact on our current mood and interpretation of our surroundings. Therefore, by recreating past smells and experiencing them in situ, we are challenging our perceptions and considering the place in a new way both spatially (how the smells change as we move through the site) and temporally (how differently the place may have smelt in the past) (Eve 2016). The embodied GIS is allowing us to think differently about a place, and this in turn allows new or different interpretations of the archaeology to be formed. Would certain buildings be placed in certain positions to minimise the smell of the animal pens? If animals are kept in a certain place, would those noises be heard at all times? If people were working in this area, what sounds would be produced and how would that permeate across the settlement? What relation do these sounds have to the ritual areas, etc.? If this roundhouse's view of the 'holy mountain' was obscured, what would it mean for the inhabitant of that house?

Conclusion

In this paper I have presented my vision for the embodied GIS, and demonstrated its effectiveness in changing the archaeologist's perception of an archaeological landscape through three different senses. In this paper I have presented each sense independently, but the embodied GIS can (and should) combine all of these sensory applications (see Eve 2014). This type of application has great potential for being developed further and for acting as a way to feed new information into the GIS database as a result of fieldwork. Coupling the AR-enabled fieldwork with a GIS model means, in the case of the Cornish example, it would be possible to use the attributes of each roundhouse (for instance the time span, or 'type' of house) to automatically and dynamically change the augmented models. In this way it would be possible to investigate the views of the settlement over the life of the settlement itself, perhaps first showing the early phase, and then adding new houses as they are built, and being able to view the site during these different time phases. The same could be applied to the York and the Moesgaard examples, using the spatial as well as the temporal depth represented within the GIS model. This results in an application that allows archaeologists to explore their sites dynamically in any number of different ways in any number of different time periods *in-situ*.

The embodied GIS is not a system that encourages mere consumption of data, instead it fosters the opportunity to question both the landscape being walked through, and the data that underlies the computational analysis. I have shown the potential of a mixed reality application to transform the practice of landscape archaeology and bridge the middle ground between computational and phenomenological fieldwork and, in doing so, I have created a way in which we can view archaeological landscapes in a more nuanced and sometimes completely different light. We can now experiment with the experiential approach *in situ* but in such a way that the conditions of the experiments can be reproduced, shared and documented.