A DWELLING PLACE IN BITS

by

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Abstract: This paper considers computed means for constructing and interrogating prehistoric architectures. We ask where the 'landscapes' created through points and arcs divide us from the prehistory we seek and whether in fact these virtual landscapes offer new prehistoric places in which to dwell. Taking as a starting point the formulation of models of prehistoric space the paper considers how habitual computed action, constrained as much by technological systems as by archaeological information, and informed by analytical approaches to such 'architectures', defines places usefully from which to consider dwelling choices and dwelling experiences. By considering the development of landscape as a complex cultural continuum, incorporating both prehistoric architectures and natural features reinterpreted through the environmental experience of successive generations, it becomes possible to produce parallel dwelling places in virtual worlds which we can inhabit, and from which we can develop novel narratives of the past.

Key-words: Avebury; archaeological computing; GIS.

Resumo: Este artigo trata dos meios de construir e de interrogar arquitecturas pré-históricas por computador. Perguntamos em que é que as "paisagens" criadas através de pontos e de arcos nos separam da pré-história que procuramos entender, e se de facto estas paisagens virtuais nos oferecem novos sítios pré-históricos propícios a "serem habitados". Tomando como ponto de partida a formulação de modelos do espaço pré--histórico, o artigo considera o problema de como é que a habitual metodologia de computação, condicionada tanto pelos sistemas tecnológicos, como pela informação arqueológica, e informada por perspectivas analíticas dessas "arquitecturas", define lugares de forma útil, lugares esses a partir dos quais possamos considerar várias hipóteses e experiências de "habitar". Considerando o desenvolvimento da paisagem como um *continuum* cultural complexo, e incorporando tanto as arquitecturas como os acidentes naturais pré-históricos, reinterpretados através da experiência ambiental de gerações sucessivas, torna-se possível produzir "lugares de habitação" ["dwelling places"] paralelos em mundos virtuais em que possamos habitar, e a partir dos quais desenvolver novas narrativas do passado.

Palavras-chave: Avebury; computação arqueológica; SIGs.

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INTRODUCTION

Perhaps perversely this paper focuses on the nature of one specific form of architecture – computing systems – and the impact of it on understandings of what might be a second architecture – that of the Avebury henge monument. We argue that as practitioners in archaeological computing we are embedded in worlds in some ways more profoundly than all but the most developed landscape study, photographic essay, or performative artwork. We believe that the act of dwelling within the architecture of bits and bytes is key to the negotiation of our pasts. Much of the extant GIS and other computational literature deals with the relationship between dwelling in constructed binary spaces, relative to the pasts these seek to construct, define, represent and rediscover. Here we add to this the dwelling process of sitting at the computer, merging with and being constrained by it. We are sometime architects of the past, using software designed for the modern tower block to divide up and to enclose. But as architects create spaces that are used, gain further histories and are redefined, we seek to define architectures on the basis of what remains and our own understanding of those who have dwelt in them, a form of architectural reverse engineering. We are also cartographers of the past, drawing in a landscape for dwelling tied to specific computer architectures of practice. As Andy Clark (1997) argues, we use our surroundings, in this case our virtual worlds, as an extension to our own minds; as such, the GIS becomes an integral part of our thinking, giving us new potential for considering the prehistoric, "*as much as a place to think as a simple data management and mapping tool*" (Gillings and Goodrick 1996).

Perhaps due to the apparent simplicity of their application, computer representations of space now pervade our archaeological consciousness. The plans and sections we use, the location maps, the isometrics, matrices and sketches. We know, frequently from geography, the power of such devices. But in constructing architectures of the past we might often break the relationship between embedded knowledge of material culture and the systems used to pass the knowledge on. One might argue that just as we redefine our understandings of material culture better to represent a period and geographic context, so we must redefine the tools employed. Taking GIS as an example, here we have a tool that is in no sense revolutionary. It is largely overlooked by a computer science baffled that something so technologically mundane can be seen by a particular discipline as something of a panacea. But it is perhaps because of the synergies between archaeological practice and GIS that it has become so commonplace. In fact, GIS is archaeological practice. The authors are all archaeologists first and foremost and GIS practitioners second. Just as the hard-won skill in excavating a feature, constructing and illustrating a matrix in a wind swept, rainy field is performative so is the point, click and attribute of the laboratory.

ARCHAEOLOGICAL COMPUTATION IN THEORY

Archaeological applications of computational approaches have been critiqued (see for example Tilley 2004; Thomas 2001), largely in terms of their perceived objectifying, systematising (they are after all geographic information systems), sanitising or gendered biases inherent in them. Criticism of computational approaches is frequently oblique, and rarely references the extensive literature produced by practitioners. Typical is Thomas (2001) for whom the contemporary concept of landscape is feminized, with the female body acting as metaphor for landscape and nature which is in turn treated as a passive object of visual pleasure. It is, he continues, therefore troubling that "*we habitually make use of a series of spatial technologies (GIS, satellite imagery, air photography) which seek to lay bare and penetrate the land* " (2001: 169). Whether or not one accepts the argument regarding feminisation of landscape, the case that the spatial technologist is a kind of 'landscape pornographer' relies on further assumptions (unsupported by reference to the available literature) that practitioners are somehow disengaged from the landscape of interest by their use of such methods, and that they are unaware and uncritical of the active role of the tool in framing how landscape is viewed. We take the view – based on considerable personal experience and supported by a wide reading of the literature on GIS and computational methods – that neither of these assumptions holds. None of this is to argue (as some practitioners have) that computational approaches to archaeology are 'theory neutral' or 'just tools', but rather that our relationship with the machine is actually highly significant and is rather more complex than either critics or practitioners have yet accepted.

Huggett has demonstrated that archaeological computation has not avoided self-reflection (2004; see also 2000), an example being Lock's critiques of assumed technological progress (2003). The computer no longer requires certainty – the advent of fuzzy approaches means that it is not based on hard data (Nackaerts, et al. 1997; Fisher 1991; 1992). The assumption that computer practice fosters generalisation and standardisation is also incorrect. The computer does not represent interpretations any more or less convincingly than the book, article or presentation – three decades of computer games and film mean that we are all constantly problematising the digital. Further, computational work is rarely devoid of emotion – construction of a model is tied to experience and interaction, and relates directly to the physical environments in which that interaction takes place (the laboratory with its people, sounds, smells and peripheral images, and the computer itself, organised through personal histories into a familiar place). Computational practice is gendered but this does not go uncritiqued, with continuing debates surrounding hypermedia, GIS and the body, particularly considering a gendered perspective (Kwan 2002). The computer

does not restrict us to gross simplifications of human action and material culture – we do that ourselves. The computer, when understood for what it is and how it functions, is not that different from other modes of interpretation and interaction with our source material. For example, approaches to time, human agency and perception, semantics and linguistics of space are all research topics being investigated using GIS (see for example Fisher and Unwin 2005; Gaffney et al 1996); far from being reductionist, the GIS facilitates such complex analysis.

The broad range of contemporary computational practice should not come as a surprise. As an immediate example one might consider hypermedia; a technology at times grossly hyped but with considerable, enduring potential. The archaeological reader may follow a host of authors through the ebb and flow of technologies that purport or succeed in disrupting previous interactions and providing novel dwelling environments (e.g. Haraway 1997): the wiki, Traumwerk[1], collaborative learning environment, the computational ontology. These are areas in which computer science is profoundly interested and within which sociology and psychology have found a seemingly inexhaustible resource. In the broader definition of cybercultures, and further extensions to dwelt realities, we see useful exploration – in cinema, photography, and art. Here technology creates whole new, extensively theorised sensory spaces (Tomas 2004) with the virtual defining our understanding of the world, not the model of it. So then in virtuality – in the construction of worlds to cohabit immersively and interactively – we see in the archaeological, urban geography and architectural literature specific concepts of dwelling in unreal spaces and their relationship to experience (e.g. Beckman 1998; Earl and Wheatley 2002).

The literature references simulation; virtual geographies dwell on the nature of place; computer science attempts fully and near totally to mimic reality; museologists commission and give voice to avatars as representatives of self and others. Critiques of these areas tend to deal with the consequences of the system as produced. But the dwelling we define here is also in the habitual production of such environments. We have argued elsewhere that it is the making of virtual reality archaeologies that renders them useful, rather than their exploration. So too we argue that it is the making of the geographic information system, the construction of our virtual dwelling place, that pervades our understanding of the past. So what kinds of dwelling experience can we see in a specific prehistoric case, that of the landscape around Avebury?

[1] http://metamedia.stanford.edu/projects/Traumwerk/Home

AVEBURY

The Henge at Avebury is one component of a much larger complex of prehistoric sites in the Kennet Valley. The broader landscape includes a large number of barrows, including a number of chambered long barrows, the enigmatic Silbury Hill, Europe's largest man-made mound, and two avenues, lines of paired megaliths. In addition there are numerous flint scatters, enclosures and stone circles of prehistoric date, with much of the activity dating to the Neolithic. The henge itself exhibits a number of interesting characteristics with regard to its internal spatial and temporal configuration; multiple phases of activity resulting in an internal ditch with external bank, internal stone circles and other features and multiple entrances. These characteristics have been considered both to define and imply interactions within the constructed spaces. The broader context for the henge, the surrounding landscape and the plethora of archaeological sites found there, again exhibit a variety of spatial phenomena, some of which reference natural aspects of the landscape; circular monuments in circular landscapes, alignments between henge entrances and watercourses, visual relationships between sites. These characteristics might be understood and made meaningful through movement and interaction. In blending elements through time, the natural and the anthropogenic today at Avebury we see the results of generations of renegotiated meaning. It is within these contexts that our interests in Avebury have grown. Two of the authors, in addition to being specialists in archaeological computing, have significant research interests in this complex Avebury landscape. One is a co-director of the Negotiating Avebury Project and one is undertaking doctoral research on the formation of the monumental complex. This research has involved development and application of GIS, alongside significant three-dimensional visualisation and analytical components. One of the authors also had responsibility for the Avebury World Heritage Site GIS for a number of years. We would all argue that we have drawn much from the experiences of dwelling in these computed architectural spaces, worlds of dots and lines, texts and images.

How then can we begin to think about Avebury from a dwelling perspective, with the full gamut of meaning that phrase implies? One of us (Wheatley 1995, 1996) has made extensive use of GIS-based techniques to investigate patterns of visibility associated with the long barrows of the region. This has contributed to a growing understanding of the complex and socially inscribed relationships of visibility that may have partly informed the structure of the earlier Neolithic landscape in the region. Such an approach, although unapologetically generalising, is based around the characteristics of the body – the height of human eyes and the limits of human visual acuity. Formal analysis of visibility is also not unproblematised, both theoretically and methodologically (Wheatley and Gillings 2000, Gillings and Wheatley 2001)

and is not seen by practitioners as a totalising explanation, but as contributing one human-centred methodology to complement others that may bring different perspectives. In what we would argue is a complimentary approach Thomas (1999) used field visits and narratives of journeys through the landscape in approaches to the West Kennet Avenue, whilst Devereux (1991) visited numerous locations and observed their visual properties and interrelationships. Approaches such as the latter have been informative and useful by engaging with landscape at a human scale as opposed to the much broader scale, sterile analysis more generally associated with computational landscape practice. This concentration on individualism, however, is not unproblematic. Choice of view, part of an engagement with place, requires assumptions and choices at least analogous to the inputs and outputs selected for GIS based analysis. The difference being in the form by which choices are made explicit, or at least the terms of reference used to define such potential distancing from the act of perception. Since "*[t]he equivocality, heterogeneity or multiplicity of the material world means that choices must be made in perception and to what we attend"* (Shanks and Hodder 1995: 11), we argue that a combination of approaches is required successfully to tackle such issues; using ostensibly 'structured' techniques for the controlled investigation of phenomena but at a meaningful scale taking into account human agency.

Archaeologies of the body (e.g. Hamilakis et al. 2002) have much to offer computational approaches. We cannot disregard bodily interactions with computational devices in our understanding of the worlds created and explored through them. This body-subject is defined through habitual practices and by the specificity of activity. Computation, governed in large part by repetition and extrapolation within minutely defined frameworks leads to a rapid development in such bodily understandings of the virtual worlds encountered (Heim 1998). Here the human scale pervades as much as in a landscape encounter, with the very environment itself governed by what can be seen and touched rather than affording spaces within which to see and move. Given our movement from bodily experience in the world, to embodied understandings of the past landscape, can we see movement in a digital environment any differently? In fact, having walked, smelt and heard a landscape as it is, thinking of how it might have been, how can we not take the opportunity to walk in it as we have imagined and built it to be? Forested, landscaped, denuded of roads and pylons – or are our own landscape archaeologies to be constrained to the apparently, environmentally pristine? And if the bodies exploring these landscapes cannot be the bodies of the past why not explore virtual landscapes more freely, in bodies not wholly our own? Correctly Lock (2003) identifies the distinction between an archaeological virtual landscape and 'real', a point implicit in the bulk of virtual reality and related cyborg theory, and indeed one need draw back from the " *flawed*

pseudo-phenomenology" (2003: 261) he highlights. However, this cannot preclude the use of computed practice and sensory stimulation by archaeologists thinking through things, in this case computers.

Certainly in technologically defined worlds the articulation of senses need never remain static and in particular need never rely on visual components to the detriment of others. Arguments that the technology gets in the way must, and have also acknowledged that this separation is not distinct from the remainder of the representative morass through which the archaeologist wades, whether this might be photography, video or audio. However, following Thomas (2004) the project to 'humanise' digital technologies in this way, itself implying a prior dislocation between the human and the machine created, "*is misguided, principally as a result of the way in which it deals with the concept of perception*" (2004: emphasis original). We do not assume that the world is as Descartes imagined, but rather draw from the Cartesian model of the world within which we, being the we participating in the archaeology, contingent in place, in time, are defined. We do not assume that geometry can be taken as "*unquestionable grounds for digital reconstructions of past worlds*" (Thomas, 2004: 200). Rather that as Gillings (2004) notes, virtual worlds can be understood through Baudrillard's notion of simulacra and hyperreality. As such they are never to be seen as progressively improved correlates to the world. They resemble (or perhaps they sound and feel like) and that, in their carefully considered context, is enough.

CONSTRUCTING INFORMATION SYSTEMS FOR ARCHAEOLOGICAL GEOGRAPHIES

A computational landscape has many histories. One might therefore conceive of a reflexive approach to its creation and to the dwelling within it as an approach to biographical GIS. Here the construction of data models is understood as a series of dwelling processes. In what follows we shall attempt to unravel one such biography for the Avebury simulacra worked with over the past decade. Before analysis comes data, and the gathering of this for any computational model will inspire information assimilation, generally collation into files with accompanying summaries and indices, some of which may be spatial. This is no different from any assimilative research activity – it occurs within a meaning laden, rule based context. It is one which happens computationally to be described as an information schema, but which is in practice a cultural container for experience.

With drawing conventions and orthogonal co-ordinates as their cultural referent GIS have inevitably grown from a top down position of visual dominance. Criticisms

by Thomas (2001) and others perhaps fairly define these explicitly Cartographic metaphors of GIS, at least as generally understood. These rely on a set of representative devices which with great success communicate Cartesian spatial orientations, much as do the excavation plans in an archaeological text. GIS is thus not in itself an imposition but rather a migration of a representative tradition, and one that bases its symbology explicitly on a set of closely circumscribed cultural references. It is only one method for information transference, flawed as is the printed text (Tilley 2004). But still this GIS – the GIS equated to the ceramic distribution plan or context record – falls far short of the GIS of archaeological computing's present and its future. Efforts to move beyond the Cartesian and to explore archaeological datasets in alternative ways have been a constant throughout the development of archaeological GIS, moving ever further away from the "*flat map with its static patterns*" (Hägerstrand 1982); instead we see that encounter, passage, movement, history and memory are and should not be beyond the GIS (Llobera 2003).

At Avebury the compilation of the resource for analysis involved considerable time working with the data to transform it into material suitable for analysis. One of the most informative parts of this process involves examination of data from different sources. It is noticeable the extent to which enforced data structures and multiple and varied interpretations become apparent through the creation of derived datasets from archaeological source material. It is here that the strengths and the weaknesses of the map with lines and dots become apparent. The GIS in this form conveys a simplified message using a range of devices which have become almost ubiquitous. These devices are the lingua franca of human computer interaction and are expected and relied upon, with the effect that interaction can be restricted by them, despite the apparent benefits of having a shared language for communication. However this similarly provides an opportunity since the simplified representation provides in a simple form alternative ways of approaching and presenting archaeological information, ideally producing conflicting or contentious outputs. The ability to encounter a scenario from different angles and to incorporate alternative subsets of the total information set available is useful collage.

Richer datasets give the impression of being able to provide more information and so, from the point of view of information consumption, will be more desirable. As computer interfaces have developed to give us more and more information at once, our expectations have also grown. It is possible to include far more in GIS based systems, both in terms of amount of information and also types and quality of information. While we are only ever creating models or abstractions of reality for use in our analyses, these models are becoming increasingly detailed. Terrain models now have resolutions in the order of metres rather than tens of metres; visibility analyses now include environmental evidence rather than being based on a barren

moonscape; aspects of probability and uncertainty can be modelled rather than assuming simple binary scenarios. While the underlying models become increasingly complex, one consistent interface remains the map representing a simplified view of the data. Onto this and from this extensions into alternative representative mechanisms may grow.

Having assembled the data we have chosen to use in our non-Avebury we then repeatedly explore and modify their representation. Our computed dwelling then is the repeated habitual interaction with GIS, compiling and collating sources, choosing and modifying views on the data, producing derived datasets, comparing and contrasting observations, and extending the limits of knowledge acquisition and storage beyond the mind, through the computer interface and into the GIS-based world created. If "*to build is in itself already to dwell"* (Heidegger, 1951) the perspective on so much data afforded the user is fundamentally changed. Disparate pieces of information, text, images, numbers and geometric shapes, become a multi-dimensional, at times dissonant world available for exploration. Three-dimensional approaches are an aspect of this new archaeological world that can provide additional dwelling experiences over and above those found in two-dimensional GIS, even if their implications are substantively the same as those in a flat-world GIS environment; i.e. dwelling in virtual spaces provides alternative ways to approach data, create information, make interpretations. This is *not* dwelling in virtual spaces that in some way approximate the past. We have never suggested science fiction approaches to archaeological investigation, by which through sensory immersion in a virtual world, acting as a proxy for some indistinctly defined real world, we can develop insights into what the past was really like. The technology will improve and sensory overload will and does occur, leading to environments already indistinguishable from reality. The vocabulary for three-dimensional GIS will become better understood. But dwelling in these will always refer to the varied interactions made possible within a merged human-computer interface, including the structured approaches proffered by Whitley (2004).

PROBLEMATISING DIGITAL DWELLING

There remain serious issues with the ways in which dwelling in a GIS environment influences our thinking. A prime example of this is the representation of archaeological sites in GIS where any site must be represented using one or more of a limited range of geometric shapes. A site can be represented at national scale using a point location, the same site may be represented on a scheduling maplet as a polygon extent, while in the local Sites and Monuments Record (SMR) it may be represented using a

collection of lines to denote extant surface features. This is not simply a matter of depiction but something rather more fundamental. Data types determine the forms of operation it is possible to conduct, and furthermore, they have issues for meaning. Thus, does a barrow or a flint scatter really have a clear-cut 'edge' or boundary? What about coordinate precision and the implications on locations of point entities? What do mean by a 'site' as recorded in a SMR? How many 'sites' are there in a given study area? This is where an uncritical acceptance of the environment in which one finds oneself can be as dangerous in cyberspace as it is in the real world.

The idea that it is this act of dwelling in the digital worlds we create that is important to informing our understanding of the past is further supported by the authors' own experiences building and working with GIS and three-dimensional technologies to investigate the Avebury region. This experience shows that this habitual action is a form of dwelling. It is being and living through an environment, with the processes conducted there themselves undoubtedly a consequence of the lived environment. In a very real way, the authors have spent years dwelling in and experiencing an Avebury that does not and could not exist, other than as a personalised landscape. The computer system is defined according to preference, with an interface produced in history to structure the user's view of the world. The metaphors of the computer are habitual – favourites, bookmarks, a desktop and history encouraging ever greater personalisation of the environments attended.

Dwelling in time is here as contingent as in the real world of birds and sunlight. GIS time, the time inherent in the data, is treated as a series of discreet events along a bi-directional time-line with large periods of unknown between these events. Dwelling time, the time experienced by the user, might be expressed through self-defined interfaces and moments, or by the progress of the clock. These will always be disjointed to allow for periods where the user is literally otherwise engaged or where the nature of engagement is changed by use of a given interface. Where the passing of time is an important factor in the use of the GIS, as in the case of studying movements through the Avebury landscape to develop an experiential narrative, this lack of a temporal model comparable with that found in the real-world is a limiting factor. In the same way that the third spatial dimension in a GIS environment is frequently an approximation, any attempt to represent the fourth (temporal) dimension must be also, with implications for developing an understanding of any model created using such approximations.

Views presented using computational models are simplifications, demonstrating aspects of a set of information selected by the user, based upon a particular theoretical framework. Such views can be very useful, allowing a user to browse information resources from a particular point of view, without having constantly to refer to an external frame of reference. Indeed, such carefully controlled simplifications are an

essential part of coming to form an understanding of a complex phenomenon. An example of this would be ongoing attempts to quantify the nature of circular landscapes, of which Avebury is asserted to be one (e.g. Watson, 2001: 306), a concept much discussed in theoretical discourse but one which has never been adequately defined. By taking falsifiable hypotheses as a starting point and using simplified views on a complex information resource whilst dwelling in a GIS based environment, we can start to formulate novel interpretations of the information available regarding Avebury. We can attempt to deconstruct, for example, this assertion of circularity, what it means and its significance. Are we simply talking about extreme geometric properties of space, that is to say our perception of the world's tendency towards the circular – the world appearing to surround us, being located consistently in the centre of our environment? Or are we talking about some significant and quantifiable properties of certain landscapes, distinguishing them as being circular in nature?

By understanding our practice with regards to GIS from a dwelling perspective we have created a notional space in which to experiment and investigate. There are as ever problems with this approach, and always work to be done creating our particular Avebury resource, but this work has many potential outputs and can be repurposed easily. Undertaking the necessary work in a common GIS-based environment means that familiarity is constantly growing as constant exposure to, and absorption within, digital impressions of a particular location result in a steady increase in awareness of it, irrespective of the professed wishes or needs of the observer.

Interpretation can never begin after the GIS or virtual reality model has been created, after the maps have been printed, and the DVD pressed. We look forward therefore both to spending more time dwelling in computer based worlds and thinking outside them. The digital archaeological future is one against which we may all rail in part, but it seems a likely future and one with which we should engage, if only in order to induce change. The dislocation between archaeological computation and theory perhaps best explored by Gidlow (2000) remains, and can only be hampered by mutual suspicion and critique. Despite many years of research into methods for improving the transparency of computational approaches (Thomas, 2004: 201; cf. Ryan, 1996) the distrust of the omnipotent, lying machine on archaeologists' desks remains. It is only through informed debate and a degree of collaboration on both parts that the potential of digital and non-digital alternatives might be realised, and this spurious distinction deflated. We sincerely hope that this paper and our views on the place of dwelling in computational practice are one step in this direction.

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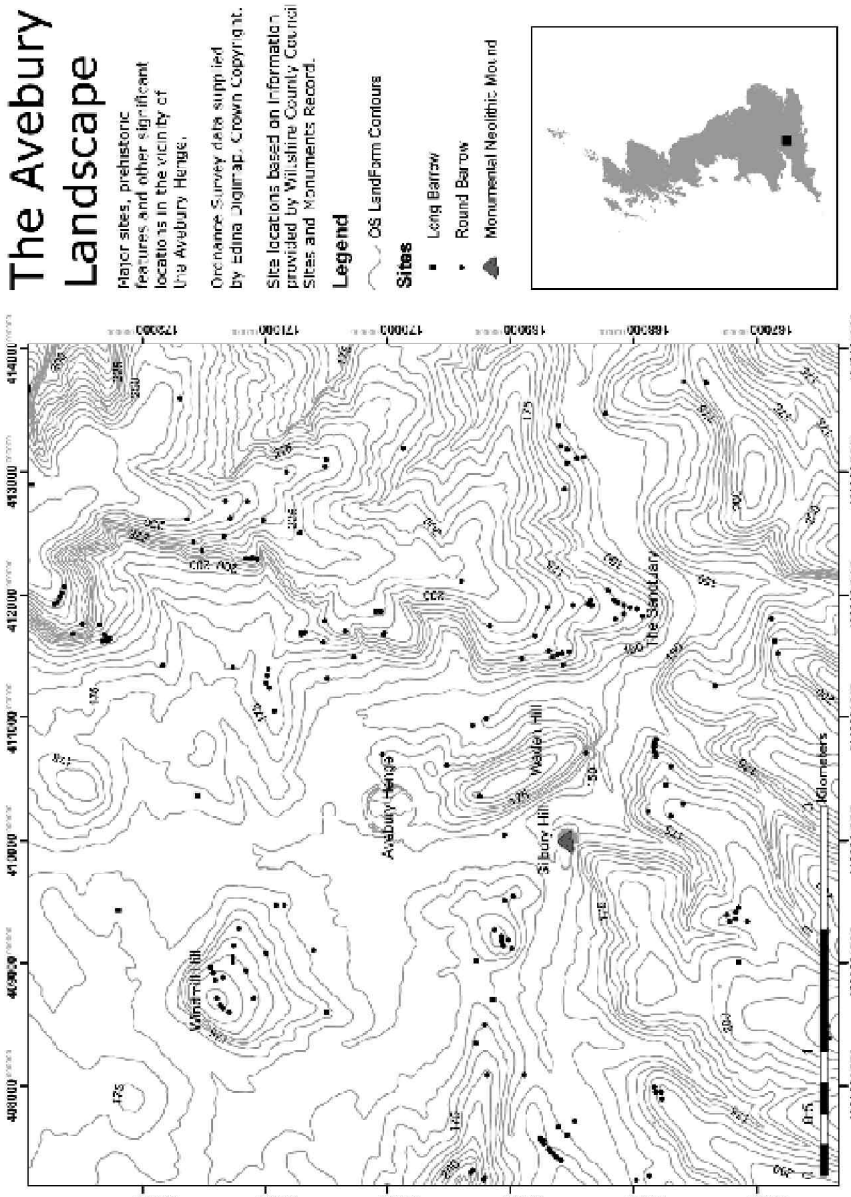

Fig. 1 – Major sites, prehistoric features and other significant locations in the vicinity of the Avebury Henge.

Fig. 2 – A three-dimensional reconstruction of the Beckhampton Avenue, looking down the Avenue from the western entrance to the Avebury henge.