# *Households, Settlements, and Landscapes in Iron Age, Roman, and Early Medieval Northumbria: A Spatial Analysis of North-East England, c. 100 BC-AD 800*

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# ABSTRACT

**Households, Settlements, and Landscapes in Iron Age, Roman, and Early Medieval Northumbria: A Spatial Analysis of North-East England, c. 100 BC-AD 800**

This thesis argues that the spatial organisation of the built environment in north-eastern England between c. 100 BC-AD 800 reflects the complexities of culture contact, the transmission of ideas, and social change. It is suggested here that the examination of space and place in Britain between the late Iron Age (c. 100 BC-AD 43), Roman (c. AD 43-410) and Early Medieval (c. AD 410 to 800) periods can be used to analyse the changes and/or continuities in socio-cultural ideas and traditions. Two study regions to the north and south of Hadrian's Wall within the boundaries of the Anglo-Saxon Kingdom of Northumbria are analysed using established and innovative computational techniques to understand what affect, if any, the inhabitants of Iron Age and Roman Britain had on the shape of the Early Medieval built environment. Settlement data was compiled into a Geographical Information System and established spatial analysis techniques that focus on site placement were combined with an innovative use of Visibility Graph Analysis to quantitatively analyse the spatial organisation of households and communities between c. 100 BC and AD 800.

Visibility Graph Analysis is used to statistically measure the visual arrangement of built space in order to examine continuities or disruptions to the organisation of structures and settlements. The results alter our understanding of this period by revealing broad continuities in the spatial organisation of the built environment across the analysed time periods. This suggests that regional identity was influential in the formation and use of the built environment in the two study regions between c. 100 BC and AD 800. This has significant implications for understanding how Britain was transformed over the *longue durée* between the Iron Age and Early Medieval periods. These findings suggest that continuities in the spatial arrangement and organisation of the built environment are indicative of gradual change rather than abrupt disruption, and adds to current debates on how regions of Britain were transformed between late prehistory and the early historic era.

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# CHAPTER 1

# INTRODUCTION

This thesis investigates how ideas on settlement planning and the use of space in the late Iron Age (100 BC-AD 43) and the Roman occupation of Britain (AD 43-410) influenced the spatial organisation of the built environment during the Early Medieval period (AD 350-800) in what is today north-east England. Scholars have debated the origins of Early Medieval Britain as the result of processes related to the collapse of centralised control in provincial Britain linked with either a large-scale invasion of Germanic peoples or a small-scale, elite takeover of society by the Germanic immigrants (Hamerow, 1994, 1997; Härke, 2011; Hines, 1997; Scull, 1995). This thesis critically examines the relationship between Iron Age, Roman, and Early Medieval Britain by focusing on continuities or disruptions in the spatial organisation of the built environment across regional and temporal boundaries over the *longue durée*. An innovative adaptation of Visibility Graph Analysis (VGA) quantitatively examines the visual organisation of space in conjunction with a landscape analysis using Geographic Information Systems (GIS) and theoretical frameworks focused on the built environment to examine how ideas of space and place were developed, maintained, and adapted over this long period.

North-eastern England can be seen as a marginal frontier zone during both the Roman and Early Medieval periods and this region witnessed varying degrees of contact, immigration, acculturation, and assimilation between multiple cultural groups in what has been argued was a colonial/post-colonial setting (Bowles, 2007; Webster and Cooper, 1996). Scholars have argued that past individuals adapted or responded to living in environmentally or culturally marginal landscapes in culturally specific ways that can be investigated archaeologically (Altenberg, 2001; Coles and Mills, 1998a; Taylor, 1972; Wilkinson, 2003; Young and Simmonds, 1995). Following on from this argument, this thesis focuses on north-eastern England to address the transition from Iron Age through to Early Medieval Britain by examining how changes to the built environment were influenced by the natural environment as well as by the cultural transmission of ideas on space between disparate groups.

Several archaeological and historical priorities for research on the Early Medieval period in north-eastern England are noted in *Shared Visions: The North-East Regional Research Framework for the Historic Environment*. Three of these priorities are understanding Early Medieval settlement patterns and clarifying the Iron Age to Roman and Roman to Early-Medieval transitional periods (Petts and Gerrard, 2006, pp. 146, 153-156). These priorities are not limited to the north-east, as the events and processes following the end of Iron Age and Roman Britain have been a continued source of debate and scholarship by archaeologists and historians. The results of an analysis of the use of space in this region have wider implications for how the built environment was structured throughout the Saxon world. Differences or trends between temporal periods in how space was organised may reflect continuities or disruptions to society during the 1st millennium AD, and could add to the discussion of the origins of Early Medieval Britain.

This thesis demonstrates that the priorities of the North-East Regional Research Framework are linked and that an understanding of the transition from Iron Age to Early Medieval Britain can be understood by focusing on how space and place are arranged at the household, settlement, and landscape levels. This research demonstrates that a specific study of how individuals design (either consciously or unconsciously) the spatial arrangement of the built environment affects what Hall terms the 'the hidden dimension' of a society; the ideas of space and how to act in these areas as specialised aspects of a culture (Hall, 1966, p. 1). This innovative approach allows a reinterpretation of previously recorded archaeological data in order to address these priorities in a different way by focusing on the subconscious cultural norms of spatial development and awareness.

## 1.1 AIMS AND OBJECTIVES

This study investigates the role of Iron Age and Roman Britain in the formation of Anglo-Saxon England through a quantitative investigation of the spatial arrangement of structural forms within settlements and across the landscape in order to address how variations or continuities in spatial patterning reflect cultural transmission between disparate groups. It is centred on two study regions, one north and one south of Hadrian's Wall within the boundaries of the Anglo-Saxon kingdom of Northumbria, itself formed from the merger of Bernicia and Deira (Figure 1.1). It is believed that Early Medieval settlement outside of the formal boundaries of Roman Britain (i.e. north of Hadrian's Wall) would be markedly different from Early Medieval settlement within the boundaries of provincial Britain. These differences may be due to the influence of the social history and values of both indigenous and incoming populations. The different trajectories of settlement and population change over the long term within each region may well have created distinctly different settlement and house forms.

FIGURE 1.1 Overview of approximate boundaries of known Anglo-Saxon and British Kingdoms in the Early Medieval period by the late 8th century, highlighting Northumbria and the two shaded study regions to the north and south of Hadrian's Wall (based on Higham and Ryan, 2014, p. 11, Fig. 1.7).

A focus on space and place as cultural constructs and ethnic markers is an aspect of late Iron Age, Roman, and Early Medieval archaeology that has generally not been examined in a quantitative fashion. An investigation of these concepts and their effect on structural space, transmission of ideas, and cultural hybridisation has the potential to provide insight on many of the pertinent questions dealing with transition from the late Iron Age through Early Medieval Britain. Therefore a primary aim of the thesis is to develop a methodology to quantifiably examine space and the built environment and use this data to compare how culturally specific ideas of structural space were transmitted between social groups in the past. To meet this aim, the following objectives were identified at the outset:

- To quantifiably examine the arrangement of the built environment based on the spatial and visual organisation of structural elements across the *longue durée*, by means of a combination of established computational spatial analysis techniques using GIS integrated with innovative techniques in VGA.

- To statistically compare the quantified data and results and interpret the findings within a framework of established and new theoretical ideas regarding how individuals in the past perceived and used space in the household, community, and/or the landscape.

In order to meet these objectives in this thesis, specific types of archaeological sites from the two study regions are examined using different computational techniques. The GIS analysis investigates patterns of recorded site locations across the landscape, comparing types of site location over time within and between regions and analysing locations in relation to the natural topography, water resources, and underlying geomorphology. The analysis of the visual and spatial organisation of the built environment using VGA examines a range of settlements chronologically dated from the late Iron Age (c. 100 BC-43 AD) through to the 9$^{th}$ century AD. These settlements are drawn from legacy data. The sites chosen have been selected specifically for their relatively complete plans. In each case the settlement plan has been identified based on excavation data, earthwork surveys, and/or remote sensing techniques. While it is recognised that the information provided by these different archaeological techniques can vary dramatically, the emphasis placed here on utilising sites with extensive and relatively complete plans necessitated drawing in sites discovered through a range of different techniques. This is an experimental method in terms of its application to UK settlement data and the priority here has been to test the application of VGA to settlement data over time. Visibility Graph Analysis, as used here, quantitatively compares the built environment across chronological and regional boundaries due to its abilities to determine the visual organisation of settlements and structural forms.

This methodology addresses how the organisation of space and place in Iron Age and Roman society affected the development of the Early Medieval built environment in a comparative fashion between the two study regions, focusing on recorded location and on settlements from across the chronological periods. The need to select sites with relatively complete settlement plans meant some significant type sites are excluded. Notably recognised and well established monastic settlements do not feature in this analysis: several were located outside the study regions (for example Jarrow or Hartlepool) and Lindisfarne, which is included in the landscape analysis in Chapter 4, has not seen extensive excavation and recovery and thus does not have a complete enough plan to be analysed using VGA. Though monastic sites are important for our understanding of Early Medieval society in the North, the adoption of Christianity and growth of monasticism dramatically changed the built environment of Early Medieval Northumbria through imported ideas from the Continent and the Irish Sea zone. For the purposes of this thesis, which aimed to test a variety of applications, it was felt that the focus should be secular settlement forms over time.

There have been excellent studies and reviews of Iron Age, Roman, and Early Medieval buildings and settlements, but relatively few have attempted to examine continuities between these time periods due to the obvious structural variations in house types (roundhouses, villas, and timber halls for example) (Breeze, 2002; Cunliffe, 2004; Foster, 1989; Griffiths et al., 2003; Hamerow, 2002, 2012; Harding, 2004, 2012; Hingley, 2004; Pope, 2007; Powlesland, 1997; Tipper, 2004). VGA is an application that facilitates the testing of continuities in spatial layout and form. Such continuities can exist even when communities choose to change their house or settlement forms – for example, the shape of houses might change but the way houses are situated together within a settlement might continue to be employed. Similarly the structures people live in might radically change in terms of their shape and built form, but the way inhabitants experience that space can be very similar to the way preceding built environments were experienced. This thesis approaches the study of structural space employing VGA as a means of testing:

- continuities in the arrangement of space in the interiors of structures over time.
- similarities between buildings and structural forms within settlements over time and across regions.
- enduring traditions of spatially situating the built environment across the landscape over time.

The results of the spatial analysis and VGA are assessed and interpreted in Chapters 4-7.

In order to critically situate the results from both the spatial analyses and VGA, the following research questions were identified:

- Did settlement placement and settlement form change over time? Can continuities be identified? What may have motivated such continuities?

- Can trends or regional distinctions be discerned, within and outside the frontier, in the placement of settlements and the changing built environment? What role did the natural environment play in the shaping of the built environment over time – can it account for continuities and discontinuities and variations? Can these similarities and variations be explained by long term socio-cultural traditions or political and social interruptions?

- Can similarities or continuities in the use of space between the Iron Age (1st century BC to 1st century AD), Roman (1st to 5th centuries AD) and Early Medieval periods (5th to 9th centuries AD) be discerned within or outside the frontier? What does this suggest regarding the inheritance and exchange of spatial ideas within and between groups and across time?

This thesis tests whether the building and settlement traditions and use of space evident in Iron Age and Roman/ Romano-British societies influenced the practices of the Early Medieval populace. The continuities and changes evident in the results of the analyses presented here are argued to be the product of the insular and transformative changes that were stimulated by cultural continuities and interactions between the social groups inhabiting Britain in the first millennium AD.

## 1.2 HISTORICAL AND ARCHAEOLOGICAL CONTEXT

Traditional views on the origins of England were derived from a fairly limited number of historical narratives written long after the 5th century that focused on a cataclysmic end to Roman provincial Britain brought about by invasions of Anglo-Saxons (so named due to their place of origin on the continent) sweeping away the last vestiges of Rome through conquest. The Anglo-Saxons established kingdoms drawing on their own cultural traditions, ideas, and norms derived from what is today Denmark, Germany, and the Netherlands (K. Dark, 2000; Higham, 2004; Wilson and Wilmott, 2000). Bede notes that British rulers invited Anglo-Saxon mercenaries to Britain for protection after the withdrawal of Roman protection, but this was followed by a large-scale migration of Germanic peoples that drove out, assimilated, or destroyed the native populace in conquering southern and eastern Britain (*EH,* 1:15). This long-established view argues that "a highly visible and famous civilisation, the Roman, disappears totally; a 'Dark Ages' ensues; out of this eventually emerges the origins of Anglo-

Saxon England" (Hooke and Burnell, 1995, p. 12). Archaeologically, the mid-5th century has been seen by scholars as a 'black hole' due to lack of datable material culture or historical documentation of this period before Anglian artefactual evidence becomes more prevalent by the end of the 5th century (Esmonde Cleary, 2001, p. 93; Härke, 2007, p. 58). The differences in the archaeological record between the Romano-British and the Early Medieval periods are stark; the archaeology of Roman Britain is characterised by a wide variety of artefactual and settlement evidence while the studies of Early Medieval archaeology have been dominated by burial evidence and their artefacts. In his comparison of the archaeology of the two periods, Esmonde Cleary states:

> The gross differences in the archaeological record between the later fourth century and the later fifth century are very marked; indeed one of the most marked 'mass extinctions' in all the archaeological record of Britain, and deserves some characterization. In a nutshell, the archaeology of the later fourth century is plentiful, very varied, and very visible to the archaeologist: the archaeology of later fifth century is much less plentiful, biased towards certain areas of expression, and often difficult to detect (Esmonde Cleary, 2011, pp. 13–14).

Recent scholarship has argued against this traditional, historical view and has advocated that there was more of a gradual transformation, not a sharp replacement of one cultural group with another. Whilst the argument against the traditional view has varied, the majority of the research has focused on migration as the key concept to understanding how Britain changed in the post-Roman period, with the debate alternating between large migrations/conquest and smaller migrations with elite takeover (K. Dark, 2000; Härke, 2011; Higham, 2007; Hills, 2003; Loveluck, 2002; Wilmott, 2000). Archaeological investigations have increasingly found evidence of sites with no break in occupation from the end of the Roman period through the early medieval period, perhaps indicating that gradual cultural transitions, rather than sharp breaks or overwhelming conquest, characterised the 5th century in Britain (Ferris and Jones, 2000; Higham, 1993; Wilmott, 2000).

More nuanced theoretical ideas and models have argued that the incoming Germanic peoples interacted with the Romano-British inhabitants and together, through a process of contact, negotiation, and change, formed the new Anglo-Saxon kingdoms. As Härke states, "It is now widely accepted that the Anglo-Saxons were not just transplanted Germanic invaders and settlers from the continent, but the outcome of insular interactions and changes" (Härke, 2011, p. 1). This is not to say that the transition from empire to kingdom was a smooth process. This was a troubled time and the breakdown of the Roman infrastructure, economy, and military protection, along with the incoming Germanic immigrants, undoubtedly affected the inhabitants of Britain. The challenge for the archaeologist is recognizing this transitional time period through the material remains. It is argued here that the built environment should be specifically examined as a social construct that reflects and structures cultural ethnicity. This study focuses on changes and continuities to how space and place are arranged in a multi-scalar fashion by quantifiably examining households, settlements, and the landscape.

## 1.3 TERMINOLOGY

This thesis focuses on chronological distinctions in order to conduct the methodologies, but broadly speaking is concerned with demonstrating that these historic temporal distinctions do not reflect the transitional changes occurring in the 1st millennium AD Britain. It is specifically focused on the changes and continuities that occurred between the Iron Age, Roman, and Early Medieval periods from approximately c. 100 BC-AD 800 and a detailed explanation of the chronologies of the examined sites is discussed in Chapters 4 and 6.

Four broad terms for the various periods are used in this analysis and are taken from the terminology used by the Historic Environmental Record (HER) offices consulted for this research: Iron Age (c. 800 BC – AD 43), Roman Iron Age (AD 43-410 in areas north of Hadrian's Wall), Roman (AD 43-410 in areas south of Hadrian's Wall) and Early Medieval (AD 410-800). These broad terms are used to describe the settlements and temporal periods analysed in this thesis, with historically defined terms such as tribal names (the Votadini or Parisi for example) used when referring to specific cultural populations within regions and temporal periods. For the presentation of the results the existing framework is used for clarity.

The difficulty in ascribing terminology reflects the scholarly debates of describing the various temporal periods and ethnic groups inhabiting the modern geographical region of north-east England. Popularly and historically referred to as the Dark Ages and the people inhabiting it (at least in southern and eastern Britain) as Anglo-Saxons, labels for the analysed periods have varied. Scholars have attempted to define it so as to emphasise its distinction from the preceding and following periods while at the same time acknowledging that 4th to 9th century Britain was a product of the preceding times and the antecedent for later periods. Describing this period as the Dark Ages has fallen out of use due to its negative connotations. Simon Esmonde Cleary presented the term *late antiquity* to define the late Roman to post-Roman transitional period, extending from the late 3rd century through the rise of Islam in the 8th century as a distinct period of history that was separate from the Roman and Medieval periods

(Esmonde Cleary, 2001, p. 97). This term has been adopted by a variety of scholars due to its strengths in acknowledging Rome's influence while maintaining it as a distinct period (Bowersock et al., 2001, pp. ix–x; Bowles, 2007, pp. 6–7; Dark, 2001, pp. 24–26; Harris, 2003, p. 17). Others have chosen to refer to the period as post-Roman or sub-Roman, emphasising the temporal periods' debt to the preceding Roman period in a similar manner (Dark, 1992; Higham, 2004; Snyder, 2003). Early Medieval has become one of the standard ways of discussing this period, which emphasises the sharp break with antiquity and associates it with the medieval period. Terminology has even come full circle, with some arguing for the re-adoption of Dark Ages by archaeologists working north of Hadrian's Wall as it was felt this region was outside of the Roman Empire and they could not be certain of the cultural attribution of the archaeological record in this region with Anglo-Saxons (Johnson and Waddington, 2008, p. 155).

This terminology problem is not only an issue for examining the period after AD 410, as Loveluck points out that the terms Roman Iron Age, Romano-British, Roman, and/or British all carry weights and expectations of culturally uniform societies that simply did not exist in Britain during this period (Loveluck, 2002, p. 127). Thus, caution must be used when ascribing broad identities to the past, as these are historically determined descriptions and individuals in the past would have had multiple identities that may not fit under any of these titles. That said, when terminology either becomes too broad or too narrow, there is the possibility of confusion on the part of the reader obscuring the relevance of the study.

## 1.4 GEOGRAPHICAL SCOPE

The geographic focus examined here is on north-east England in what was the Roman frontier region and also within portions of the Anglo-Saxon kingdom of Northumbria. Northumbria emerged in the early 7$^{th}$ century upon the unification of the two earlier kingdoms of Bernicia and Deira (Rollason, 2003, p.6). Northumbria's broadest extent stretched from the Firth of Forth to the Humber and from the Irish to North Seas. It included regions that were within and outside of the boundaries of Roman Britain, as Hadrian's Wall bisected the kingdom in half (Petts and Turner, 2011a, p. 1; Rollason, 2003, p. 6). The author agrees with Rollason in the usefulness of studying Northumbria due to its unique characteristics of being positioned along the Roman periphery and the potential of the region for "(…) exploring the relationship of incoming barbarians to both the Romanized and the non-Romanized native inhabitants of Britain (…)" (Rollason, 2003, p. 9). This was particularly useful for the aims and objectives of this research, as the methodologies are comparative in nature and require at least two regions that are known to have experienced very different cultural interactions during the Roman period in order to investigate Roman Britain's affect, if any, on the later Early Medieval settlement patterns.

Two of the core areas of Northumbria coincided with the two of the 'heartlands' of its antecedent kingdoms in the Tweed and Humber basins (Rollason, 2003, pp. 45-49). Two study regions, the Northumberland study region (NSR) and Yorkshire study region (YSR), were chosen as the main focus of analysis because both regions have excellent settlement evidence from the Iron Age through Early Medieval periods. In addition, they are located in regions that received very different levels of Roman influence and were later on centres of Early Medieval settlement in the burgeoning kingdoms of Bernicia and Deira (Figure 1.4). The NSR is located approximately 65 kilometres (40 miles) north of the path of Hadrian's Wall along the North Sea coast, whilst the YSR is approximately 100 kilometres (62 miles) southeast of the wall in an area to the north of the Humber Estuary. The two regions differ from one another environmentally, although they were more similar to each other when compared to the other Anglo-Saxon kingdoms south of the Humber. Due to their geographical location, the two study regions received different degrees of interaction with the Roman Empire, which affected the structure and arrangement of the built environment during this period and it will be argued, later on in the Early Medieval period. The NSR, to the north of Hadrian's Wall, received less contact and presumably less change from the empire, mainly through trade or on forays or invasions by the army. This region was likely a client state of Roman *Britannia*, receiving patronage and on friendly terms but never fully part of the provincial rule of Britain (Haselgrove et al., 2009, p. 2). The YSR, on the other hand, was in an area that was firmly part of Roman *Britannia* by the late 1$^{st}$ century and the later subdivided provinces of *Britannia Inferior* in the 3$^{rd}$ century and *Britannia Secunda* in the 4$^{th}$ and early 5$^{th}$ centuries (Mattingly, 2006, p. 229). This region was associated with a major power centre in the province (the Roman city of *Eboracum* (York), and included many of the built environment features of Rome including roads, forts, and villas.

## 1.5 REGIONAL AND TEMPORAL DIFFERENCES

Implicit in the aims and objectives of this research is the analysis of the importance of locality and temporality in understanding the built environment of the Early Medieval period. Traditional views on the Early Medieval period have emphasised its distinction from Roman

Britain in a way that highlights the strict temporal boundary between provincial and Dark Age Britain. Historical distinctions between cultural groups and temporal periods have been acknowledged as too rigid; post-Roman Early Medieval Britain, it is argued here, should be seen more as a period of transitional change. By focusing on transitional change, this research specifically examines whether changes or continuities to the built environment are a result of locality. Petts and Turner note that communities across Northumbria differed from one another in culture, politics, and organisation and the kingdom was not a homogeneous zone (Petts and Turner, 2011a, p. 5). The methodologies chosen to analyse the research question examine the differences in where settlements are positioned in the landscape as well as the visual arrangement of space in households and settlements, and are ideally suited to address the differences noted by Petts and Turner in communities across Northumbria. It does so by comparing these features and sites by temporal period (Iron Age, Roman Iron Age, Roman, and Early Medieval) as well as region (NSR and YSR). The results of this thesis will demonstrate the importance of the region to understanding how ideas on the built environment were passed between different social groups and affected the development and arrangement of households and communities.

## 1.6 COMPUTATIONAL ARCHAEOLOGY

An important aspect is the investigation of previously recorded archaeological data using innovative computational techniques. This legacy data includes recorded site locations, published and unpublished excavation reports, and cropmark evidence derived from the National Mapping Programme. The use of GIS to study the spatial organisation of sites across the landscape is a tried and tested methodology (see Chapman, 2006; Conolly and Lake, 2006; Wheatley and Gillings, 2002). Using these techniques in combination with an expanded and innovative use of VGA to statistically compare the arrangement of space at multiple scales of analysis, however, highlights the strengths of using long published resources for new research. Visibility Graph Analysis was developed to investigate the visual arrangement of the interiors of buildings. It has been expanded in this thesis to analyse the organisation of structural elements in archaeological settlements. This novel use of VGA makes it possible to make quantitative interpretations on the spatial plan of households and settlements across regions and time periods. This new methodology that systematically and quantitatively examines the visual arrangement and organisation of the built environment was essential for addressing the research question, and it is felt that it could be used in a variety of archaeological regions and time periods.

## 1.7 LIMITATIONS OF APPROACH

The selection of the study regions and sites chosen for this analysis are largely predicated on the limitations of the methodologies using GIS and VGA. The two study regions were chosen due to their location (north and south of Hadrian's Wall) as well as the diverse settlement types recorded in the two regions from the Iron Age, Roman, and Early Medieval periods. At the outset of this project, a third study region was intended but the time-consuming nature of the application of VGA meant this could not be completed within the scope of the thesis. A third study area in the Anglo-Saxon heartlands, where well-dated and extensively excavated settlement sites are known, would have been beneficial as a comparison. Likewise, in the future, comparative work with settlements on the continent may well prove interesting – sites such as Wijster and Flögeln-Eekhölten offer large and expansive excavated settlement data which might be successfully tested against excavated settlement types in the east of England. .

The application of VGA requires detailed and full plans of settlements which clearly demark the spatial layout and organisation of the sites. This resulted in a selective approach which harnessed data from sites with extensive information on plan forms. A significant implication of this selective approach is that the date range of settlements chosen from the two regions differs. Early Medieval settlements in the NSR date broadly to the 5$^{th}$-8$^{th}$ centuries AD, whereas settlements in the YSR can be placed between the 5th to 9th centuries, however the YSR sites are largely at the middle and late end of that chronology. One analysed settlement from the YSR, West Heslerton, can be dated from the 5$^{th}$ to 9$^{th}$ centuries (Powlesland, 1998, 1997; Powlesland et al., 1999). The other examined settlements in the YSR are later (Thwing, 7$^{th}$-9$^{th}$ century AD) or are so far insecurely dated (the Butterwick-type sites). There is now evidence that the Butterwick-type settlements may date to the 8-9$^{th}$ centuries and even continue as late as the 10th century (see Burdale discussed by Richards and Roskams, 2013), however at West Heslerton a similar complex is considered to be much earlier in date (see section 2.3.3.6). Despite these issues, the site selection was felt to be appropriate given the methodological and applied thrust of this thesis. The potential for overlap between the regions and the focus of examining continuities or change over the *longue durée* were the key justifications for the site choices (the sites selected for VGA are detailed in Chapter 6).

## 1.7 OUTLINE OF THESIS

Chapter 2 provides a historical and archaeological overview of the built environment and the archaeological landscape in what is today north-east England between c. 100 BC-AD 800. The topographic relief, underlying geology, and water resources of the two study regions are detailed in this chapter. The importance of these environmental factors for settlements over the *longue durée* is discussed in relationship to the location of sites within this region. Issues of marginality and frontiers along with landscapes of survival and destruction are discussed. Finally, the built environment and how it is addressed in this thesis is detailed in this chapter along with a detailed description of the settlement and household types of the two study regions in the 1$^{st}$ century BC to 9$^{th}$ century AD.

Chapter 3 describes the theoretical context of this thesis, focusing on the role of space and place in understanding cultural interaction in Northumbria. The multi-scalar approach to investigating the built environment in this thesis is introduced; with households, communities, and the landscape all playing a vital role in understanding cultural continuity and change in the 1$^{st}$ century BC to 9$^{th}$ century AD. The chapter concludes with a discussion on post-colonialism and the value of using creolization for interpreting how changes to space and place are reflective of social change due to interactions and transmission of ideas when different cultural groups come into sustained contact within one another.

Chapter 4 explains the landscape analysis methodology and results by examining two smaller study areas within the NSR and YSR in order to explore the spatial positioning of the sites in relation to topographic elevation, underlying geology, and access to water. The chapter describes the GIS spatial analysis of the built form sites based on their location and temporal/cultural affiliation results and then statistically examines the observed trends and patterns in the results.

Chapter 5 introduces the use of VGA to investigate the visual arrangement of space within the archaeological plans of settlements and structures. The theoretical origins of VGA along with its previous uses are discussed, and the novel application of VGA to examine settlement organisation is presented in detail. This chapter concludes by demonstrating the VGA's utility in examining settlements by testing the new method on two archaeological settlements and their structures in order to demonstrate the utility of the method for investigating transitional periods in the past.

Chapter 6 expands on Chapter 5 by using the VGA methodology to investigate settlements and structures from the Iron Age, Roman Iron Age, Roman, and Early Medieval periods in the NSR and YSR. The results are discussed, statistically analysed, and summarised. Tables and graphs of the most relevant results are shown in this section, with the majority of the supporting evidence included in the appendices.

Chapter 7 discusses the significance of the Landscape Analysis and VGA results. It compares the statistically significant patterns from the analyses, the trends in the data, and how the results address the aims and objectives of this research. The results are interpreted using creolization in order to describe how cultural contact and transmission of ideas and social norms can explain the patterns in settlement arrangement at multiple scales of analysis. The chapter concludes with the limitations of the dual methodologies and theoretical approach.

Chapter 8 concludes the thesis and details the importance of the study in understanding how the Roman period affected the built environment of Early Medieval Northumbria. The chapter considers avenues of future research addressing the limitations and the utility of these methods in other archaeological investigations.

The appendices contain supporting material, definitions, and the data used for this research.

- Appendix A – GIS terms and definitions
- Appendix B – Statistical analysis terms, definitions, and data
- Appendix C – Databases of built form sites used in the Landscape Analysis
- Appendix D –Imagery results of VGA performed on settlements and structures from the NSR and YSR
- Appendix E – (Additional File) Database of VGA numerical results

## 1.8 SUMMARY OF INTRODUCTION

This thesis approaches the research priorities for Early Medieval scholarship in north-east England using a two-pronged methodology specifically examining space and the built environment. The aims of this study are to critically investigate Roman Britain's influence on the Early Medieval built environment in Northumbria, arguing that regional differences are the result of the complexities of creolization that occurs when different social groups come into sustained contact with one another in post-colonial contexts. It argues that these spaces and places are facets of the material record that should be studied as they can be quantified and compared across both regional and temporal boundaries in order to address the identified research priorities for the region as well as broader debates in the discipline of the effect of migration on Britain after the withdrawal of Roman power and support.

# CHAPTER 2

# HISTORICAL AND ARCHAEOLOGICAL BACKGROUND OF THE BUILT AND NATURAL ENVIRONMENTS

The inhabitants of the portion of Britain from the Forth to the Humber witnessed significant transformations to the cultural, ethnic, and political identities of the region during the 1st millennium AD. These changes affected both the built and natural environments and were heightened during the Roman period due to the demarcation of the Empire's northern boundary along Hadrian's Wall, which led to cultural differences on both sides of the frontier due to differing levels of interaction and acculturation with the Roman world. The 1st century BC to 9th century AD witnessed the invasion and occupation of Britain by Rome, the formal end of provincial *Britannia*, and the development of the kingdom of Northumbria through the unification of Deira and Bernicia. These events had a profound influence on how people perceived their cultural and environmental landscape, as shifts in settlement patterns and built form construction styles attest.

This chapter introduces the physical and cultural landscape of Northumbria by examining the built environment of the different time periods and study regions compared to the background history of the region. This chapter provides a detailed description of the settlement and household types of the region from the analysed time periods that are investigated in depth later in this thesis in order to understand continuity and change during the transitional period.

## 2.1 THE BUILT ENVIRONMENT

In order to appreciate how cultural events and exchanges shift ideas on the built environment, a definition and understanding of the term is needed. The *built environment* has been studied by social scientists since the 19th century, and is a somewhat abstract concept that "(…) refers in the broadest sense to any physical alteration of the natural environment" by human activities (Lawrence and Low, 1990, p. 454). Studies of the built environment have often focused on polite or vernacular architecture and their roles in defining peoples' practice. The built environment has become a popular focus of research in the late 20th century due to publications such as Amos Rapoport's *The Meaning of the Built Environment: A Nonverbal Communication Approach*, which posited that understanding people's interaction and use of space within the built environment leads to an understanding of how people interpret the meanings and importance of the constructed world and how this interplay reflects and in turn conditions a society (Rapoport, 1982). The built environment can refer to any part of the landscape altered by humans such as roads, buildings, cemeteries, and includes, depending on the scholar, alterations to the natural environment such as forest clearing or agricultural fields (Lawrence and Low, 1990; Mackie, 2001; Rapoport, 1982).

Since the built environment can refer to any portion of the landscape that has been transformed by human activity, additional terminology is used for the specific investigation of households and settlements. Lawrence and Low define the *built form* as:

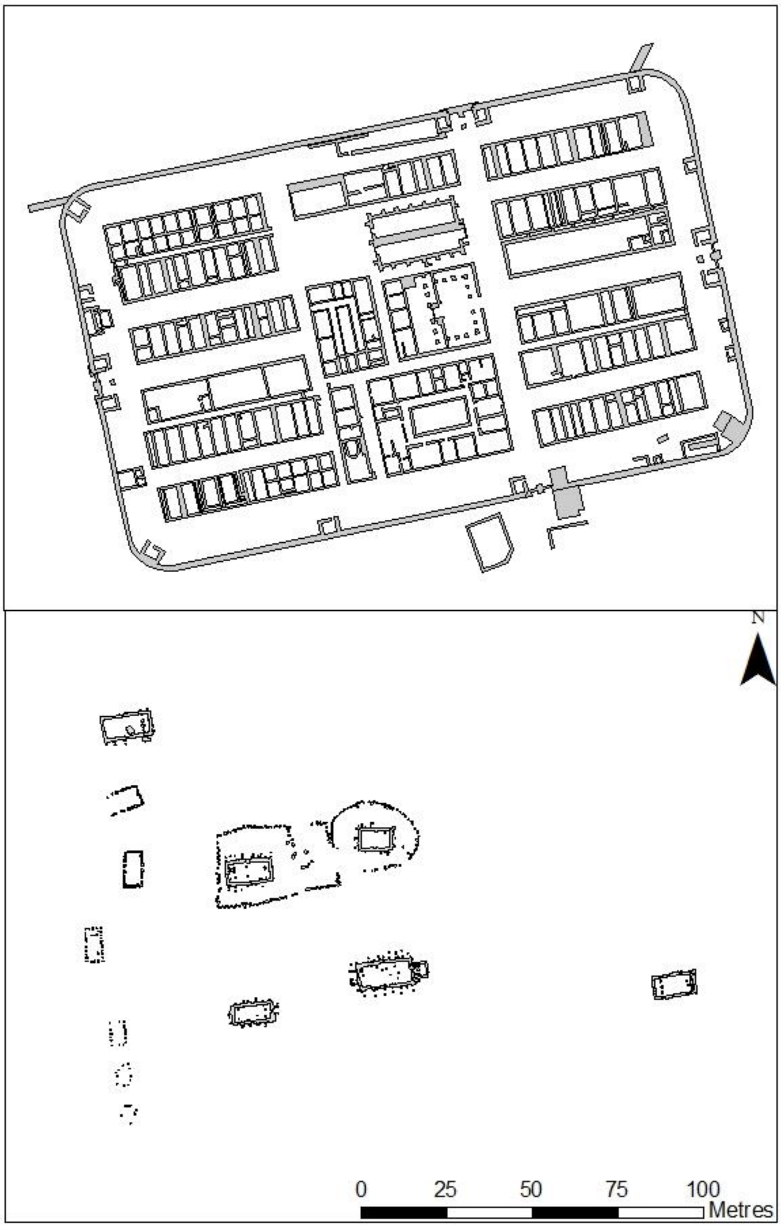
> (…) building types (such as dwellings, temples, or meetinghouses) created by humans to shelter, define, and protect activity. Built forms also include, however, spaces that are defined and bounded, but not necessarily enclosed, such as the uncovered areas in a compound, a plaza, or a street. Further, they may include landmarks or sites, such as shrines, which do not necessarily shelter or enclose activity (Lawrence and Low, 1990, p. 454).

Built forms include all aspects of a community from the smallest outbuilding up to and including monumental architecture. Of particular importance for this thesis is that Lawrence and Low acknowledge that the spaces between building types are also important for understanding this subset of the built environment. As discussed in Chapter 3 on the use and importance of space, many scholars have argued that how people align their settlements, and how the space within them is used, is an important facet of understanding a cultural group. A condensed subset of Lawrence and Low's built form (including any buildings and structures, settlements, enclosures, walls, etc.) has been chosen as the best-fit terminology to describe the type of data used in this thesis in the examination of understanding settlement patterns in the 1st century BC through to the 9th century AD.

### 2.1.1 ENCLOSED AND UNENCLOSED SETTLEMENTS

The demarcation or use of space within settlements is used as a measurement for understanding cultural continuity or change. Settlements that were bounded by enclosure ditches or palisades have a very different character than those with no boundaries. Living in an enclosed or unenclosed settlement affects the activities practised within a community, the movement of individuals, and how people visually interact with the built environment. Harding states that "Life in an open settlement, especially a shifting one, was different from that of an enclosed community" (Harding, 2012, p. 5). Figure 2.1.1 shows example enclosed and unenclosed settlements used in this analysis. Defining the liminal boundaries or spaces separating the built from natural environments is difficult if not impossible for unenclosed settlements based on the archaeological evidence. This could also be true for enclosed settlement, where the built environment extended outside of the enclosures or palisades. For instance, there are many examples of *vici* surrounding Roman forts in Britain showing that the built environment extended beyond the fort walls (although there were also examples of these being incorporated within the fortifications or having their own separate fortifications). Therefore, while many of the settlements analysed here used enclosures as the defining boundary of a settlement, it is important to remember there were instances where the built environment extended beyond these boundaries. These liminal zones, however, would have affected visibility and movement. Finally, settlements can have enclosed and unenclosed phases due to changes to the socio-political environment. For example, many of the currently occupied towns in Britain have medieval antecedents that were enclosed by fortifications or walls that have long since been replaced or abandoned.

FIGURE 2.1.1 Example of enclosed settlement of Housesteads Roman fort (top plan) and unenclosed settlement of the Early Medieval settlement at Thirlings (bottom plan).



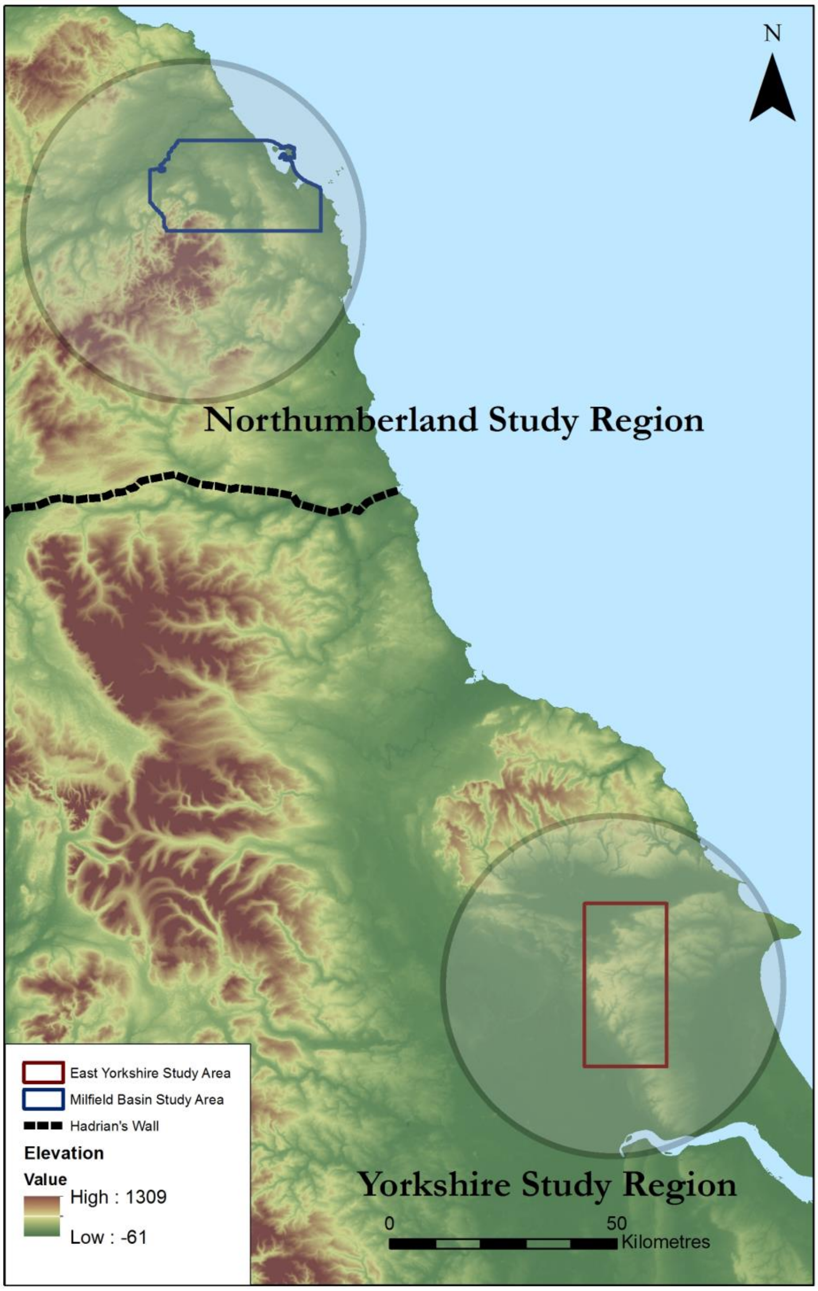

## 2.2 THE LANDSCAPE OF NORTHUMBRIA

The natural and built environments affect each other in a reflexive process. Human activities are dictated by the landscape but also change and alter the environment that in turn changes future practice. In addition, different environments influence the survival and recovery or destruction of archaeological sites. Therefore, an understanding of the natural landscape is important to understand how the use of space in the built environment was constructed and used. The underlying geology and soils, topographic relief, and water resources make up the physical/natural landscape and are products of how these factors altered and were altered by the climate, vegetation, and human activities. Inside the boundaries of Northumbria are the highest proportion of uplands of any of the Anglo-Saxon kingdoms (Higham, 1993, p. 2). These uplands constrained and strongly influenced agricultural production and therefore the location and density of settlements. Even today, the major population centres of the region are concentrated in the coastal plains and the river valleys, with the upland areas more sparsely settled. The landscape of modern-day Northumbria is diverse and reflective of the underlying geology of the region and the erosional reshaping of the landscape due to both repeated glaciations as well as human activities such as woodland clearing or agriculture (Higham, 1993, p. 4). Although the modern climatic data on temperature and rainfall is undoubtedly different today than in the past, it provides insight on the regional variation of agricultural activities that may have been practised due to micro-climatic changes in the altitude, topography, and rainfall.

The topographic relief of a region affects the regional microclimate of an area. Portions of north-east England east of the Pennines and Cheviot Hills receive less rainfall than west of the upland divide (Higham 1993, p. 7). The climate in the past differed from today, with the Iron Age witnessing a cooler period in the early 1st century BC before warming up in the later Iron Age and Roman periods, where the average temperatures were warmer than the mid-20th century average (Passmore et al., 2012, p. 266). It is feasible to assume that the drier or wetter portions of the region followed a similar pattern in the past, due to the influence of the uplands on weather patterns in north-east England. Following the Roman period, the climate cooled into the Early Medieval period, which no doubt altered the settlement of the time (Passmore et al., 2012). These climatic changes may have influenced settlement as marginal regions shift across the landscape due to increased or decreased rainfall and temperatures, which in turn affects where agricultural and grazing areas can best be positioned (P. Dark, 2000, p. 171; Wilkinson, 2003, pp. 41–43).

During the Iron Age, Roman, and Early Medieval periods the Northumbria landscape presumably changed due to the migration of incoming peoples, the establishment of road networks and associated "urban" settlements, the subsequent abandonment of major Roman centres, and the development of Early Medieval communities. These human activities were in turn shaped by the natural landscape, which had a profound effect on the spatial locations of these events. For example, an increased emphasis on upland wood clearances in the later Iron Age and early Roman period led to an increase in moorland when the climate shifted (P. Dark, 2000). The cyclical nature of landscape shaping human activities while also being formed by them is important to understand when examining how the built environment and settlement patterns changed and/or remained constant over time.

FIGURE 2.2 Map of the Northumberland and Yorkshire Study Regions and the Milfield Basin and East Yorkshire study areas. The digital elevation model is based on data from the Shuttle Radar Topographic Mission and available from the United States Geological Survey.

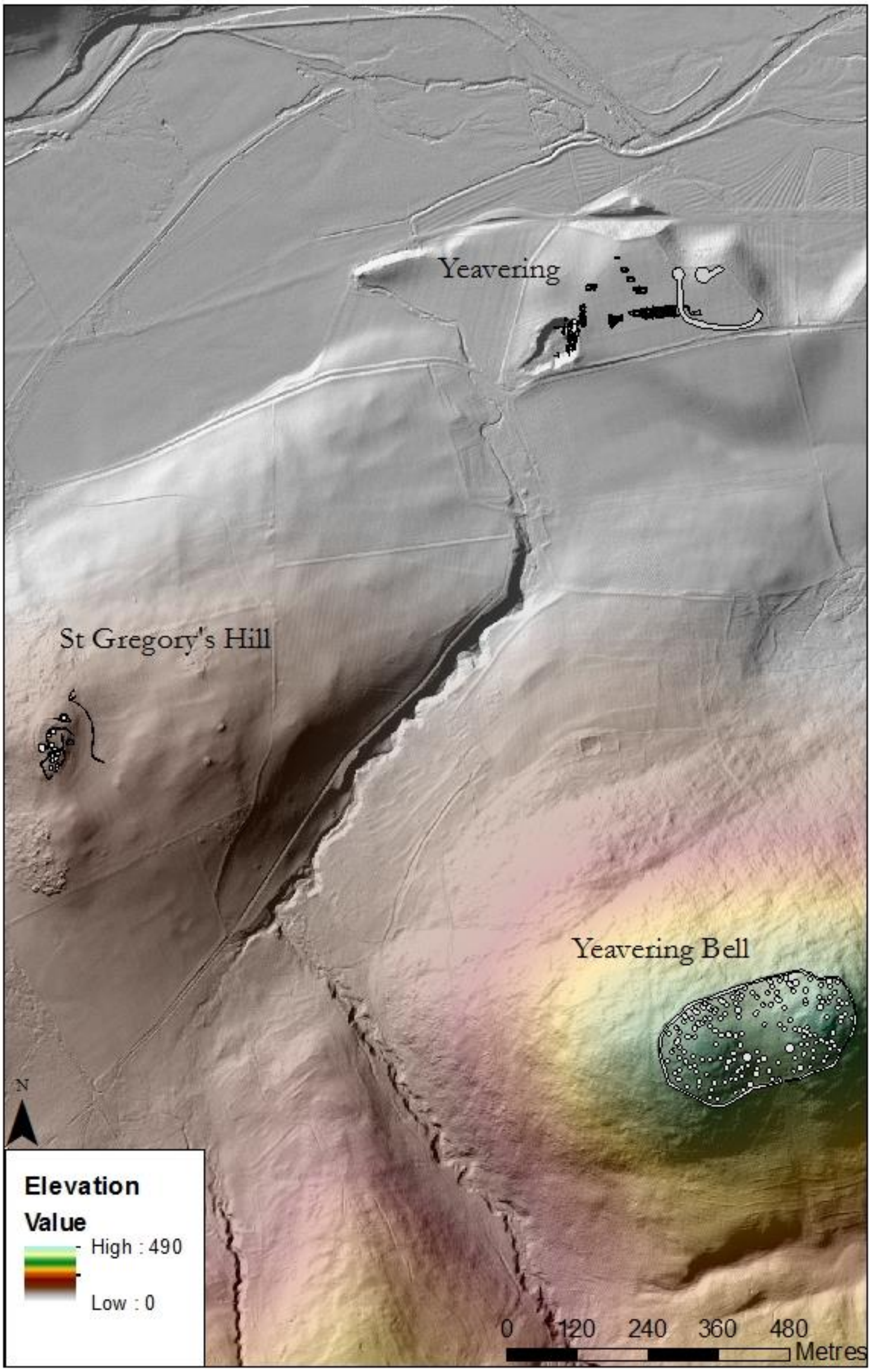


## 2.2.1 THE NORTHUMBERLAND STUDY REGION LANDSCAPE

The NSR is located along the Scottish-English border, covering approximately 400,000 hectares of northern Northumberland and the River Tweed basin. The physical environment of much of the NSR has been examined in two volumes of the Till-Tweed Studies project (Passmore et al. 2009; 2012). The landscape is diverse and contains rolling glaciated uplands (the Cheviot hills), gravelly river drainage basins along the Rivers Tweed and Twill, a gently undulating sandstone escarpment to the east of the River Till basin, and the coastal lowlands leading down from the sandstone plateau to the North Sea (Passmore et al., 2009, p. 7). The underlying geology of the region can be generalized as being comprised of Magnesian/Carboniferous Limestone, sandstone, and chalk (Higham, 1993, p. 4), and the region contains numerous springheads, streams, and rivers ideal for cultivation and settlement.

The coastal plain stretches in a broad band from the Scottish/English border in the north to the River Coquet in the south (Land Use Consultants, 2012, p. 37). Today it is an intensively cultivated zone of open pasture and semi-natural grasslands. The River Tweed is the second largest river catchment area of Scotland, and the Till is the second largest drainage of the Tweed. Both of these low-lying gravelly basins are today centres of agricultural activities and settlement such as at Wooler, Milfield, and Coldstream (Passmore et al. 2009, pp. 11-13). The Milfield Basin, a large, relatively flat, and low-lying area along the River Till, contains deep glaciolacustrine sediments associated with the deglaciation of the region (Passmore et al., 2012, p. 17). These sediments make this an excellent resource for agriculture and the basin became a focus of agricultural settlement from prehistory onward. Between the low-lying coastal plain and the Till Basin is the Northumberland Sandstone Hills, a plateau landscape of moorland and pasture that today contains limited settlement (Land Use Consultants, 2012, p. 53). The final landscape zone of the NSR is the granitic upland Cheviot Hills. The Cheviots are characterised by rolling hills divided by broad valleys, and were a focalised region of settlement during the late Iron Age. Figure 2.2.1 shows a representative portion of the NSR landscape.

FIGURE 2.2.1 Overview of the NSR landscape and representative settlements of the Iron Age hillfort of Yeavering Bell, the Roman Iron Age hillfort at St Gregory's Hill, and the Early Medieval royal centre of Yeavering. LiDAR derived Digital Terrain Model. Spatial resolution 1 metre, care of Environment Agency and the Geomatics Group.



### 2.2.2 THE YORKSHIRE STUDY REGION LANDSCAPE

The YSR is also approximately 400,000 hectares and is located mostly in the East Riding of Yorkshire and North Yorkshire (with one study settlement, Dalton Parlours, located in West Yorkshire) and is dominated by the rolling chalk hills of the Yorkshire Wolds. The Wolds stretch in a crescent shape from the River Humber in the south to the Vale of Pickering in the north before turning east to Flamborough Head and it sweeps from the Vale of York in the west to the Holderness Plain in the east (Halkon, 2013, p. 42; Stoertz, 1997, pp. 1–3). The Yorkshire Wolds are the northernmost outcropping of Cretaceous chalk stretching in a broad band across south-eastern England. The Wolds are characterised by rolling uplands, are permeable and well drained, and are well suited to agricultural pursuits (Stoertz, 1997, p. 3). The Great Wold Valley and its corresponding drainage, the Gypsey Race, runs west to east in the northern half of the Wolds (Halkon 2013, p. 44). Besides this drainage, the Wolds are divided by a series of hollow valleys referred to locally as *slacks* that were formed in the last glaciation (Halkon, 2013, p. 44; Stoertz, 1997, p.3).

An escarpment runs along the northern and western boundaries of the Yorkshire Wolds, leading somewhat sharply down to the broad valleys of the Vale of York and Vale of Pickering. A spring line along the Wolds escarpment drains into these two vales, which were once the sites of large glacial lakes, and have an underlying geomorphology of alluvial clays and blown Aeolian sand (for detailed descriptions see Halkon, 2008; Powlesland et al., 2006). Both the Vale of Pickering and Vale of York are extensively farmed today, although differing patterns of water management and cultivation in modern times have changed the shape of the modern landscape in comparison to in the prehistoric, Roman, and Early Medieval periods (Halkon, 2013, p. 45) (Figure 2.2.2). The soils of the Holderness Plain to the east of the Wolds are generally poorly drained, and in the past this region was quite marshy (Halkon, 2013, p. 45). Small areas of the plain are elevated due to deposits of gravelly glacial till, and these better-drained regions become foci of agriculture and settlement in the past, such as the Roman villa at Rudston or the Early Medieval settlement at Thwing (Paddock Hill). Figure 2.2.2 shows a representative portion of the landscape.

FIGURE 2.2.2 Overview of the YSR landscape and representative settlement of Hayton Roman Fort, located in the Vale of York. LiDAR derived Digital Terrain Model. Spatial resolution 2 metres, care of Environment Agency and the Geomatics Group.

## 2.3 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

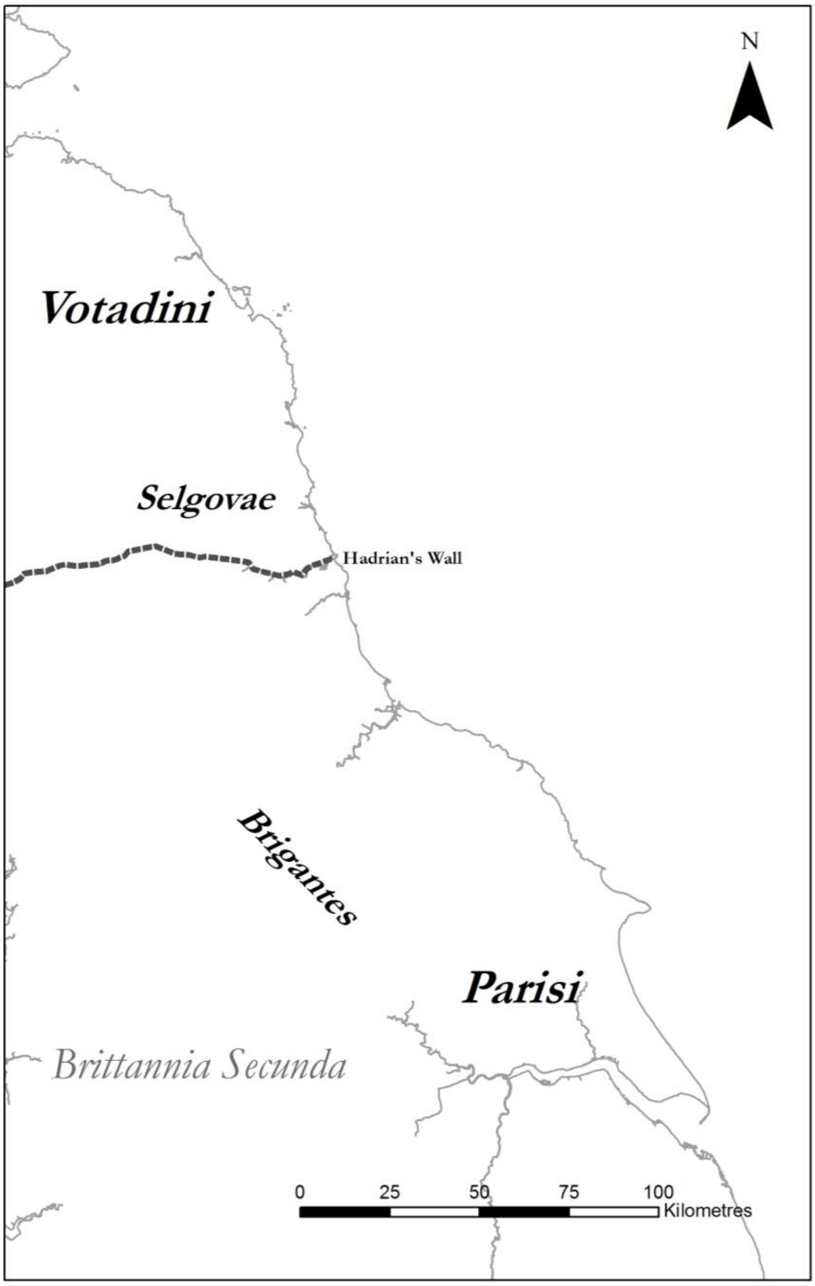
The following section provides the historical and archaeological background of transitional Northumbria. The Anglo-Saxon kingdom of Northumbria's power extended from the North Sea to the Irish Sea and from the Firth of Forth to the Humber until the incoming Viking raids and later border warfare between the political entities of England and Scotland divided and ended the influence of this kingdom (Petts and Turner, 2011b, p. 1; Rollason, 2003, p. 277). Northumbria has always attracted scholarly attention, although Petts and Turner (2001a, p. 2) note that these studies have followed traditional academic trends and these studies have not been evenly spread across the central Northumbrian landscape. Many Northumbrian studies have focused on the so call 'Golden Age' (Hawkes and Mills 1999) of the kingdom following the conversion to Christianity and prior to the Viking invasions. Related to the study of the Golden Age is understanding how Northumbria came into being during the 5th century after the end of Roman Britain in AD 410. Recent scholarship has focused on this period being one of transition, and has looked to DNA and isotope studies to chart the movements of individuals and the ethnogenesis that occurred during this period (Hamerow, 1994, 1997; Härke, 1997, 2001; Hines, 1997; Loveluck, 2002; Montgomery, 2002; Montgomery et al., 2005; Powlesland, 1997). This thesis argues that a detailed examination of the built environment can provide contextual evidence to consider the formation processes of the kingdom of Northumbria and that in order to understand these processes the Roman as well as Iron Age evidence needs to be considered in order to identify any evidence of continuity in spatial patterning over the *longue durée*. This section provides a description of the three time periods by focusing on the built environment and most commonly identified built forms of the late Iron Age, Roman, and Early Medieval periods from the two study regions. Much of our historical knowledge of north-east England in the Iron Age, Roman, and Early Medieval periods comes from relatively few written sources. In contrast, there are excellent archaeological examples of built environment and form sites from the three examined periods in both study regions.

### 2.3.1 THE LATE IRON AGE

In Britain, the Iron Age extended roughly from the 9th century BC to AD 43 (the onset of the Roman invasion). North of Hadrian's Wall this end date can be put much later, and in portions of Scotland may be thought of as extending up to the medieval period. The arbitrary distinction of the use of Iron Age and Roman as temporal and cultural markers reflects the hypothetical limits of Roman power, culture, and material remains. Portions of Britain north of Hadrian's Wall received variable and relatively less contact during the Roman period, but still would have been impacted by the new power in the south, which undoubtedly changed cultural ideas and perceptions. That said there is little doubt that the Roman Empire more heavily impacted the areas south of Hadrian's Wall, and presumably affected cultural patterns and lifeways to a greater degree. Although the use of these terms can thus be seen as problematic, they remain easily recognisable and therefore are adopted here, regardless of study area, for the temporal period preceding 43 AD.

Historical information on the late Iron Age in what became the kingdom of Northumbria is derived from Roman sources describing the native Britons. Two of these writers, Tacitus and Ptolemy, provided the spatial location as well as historical names to the different groups inhabiting Northumbria. Although there were undoubtedly a variety of ethnic groups inhabiting the region, the two main tribal societies in the study regions were the *Votadini* in the NSR and the *Parisi* in the YSR, although portions of the study regions also may have included territory attributed to the *Selgovae* in the north and the *Brigantes* in the south (Mattingly, 2006, p. 49). The Brigantes were the dominant tribal group of the north by the beginning of the Roman period and had territory stretching from the Votadini in the north to the south and west of the Parisi, and were mentioned by Tacitus as the most populous group in the province of *Britannia* (*Agricola*, xvii, 2). Cunliffe argues that the Brigantes probably had hegemony over the neighbouring tribes such as the Votadini and Parisi (Cunliffe, 2004, p. 211) (Figure 2.3.1).

FIGURE 2.3.1 Locations of Iron Age tribal groups within what is today north-eastern England during the late Iron Age and Roman periods.




The mid to late Iron Age populace of what is today north-east England widely cultivated cereals and cleared large areas of woodland, accelerating heather moorland growth in the uplands of the region (P. Dark, 2000, p. 58). The two study regions shared a similar house type, the ubiquitous roundhouse, although the scale and orientation of these differed slightly between the regions. There were distinctions, however, in the development and plan of settlements as well as in the burial practices in the two regions.

#### 2.3.1.1 IRON AGE PERIOD IN NORTHUMBERLAND STUDY REGION

Ptolemy's *Geographia* described the *Votadini* as inhabiting what is today south-eastern Scotland and northern Northumberland. The Cheviot Hills became a natural boundary of the Votadini territory, with the *Selgovae* inhabiting the areas to the west of the upland range. Historically there is very little known on the Votadini and their origins, however, there is a relatively large amount of archaeological evidence of the later Iron Age (c. 100 BC-43 AD) in the NSR, especially when compared to the early Iron Age (c. 800 BC-400 BC) (Cunliffe, 2004, p. 32). The archaeological and environmental evidence for the later Iron Age demonstrates a growth in population, forest/land clearance, and agricultural intensification (Passmore et al., 2012, p. 223).

During the later Iron Age in the NSR, there was growth in the construction and use of enclosed settlements, often along the crests of hilltops along the margins of the Cheviot Hills. These often intervisible settlements are discussed in detail in Chapter 6, but it is noted that there have been relatively few excavations of these settlement types and their functions have been debated as relating to military and/or social status displays (Passmore et al., 2012, p. 250). Many of these were small, although larger examples such as Yeavering Bell and Traprain Law were also in evidence (the later considered to be the tribal *oppida* of the Votadini) (Higham, 1993, p. 10; Mattingly, 2006, pp. 423-234). Scholars have argued that these types of enclosures indicate some measure of centralised authority in order to organise and maintain these types of settlements (Higham, 1993; Oswald et al., 2006; Passmore et al., 2012). It does appear that the hillforts in the Northumberland study area were either abandoned or adapted to a different role during the late-Iron Age and early-Roman periods, as many of the hillforts fortifications had fallen out of use prior to being reoccupied (for examples see St Gregory's Hill Hillfort, West Hill Hillfort, Mid Hill Hillfort, etc., in Oswald and Pearson, 2005; Oswald et al., 2000, 2002, 2006) (see Figure 2.1.1 for representative hillforts in the NSR landscape). In addition, there appears to be a north/south divide on settlement morphology, with more enclosed settlement in the north and unenclosed to the south (Passmore et al., 2012, p. 249).

#### 2.3.1.2 HILLFORTS

Christopher Hawkes first described hillforts as a settlement type in 1931, and attributed them to the Iron Age (Hawkes, 1931). The hillfort is arguably the most recognizable settlement type in prehistoric Britain and dates from the Bronze Age through to the Roman period, although regionally they were occupied and fell of out use at different times, with southern examples being abandoned earlier than the north. A hillfort is a general term for a settlement-type typically positioned along the crest of a hill and bounded by enclosures, ditches, and/or palisades. Hillforts come in a variety of shapes and sizes, and are spread throughout the uplands of Britain. Harding argues that the key feature of hillforts are the enclosures which "(…) physically or conceptually demarcate an area to which access is restricted or controlled" (Harding, 2012, p. 1). Hillfort enclosures throughout Britain were often constructed using single or multiple ditches and associated ramparts, and the enclosures defined the communities' social environment, separating the cultural built space from the outside world. This act of enclosure affected the development of communities and the potential activities that could be practised within.

Due to the differences in size, scale, and distribution across Britain, the hillfort as a class of settlement had a multiplicity of functions and meanings. This is especially true in the NSR, where many of the hillforts differ in scale significantly from the large hillfort communities of southern England. Most of the Northumberland hillforts are small in scale, and could have probably supported a population of one extended family or a small group of families. Yeavering Bell hillfort was the largest in the region and built on a greater scale, containing over one hundred roundhouse platforms (Oswald and Pearson, 2005, p. 120). In contrast to Yeavering Bell, the other hillforts in Northumberland are much smaller, and would have supported only a few households or a small farmstead. A recent field survey by English Heritage to record the earthworks of all of the hillforts in Northumberland National Park has revealed that even though the forts varied in size and shape, there were similarities in the construction, materials, and use. For example, one commonality was that many of the hillforts' ramparts crossed across and down the crest of the hill towards certain aspects, which may relate to the 'territory' of a hillfort (Oswald and Pearson, 2005, p. 122).

Neustupný argues that there are three broad functional categories of hillforts: practical, social, and symbolic (Neustupný, 2006, pp. 1–4). Practical aspects of hillforts are that they were used for defence, to corral livestock, and to protect against predators. Socially, hillforts were centres for trade, and gathered people for festivals, celebrations, and for defence in times of unrest. Finally, hillforts may have had symbolic meanings, separating the natural and cultural worlds, defining a sense of community, and establishing a sense of place and identity for individuals. These three functions were not mutually exclusive and probably co-existed as hillforts were centres for community and settlement.

All of the examined Iron Age and Roman Iron Age settlements in this thesis in the NSR were hillforts. These were analysed because firstly, while there are examples of both Iron Age and

Roman Iron Age settlements in the lower lying areas of the Milfield Basin and the coastal plain of the NSR (for examples see Ingram Hill and Flodden Hill; Passmore et al., 2009, p. 129) many of these settlements have either not been sufficiently excavated to have an adequate plan for evaluation, were predominately cropmarks evidence of univallate enclosures with limited internal differentiation visible, or they have not been published. The low-lying Iron Age settlements were investigated in the landscape analysis, which focuses on spatial patterns across the landscape (Chapter 4) but the interiors of these communities were not examined using VGA due to their inadequate plans (Chapter 6). Not including these univallate enclosures in the VGA may adversely affect the comparative results of spatial arrangements of built space across the analysed time periods because the Traprain Law Environs Project has demonstrated that these late Iron Age and Roman Iron Age enclosures are important components of the settlement patterns during this time and are relevant to the results (Haselgrove et al., 2009, pp. 229–231). That said, the lower-lying settlements in the NSR share many similarities in size and scale to the hillforts so excluding them from the VGA does not necessarily adversely affect the results. The analysed hillforts do provide examples of a Roman period re-use of Iron Age settlements, so any continuities or disruptions between the periods are potentially evident through the analysis of these examples and thus the inclusion of these site types somewhat mitigates some of the issues with not having lowland, non-hillfort communities in the settlement analysis. If future excavations are conducted on these low-lying cropmark settlements these plans should be analysed using VGA as they are essential to understanding Iron Age settlement in different environmental locales in the NSR.

#### 2.3.1.3 THE IRON AGE IN THE YORKSHIRE STUDY REGION

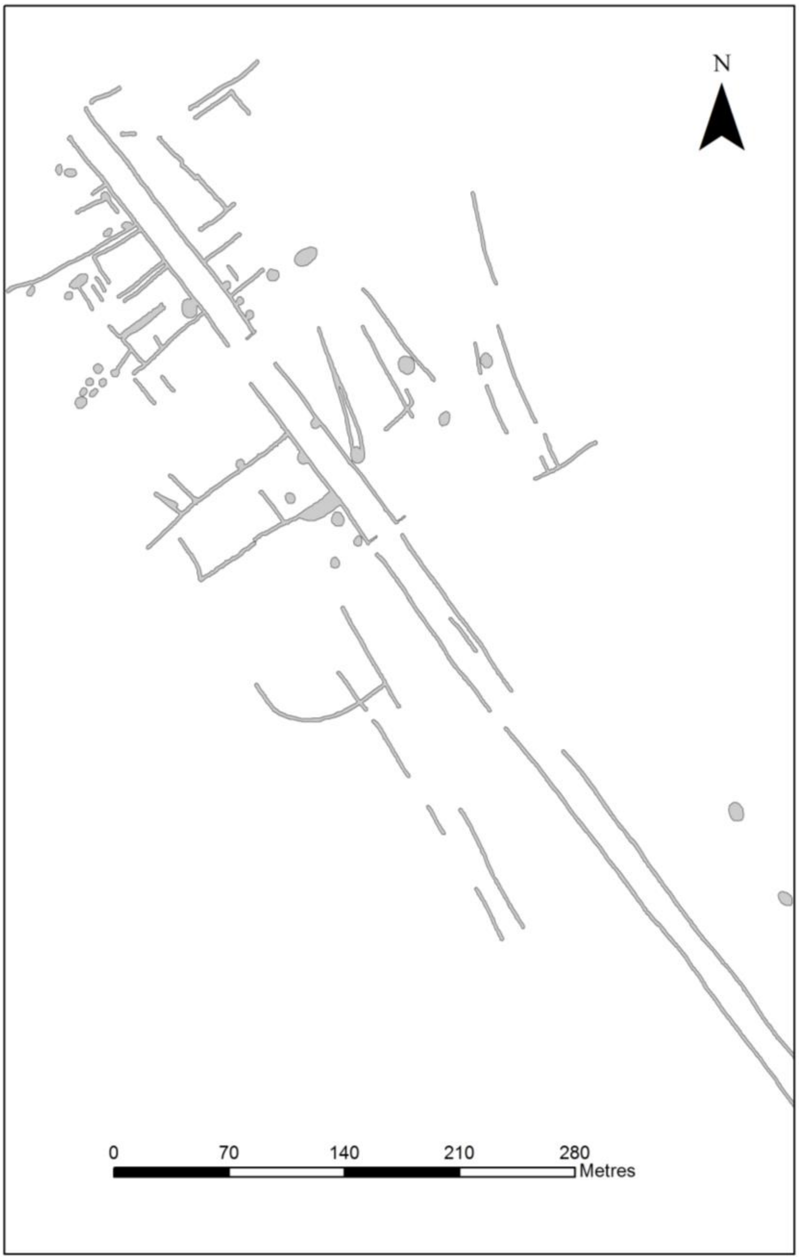
Ptolemy identified the *Parisi* as the inhabitants of a region of Britain that probably corresponds to what is today East Yorkshire. They are also referred to as the *Arras* culture, named for the distinctive Iron Age cemetery excavated in the early 19$^{th}$ century. Their archaeological sites display distinct material culture, burial activities, and settlement patterns not only to the NSR, but to the areas surrounding the YSR as well (Higham, 1993, p. 12; Halkon, 2013, pp. 14-15). It has been argued that the burial practices in particular are similar to the La Téne culture of northern Gaul (Halkon, 2013, pp. 15). Eastern Yorkshire contains the greatest concentration of square barrows in England and also the distinctive tradition of chariot burials, which are similar to burial practices on the continent and are generally dated to the middle Iron Age (400-200 BC), although some examples have been radiocarbon dated to as late as the 1$^{st}$ century BC (Halkon, 2013, p. 79).

Even though there are examples of enclosed 'hillfort' settlements in this part of Yorkshire (such as the early Iron Age site at Staple Howe; Brewster, 1963), by the mid to late Iron Age communities had abandoned these defined boundaries and were spread out in larger, unenclosed settlements (for example the excavations at Wetwang/Garton slack; Brewster, 1980; Dent, 1983a). Prior to the Roman invasion, an additional change to the settlement patterning of the late Iron Age in the YSR was the development of linear complexes of enclosures that have been interpreted as being used for land demarcation rather than defensive purposes, perhaps indicating a reaction to an increased stress on resources due to population growth in this period (Dent, 1983b, p. 37; Stoertz, 1997, p. 67). Many of these "ladder settlement" complexes were arranged along trackways or linear boundaries and appear to continue as a built form type into the Roman period (Dent 1983a, Millett et al., 2006a, Stoertz, 1997).

#### 2.3.1.4 LADDER SETTLEMENTS

Some of the most distinctive built environment features of the late-Iron Age and Roman period in East Yorkshire are long, linear settlements often referred to as ladder settlements (Figure 2.3.1.4). These contained groups of contiguous enclosures arranged along trackways or ditches. "On the Wolds, the disposition of the cropmarks strongly suggests that they represent settlements of village proportions, including small paddocks or individual holdings, typically enclosing areas of 0.25-0.5 ha" (Stoertz, 1997, p. 51). These settlements are unenclosed because even though they are made up of small enclosures, ditches or walls did not encircle these communities. Approximately 125 linear enclosure features have been recorded across the Yorkshire Wolds, with little information available on their function and date. Three of the settlements that have been analysed using VGA; Wetwang/Garton Slack, Shiptonthorpe, and Cottam are examples of ladder settlements that have been partially excavated and their dates span the Iron Age and Roman periods (Dent, 1983a; Millett et al., 2006; Richards, 1999a). The excavations at Wetwang/Garton Slack in particular have shown that these types of enclosures may be related to stock rearing (Dent, 1983a, p. 39).

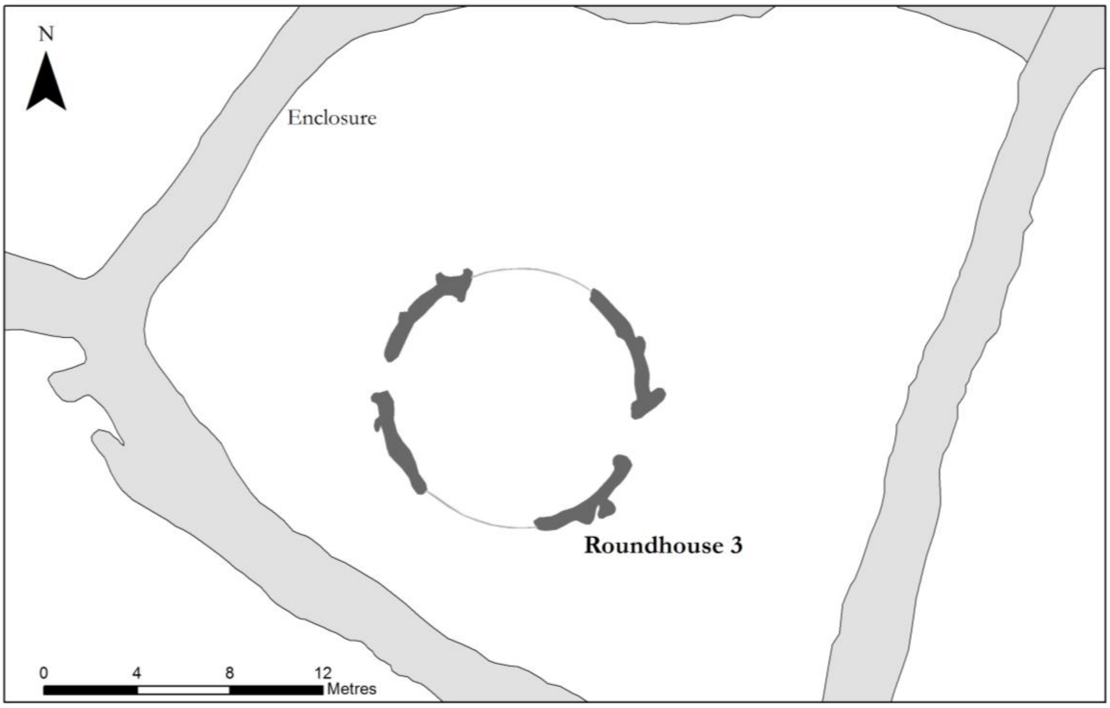
FIGURE 2.3.1.4 Example of a 'ladder settlement' from the YSR: Shiptonthorpe Roadside settlement.




### 2.3.1.5 ROUNDHOUSES

Perhaps the most defining built form of Iron Age Britain, roundhouses are circular-shaped structures with a conical thatched roof (Oswald et al., 2006, p. 71). Ring grooves cut into the ground surface supported the framing of these structures and are generally the most visible remains on the landscape. Although at first glance it would appear that there was little differentiation in the interiors of the structures, excavations across Britain have shown that distinct activity areas and uses of space occurred within (Oswald et al., 2006, p. 78; Pope, 2007, pp. 215–223). Even though the artefactual evidence and ethnographic research confirm the differential use of space in roundhouses, it is difficult to reconstruct how space was visually divided and therefore the internal structuring of roundhouses are not examined further here. Their uniform shape, however, would have structured movement and practice within settlements in ways potentially unique compared to the later settlements in the Roman and Early Medieval periods. All of the examined Iron Age settlements in this thesis contained at least one roundhouse (Brewster, 1963, 1980; Cunliffe, 2004; Harding, 2004; Oswald et al., 2000, 2002; Pearson, 2001; Wrathmell and Nicholson, 1990). Figure 2.3.1.5 is a digitised example of the excavation plans of a roundhouse at Dalton Parlours in the YSR.

FIGURE 2.3.1.5 Roundhouse 3, Dalton Parlours excavation. The darkly shaded areas of the roundhouse were the excavated features of Roundhouse 3, and are connected by the presumed outline of the structure.




## 2.3.2 THE ROMAN OCCUPATION OF BRITAIN

The conquest of Britain began in AD 43 and by the end of the 1st century AD, the campaigns of the Roman general Agricola had pushed the boundaries of Rome into what is today Scotland (*Agricola*, XX). These gains were relatively short-lived, and in AD 122/3, the Emperor Hadrian ordered the construction of a wall stretching from the Tyne to the Solway that effectively divided the island into two. From this point on, the region to the south of the wall developed in a different manner than the region to the north which had comparatively limited contact with Roman Britain (Oswald et al., 2006, pp. 1–4). The Roman occupation dramatically changed the physical and cultural landscape of Britain. Through culture contact and intermixing with the Roman army, bureaucracy, and immigrants, southern Britain shifted from a collection of tribal territories into the Roman province of *Britannia* (*Provincia Britannia*). Perhaps the most visible change due to the arrival of Rome was on the built environment due to the construction of monumental walls (Hadrian's and the Antonine), an integrated road network, a series of military forts and camps across the island, increased urbanism, and the construction of new rural sites known as villas (Mattingly, 2006, pp. 255–260; Taylor, 2007).

The spatial locations of settlements followed similar patterns and trends during the Roman period as during the Iron Age, concentrating in river valleys and the coastal plain of north-east England and more sparse in Cumbria, the Pennines, and the North Yorkshire Moors (Mattingly, 2006, p. 418). However, the settlement character changed dramatically with the adoption of extensive field systems, the widespread construction of fortifications and agricultural centres (villas), and the development of urbanism (K. Dark, 2000, p. 81). The northern frontier was the most militarised area of Roman Britain and the Roman Empire as a whole, and was under military administration throughout the Roman period (Mattingly, 2006, p. 422). Most of this military concentration was based along Hadrian's Wall, spanning 80 Roman miles and connecting the Solway in the west to the Tyne in the east (Mattingly, 2006, p. 154). The resources needed to maintain the large military presence in the north would have required large amounts of both woodland and agriculture to supply the army, which would have affected both study regions due to an increased demand for resources (P. Dark, 2000, p. 82).

The curtain wall would have stood approximately 6 metres in height, and was stone from the eastern terminus to the River Irthing, where (during its first phase) it became a turf wall due to limited stone resources (on the other hand, the stone constructions to the east of the Irthing could be related to a lack of timber resources, necessitating construction in stone) (Mattingly, 2006, p. 156). A total of 80 fortifications, including 17 major forts as well as numerous watchtowers and a large turf ditch to the south known as the *vallum,* were built along with the wall. Scholars have debated the function and role of the wall, positing it had different functions at different times in its life (Breeze and Dobson, 2000; Collins and Symonds, 2013; Dark, 1992; Hingley, 2012; Mattingly, 2006; Wilmott, 2000). It undoubtedly had a defensive role; it may also have been used as a demarcation line to manage trade due to the presence of gateways through the wall. The consequences of Roman occupation on the two study regions was quite distinct, as the NSR was, for much of the period, north of the formal boundary of the Empire, Hadrian's Wall.

In the late 4th and early 5th centuries, the Empire was in turmoil and by AD 410, Britain was no longer officially considered a Roman province. The traditional view of the Roman legions getting on boats and leaving Britain to its fate have faded, with a recognition that the this period was one of transition rather than abrupt endings, due to continuity in the archaeological record at sites such as Binchester and Birdoswald as well as new theories on post-colonial interactions (such as creolization or hybridisation) affecting the discussion (Ferris and Jones, 2000; Webster, 2001; Webster and Cooper, 1996; Wilmott, 2000). This transitional period is difficult for both the historian and the archaeologist, with limited resources available to both disciplines to ascertain the state of Britain in the early 5th century AD. Careful analysis of the 5th through 8th centuries built environment in Chapters 4 and 6 yields insight into potential continuities and/or disruptions.

#### 2.3.2.1 THE BUILT ENVIRONMENT AND STRUCTURAL FORMS OF ROMAN AND ROMAN IRON AGE NORTHUMBRIA

The Roman period witnessed a dramatic shift in how the built environment was constructed and used in Britain. Large Roman forts first constructed of timber and/or turf and later stone, planned road networks, rectangular structures, and villa complexes gradually replaced the earth and timber-framed roundhouses and hillforts of prehistoric Britain. Although Iron Age built forms did not entirely disappear (as the reoccupation and use of hillforts and continual use of roundhouses in portions of Britain through the medieval period displays), the changes to how space was structured at a macro-scale (across the landscape) and micro-scale (in newly developed urban centres, within multi-room villa structures) demonstrate how the new cultural ideas from the Roman occupiers/settlers affected the indigenous population.

#### 2.3.2.2 FORTS

The distinctive 'playing-card' rectangular-shaped camps and forts of Roman Britain are found throughout north-east England (see Figure 2.2.2). Forts were some of the most important features of the Roman built environment due to the large number of troops occupying Britain during this time and how the military exerted Rome's power and control over the landscape and populace. Their primary purpose was to house troops, but often forts were also used to control movement of people and trade (such as along Hadrian's Wall) or as storage for trade goods (such as at Malton) (Breeze and Dobson, 2000; Mitchelson, 1964). Frequently constructed to an ideal, regular, and rectangular-pattern with rounded corners of ditches, walls, and internal structures, the use of defined space within the forts reflects the discipline and order of the Roman army. Roman forts were generally divided into three ranges of two transverse roads that connected barracks, granaries (*horrea*), a hospital, baths, latrines, officer's headquarters (*praetorium*), and administrative areas (*principia*) (Breeze, 2002; Wilson, 2011). The earliest forts and most of the marching camps in Britain were constructed of turf and timber, and later forts were reinforced or rebuilt with stone (Rushworth, 2010). Two Roman forts (Hayton and Housesteads) and selected buildings from the analysed Roman settlements were examined using VGA.

#### 2.3.2.3 ROMAN IRON AGE PERIOD IN NORTHUMBERLAND STUDY REGION

The Roman period in the NSR has been dubbed the Roman Iron Age to reflect the somewhat limited Roman impact on this region. During the Roman occupation of Britain, the NSR was incorporated into the province only when the Roman armies were further north during the Agricolan incursions (AD 79-105), the Antonine Wall occupation (AD 139-160), and during the Severan invasions (AD 208-212) (Passmore et al., 2012, p. 261). This is not to imply that there was direct Roman control or contact of the NSR during these times. Indeed, the Antonine Wall was abandoned and reoccupied during its lifetime, and the ebbs and flows of the Roman occupation and withdrawal would have affected the native Votadini very differently to the Britons living south of Hadrian's Wall. The main Roman road north, Dere Street, would have cut directly through the Votadini territory, and there are many examples of Roman temporary camps/forts within the NSR (Figure 2.3.2.3). That said, there is relatively little evidence of conquest or destruction in this period, and the environmental evidence indicates little disruption in the agricultural land use of the region (P. Dark 2000). These factors point to probable peaceful relations between Rome and the Votadini, with the British tribe being under the hegemony of Rome and probably acting as a buffer to the more northern and antagonistic tribes of Britain (Haselgrove et al., 2009; Higham, 1986, p. 148; Passmore et al., 2012, p. 261).

Evidence of Roman Iron Age settlement in the NSR includes the re-occupation of the Iron Age hillforts as well as numerous temporary forts and camps in the lowland areas. Many of these have not been excavated, and of those that have (such as Flodden enclosure) the complete plans of the settlements have either not been published or were not complete. On the other hand, a recent English Heritage project mapping the earthworks of the Northumberland National Park hillforts described a large number of Roman Iron Age occupations based on morphology and typology.

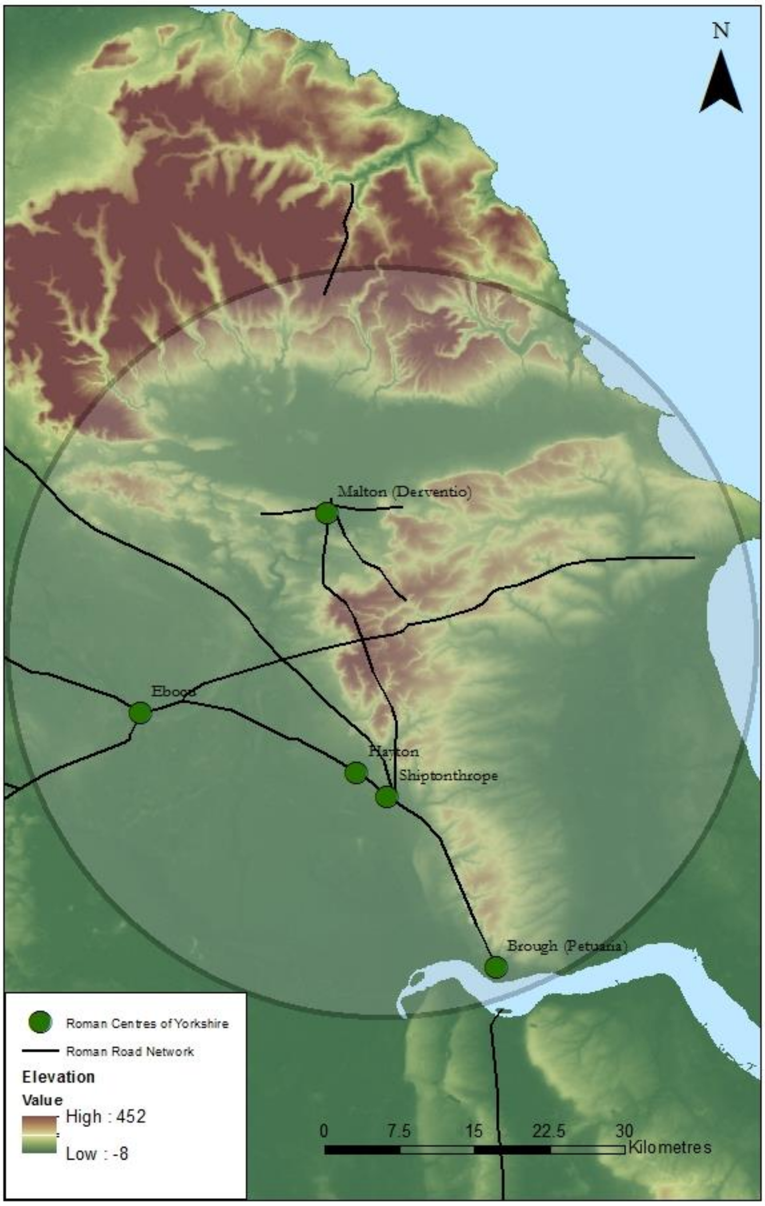
### 2.3.2.4 RE-USE OF PREHISTORIC FEATURES

Many of the Iron Age hillforts in the NSR were reoccupied during the Roman Iron Age, placing roundhouses or new enclosures along the older, collapsed walls of the previous hillforts (Harding, 2012; Oswald et al., 2002, 2006). Current investigations of the NSR hillforts earthworks chronologically identify the Roman Iron Age settlements based on the typological differences in architectural shape and form, as well as changes to enclosure systems surrounding the hillforts (Oswald et al. 2002, pp. 106-108). The chronology of these reoccupations is problematic, as most of these sites have not been excavated. In addition to the re-use of the hillforts, a new settlement form of so-called 'scooped enclosures' appeared on the down slopes from the hillforts in the NSR. Jobey first identified these settlement types in 1962, and subsequent studies of these types at Hethpool are dated to the late Iron Age/Roman Iron Age (Burgess, 1970; Jobey, 1962). However, these scooped enclosures were not examined using VGA as more complete plans of these settlements are needed for this methodology. Future research of these settlement-types will hopefully provide complete enough plans to incorporate scooped enclosures into the VGA analysis of the NSR, as these are an important component of the Roman Iron Age built environment. Regardless, it appears that in the NSR, at least, there was a reoccupation of early hillforts, although these were left unenclosed and the fortifications were not reinforced, perhaps indicating there was a general state of peace at the time. The use of space within these forts, observationally at least, appeared to shift dramatically at this time, perhaps indicating a societal change in ideas on community and household organisation.

### 2.3.2.5 ROMAN PERIOD IN YORKSHIRE STUDY REGION

In contrast to the NSR, the Roman period in the YSR was marked by more influence, acculturation, and impact by the Roman occupation. The Roman legionary fort at York, *Eboracum*, was one of the major urban and administrative centres of *Britannia*, and was positioned close to the territorial boundaries of the Brigantes and Parisi people (Ottaway, 2003, p. 125). Roman Yorkshire contained many of the features of the Romano-British built environment including forts, vici, towns, a road network, villas, farmsteads, and other nucleated settlements and it "(…) presents the archaeologist with, *inter alia*, an excellent opportunity to study the interrelationship between Roman and native, and between settlements with widely differing functions" (Ottaway, 2003, p. 126). Besides York, there were major Roman town centres at Malton/Norton, Brough, Hayton, and Shiptonthorpe, all of which were located along the Roman road network or along waterways (Halkon, 2013, pp. 147–148) (Figure 2.3.2.5).

FIGURE 2.3.2.5 Roman centres and roads in the Yorkshire study region.




Although there were Roman military centres at York and Malton/Norton, the region appears to have been relatively calm after the initial conquest and it became a major agricultural region of Roman Britain that presumably fed the large military occupation further north along the border zone. By the late 3rd and into the 4th century, the YSR appeared to have been quite prosperous as the spread of villa farmsteads that were decorated with mosaics and wall paintings in a similar fashion to other regions of Britain demonstrates (Halkon, 2013, p. 232).

The YSR contains some of the most northern villa-complexes in the Roman Empire, with examples excavated at Rudston, Beadlam, and Dalton Parlours. The major urban centre at York and the many examples of not only villas but also other Roman rural settlements shows the populace of the YSR was presumably more acculturated to Roman lifeways than the native inhabitants of the NSR.

#### 2.3.2.6 LADDER SETTLEMENTS

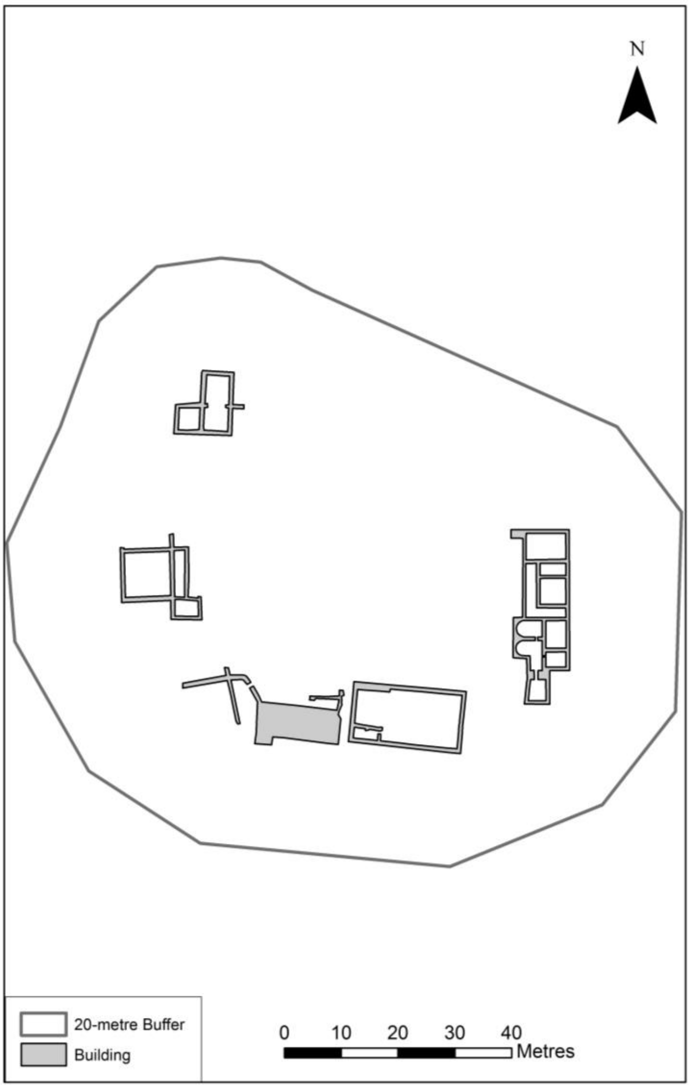
The use of the rectilinear enclosures, or ladder settlements that began in the Iron Age continued into the Roman period. These features went out of occupation and use in the late 2nd /early 3rd century when this region transitioned into a villa-style form of agricultural organisation (Derych, 2012, p. 40; Stoertz, 1997, p. 67). These features are well documented through aerial photography, but only a select number such as at Shiptonthorpe have been excavated (see Figure 2.3.1.4). The ladder settlements demonstrate the long "cultural memory" that can occur with built environment sites, as this style continued long after the Roman occupation and the region had presumably transitioned into a Romano-British society.

#### 2.3.2.7 THE ROMANO-BRITISH VILLA

"The villa is one of the best-established categories of rural settlement in Roman provincial studies, although in reality the definition applied varies widely between different areas and from one scholar to the next" (Mattingly, 2006, p. 369). The villa, in the case of Britain, can be viewed as one of the characteristic domestic structure of Roman Britain and is usually considered as related to the upper classes of Roman life (Figure 2.3.2.7). The basic form of the Romano-British villa shifted over time, and by the mid-2nd century many villas in Britain had adapted winged corridors, symmetrical facades, and courtyards (Mattingly, 2006, pp. 370–372). In the 4th century, there was enhanced villa development in Britain, which Scott feels represents a subconscious response to the breakdown of Roman control (Scott, 1990). The more ostentatious displays of wealth were a way to "(…) re-establish some form of control over the world. The architecture both reached out to embrace the Roman world and at the same time drew its occupants back and protected them from it" (Scott, 1990, p. 171). Mattingly noted other interpretations for the rise in the development of villas during the 4th century; the influence of the increased immigration of wealthy Gallic families, the fragmentation of the Roman bureaucracy, and/or the apogee of economic development in Roman Britain during this time (Mattingly, 2006, p. 374).

In Britain, archaeologists generally classify any large rural farmstead as a villa that has "Roman" aspects such as stone, brick, or tile materials, a rectilinear plan, mosaics or tessellated paving, and/or baths (Mattingly, 2006, p. 370). The four examples of structural complexes with at least one of these aspects from the YSR are Beadlam, Rudston, Welton Wold, and Dalton Parlours. These sites contained a winged principal structure with multiple rooms surrounding a presumed courtyard along with associated outbuildings including baths, stables, barns, etc. and were some of the northernmost villas in Roman Britain. Collectively, they are representative of the relatively large number of villas that have been recorded in East Yorkshire. This concentration of villas in YSR demonstrates not only the importance of agriculture to the region, but also the degree to which the inhabitants of the region were a 'Romanized' society that had adapted traditional Roman built forms to the local environment.

FIGURE 2.3.2.7 Representative example of a Romano-British villa. Excavation plan is of the Romano-British villa at Rudston, Yorkshire study region.



### 2.3.3 EARLY MEDIEVAL NORTHUMBRIA

Northumbria emerged as a political entity through the union of two Anglo-Saxon kingdoms, Bernicia in the north and Deira in the south. Writing on the uniqueness of the kingdom of Northumbria, Rosemary Cramp states:

> I think we can accept that Northumbria in its Golden Age did have a distinctive identity. This identity was partly shaped by its geography – its highlands which allowed refuge in times of stress, and its seaboards, in particular the open way to the British west and to Ireland – but also by Roman territorial development and the early takeover by unruly native tribes who called themselves the men of the north (Cramp, 1999, p. 10).

Cramp refers here not only to the importance of the natural landscape in shaping the Northumbrian kingdom, but also on the *Golden Age* of the kingdom. This somewhat romanticised term refers to the chronological period from the adoption and spread of Christianity in the kingdom in the early 7$^{th}$ century through to the Viking Raids of the late 8$^{th}$ century. This period has generated a large amount of the scholarship on Northumbria (i.e. Hawkes and Mills, 1999) due to its iconic figures (Bede, Edwin, Oswald, Cuthbert), places (Lindisfarne, Whitby, Bamburgh, Jarrow, Yeavering), and artefacts (Lindisfarne Gospels, pectoral cross of Cuthbert) that have all contributed to the notion of a Golden Age (Petts and Turner, 2011b, p. 3). Petts and Turner argue there are important unanswered or under-researched questions on the period, including how the transition from Roman Britain to Anglo-Saxon kingdom occurred (Petts and Turner, 2011b, pp. 4-7).

Much of what is known, historically, on the Early Medieval kingdom of Northumbria is based on the writings of Bede, especially his *Historia Ecclesiastica gentis Anglorum (The Ecclesiastical History of the English People)*. In the closing chapter of the Ecclesiastical History (Book 5, Chapter 24), Bede described his life from entering the twin monasteries of Wearmouth and Jarrow at seven, becoming a priest at his thirteenth birthday and spending his life writing and compiling works on the bible, geography, and of course, history. The Ecclesiastical History provides detailed descriptions of not only the history of the kingdom, but also refers to specific spatial locations of settlements and their importance. Bede's work, along with Gildas's earlier *Ec Excidio et Conquestu Britanniae* (*On the Ruin and Conquest of Britain*) and the later *Anglo-Saxon Chronicle* provides historical context to the relatively limited archaeological remains of the Early Medieval period. Bede states that the first king of Bernicia, Ida, ruled from AD 547-572 (*EH* 5:24). The earliest king of Deira discussed by Bede was Ælle, who was the father of Edwin who united the two kingdoms into Northumbria and ruled from AD 616-633 (*EH* 2:1). At its greatest extent the kingdom spread from the Forth in the north to the

Humber in the south and from Irish to North Sea, although the coastal plain east of the Pennines was the heartland of Bernicia and Deira as well as the later kingdom of Northumbria.

The traditional view of the origins of the English people according to Bede and Gildas, originated with the migration of Angles, Jutes, and Saxons to Britain in the early 5$^{th}$ century AD, establishing their own ethnic kingdoms based on from where they emigrated (i.e. Angeln, Juteland, and Saxony). This interpretation focused on a mass migration of individuals that pushed the native inhabitants of Britain west, assimilated them completely into "English" lifeways, or eliminated them completely. The traditional view explained the dramatic changes to the archaeological record in the 5$^{th}$ to 8$^{th}$ centuries from the preceding period. It argues these changes are the result of this massive migration that removed the Romano-British traces from the cultural and material records and combined with the historical narrative became the established paradigm of archaeological understanding of the period throughout the 20$^{th}$ century (Brugmann, 2011, p. 33). Following the growth of processual archaeology, this traditional viewpoint was questioned and vigorously debated by a number of scholars that rejected the idea of near-complete displacement or replacement of the native inhabitants (Arnold, 1984; Brugmann, 2011; Crawford, 1997; Hamerow, 1994, 1997; Härke, 2011; Higham, 1993, 2004; Rollason, 2003; Scull, 1995; Woolf, 2007).

The proposed alternatives to the traditional view can be broadly summarised as focusing on large migrations, smaller elite migrations, or a hybridised version of both. Rollason (2003) summarises the opposing views well by dividing the evolution of Northumbria into three models based on these debates. Model one focussed on a peaceful cession of power from the imperial authorities to a small elite group of immigrants, model two argues that there was a breakup of Roman authority into native rulers that also handed power over to the elite groups of immigrants, and model three involved the conquest of north-east England by the incoming "English" that pushed out and eliminated previous Romano-British organisational structures (Rollason, 2003, pp. 65–66). Rollason felt there was good justification to accept a nuanced version of the third model, with conquest being the primary driver of the material and social change observed in the historical and archaeological records (Rollason, 2003, pp. 108–109). Higham, on the other hand, has argued for the more limited model of migration due to issues of scale as well as the elimination of the native population in a form of genocide that seems unlikely due to the evidence available (Higham, 2007, pp. 3–7).

More recently, advances in DNA and stable isotope analysis have been put forward as methodologies for discerning answers to these questions. Montgomery's work at West

Heslerton's cemetery, for example, has shown that there were both native and immigrant populations buried together, implying interaction (Montgomery, 2002; Montgomery et al., 2005). Härke, on the other hand, has developed a model of an ethnically divided society between native and immigrant in the 5th to 6th century that gradually acculturated and assimilated in the 7th to 8th centuries. This model combines historical, archaeological, and biological data to explain the apartheid-type society of the 5th to 6th centuries of ethnically separate communities that gradually become part of one society, which he argues explains the limited biological data and shifts in archaeological material culture in these times (Härke, 2011, pp. 19-21).

Archaeologically speaking, north-eastern England contains a relatively large number of settlement sites ranging from the largest excavated Early Medieval settlement in Britain at West Heslerton (YSR), to smaller farmsteads in the Milfield Basin such as the grouping of structures at Lanton Quarry, (NSR). Arguably the most famous site from Early Medieval Northumbria, the remarkable royal vill at Yeavering, is located in the NSR region along with the other famous Early Medieval settlements of this region, Lindisfarne and Bamburgh. In addition, both study regions have been extensively examined using remote sensing techniques that have revealed extensive cropmark complexes such as Milfield in the north and the Butterwick-settlements in the south. These features are discussed in detail later in this chapter and in Chapter 6.

Although relatively wide range of built environment sites from the Early Medieval period are analysed in this thesis, it is important to note that the recognised range of sites in each region may be biased. Post-depositional activities may well have altered the archaeological visibility of sites. Post-medieval agricultural activities such as intensive ploughing can obscure cropmarks and thus site visibility. Whilst these activities also can affect archaeological settlements from the Iron Age and Roman periods; Early Medieval settlements are more easily obscured as their structural remains generally are comprised of post-holes or trenches as opposed to the stone foundations of the Roman period or the substantial large-ditched enclosures of the Iron Age. Such variations in archaeological visibility have important implications for the results of both the GIS and VGA analysis.

#### 2.3.3.1 THE BUILT ENVIRONMENT AND FORMS OF EARLY MEDIEVAL NORTHUMBRIA

The materials and styles of the built environment and material culture changed dramatically between the Roman and Early Medieval period. Architectural materials shifted from stone to timber while the size, shape, and scale of the structures differed between the periods. The majority of the Early Medieval structures examined in this thesis were either post-in-ground or post-in-trench timber framed buildings. These timber-framed structures display remarkably similar styles and ground plans across the excavated Early Medieval British settlements (Dixon, 1982; Hamerow, 1999, 1994; James et al., 1984; Marshall and Marshall, 1991; Tipper, 2004). These factors also display correlations to structures excavated across north-western Europe (Hamerow, 2002, p. 19). The use of space in Early Medieval settlements in Britain differed from the preceding time periods as well as from the Early Medieval examples on the continent. These settlements were unenclosed and open, with most of the structures dispersed across a broad area and oftentimes laying along an east-west alignment (Hamerow, 2002, pp. 93-94).

Reynolds has summarised Anglo-Saxon settlement patterns and processes into four phases of chronologic development. The earliest phase, extending from the 5th to mid-6th centuries was characterised by settlements containing no obvious difference in the social distinction of the settlement plans or the buildings. However, there was social distinction in the burial evidence of the phase. The second phase extended from the later 6th to 9th centuries, and witnessed the growth of high-status settlements (such as Yeavering) that had a defined orientation and plan. This phase witnessed the growth of minor and major enclosures as well as rectilinear settlements. The third phase went from the 9th to 12th centuries and saw the appearance of manorial sites and associated settlements as well as the development of village plans. The final phase of medieval settlement extended from the 12th to 14th centuries, where a loosening of the tight boundaries defined in the second and third phases, as well as the growth of urban and suburban areas affected the settlement patterns (Reynolds, 2003, p. 130). The settlements analysed by VGA predominantly date to the first and second phases of Reynolds' chronology.

Settlements from Early Medieval England have been characterised as shifting positions over time. Structures were built, used, abandoned, and rebuilt nearby, thus the settlements gradually wandered across the landscape (Hamerow, 2012, p. 67, 1993, pp. 86–91; West, 1986, p. 151). Settlement shift has been used to discuss the development and use of 5th to 7th century settlements throughout Britain. The large excavation at West Heslerton, however, appears to differ from this pattern and the excavator has argued that it was constructed in one phase as a planned "proto-village" (Powlesland, 2000, p. 25). Thus, it appears there are different methods of community development and planning during this period.

Over time, enclosures in the Early Medieval period changed in scale, size and function. "Between the 7th and 10th centuries, more frequent use was made of major ditches and palisades to define space within Anglo-Saxon settlements in England and southern Scotland, in comparison with sites from the 5th and 6th centuries" (Loveluck, 1996, p. 66). Enclosure ditches and palisades from this period have been interpreted as defining portions of settlements (West Heslerton, Butterwick-type settlements e.g. Burdale, Thwing, Cottam) or for making enclaves for protecting livestock (Sprouston, Yeavering, Maelmin) (Loveluck, 1996, p. 67). Regardless of their function, the increased numbers of enclosures and boundaries reflect a more formal view of how the built environment was planned, viewed, and used by an increasingly diverse and stratified society (Reynolds, 2003, p. 130).

#### 2.3.3.2 GRUBENHAUS

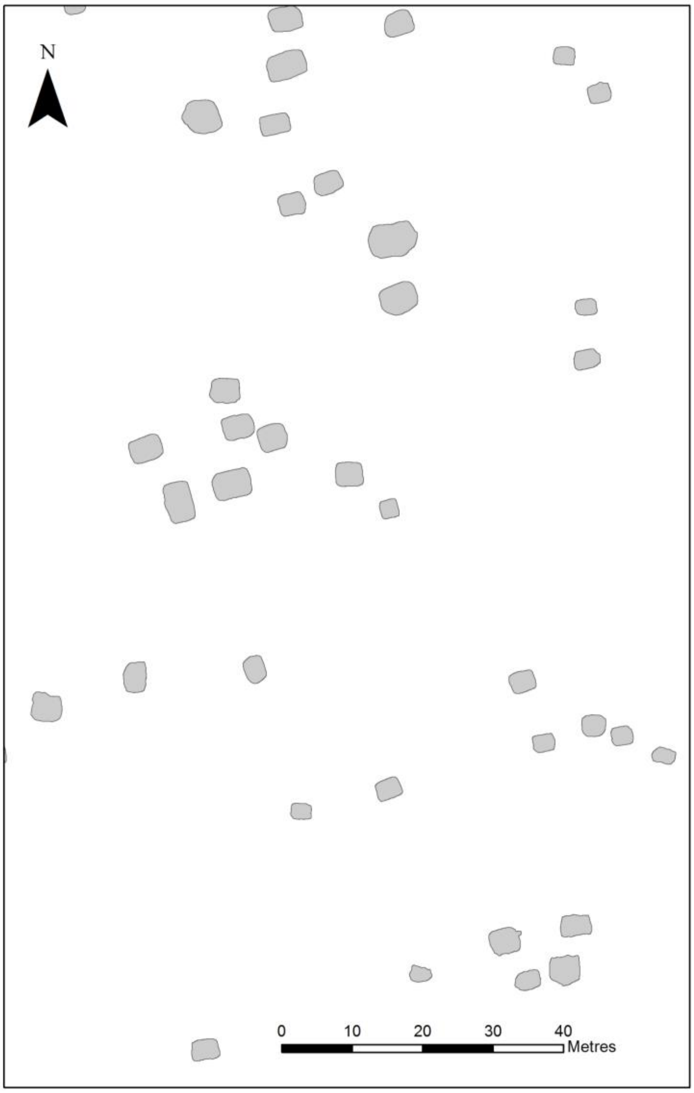
Grubenhäuser, or sunken-featured buildings, are a distinctive building style attributed to the Early Medieval period and found in contexts throughout north-western Europe. Although sunken-floored structures have been excavated from Roman settlements in Britain, such as at Dalton Parlours and Welton Wold Villa (Mackey, 1999; Wrathmell and Nicholson, 1990), these earlier examples are distinctly different from the grubenhäuser of Early Medieval settlements based on structural characteristics and style (Tipper, 2004, p. 7). Jess Tipper's monograph on this structural style describes them thus:

> They are typically sub-rectangular in shape, measuring *c.* 3x4 m in area *c.* 0.3-0.5 m in depth with sides sloping down to a roughly flat base. There are often two post holes along the short walls of the pit, often referred to as the gable post-holes, although the number of post-holes varies from zero to six, including additional post holes in the four corners of the pit (Tipper, 2004, p. 1).

This structure-type has been found throughout southern Britain (e.g. (Hamerow, 2002, 2012; Marshall and Marshall, 1991; Tipper, 2004), but with relatively few examples found north of the Vale of Pickering. Remote sensing at New Bewick, Northumberland identified a number of features that resembled grubenhäuser, and one of these was later confirmed by excavation as a sunken-featured building (Gates and O'Brien, 1988; Glover, 2010). Based on this, cropmark evidence at Milfield and Sprouston and geophysical evidence at Yeavering are also interpreted as grubenhäuser (Gates and O'Brien, 1988), indicating that this structural style, although more commonly found in the south, is also found in Northumbria.

The function, use, and construction techniques of grubenhäuser are hotly debated. Functionally, these structures have been interpreted as dwellings, craft buildings (such as weaving sheds), and food storage based on the artefactual evidence that has been found in the structures (Hamerow, 2002, pp. 31–5; Rahtz, 1976, p. 76; Tipper, 2004, pp. 160–185). As Tipper (2004) has argued, most of the artefacts found in grubenhäuser probably related to tertiary deposition and are not reflective of the activities that occurred in these structures. Central to the debate is discussions of whether or not these structures had suspended or sunken floors. It has now become mostly accepted that these structures probably had a variety of functions, even within the same settlement or at different times in the life of the structure or settlement. Tipper argues that care must be taken in interpreting the functional use of these structures as the artefactual record within these features may not have related to the activities performed within them (Tipper 2004, p. 185).

FIGURE 2.3.3.2 Grubenhäuser from the West Heslerton

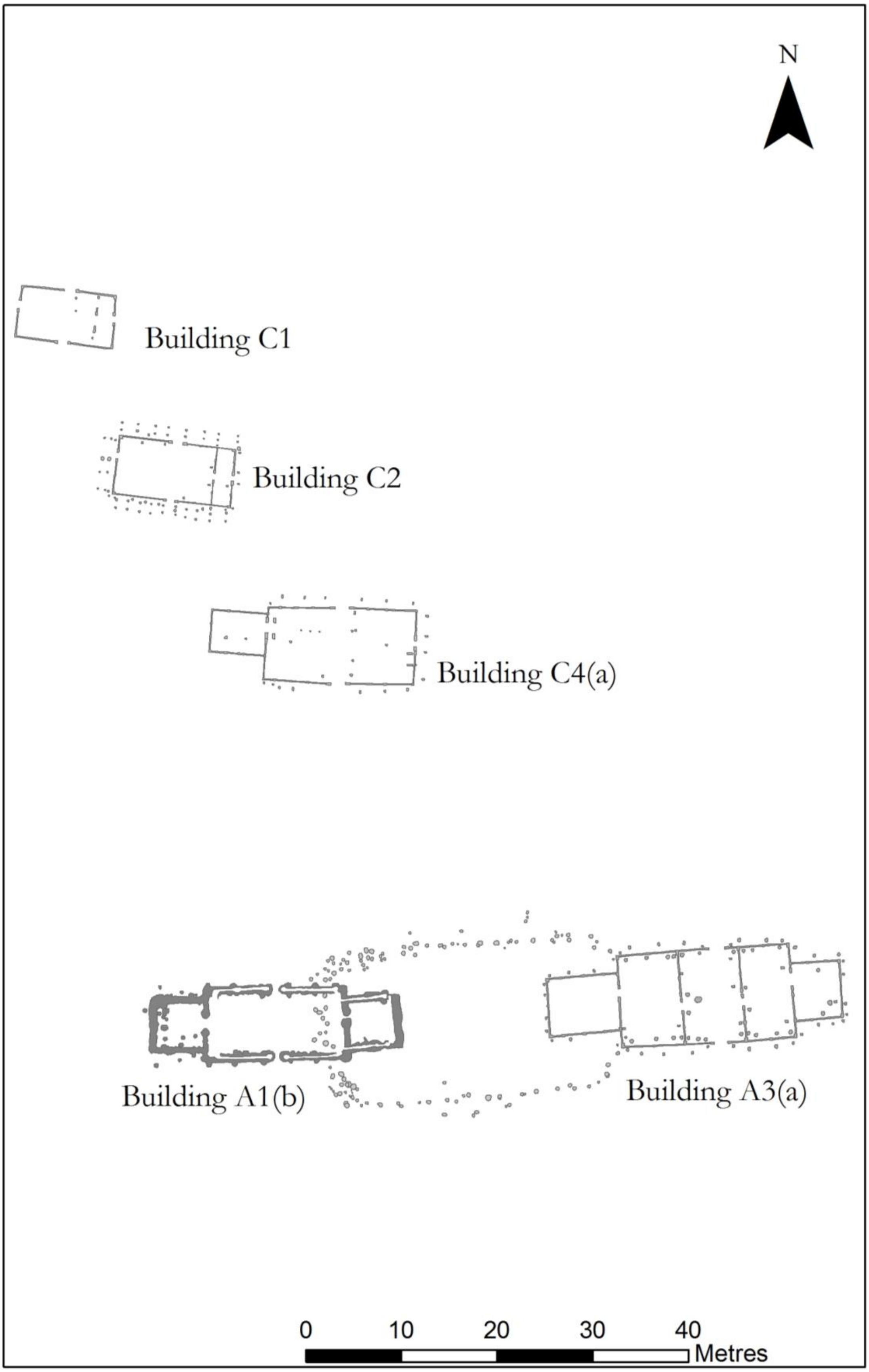


#### 2.3.3.3 RECTANGULAR EARTH-FAST TIMBER BUILDINGS AND HALLS

Even though the grubenhaus is arguably the most distinctive architectural form of the Early Medieval period, rectangular earth-fast timber buildings and halls comprise a substantial proportion of the Early Medieval built environment. These structures were built using post-in-ground and post-in-trench construction techniques, and ranged in size from smaller structures of *c.* 5 by 10 metres to the large Great Halls of Yeavering that were close to 30 metres long (Figure 2.3.3.3). These structures are found throughout England and in the case of the 5th to 7th centuries, appeared in remarkably similar forms and scale (Hamerow, 2012, p. 31; Powlesland et al., 1999, p. 59).

Hamerow has suggested a chronological development of Anglo-Saxon earthfast timber buildings based on particular trends over time in the form and style of the structures (Hamerow, 2012, p. 22, 2011, p. 130). Fifth century buildings, in general, were laid out in a two-square module style and were mostly small, aligned east-west, and built using individual postholes (Hamerow, 2012, p. 22; James et al., 1984; Marshall and Marshall, 1991). The buildings often had two entrances on the north and south sides of the structures, and little to no internal support (Hamerow, 2002, p. 46). The 6th century had greater variation in structural length and width, and by the end of the century foundation trenches had begun to make an appearance (Hamerow 2012, p. 22). This variation increased in the early 7th century with the arrival of exceptionally large buildings (such as halls) and also very small structures (less than 6 metres in length) (Hamerow, 2012, p. 23). Approximately half of the 7th century buildings were built using foundation trenches, and the alignment could be either east/west or north/south. Foundation trenches became the norm in the 8th and 9th centuries, and began to fall out of use by the 10th century (Hamerow, 2012, p. 24). This chronology is a general model, and there are examples of foundation trenches appearing alongside post-in-ground structures at a similar time (for example Thirlings and West Heslerton). The similarity in structural techniques and styles implies there were links between the different regions of Britain in the Early Medieval period. Conversely, the layout of these structures and how they were used appears to be regionally different based on settlements' layout (for instance the shifting settlement model versus planned curvilinear enclosures of the YSR). Potentially this implies that while construction techniques remained static, interaction between the local and migrant populace may have affected how settlements were developed.

Figure 2.3.3.3 Representative examples of rectangular earth-fast timber buildings and halls from the Phase 4 occupation phase at Yeavering (Ad Gefrin).



### 2.3.3.4 THE EARLY MEDIEVAL PERIOD IN THE NORTHUMBERLAND STUDY REGION

David Rollason describes at least three and potentially more "heartlands" of the Northumbrian kingdom that were concentrated areas of royal interest and power (Rollason, 2003, p. 45). The Bernician heartland coincides with the NSR, containing the important royal centres of Yeavering, Bamburgh, and Milfield as well as the monastic settlement of Lindisfarne. The large and impressive structures excavated at Yeavering have been interpreted as the royal *vill* described by Bede as where Paulinus spent 36 days baptizing the local inhabitants (Hope-Taylor, 1977).

In addition to the royal and monastic settlements of the Northumberland study region, archaeological investigations over the last 30 years have identified smaller Early Medieval settlements and farmsteads such as at Thirlings, Lanton Quarry, and Cheviot Quarry (Johnson and Waddington, 2008; Miket et al., 2008; O'Brien and Miket, 1991; Passmore et al., 2009, 2012; Stafford and Johnson, 2007). Many of these newly identified settlements have been found during development-led archaeological work conducted prior to large-scale quarrying activities, which have yielded complete or nearly complete settlement plans. These smaller community areas have been interpreted as contemporaneous with the larger royal and monastic sites, forming a concentration of Early Medieval activity in the Northumberland study region.

### 2.3.3.5 THE EARLY MEDIEVAL PERIOD IN THE YORKSHIRE STUDY REGION

Another of David Rollason's heartlands was found in the YSR, and was the centre of Deira power and prestige (Rollason, 2003, p. 45). Two major Early Medieval settlements have been excavated in the former territory of Deira at West Heslerton and Thwing (also sometimes referred to as Paddock Hill). The West Heslerton excavations, the largest Early Medieval settlement excavated in northern Britain, revealed a large proto-village/planned community with distinct zones for different activities (Powlesland, 2000, 1998; Powlesland et al., 1999). The investigations of Paddock Hill at Thwing, on the other hand, have been hypothesised to be the royal seat of the Deiran kings as it was built within the remains of a Bronze Age ring fort and contained a large hall similar to that at Yeavering (Manby, unpublished). The settlements at West Heslerton and Paddock Hill, as well as curvilinear enclosure settlements (see below), and the numerous Early Medieval settlements discovered during the Landscape Research Centre's intensive geophysics programme (Landscape Research Centre Online

Digital Atlas) have shown that the YSR, as a heartland of Northumbria, contained a high density of Early Medieval settlement.

#### 2.3.3.6 CURVILINEAR ENCLOSURES (BUTTERWICK-TYPE SETTLEMENTS)

Catherine Stoertz, in her survey of cropmarks in the Yorkshire Wolds, identified eleven examples of a settlement-type dubbed *curvilinear enclosure complexes* that contained a nucleated cluster of curvilinear enclosures along with cropmarks representing grubenhäuser (Stoertz, 1997, p. 59; Figure 2.3.3.6). Numerous examples of curvilinear enclosure settlements have been catalogued in the YSR and have been attributed to the Early Medieval period. West Heslerton, for example, has this type of feature in the southern half of the settlement. For ease of discussion, this thesis uses the term Butterwick-type for these features, after Wrathmell et al. (2012) and the type-site for these complexes found near the current village of Butterwick. Seven of the eleven Butterwick-type settlements were analysed using VGA as these were felt to be the clearest indicators of the type (Richards and Roskams, 2013; Wrathmell et al., 2012, p. 106). All of these settlements were located close to medieval and later villages, possibly indicating continuity and reuse of the landscape into later periods, albeit at a sifted spatial location.

FIGURE 2.3.3.6 Butterwick-type enclosure at the Butterwick site.


The dating of these Butterwick-type sites is problematic, as they have generally not been closely examined. Increased boundedness and enclosure of settlements in Early Medieval

England grew from the 7th century AD onwards (Hamerow, 2012; Reynolds, 2003). One of the Butterwick sites, Burdale, has been partially excavated and dates from the 8th century with activity continuing into the 9th and even 10th centuries AD (Richards and Roskams, 2012, 2013). Other Butterwick-types, such as the enclosures incorporated into the settlement at West Heslerton, have been tentatively dated to earlier periods (with West Heslerton dated from the 5th through 9th centuries). Table 2.3.3.6 shows the relative chronology of the Early Medieval settlements examined from the NSR and YSR. It has already been acknowledged, and is underlined again here, that on current dating, the YSR sites largely date to the middle and later end of the period under consideration (see pp. 31, 277-281). This thesis however is primarily testing out a new combination of methods for understanding continuities of tradition in the built environment. The need for comprehensive site plans is a driving motivation in the choice of sites and this results in the chronological bias evident below in Table 2.3.3.6. The bias is therefore acknowledged and has been taken into account in the interpretations presented in the concluding chapters of this thesis.

Table 2.3.3.6 Relative dating of Early Medieval settlements examined using VGA

| **NSR Settlements** | |
|---|---|
| Yeavering | 5th-7th centuries |
| Lanton Quarry | 5th-6th centuries |
| Cheviot Quarry | 5th-6th centuries |
| Thirlings | 6th century |
| Milfield | 7th century onwards |
| Sprouston | 7th century onwards |
| **YSR Settlements** | |
| West Heslerton | 5th-9th centuries |
| Thwing/Paddock Hill | 7th-10th centuries |
| Cottam | 8th-9th centuries |
| Huggate Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |
| Boynton-Caythorpe Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |
| Lutton Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |
| Wharram Percy Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |
| Binnington Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |
| Burdale Butterwick-type | 8th -10th centuries |
| Butterwick Butterwick-type | 5th-9th centuries, but probably 7th centuries onwards |

## 2.4 SUMMARY OF CHAPTER 2

This chapter has provided an overview of the cultural and physical landscape of Northumbria during the 1st century BC to 9th century AD and provides a framework for the detailed discussion of the results in Chapter 7. The physical landscape of the two study regions differ from one another topographically, geologically, and climatically but, in general, share similarities to one another as compared to other regions of Britain. The chronological built environments share similarities between the study regions in the Iron Age and Early Medieval periods but Roman Iron Age/Roman periods in the NSR and YSR had very different types of settlements and structures. North-east England during the 1$^{st}$ millennium AD was the centre of a complex series of contested transformations as a variety of ethnic, political, and cultural groups interacted with one another. Understanding how these changes would have occurred is discussed in the theoretical background of the thesis in Chapter 3.

# CHAPTER 3
# THEORETICAL CONTEXT

A multi-scalar approach is utilised in this thesis to investigate the households, settlements, and landscapes of the two study regions to examine the origins, development, and use of space in and between Roman to Early Medieval Britain. These levels of analysis are then interpreted using a post-colonial approach focused on how humans interact with spaces and places and how cultural identity and ideas are passed among disparate societal groups during periods of migration and colonisation (such as during Roman conquest or the sub-Roman/Early Medieval period). During the transitional period native Britons, the Romano-British, and immigrants from Germanic and Scandinavian regions interacted, mixed, fought, assimilated and acculturated forming into a dynamic cultural group inhabiting Northumbria in the Early Medieval period. Understanding these complex processes based on the archaeological record requires a detailed theoretical understanding of how individuals act in and interpret space, what ideas of space and the built environment can and do mean to a society, and how these values and ideas are shared between disparate groups. This multi-scalar and multi-disciplinary approach, combined with new and innovative methodologies investigates how preceding periods affected the development and use of space and the built environment in Early Medieval Northumbria. This chapter defines the key theories used here beginning with a discussion on space and place followed by a description of the scales of analysis from the household through to the landscape levels. The chapter concludes with a discussion of post-colonial theory, its appropriateness for interpreting the analysis of transitional Britain's spaces and places, and how it brings together the multiple scales of analysis to understand the role of space and place in the transitional period.

## 3.1 SPACE AND PLACE

"'Space' and 'place' are familiar words denoting common experiences" (Tuan, 1977, p. 1) and are fundamentally intertwined components of the human experience. They have become critical terms and areas of study in the humanities and social sciences (Agnew, 2011; Gieryn, 2000; Goodchild and Janelle, 2010; Ingold, 1993, 2009; Tuan, 1977). These recognizable yet abstract and multifaceted terms refer, somewhat simplistically, to where something is (place) or is not located (space). Space and place are interrelated, and often used to define one another. For example, National Parks in North America can be seen as embodying both place and space, as they have distinct boundaries demarcating the parks, but the park interiors are often thought of as empty and open space. Tilley discusses a similar point, arguing that places have embodied meanings, and the more abstractly defined spaces are defined by their relationship to places (Tilley, 1994, pp. 14–17). Archaeological examinations of how space and place (often referred to as the built environment) were conceived, developed, and used by past cultural groups have become increasingly common in research across diverse time periods and regions. This is true for scholars interested in Early Medieval Britain who have examined space in a variety of ways including, but not limited to, focusing on the morphological characteristics of structures and settlements (Hamerow, 1999, 2011; Powlesland, 1997, 1998; Tipper, 2004), the use of natural space in comparison to sacred spaces and places (Semple, 2011, 2013; Williams, 2006), the re-use of prehistoric monuments and/or Roman features (Driscoll, 1998; Powlesland et al., 1999; Semple, 2013; Williams, 1997, 1998), the demarcation of space by boundaries and enclosures (Griffiths et al., 2003; Reynolds, 2003; Stoertz, 1997), examining space and the historical mind-set of individuals inhabiting Early Medieval Britain (Scheil, 2012), and the importance of household and settlements as social constructs reflecting societal norms and identity (Hamerow, 2002, 2012). These and other investigations show that there is a broad interest in how space and the built environment were used in the Early Medieval period. Powlesland comments on the importance of space for understanding Early Medieval settlements:

> If we are to build any models for the development and function of these (Early Medieval) settlements then it is to the spaces between the structures that we should look rather than simply looking at the structures themselves (Powlesland, 1997, p. 114).

However, while the analysis of space in Early Medieval Britain has been deemed important, it has been difficult to make measurable comparisons of the use of space between sites as well as to spaces and places from other temporal periods. These limitations are due to a relatively small data set of households and settlements that have been sufficiently excavated to determine the spatial characteristics of these structural units.

Tuan is not alone when he argues that the organisation of built space is based on sight (Tuan, 1977, p. 16), making a methodology centred on visibility ideal for understanding the spaces and places of the past. Ingold disputes the duality of space and place, advocating that wayfaring based on movement and visibility makes no separation between the two because as individuals move through the environment, they are constantly redefining the boundaries of place and space to the point these no longer exist as distinct entities (Ingold, 2009, p. 38). Regardless of the theoretical approaches to space and place, there is broad agreement that visibility and movement are essential components of individuals' and societal understanding of the organisation of the built environment.

### 3.1.2 THE SOCIAL THEORY OF SPACE AND THE BUILT ENVIRONMENT

Built environments (place) and built forms (human constructions/architecture) are important for research on the effect of space on human culture and identity because, as Fisher describes, they transform "(…) contiguous space into discrete but interconnected units, buildings structure patterns of movement and encounters and therefore directly influence social relations" (Fisher, 2009, p. 439). Social scientists have always focused on socially constituted place, with archaeologists and anthropologists particularly interested in the relationship between society and the built environment because "(…) people both create, and find their behaviour influenced by, the built environment" (Lawrence and Low, 1990, p. 454). One of the earliest and most important theories on the relationship between space and culture was Edward T. Hall's *proxemics*, which argues that an individual's use of space is a specialised elaboration of culture (Hall, 1966, p. 1). Proxemics refers to how individuals react to the built environment and other people when they come into contact with four fixed zones of space that Hall argues surround each individual (intimate, personal, social, and public distance) (Hall, 1966, pp. 114-115). His work demonstrates that ideas of how to act in space are dependent upon cultural membership influenced by many social scientists interested in space and the built environment.

Due to the popularity of the built environment as a research subject, it has been examined using a variety of methods and theories. Amos Rapoport's *cognitive congruence model* contends the built environment *reflects* the thoughts and practices of society (Rapoport, 1980, pp. 287–289). This model shows that people shape their natural and built environments according to their particular and shared social memory, cultural ideas, preferences, and practices. Following this, the built environment is a form of nonverbal communication that is decoded and understood by the members of society. In contrast, Anthony Giddens' structuration theory focuses on the 'duality of structure', the relationship between social structure and an individual's agency that cannot exist without one another. Structuration implies that architecture is one of the principal ways in which society and culture are directly constituted. Enclosed space *enables* and *constrains* activities and social interactions, and therefore the built environment plays a primary role in the formation of cultural practices and ideas, which are then reproduced through contextual practice (Giddens, 1984, pp. 17–25). Both of these schools of thought posit that space needs to be both studied and understood in order to appreciate how socio-cultural groups interact, define, and practise activities within their households, communities, and landscapes. Though both structuration and the cognitive congruence model have informed this thesis, Rapoport's ideas on how the built environment reflects society have been found to be more useful in understanding the duality of the relationship between structural space and culture in transitional Northumbria.

Connections between space, place, and society are reflexive, with social groups demarcating space in settlements and structures according to environmental concerns, communal practice, and societal norms related to the built environment's style, function, and identity. The built environment is either consciously or unconsciously planned according to these norms when the structures and settlements are built, and over time the meaning of these built forms in the society could potentially change as activities adapted to new cultural trends, ideas, and interactions. Both Giddens' structuration theory and Pierre Bourdieu's notion of the habitus argue that culture is replicated through the routine practices of individuals. In contrast to structuration's interrelated duality of structure and agency of individuals (Giddens, 1984), Bourdieu's habitus refers to the mental space of practice, "(…) the structured dispositions within which those structures are actualised and which tend to reproduce them" (Bourdieu, 1977, p. 3). A group's habitus internalises perception, understanding, and practice whilst it *creates* and is *created* by a cultural group. According to Bourdieu, the habitus explains the symbolic interpretations of space and how a society's concept of space relates to individual practised actions. These two theories demonstrate the reason cultures reproduce societal rules as a result of routine and practice, and when social change occurs through agency or disruption, it affects all aspects of social structure due to the interrelated qualities of culture.

### 3.1.3 SUMMARY OF SPACE AND THE BUILT ENVIRONMENT

Investigations concentrating on space and place as socially constituted forms and ideas have become common areas of research in the social sciences. The specific investigation of space and place in Northumbria has the potential to yield insights into how social relationships may have influenced the spatial layouts of the built environment (Rapoport, 1980, p. 9). This is important for archaeological research of Early Medieval Northumbria, as the artefact record is limited from the excavated settlements (or non-existent from cropmark sites). However, the household, settlement, and/or landscape should not be examined uncritically, as these factors are all influenced by cultural ideas and identities. As Hamerow suggests, much of the artefactual evidence from Early Medieval settlements is limited or 'clean' (i.e. excavations find few middens or preserved ground surfaces) (Hamerow, 2012, p. 2). In Northumbria, most of the artefactual record of the Early Medieval period has been recovered from burial contexts (particularly in the YSR as at the Anglian cemetery of West Heslerton) or from random finds catalogued by the Portable Antiquities Scheme. Therefore due to the nature of Early Medieval settlements in general as well as the relative paucity of artefactual evidence, a methodology focusing on the organisation of the built environment based on the one form of evidence we do have in relative abundance would seem to be not only important, but required in order to understand the complex questions of the period.

## 3.2 THE HOUSEHOLD

Sharon Steadman (1996) describes settlement archaeology as a "parent" to both household archaeology and spatial analysis. Household archaeology was developed as a method to examine space and the remains of dwellings in order to make inferences about the broader social system, and moves away from the strictly morphological analyses of buildings. The specific examination of the household as a cultural construct was first discussed in the early 1980s, although Mesoamerican archaeologists were working with similar ideas in the 1970s (Flannery, 1976). Even though archaeologists have always examined dwellings and house remains, household archaeology focuses on the economic and social functions of dwellings as well as morphological and stylistic attributes. Iron Age, Roman, and Early Medieval households varied according to region, function, and site-specific styles dictated by the local environment as well as local traditions, but are all seen as emblematic of socio-cultural ideas and identities.

### 3.2.1 THE DEVELOPMENT OF HOUSEHOLD ARCHAEOLOGY

Anthropologists in the 1970s began to study households as the primary building blocks of societies, focusing on the primary household functions of production, distribution, transmission, and reproduction (Wilk and Rathje, 1982). Households vary from society to society, but all humans live in and use material culture in households, and as such the household can be seen as a universal value that can be examined cross-culturally and across time periods. Anthropologists are concerned with the ethnographic household, which does not necessarily equal a single dwelling. A household may include numerous components such as the main dwelling, outbuildings (kitchen, stables, privy, etc.) as well as boundary markers (fences, enclosure ditches, roads, etc.). As Penelope Allison states, "a household, as a social entity, is not bounded by the identification of its 'house'" (Allison, 1999). In fact, there can be more than one "household" within one dwelling based on numerous familial or production units, and likewise a single household can include numerous buildings.

Richard Wilk and William Rathje were among the first to adapt the anthropological theories on households for use in the study of archaeological remains and defined households as the "(…) level at which social groups articulate directly with economic and ecological processes. Therefore, households are a level at which adaptation can be directly studied" (Wilk and Rathje, 1982, p. 618). They posited that understanding household organisation and structure could bridge the "mid-level theory gap" in archaeology between large-scale theories of culture change and the smaller-scale "practical" archaeology of sites and excavated artefacts by focusing on a defined unit of study that reflects the larger socio-cultural structure (Wilk and Rathje, 1982). Household archaeology developed out of the functionalism school of archaeology that focused on activity areas as well as early processual theories on cultural ecology (Seibert, 2006). Later on, archaeologists influenced by post-processual and post-modern theories adapted the study of households to suit their own agendas, demonstrating that the study of space in a small, focused area can be useful for archaeologists regardless of their theoretical background (Allison, 1999; Hastorf, 2001).

Archaeologists studying households utilise an anthropological perspective that concentrates more on the functions of dwellings rather than on a dwelling's morphology. Households are seen as the fundamental unit of a cultural group and as such they reflect the overall structure of a society. Archaeologists traditionally focused on dwellings as a means to study population size and strength within an archaeological site, estimating the number of individuals that would have inhabited the dwelling and thereby making local and regional population estimates (Allison, 1999). Household archaeology adds to this by focusing on behaviours that were practised within the household unit.

Wilk and Rathje (1982) focused on the economics of households, and noted that households are composed of three elements that perform four types of functions. The social element refers to the members of the household; the material element includes the dwelling, activity areas, and possessions; and the behavioural element comprises the activities the household performs. The archaeologist's task in studying households is to understand how the material culture found during fieldwork relates to the interactions between the elements and functions of a household. Archaeologists infer dwellings from excavated material culture, and then infer households from the dwelling units (Wilk and Rathje, 1982). The four functions classified by Wilk and Rathje comprise production, distribution, transmission, and reproduction. Production includes the procurement of resources and somehow increasing their value. Households throughout human history have had a broad range of productive activities, with food processing the most common form of production that is still practised in modern households. Distribution moves resources from producers to consumer, either within the household, between households, or between larger societal units. Transmission includes transferring knowledge, rights, roles, land, and/or property between generations, and varies according to societal mores. The final function of a household is the reproduction of its members, deemed by Wilk and Rathje to be "one of the least flexible of household functions" as a society's individuals must reproduce to maintain society (Wilk and Rathje, 1982, p. 630).

By focusing on function, household archaeologists move beyond comparing structures based on an architectural basis of shape, size, and style. This is not to say that the household archaeologist ignores the morphological characteristics of structures; the form of a dwelling can lead to clues of the activities practised in a household. Likewise, the design of a dwelling was likely influenced by the functions practised within the space by the members of the household. It is important to note however, that dwellings' forms do not necessarily illustrate the functions that occurred within them. Even today, modern buildings are not necessarily designed specifically for the functions and practices that occur within them. In addition, the boundary line between a large household and a small settlement can be difficult to ascertain archaeologically.

One of household archaeology's strengths is that interpretations can be made about the broader society, which is especially useful in studies containing little historical documentation. Archaeologists working in the Americas utilise household archaeology to examine prehistoric populations with no historical record to explain their social structure (for example: Allison, 1999; Blanton, 1994; Hastorf, 2001; Wilk and Rathje, 1982). Historic archaeologists working in the United States have also used this technique to analyse African-American slave sites to examine the relationships of power within a class of people that are "historically invisible" (Deetz, 1996; Delle, 1998; Ferguson, 1992; Wilkie, 2000a, 2000b). European archaeologists have been slow to adapt household archaeology due to the wealth of written knowledge about the classical and medieval time periods that allow a different theoretical examination. Helena Hamerow and Ruth Tringham demonstrated that these approaches can be adapted to European contexts, with Hamerow's work examining the Early Medieval period of north-western Europe (Hamerow, 2002, 2012; Tringham et al., 1985; Tringham and Krstic, 1990) It is argued here that due to the limited historical documentation of this transitional time period, household archaeology can be utilised effectively to answer the research questions.

### 3.2.2 PREVIOUS EXAMINATIONS OF HOUSEHOLDS

Archaeologists examine households in a variety of ways. Steadman (1996) provides an excellent history of the study of households in *Recent Research in the Archaeology of Architecture*. As mentioned previously, early household archaeologists initially focused on economics as the most important factor to shaping the household (Netting et al., 1984; Wilk, 1989a, 1989b; Wilk and Rathje, 1982). They utilised a production model whereby the more complex tasks performed within households require larger households and smaller households tend to be more mobile and better suited to less complex production (Wilk and Rathje, 1982). The following is a limited review of how the archaeological household has been studied.

Richard Blanton's book *Houses and Households: A Comparative Study* focuses on examining architectural layouts using a graphical analysis that breaks dwellings into separate architectural components and "illustrates relationships among cost, connectivity, accessibility, and privacy in floor plans" (Blanton, 1994, p. 28). Blanton examines the symbolic principles of households and the examination of liminal space in the household with the goal to produce a consumer-behaviour theory that would work cross-culturally, comparing wealth (although not necessarily money) and variation based on the architectural and material remains of the archaeological household (Blanton, 1994). In doing this, Blanton's work expanded upon the early household archaeologist's work on household production, providing a method that can be used to spatially analyse architectural features of the past.

Though household archaeology began with archaeologists working in Mesoamerica, European archaeologists in the 1990s began to adopt household studies using post-processual theories that focused on socioeconomic organisation, social inequality, and gender relations. Steadman proposed that although Blanton did examine the symbolic meanings of households, other archaeologists approached the study of the household from a "more explicitly perceptual, nonmaterial perspective" (Steadman, 1996, p. 29). Ruth Tringham's work in the former Yugoslavia helped begin the new interpretations of household archaeology in the Old World (Tringham and Krstic, 1990; Tringham et al., 1985). Tringham's model focused on the household as the primary unit of economic organisation, and found that a realignment of economic organisation within a household brings about a change in the economic processes of the entire settlement Steadman proposes that Tringham's work demonstrates that "the application of new models to old sites represents a viable method for retrieving data not previously explored" (Steadman, 1996, p. 61) - which is a vital point for this thesis. Another early discussion of the household in Europe was in the edited volume *The Social Archaeology of Houses*, with topics primarily focused on British archaeology from the prehistoric through post-medieval periods (Samson, 1990). Of particular note was Scott's discussion of the evolution of the villa in Roman Britain, which she attributes to socio-political and economic pressures affecting the increased construction and use of these structures in the late 4th century (Scott, 1990).

As described in Chapter 2, the Iron Age, Roman, and Early Medieval households have always been foci of archaeological research. These investigations, however, have tended to focus on the morphological attributes of the structures: the size, materials, and style. Studies that have focused on these periods' structures as a cultural form representative of a society have become increasingly popular, with examples such as Pope's spatial analysis of the interiors of Iron Age roundhouses, or Ware's examination of the social use of space of the halls at Yeavering (Pope, 2007; Ware, 2009). Helena Hamerow's work, in particular, has focused on how the spatial order in both the Early Medieval household and settlement reflect the societal norms and practices of Early Medieval life (Hamerow, 2002, 2012). These studies demonstrate the utility of focusing on the household as a unit of analysis in order to interpret the social life of past societies in transitional Britain. Following these studies, this thesis argues that an understanding of the visual differentiation of space can approach these structures in an innovative method that can be used to cross-culturally and cross-regionally compare and contrast interior space.

## 3.3 THE ARCHAEOLOGICAL SETTLEMENT

Archaeologists are used to examining settlements and settlement patterns. Trigger (1967) in his discussion on settlement archaeology, argues that archaeologists had been concerned with understanding social structure and social behaviour of ancient peoples since the Daniel Wilson defined it as a goal of the field in 1851 (Trigger, 1967, p. 149). Discussions of settlement patterns in the landscape, the layout of structures within settlements, and the functions of settlements have long been a focus of archaeological research. What has generally been missing, however, is an emphasis on the settlement not as just a collection of structures but as a socially-constituted institution that lies somewhere between the examination of a household and the examination of the landscape (Marcus, 2000; Yaeger and Canuto, 2000). As Carolyn Aslan describes for the importance of studying the past built environments "A study of the placement and position of physical boundaries and the division of space within houses and settlements can lead to an understanding of the social categories operating in ancient communities" (Aslan, 2006, p. 134). The settlements of Iron Age, Roman, and Early Medieval Northumbria are the central focus of this thesis, and generally are examined in a similar manner to how household archaeology has examined structures, as demonstrated in Canuto and Yaegar's *The Archaeology of Communities: A New World Perspective*. While Canuto and Yaegar argue that the traditional studies of settlements, focusing on spatial morphology and function are different from the examination of an archaeological community (see below), these terms are used interchangeably in this thesis as it is important to focus on both aspects to understand how spatial orientation of a settlement reflects the social meaning of the built environment.

### 3.3.1 SETTLEMENTS/COMMUNITIES AND THEIR RELATIONSHIP TO HOUSEHOLDS

The community has been defined as "(…) an ever-emergent social institution that generates and is generated by supra-household interactions that are structured and synchronized by a set of places with a particular span of time" (Canuto and Yaeger, 2000, p. 5). The community can be thought of as a grouping of people with similar ideas, values, and is interchangeably with "settlement" throughout this thesis. The archaeology of communities, therefore, is similar to household archaeology in that it focuses on the social behaviours and ideas that constitute a community, rather than the morphological concerns of traditional settlement archaeology. Numerous communities can be operating within a settlement, and likewise numerous settlements can make up a single community (Kolb and Snead, 1997). To put it another way, "communities are constituted in the patterned interactions between households, which are central to everyday life in many societies in all parts of the world" (Peterson and Drennan, 2005, p. 5).

Michael Kolb and James Snead identified three elements of human communities. The first element is social reproduction. "A community possesses a minimum demographic component comprised of a core of individuals who interact regularly and whose repeated interactions socially reproduce the group" (Kolb and Snead, 1997, p. 611). The second element of a community is subsistence production. While communities possess key economic components, a community is not necessarily an economic organisation, instead, a community is the setting where production is possible (Kolb and Snead, 1997, p. 611). The final and arguably most important component of a community is self-identification. The creation of a local identity is linked to the first two elements as being part of a unit with physical and symbolic boundaries (Kolb and Snead, 1997, p. 611). Based on these elements, Kolb and Snead defined the community as “a minimal, spatially defined locus of human activity that incorporates social reproduction, subsistence production, and self-identification” (Kolb and Snead, 1997, p. 611).

A community is not necessarily a group of households or equivalent to a traditionally defined settlement and because of this, it is difficult to examine the construct of the community based on the archaeological record. However, using historical records and ethnographic analogy provides the ability to study the communities of the past in similar ways that archaeologists have studied households and on a broader scale. These techniques, primarily used in Mesoamerica, can be adapted to examine previously excavated archaeological sites throughout the world in new and innovative ways.

The Iron Age, Roman, and Early Medieval period settlements in Northumbria vary in size, shape, and function. The communities of these periods ranged in size from small farmsteads of an extended household family (such as the smaller hillforts in Northumberland National Park or the Roman villas in Yorkshire) to large villages/communities (such as the large proto-village of West Heslerton). The scale and function of these varied settlements undoubtedly affected individuals’ community identity, which will be explored in Chapter 7. Differentiating between a settlement and a household is problematic for the time period being examined, as some of the smaller hillforts in Northumberland, for example, could be considered to be both. Following an interpretive model that examines settlements and households in a similar manner means that the specific labelling of a site, in effect, does not matter.

### 3.3.2 SETTLEMENTS AS PLACE

The settlement, as has been shown, is one of the most important constituted institutions of a society. By focusing on a settlement as a social construct, an analysis of the visual layout of movement of individuals within that layout can lead to interpretations of how past inhabitants understood their built environment. This will be more fully explored in Chapters 5-7, when the morphological and social analyses are combined to understand transitional settlements in Northumbria.

## 3.4 THE LANDSCAPE

The final and broadest scale of analysis used in this thesis is the landscape. Landscape archaeology relates to the studies of settlements and space because it examines the relationship between the natural and built environments. The European Convention of 2000 defines a landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors." Landscape archaeology was primarily developed in Britain, although it is practised throughout the world. It is concerned with how people perceived and experienced the landscape, and how people navigated through past landscapes both conceptually and physically. As a concept, landscape archaeology is difficult to define, with scholars from different disciplines imbuing the term with multiple meanings based on differing philosophies and/or methodologies (Chapman, 2006, p. 14).

Matthew Johnson notes that there are many different definitions for landscapes, but they can be generally can be viewed in two ways:

- The land itself, however defined: the humanly created features that exist "objectively" across space, and their natural context. Landscape archaeology in this sense is a very simple term to define: it is about what lies beyond the site or the edge of the excavation.

- How "the land" is viewed – how we, and people in the past, came to apprehend and understand the landscape, and what those systems of apprehension and understanding are, the cognitive systems and processes of perception (Johnson, 2007, pp. 3–4).

Johnson's definitions posit that landscapes can be viewed as containing physical elements such as topography, landforms, terrain, etc., and as an object, representation, or event. As Witcher adds, landscapes can be "social and qualitative, as well as economic and geometric" (Witcher, 1999, p. 14) . Landscapes have multiple meanings to both the present and past inhabitants as well as to the scholars studying them.

### 3.4.1 LANDSCAPE ARCHAEOLOGY IN BRITAIN

Landscape historians and archaeologists often refer to the British landscape as a palimpsest because humans have continuously modified the environment, with cultural impacts on the landscape repeatedly being changed by different members of the same cultural group, or later groups that inhabited the region (Thomas, 2001). The Oxford English Dictionary defines a palimpsest as "a parchment or other writing surface on which the original text has been effaced or partially erased, and then overwritten by another; a manuscript in which later writing has been superimposed on earlier (effaced) writing" (Oxford English Dictionary, 2010). This idea of the landscape as a palimpsest traces its origins back to W.G. Hoskins, a mid-20th century historian and archaeologist that wrote one of the definitive works on landscape studies. His famous book, *The Making of the English Landscape*, first published in 1955, inspired the growth of landscape archaeology, and "(…) stresses close empirical analysis of landscape, a view of landscapes as both very old and as complex documents on which many phases of settlement are 'written', of the integration of history, archaeology and geography using an inductive model, and of hostility to 'grand theory" (Johnson, 1999, p. 160). He viewed the landscape as a palimpsest that has changed over the centuries, but can be 'read' by a close examination of maps and by "getting your boots muddy" and walking through the British landscape.

Hoskins believed that the prehistoric and Roman inhabitants of Britain did not make an impact on the natural landscape, and that the Anglo-Saxon migrants "faced a virgin country" of thick forests, cold and wet moorland, water-logged heath, or sterile thin-soiled dry heath (Hoskins, 1985, p. 44). He used population figures of early 20th century historians to state that between 500,000 and 1,500,000 people lived in Britain during the Roman period (Hoskins, 1985, pp. 34-35). Due to his estimated population numbers, Hoskins speculated that the prehistoric and Romano-British peoples had an insignificant impact on the natural landscape, with the small Roman population living in scattered rural settlements and small urban areas. Hoskins views on Roman Britain were consistent with late 19th and early 20th century accounts of the end of Roman Britain (Hingley, 2000, pp. 28-37). The population numbers along with the traditional view of the sharp decline and fall of Rome fit with one of Hoskins' main assertions: that the patterns of settlement and land use of the English landscape were developed during the Anglo-Saxon era (Hingley, 2007, p. 104; Hingley, 2000; Hoskins, 1985). According to Hoskins, the Anglo-Saxons had to tame a wild and "natural landscape", and many of traditional English landscape features, such as nucleated villages, began in the early-medieval period.

Although the impact of Hoskins's work cannot be denied, archaeological work conducted in the second half of the 20th century refuted some of his ideas. Thanks to advances in aerial photography as well as the increased scale of development-led archaeological investigations, numerous Roman-era archaeological sites have been identified. These have bolstered the population estimates of Roman Britain to between 2,500,000 and 3,500,000 people (Hingley, 2007, p. 107), with much of the population living in rural settings. In addition, pollen dating sequences have shown that large areas of Britain were deforested in prehistoric times due to cereal cultivation and/or woodland management (P. Dark, 2000, pp. 78–80). These pieces of evidence point to a greater continuity between prehistoric and historic times and not the sharp breaks advocated by earlier studies.

### 3.4.2 CRITIQUES AND ADJUSTMENTS

Traditional landscape studies have been criticised for being too empirical and containing little theoretical backing (Johnson, 1999, p. 160). Landscape archaeology owes much to the romantic vision of landscapes of the 19th-century, with many scholars emulating Hoskins and describing its study as an experience, i.e., in order to understand the palimpsest of the English landscape, one needs to understand how it was formed by walking it, immersing oneself in it, and coming to an empirical understanding. Processualism changed the way archaeologists viewed and studied landscapes. The New Archaeology school of thought described archaeology as an anthropological and scientific pursuit, putting it at odds with the more cultural-historical views of landscape advocated by Hoskins. The processual movement examined the landscape more 'scientifically', asking research questions and examining demography, social interactions, and economic resources of landscapes and examining these groupings as parts of systems (Ashmore and Knapp, 1999, p. 7).

Post-processual critiques pointed out that processual techniques lacked information on individuals' agency in changing the world around them. Phenomenology is arguably the most prominent post-processual approach to landscape, focusing an archaeologist's sensory experiences to interpret the conscious human experience in the past landscape to counter the perceived lack of the individual in processual approaches to archaeology (Tilley, 1994, 2004). Christopher Tilley's work is illustrative of the phenomenological approach, and focused attention on new and different ways to examine the landscape that explored original methods and theories in order to foster an experiential interpretation of the past (Tilley 1994, 2004). Phenomenology strives to avoid the 'top-down approach' of traditional cartographic and empirical discussions of the landscape and is aligned with the growth of post-processualism views on processual and culture historical approaches to the past. This approach has been criticised as being problematic, with Fleming for instance arguing that these approaches were methodologically poor and 'hyper-interpretive', reducing past individuals into cyphers (Fleming, 2006, pp. 271-276 ). Phenomenology and other post-processual approaches to the landscape do share traits with both the traditional, Hoskins' school of landscapes, as well as the New Archaeology's views on landscapes and are not a divorced theory operating on their own. All of these techniques are now part of the landscape archaeologists' methodological and theoretical 'toolbox' and have informed current archaeological approaches to the British landscape (Aston and Gerrard, 2013; Fleming, 2012).

## 3.5 CULTURE CONTACT IN TRANSITIONAL BRITAIN

The transmission of cultural ideas between social groups has been heavily studied and theorised within archaeology and other social science disciplines. Between the Iron Age and Medieval periods, theories have been adapted or utilised to explain cultural change at contact between the various inhabitants of Britain. In order to understand how the Roman Empire affected later Early Medieval settlements in Northumbria, we need to understand the changes that may occur when groups of individuals come into continuous contact with one another. Recent socio-cultural theory has expanded the debate on contact-induced changes; however the study of how groups change when they interact has been a concern of scholars since late-19$^{th}$ century. The following section focuses on the development and use of acculturation and Romanization to explain the processes that occur during contact. Romanization has traditionally explained the spread of Roman culture throughout the empire; conquered peoples were given the "gift" of Roman civilisation through coercion or force. Romanization, as a theoretical construct, has increasingly been criticised as being an overly simplistic form of acculturation with ties to colonial dogma (Hingley, 2000; Hingley, 2005; Mattingly, 2006; Webster, 2001). This thesis uses a different theory, creolization, to identify how cultural traditions and practices were spread and adopted between the three principal cultural groups of the native-Britons, the Romano-British, and the Anglo-Saxons. Creolization provides a framework to interpret the processes and results when cultures come into contact with one another. The result is a blending of cultural identities rather than the replacement of one group's values with another (Webster, 2001, p. 218). It developed out of post-colonial thinking on how linguistic and material culture are shaped due to contact and interaction, and is proposed to explain the complex processes that occurred in Britain during the Roman occupation period, the transitional time period of the 5$^{th}$ century after the fall of Rome, and through the establishment of the early-Anglo-Saxon kingdoms.

### 3.5.1 ACCULTURATION

The theoretical model of acculturation has primarily been advocated by and used in North America, although versions of it, such as Romanization, are used throughout Europe. American anthropologists have focused on contact-induced change from the formation of the discipline at the turn of the 20 century. As Patterson notes, many Americans of the late-19$^{th}$ century felt the American Indian, immigrant European, and African-American populations would gradually assimilate with the majority white (Anglo-American) population (Patterson, 2001, pp. 86-87). The development of American cultural anthropology coincided with this feeling that traditional lifeways, such as that of the American Indian tribes, were disappearing and anthropologists needed to study and classify them before it was too late (Khan, 2007a, p. 245). Franz Boas and his followers established the key concept of 'Culture' founded anthropology as a professional and academic discipline within the United States (Patterson, 2001, pp. 45-60). Boasian anthropology focused on groups having their own inherent traits and history that were dependent upon their inner development (Winthrop, 1991, p. 4).

Minority groups, however, did not vanish into a homogenised Euroamerican way of life, and because of this, the focus of anthropological research gradually shifted from investigations of assimilation and disappearance to examinations of acculturation and cultural survival. Indeed, anthropologists working in the early-20$^{th}$ century became concerned not with assimilation, but how cultural groups change due to contact. Bronislaw Malinowski declared in 1938 that the 'detribalised' native must become the focus of scientific anthropological study due to the changing world and culture contact (Malinowski, 1938, p. xii). This realisation by scholars that contact affected group identity and development led to the defining and use of *acculturation* as the key mechanism for explaining contact-induced cultural exchange (Ferguson, 1992, p. 150; Patterson, 2001, p. 86). Acculturation can be defined as "culture change under conditions of direct contact between the members of two societies" (Winthrop, 1991, p. 3). J.W. Powell, a late-19$^{th}$ century explorer, geologist, and ethnologist coined the term 'acculturation' in an 1880 report to the U.S. Bureau of American Ethnography. Powell characterised acculturation as the psychological changes that occur when groups come into contact with one another and he focused on the "subjective adjustment of the lower to the higher" (Powell, 1883, p. 206). Many of the followers of Boasian anthropology used acculturation to examine the processes of cultural change that were occurring within the minority groups that dominated early ethnographic studies in the Americas.

In 1935, the Social Science Research Committee's (SSRC) Committee on Personality and Culture convened a subcommittee on acculturation including anthropologists such as Robert Redfield, Ralph Linton, and Melville Herskovits to assess the state of acculturation studies and new ways to examine the theoretical model (Patterson, 2001, p. 86) The committee laid out a series of questions and recommendations for acculturation studies, focusing on the nature of contact (friendly or antagonistic), the circumstances surrounding contact (inequalities between the groups), what processes of acculturation were involved, what psychological mechanisms underpinned the process, and what were the results of contact and acculturation (Patterson, 2001, pp. 86-88). These five suggestions for acculturation studies guided scholars studying contact and interaction throughout the 20th century. Archaeologists, being one of the four schools of anthropology in the United States, have adopted and adapted acculturation studies in order to examine culture contact within the archaeological record (Ferguson, 1992, p. 150).

### 3.5.2 CRITIQUES OF ACCULTURATION

From the beginning of acculturation studies, some anthropologists criticised acculturations' stance on reciprocal exchange. Alexander Lesser and Bronislaw Malinowski argued that the traditional definition of acculturation ignored the complex power dynamics that occur when two groups come into contact with one another. They stated there is rarely a straightforward reciprocal relationship and instead there are multifaceted connections between the dominant cultural group and the "lesser" group (in the case of Lesser and Malinowski between Europeans or Americans and American Indian or African tribal groups, respectively) (Lesser, 1996, p. ix; Malinowski, 1938, pp. xii-xiii; Patterson, 2001, pp. 87-88). Acculturation and assimilation have largely been abandoned by social scientists due to these limitations as well as because these models ignore the active role of individual or group agency (Hingley, 1996, pp. 42–44).

### 3.5.3 THE DEVELOPMENT OF ROMANIZATION

Traditional acculturation studies emerged from socio-cultural anthropological and archaeological studies in North America, other regions of the world used different theoretical models to explain the changes groups undergo due to interaction. British archaeologists and historians developed a theoretical model, Romanization, in the late-19th century to explain the process of how native British groups adopted Roman traditions, religions, dress, architecture, and other cultural norms. Francis Haverfield's *The Romanization of Roman Britain* defined Romanization as the tool whereby conquered peoples of Britain incorporated Roman ideals, dress, artefacts, and structural forms into their society upon joining the empire (Haverfield, 1912, p. 10). "Romanization defines the process by which Roman provinces were given 'civilisation'" (Webster, 2001, p. 209) and archaeologists have used it to explain the rapid appearance and spread in the archaeological record of Roman material culture throughout Britain. Haverfield's traditional view on the spontaneous spread of Romanization postulated that the native Britons wanted Roman paraphernalia so they quickly adjusted their lifeways to a new political master and abandoned their own traditions for the 'obviously superior' culture of Rome (Haverfield, 1912). It was obvious to Haverfield and many other scholars of the late-19th century that the indigenous inhabitants of Britain would have seen the superiority of Rome and readily and eagerly adopted the Roman lifestyle. This is the classic explanation of the rapid spread and adoption of Romanization in Britain, and still influences discussion today on the contributing factors for the rapid expansion of the Roman Empire, even though many of Romanization's central tenants have been repudiated.

Haverfield's Romanization emphasised the quick adoption by the British populace of Roman ideas and culture. In a similar way, he attributes the dramatic changes to the archaeological record in the 5th century as a result of the destruction of Roman Britain by Germanic immigrants and the incursions by Celtic peoples (Hingley, 2000, p. 24). The end of Romanization, according to Haverfield, was a wholesale destruction of the Romanized populous of Britain. This idea owes much to the historical accounts offered by Bede and the *Anglo-Saxon Chronicle* (Jones, 1996, p. 2). The remaining populace of Britain, according to Haverfield's Romanization, abandons Roman cultural traits as easily as they were first adopted.

Mattingly argues against the simplistic Romanization model:

> Under this simple model, the Romans brought the gifts of towns, villas, language, art, and culture to grateful provincials and it was assumed that all of them perceived Roman culture as self-evidently superior to what they had before. Britons were thus depicted as enthusiastic participants in the Roman lifestyle, with society undergoing progressive cultural evolution under Rome (Mattingly, 2006, p. 14).

That Britons would have easily adopted Roman values and abandoned their own traditions during the Roman conquest and then just as quickly abandoned them in the 5th century, besides being a biased and simplistic argument, ignores the fact that the vast majority of the population of Britain would not have had the option, due to location, wealth, class, etc. of adopting Roman building traits (Mattingly, 2006, pp. 15-16). In addition, Romanization denies native and Roman agency for adopting and/or rejecting aspects of each other's cultures. Romanization set up a polarising dichotomy; Rome versus native, roundhouse versus villa, civilized versus barbarian, etc. As such, this approach was criticised as being overly simplistic as an explanatory model, and by the late 20th century and the development of the New Archaeology, this theory was adjusted or abandoned to more adequately explain social change in the Roman period.

### 3.5.4 ADJUSTMENTS TO ROMANIZATION

In response to Haverfield's ideas, R.G. Collingwood stated that fusion better explained the processes occurring during the Roman occupation of Britain

> What we have found is a mixture of Roman and Celtic elements. In a sense, it might be said that the civilisation of Roman Britain is neither Roman nor British, but Romano-British, a fusion of the two things into a single thing different from either (Collingwood, 1932, p. 92).

Instead of a Romanized populace, Collingwood is basically arguing for a hybrid culture that combines Roman and native into a Romano-British cultural group, an idea that is still very much discussed to this day (Collingwood, 1932, p. 92). Related to this was Collingwood's belief that portions of Romano-British society survived the Anglo-Saxon invasions (Hingley, 2000, p. 97). Collingwood's views are somewhat similar to the proposed view of a creolized Roman Britain put forward by Jane Webster, with the important distinction being that Collingwood's fusion processes ignored the role of power and the "fundamental inequalities of the relationship between the coloniser and the colonised" (Webster, 2001, p. 211). Although his concepts on fusion differed from Haverfield's ideas, Collingwood's idea shared with Romanization a focus on the elites of British society and their interaction with the Roman conquerors, ignoring vast swaths of the population.

As discussed above, Romanization was primarily seen as a top-down approach to change, with either the Roman Empire initiating a conscious policy of Romanization, or the native groups emulating the Romans due to the obvious superiority of the empire. This viewpoint came under attack during the 1970s and 1980s, as scholars questioned the wholesale Romanization model of culture change, introducing the theme of *resistance* to the dominant society (Rome) by the native British peoples (Webster, 2001, p. 212).

A later argument against Romanization grew out of new theories on the role of the native in cultural interactions. This nativist perspective advocated that Romanization did not occur and that a Roman veneer was placed over the pre-existing Celtic culture, emphasizing that in public native peoples adopted Roman traits, but in private ignored Roman culture and focused on their own traditions (Webster, 2001). As Webster states, this viewpoint polarises the Roman versus native approach into a bipolar society and ignores provincial culture and Romano-British hybrids that Collingwood had already advocated in his arguments against Haverfield's original polarised theories (Webster, 2001, p. 211).

This questioning led to Martin Millet's *The Romanization of Britain* where he built on Haverfield's definition by adding that native British elites had an active role in emulating and adopting Roman customs (Millett, 1990, p. 1). Native elites, Millet argued, would have had a pragmatic and active need to adopt Roman customs, dress, language, etc., as status symbols. Millet shifted the Romanization discussion away from an overarching homogeneity of Roman culture throughout the empire, emphasizing provincial differences with Britain's uniqueness stressed as an important factor in the ways in which Roman cultural traits spread (Millett, 1990, pp. 9-39; Webster, 2001, p. 214). This model argues for a practical reason for the elites of British society to adopt Roman cultural traditions and lifeways in order to maintain and/or strengthen their own hold of power. This altered Romanization model reasons that Rome had a 'light hand' in the running of local governments, and as long as native elites cooperated with the imperial government and adopted their fashions, religion, material goods, buildings, etc., they would be granted the ability to rule.

Millet's argument for the end of Roman Britain focused on internal and external pressures forcing fragmentation, rather than collapse, of Romano-British administration and cultural centres (Millett, 1990, p. 228). He suggests that groups of Romano-British peoples continued operating as localised administrative units until the 6th century, while at the same time arguing that there was a large-scale migration in the Early Medieval period that wiped out the Romano-British elites, forcing a *Germanization* of the remaining populace through acculturation and emulation (Millett, 1990, 230). In a similar manner, Ken Dark's *Britain and the End of the Roman Empire* argued for a 'late antique' period where there were pockets of surviving 'Romano-Christian' groups, particularly in the west and north, that continued Romano-British practices and administration just as portions of continental Europe continued these activities (K. Dark, 2001, p. 149). Both Millet's and Dark's ideas de-emphasised sharp breaks between the ending of the Roman period and into the Early Medieval period. That said, both models tended to view this as a sharp ending from provincial Britain into a different period where there were holdovers of Roman traditions that gradually acculturated by way of 'Germanization' into Anglo-Saxon England.

Higham's *Rome, Britain, and the Anglo-Saxons* argues for a limited migration of Germanic peoples into Britain, and that the spread and success of Anglo-Saxon culture was due in no small part to the Romanized elite of Britain quickly adopting the incoming migrants socio-political systems and ideas at a local level that gradually changed eastern Britain socially, politically, and linguistically into Anglo-Saxon England (Higham, 1992, pp. 234–235). Higham and Ryan's *The Anglo-Saxon World* reinforces this model as they argue for an apartheid-type social differentiation between Briton and Saxon, with tribute duties, inter-regional contact, and the growth of chieftaincies encouraging the adoption of Anglo-Saxon values and beliefs (Higham and Ryan, 2013, pp. 109–111). This more minimalist approach aligns somewhat with Millet's and Dark's ideas and is in contrast to Rollason's more traditional view that conquest and corresponding degradation more adequately explains the disintegration of Roman Britain and the rise of Anglo-Saxon Northumbria (Rollason, 2003, p. 93).

### 3.5.5 SUMMARY OF ROMANIZATION

Millet and Dark's arguments have many positives and critically advanced the discussion of Romanization, but these theories adjusted a model that to many scholars was overly simplistic and had become too polarising to be effective. Romanization has increasingly come under attack due to its perceived ties to the thinking of late-Victorian era Imperial Britain. Richard Hingley argues that many British scholars from the Victorian and Edwardian times embraced the similarities between the British and Roman Empires, with the British Empire bringing civilisation to the non-white man just as Rome did to the barbarians (Hingley, 1996, p. 36). Scholars have critiqued Romanization due to the perceived ties between the growth of Romanization studies and European imperialism, particularly in Africa, between 1875 and 1900 (e.g., Hingley, 1996, 2000, 2005, 2008; Mattingly, 2006; Webster, 2001; Webster and Cooper, 1996). Many scholars saw emulation as the driving force of Romanization, with it being self-evident that the inhabitants of Britain would have chosen Roman culture over their own. Romanization was seen as a good thing, as Rome was bringing the benefits of 'civilisation' to the backwards and backwoods inhabitants of Britain. Other scholars have disputed how closely imperial policies were tied to the growth of Romanization model;, it is probable that early Romanization models tell as much about Imperial Britain as Imperial Rome (Webster, 2001, p. 214).

Romanization was the theoretical explanation for understanding Roman Britain, but it has been shown to have clear deficiencies as a theoretical paradigm in understanding the culture contact and interaction between the native British and Roman settlers. Many scholars, such as Millett and Collingwood, chose to adapt the concept. These adaptations have also been critiqued, with some scholars rejecting Romanization as a model; unwilling to be weighed down by a theoretical approach containing too much "baggage" in the form of an imperial agenda, simplistic emulation argument, and unsophisticated binary opposition argument of

Roman versus the native (Hawkes, 2009; Hill, 2001; Hingley, 1996, 2008; Millett, 1990; Webster, 2001).

Jane Webster argues for the adoption of the American anthropological model of creolization to explain the interaction between Romans and Britons. Creolization, in her opinion, focuses attention on the negotiation of post-conquest identities across class boundaries in Britain rather than the previous Romanization studies which tended to focus on elites only (Webster, 2001, p. 213). Simply put, creolization is the transformative process that occurs when different cultural groups interact with one another. Creolization is rooted in post-colonial thought, and grew out of a desire to understand the processes that occur in colonial situations between social groups. Creolization and post-colonial theory can be useful for explaining the spread of Roman culture, and potentially may be beneficial for examining cultural interaction between disparate social groups in Early Medieval Britain.

Chris Bowle's (2007) *Rebuilding the Britons: The Post-colonial Archaeology of Culture and Identity in the Late Antique Bristol Channel Region* summarised the limitations of traditional ideas of Romanization for answering questions on the Early Medieval period, and argued that they did not adequately address this complex time period. He used post-colonial theories on culture contact and social memory to address how the transitional period was a hybridised society. Chris Gosden states that "Post-colonial theory, as far as it can be discussed as a single entity, is a series of discussions about the sorts of cultural forms and identities created through colonial encounters" (Gosden, 2002, p. 241) and argues that colonial societies are complex mixtures of the different cultural groups that come into contact with one another, rejecting the essentialist acculturative models such as Romanization by emphasising individual and communal agency (Gosden, 2002, p. 243).

The post-colonial approach grew out of models developed by scholars such as Edward Said and Homi Bhabha that emphasises the role of the 'other' in colonial relationships. Said's *Orientalism* describes that long held prejudices and thoughts on the Middle East have continuously shaped western practices and justifications for colonising and/or dominating the region. He argues that minority groups resist the dominant group in colonial situations in a variety of ways (Said, 1978). This emphasis on resistance explains how cultural group identities solidify in colonial situations. Bhabha built upon these ideas in his thoughts on cultural hybridisation and how overt and covert resistance produced on-going and reflexive group identities that continuously shift and adopt as new cultural forms and ideas are encountered (Bhabha, 1994). Adaptations of Said and Bhabha's works into archaeological practice have tended to focus on the colonial interactions at the moment of contact in colonial situations such as the origins of Roman Britain or early colonial America.

Bowles' work adjusted Said and Bhabha's ideas to examine "(…) a period that is, while marginally colonial (i.e. Germanic settlement in Eastern Britain), decidedly post-colonial/post-imperial, in its overall social composition" (Bowles, 2007, p. 25). He argues that groups in the Bristol Channel period in the Early Medieval period actively accepted as well as resisted the changes occurring during the transition from province to kingdom based on their own social memory, identity, and agency, and that these are reflected in the material culture that archaeologists encounter (Bowles, 2007, p. 28). Bowles argues for an active agency of individuals and groups in the Bristol Channel region of adopting, changing, and maintaining certain aspects of material culture because "This was a time of identity crisis where people actively picked between their collective knowledge of the past and present to form new identities in a hybrid culture" (Bowles, 2007, p. 167).

## 3.6 SUMMARY OF THEORETICAL CONTEXT

Chapter 3 has defined the theoretical context of this thesis, which focuses on space and the built environment at three distinct scales of analysis and interprets them through the use of creolization. Understanding the use of space and the built environment over temporal and regional boundaries has the potential to yield important interpretations on how the disparate cultural groups integrated in transitional Northumbria. This chapter has argued for interpreting transitional-period space as a social construct bounded by the built forms of the inhabitants of Britain. These concepts are more fully explored in the landscape and visibility graph analysis chapters (4-6) and in the discussion chapter (7).

# CHAPTER 4

# THE LANDSCAPE AND THE BUILT ENVIRONMENT

The study of the archaeological landscape is related to research on archaeological settlements, households, and spaces. Landscape approaches have a long tradition in archaeological research, with Preucel and Hodder noting four different approaches to the study of the archaeological landscape including *the landscape as environment, the landscape as a system, the landscape as power, and the landscape as experience* (Preucel and Hodder, 2001, pp. 32-33). Archaeologists that focus on the landscape as environment reconstruct past environments and cultural groups' response and adaptations to these environments. Preucel and Hodder state that an underlying assumption of these archaeologists is that there has been relatively little change in the environment over the Holocene, and that today's environment can be considered analogous to past landscapes (Preucel and Hodder, 2001, p. 33). In order to assess spatial patterning of households and settlements within the archaeological landscape, it is important to examine how the natural environment worked with and against cultural ideas, norms, and traditions to shape where and how archaeological settlements were developed and maintained. Although the environment alone does not determine settlement placement, the natural world affects how and where communities can develop. As Tom Williamson notes

> Climate, geology, soils, and topography all affected choices made in the past and thus structured – often in ways infinitely subtle – the kinds of spatial variations in lifestyles, social structures, and farming practices which we encounter in the archaeological and historical record (Williamson, 2010, p. 135).

Higham argues that the Northumbrian landscape "(…) had a more pervasive influence on human activity than in other large Anglo-Saxon kingdoms" due to how the terrain, climate, and soil differed dramatically in this region compared to southern Britain (Higham, 1993, p. 5). Following this, the environment must be considered to understand potential continuities and patterns of settlement before, during, and after the transitional period (c. 350-750 AD) in coordination with understanding the social aspects of community development (see Chapter 2, Section 2.2 for discussion of environment and Chapter 3, section 3.4 for discussion of Landscape Archaeology). Related to the study of the environmental landscape is the concept of marginal landscapes and their effect on settlement placement, survival, and recognition. Marginal landscapes are discussed in detail in section 4.4.1 of this chapter, focusing on how ideas on marginality and living on the 'frontier' affected people living in the past as well as landscape archaeologists' perceptions of those periods.

The natural environment and how it affected past societies can be interpolated using the spatial locations of recorded archaeological features compared to the natural features of the modern landscape. This chapter outlines how GIS analytical techniques can be used to examine the location of built forms compared to elevation above sea level (asl), the proximity of the sites to water, and the position of built forms compared to the underlying soil/geology. This has been done using smaller, distinct study areas within the broader Northumberland and Yorkshire study regions in order to compare areas of a similar size and shape. Even though the current soil types, water sources, climate, and topographic elevation may be different now when compared to the past, the modern geology, water resources, and elevation indicate the probable regional environmental differences between the two study areas. This environmental analysis of the landscape focuses on examining settlement patterns in the two study areas and across the Iron Age, Roman Iron Age, Roman, and Early Medieval time periods in order to examine how the natural world affected (or did not affect) people and communities.

This analysis uses archaeological data supplied by the Historic Environmental Offices (HERs) of the East Riding of Yorkshire, North Yorkshire, and Northumberland. This chapter outlines the two study areas, demonstrates the GIS analysis of the environmental data in each area, and discusses the results. Additional environmental analytical techniques such as pollen analysis or reconstructions of past climates are not part of this GIS analysis due to limited data sets available within the study areas[1]. These additional factors undoubtedly would, however, have affected the location of settlements and are briefly discussed.

The results of these spatial analytical techniques are statistically analysed in section 4.13 of this chapter. Comparisons of the spatial patterning between the three temporal groups in the two study areas are also discussed in this section, with a focus on how past patterning and

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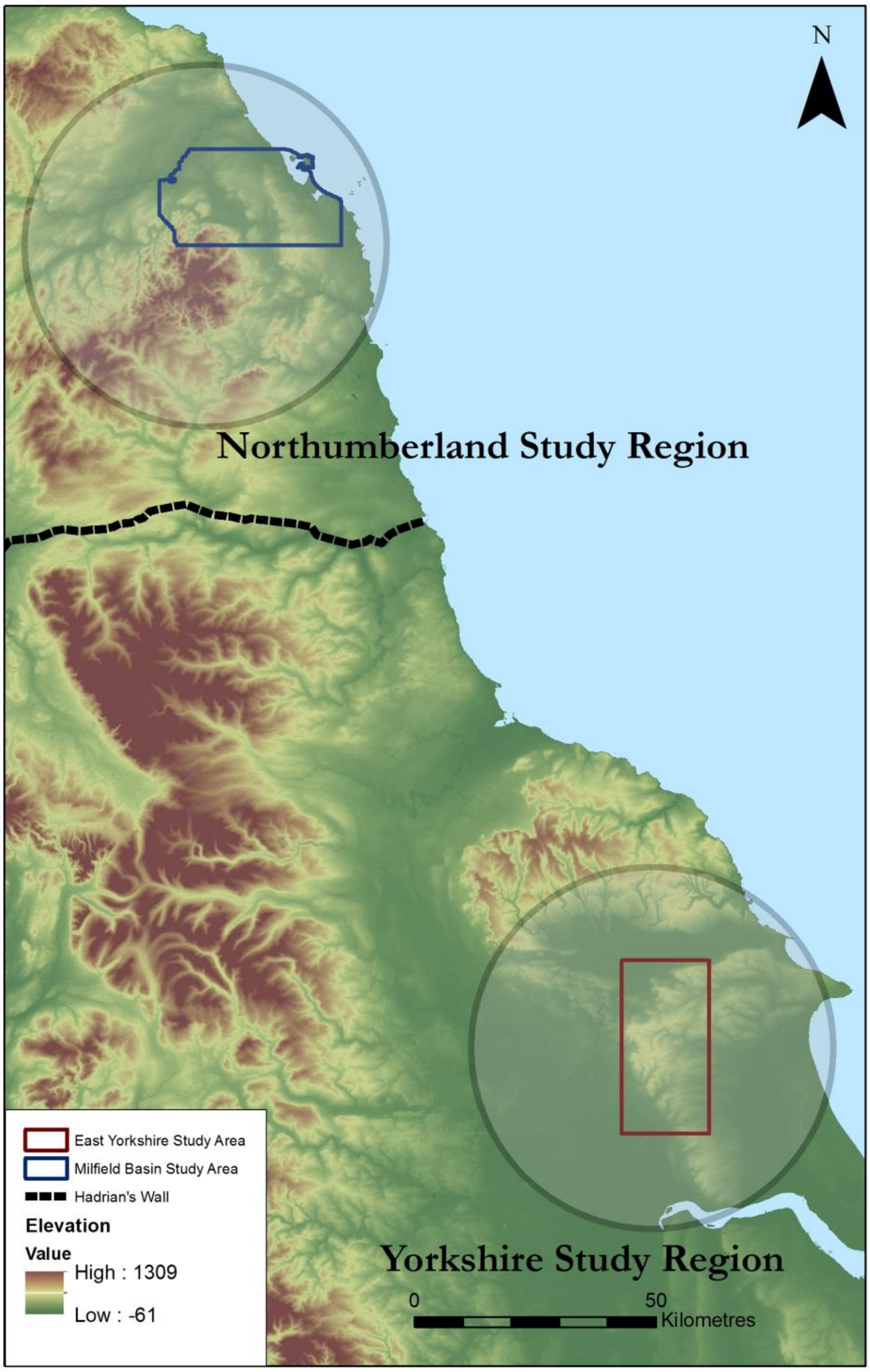
[1] An excellent discussion of the climate and environmental evidence of Britain during this time is Petra Dark's *The Environment of Britain in the First Millennium AD*. For more focused examinations of the limited environmental evidence of the two study regions see Passmore et al., 2012, 2009 for the NSR and Halkon, 2008; Powlesland et al., 2006; and Van de Noort, 2004 for the YSR.

knowledge may have affected the settlements that followed. This chapter closes with a discussion on settlement placement, development, and their use, through consideration of how cultural groups adapted to the environment. In particular, it focuses on spatiality and how groups in different regions responded. These differences are reflected in archaeological thought on responses to marginality and the landscape. Using the two different study areas, it will be shown that groups respond differently to the natural environment, and that these reactions are linked to how the built environment was viewed and experienced by the different societal groups living in transitional Britain.

## 4.1 STUDY AREAS' ENVIRONMENTAL BACKGROUND

North-east England's underlying geology and topography have created distinct environmental zones that influenced the distribution, density, and use of archaeological settlements. These zones impacted the activities and practices of past societies and have affected the extent to which mining and other economic activities have shaped the landscape in modern times (Ferrell, 1992, p. 32). The environment is not the only factor contributing to settlement patterning and distribution, but a comparison of built form locations to various environmental factors can demonstrate how the natural world informed and influenced past decisions on settlement placement and use. The two study areas chosen for this analysis are within and smaller than the NSR and YSR in order to examine a controlled representative sample of built form sites. These two study areas, dubbed the Milfield Basin and the East Yorkshire study areas are of a similar shape and size (approximately 650 square kilometres/65110 hectares), and include many of the settlements analysed by VGA discussed later in the text (Figure 4.1).

FIGURE 4.1 Overview of two study regions and study areas.

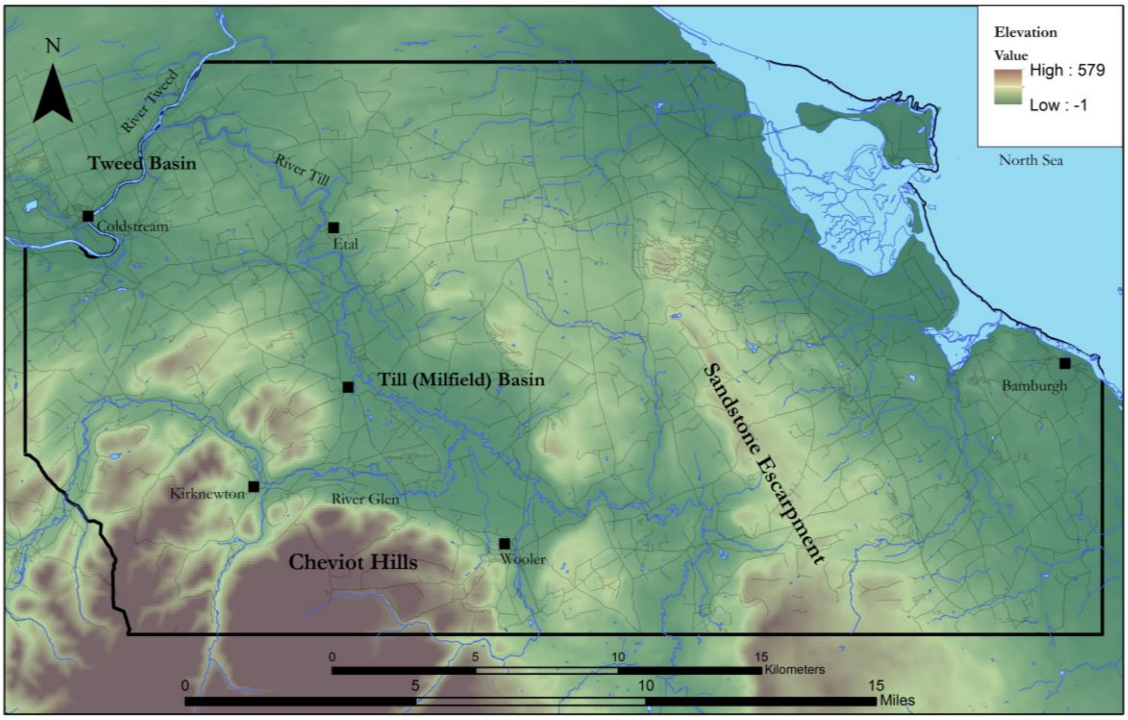


### 4.1.1 MILFIELD BASIN STUDY AREA

The Milfield Basin study area is located in the NSR along the northern boundary of Northumberland, sharing a border with Scotland along the River Tweed. Named for the small village of Milfield located in the approximate centre of both the study area and the broad drainage basin along the south/north running River Till, the study area includes a wide variety of environmental landscapes and archaeological site types. In addition to the valley floors around the Rivers Till and Tweed, the study area contains a variety of topographic features including the Cheviot Hills; a gently undulating sandstone escarpment east of Milfield, lowlands leading down to the North Sea, and the coastal zone associated with Holy Island/Lindisfarne (Passmore et al., 2009, p. 7). The Cheviot Hills are a grouping of rolling uplands straddling the Scottish/English border. They are remnants of volcanic activity dating from the Devonian period, and are dissected by numerous valleys and streams (Ferrell, 1992; Passmore et al., 2009, 2012). The underlying geology of the region can be generalised as being comprised of Magnesian/Carboniferous Limestone, sandstone, and chalk (Higham, 1993, p. 4). The valley floor areas of the Milfield Basin, surrounding the Rivers Till and Tweed, contain the "largest sand and gravel deposits in North-East England" and these free-draining regions contain the bulk of the known archaeological sites that have been found; primarily through remote sensing techniques and developer-led archaeological investigations prior to large-scale mining activities (Passmore et al., 2009, p. 3). The igneous Whin Sill's weather resistant outcrops cut through the study area, and have many historical and archaeological associations. Bamburgh Castle, referred to by Bede as the 'royal city' of Bernicia, is situated upon an outcrop of the Whin Sill along the North Sea coast (EH; 3:12).

Currently, this study area is sparsely settled, with small agricultural villages and a few market towns containing most of the population. Though most of the area is covered in agricultural fields or pasture, this portion of Northumberland has witnessed an increase in large-scale gravel and sand extraction activities over the last 20 years. The aggregate extraction has revealed a variety of archaeological sites through developer funded archaeological excavations (Passmore et al., 2009, p. 4). Combined with the known archaeological sites such as Yeavering Bell Hillfort, Lindisfarne, Bamburgh, and Yeavering (Ad Gefrin), this study area was a centre of human activity and settlement between c. 100 BC and AD 800 (Figure 4.1.1).

FIGURE 4.1.1 Milfield Basin study area




## 4.1.2 EAST YORKSHIRE STUDY AREA

The East Yorkshire study area, located in the YSR within North Yorkshire and the East Riding of Yorkshire, is located approximately 15 kilometres (10 miles) east of York. The study area can be divided into four topographic zones: the Yorkshire Wolds, the Vale of Pickering, the Vale of York, and Holderness (the region surrounding the Hull River valley). These zones are distinctly different, with the lowlands and uplands supporting diverse agricultural and settlement practices due to environmental and cultural factors.

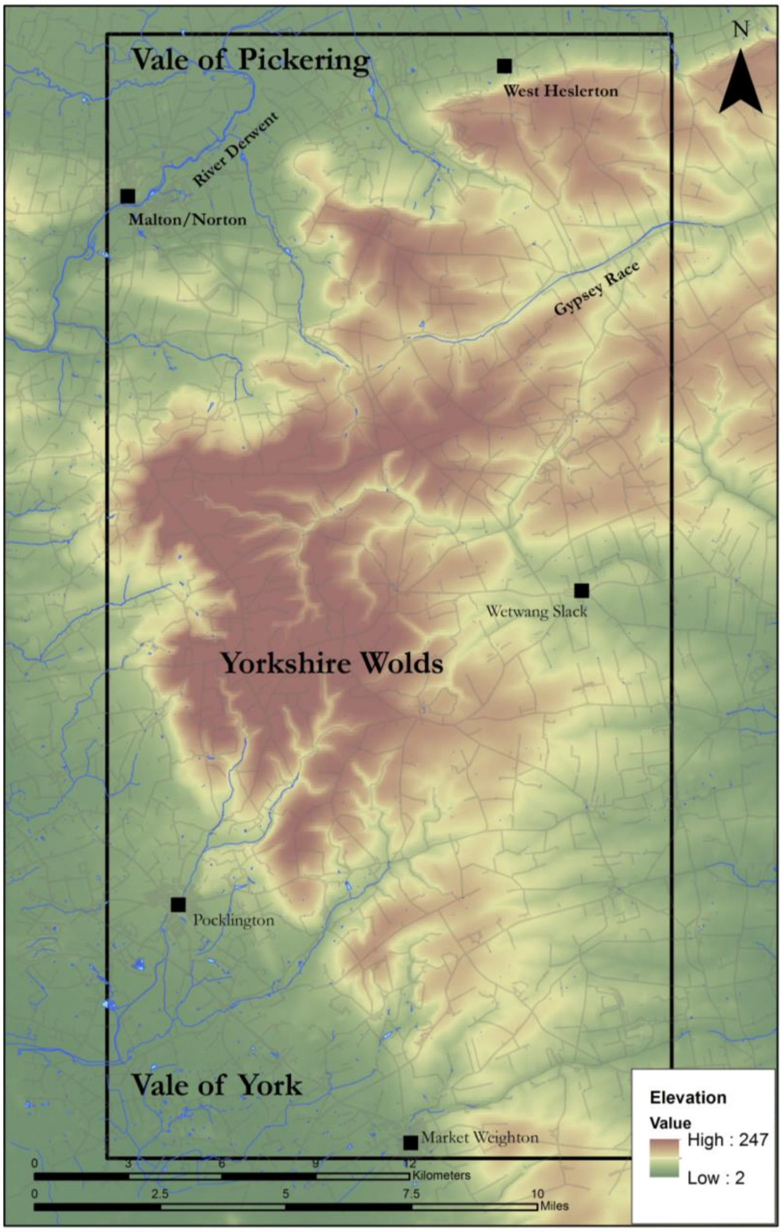
Rising sharply to an escarpment from the Vale of York to the west and the Vale of Pickering to the north, the Yorkshire Wolds are the northernmost outcropping of a broad chalk band that extends across southern and eastern Britain and dominates the study area (Stoertz, 1997, p 1). The Yorkshire Wolds stretch from the Humber River in the south in a large arc to Flamborough Head on the North Sea, covering almost 775 square kilometres (300 square miles) (Figure 4.1.2). The Wolds are comprised of well-drained and slightly rolling chalk hills divided by steep and dry valleys (Neal, 2009, p. 29). These rolling uplands gradually decrease in elevation down to the Hull River Valley to the east. Ranging in elevation between 50 and 250 m asl, the Wolds contrast with the surrounding vales and plains, which are much lower and wetter regions (Stoertz, 1997, p. 3). The underlying geology of the Wolds is comprised of

Middle and Lower Chalk from the Cretaceous and is considered excellent cultivation land that at the same displays archaeological cropmarks very well (Stoertz, 1997, p. 3).

In contrast to the Wolds, the Vales of York and Pickering are low lying, generally flat or slightly undulating landforms situated on Triassic sandstone and Jurassic mudstones (Natural England, 2012a, 2012b). The Vale of York is an open, flat landscape positioned on Triassic solid geology that has been overlain by glacial till, sand, gravel and moraines that today is characterised by dispersed agricultural settlement and small villages set on the higher ground within the region (Natural England, 2012b, p. 6). Although the Vale of Pickering shares similarities in topographic relief to the Vale of York, it was the site of the glacial Lake Pickering and as such its underlying geology is of glacial and lacustrine deposits overlain by sandy drift. This rich agricultural landscape of rivers and wetlands has been extensively drained for agricultural practice (Natural England, 2012a, pp. 5–6). Holderness, along the eastern border of the East Yorkshire study area, is a gently undulating plain centred on the River Hull that drains south towards the Humber. The geology is comprised of boulder clays, gravels, and alluvium overlying chalk that historically contained a variety of wetland and low-lying areas (Natural England, 2013, pp. 6–7). Today, all three of these regions are rural, agricultural zones with limited settlement in small, scattered villages and regional market towns, although they have a comparatively higher population than in the Wolds.

Geologically, the Vales of York and the Hull River Valley are located within the Humber Wetlands, a name ascribed to the wetlands in the Humber basin by the Humber Wetlands Project, an English Heritage and University of Hull project that surveyed and recorded archaeological sites around the area (Van de Noort, 2004, pp. 2-3). The Humber Wetlands are a complex and dynamic landscape that has changed due to glaciation, rising and falling sea levels, climate, and the role of human activities. The Humber Wetlands Project revealed that there were changes to the wetland development, climate, and sea level between the Iron Age and Early Medieval periods, which affected settlement placement and the activities of the societies inhabiting the area (Van de Noort, 2004). The project points out that individuals in the Roman period actively exploited the Humber Wetlands for agricultural and economic purposes, and the settlement patterns in the region reflect these forces (Van de Noort, 2004, pp. 123-131). The project did not find much evidence of the Early Medieval period, which could have been due to both historical factors (population decrease and practice in the wetlands) and archaeological (the project's methodology probably influenced finding more Iron Age and Roman sites versus Early Medieval) (Figure 4.1.2).

FIGURE 4.1.2 East Yorkshire study area




## 4.2 CLIMATE

The climate "is the primary environmental control affecting man both directly, and indirectly through its influence on other factors such as fauna, vegetation, and soil" (Evans, 1978, p. 3). Culture and climate are linked, with the climate of a region affecting all aspects of society including clothing, architecture, and agriculture. Environmental archaeologists have focused on the climate of prehistoric Britain, but Petra Dark (2000) notes that the climate of the 1st millennium AD in Britain is not as well known or understood. Using textual evidence combined with environmental evidence derived from pollen analysis, faunal remains, dendrochronology, and radiocarbon dating, environmental archaeologists can piece together the environmental background of Britain during the past. Generally, Britain experienced a warmer and somewhat dryer climate during the Roman period than during the Iron Age or Early Medieval periods that presumably affected settlement distribution across the landscape (Dark, 2000, p. 27). This may have made upland areas of the two study regions more attractive for settlement and agriculture during the Roman period as these would be warmer and drier than in the Iron Age and Early Medieval period.

## 4.3 POLLEN ANALYSIS

Pollen grains of plants that are preserved in different types of soils can be extracted, identified, and counted in order to reconstruct the former vegetation of a landscape (Evans, 1978, p. 15). Pollen has the benefit of being quite durable, and its analysis gives a tantalising glimpse into the past environmental landscape of Britain. Pollen evidence has been used to discuss the levels of agriculture versus forest in Britain during the Iron Age, Roman, and Early Medieval periods in order to discuss when and how the deforestation of Britain began and/or was maintained (P. Dark, 2000; Halkon, 2008; Passmore et al., 2009, 2012). Unfortunately, there are few pollen sequences from north-east England that cover the Iron-Age through Early Medieval periods in detail. That said, the pollen evidence indicates that northern England was mostly deforested during the Iron Age and Roman periods, with cereal grains in evidence indicating extensive agricultural activities. According to the limited pollen sequences, after the end of Roman occupation, woodland regeneration occurred throughout northern England (Dark, 2000, p. 101). This is important, as it is much easier to move and settle across a landscape when it has been deforested. Nonetheless, a forested area provides fuel, building materials, and access to other natural resources that were important to groups living in transitional Britain so that well-maintained woodland was essential for a society's success.

## 4.4 CORE CONCEPTS OF THE LANDSCAPE

In the Roman and Early Medieval periods, what is today north-east England was on the periphery of both the Empire and the Anglo-Saxon world. Individuals inhabiting these environments would have reacted to that marginality in culturally and regionally specific ways. These adaptations are reflected in the archaeological record and what is observed in the landscape today is a combination of archaeological techniques and how much of the record is preserved or can be discovered by those techniques. The following section details key concepts to understanding the landscape of north-eastern England between c. 100 BC-AD 800.

### 4.4.1 MARGINALITY

An important aspect to consider when examining environmental factors and their influence on settlements is the concept of marginality and the marginal landscape. Environmental archaeologists, in particular, have often discussed how peoples living on the frontier or periphery have had to adapt and respond to these marginal landscapes in culturally specific ways. The notion that certain regions are "inherently marginal is one that has had an inordinate, almost subliminal, influence on British archaeology since the 19th century" (Coles and Mills, 1998a, p. vii). Due to its broad and somewhat uncritical use, it can be difficult to pin down a single definition of marginality. Generally speaking, archaeologists define marginal landscapes as resulting from environmental, economic, social, and political differences that separates an area from a perceived core (Altenberg, 2001, p. 9; Coles and Mills, 1998a, pp. viii-ix).

Portions of both study regions have at various times in history been considered marginal. Understanding marginality, therefore, is key to understanding why and how past peoples chose and developed settlement locations. However, as Coles and Mills (1998a, vii) argue, marginality is such a common term that archaeologists "rarely take time to consider whether they [*marginal concepts*] have any underlying basis as a concept at all." Archaeologists and other social scientists have often examined social groups living in peripheral regions uncritically, with current thinking on a landscape affecting how the past is interpreted. For example, Horning cites feelings towards Appalachia and popular views on the backwardness of the inhabitants as reasons for the Shenandoah National Park's decision to preserve more "authentic" houses (small, dilapidated appearing cabins) over other more modern structures when the park opened (Horning, 2007, pp. 360-361). This feeling on the perceived marginal landscape of Appalachia affected the preservation choices of the park, which in turn affects how the general public views the park and the past inhabitants, thereby perpetuating attitudes and ideas of a 'marginal' landscape that, in fact, did not exist historically. This is an important lesson to remember, as the perceived marginality of north-east England today should not influence the perceptions of transitional Britain's marginality or lack thereof. As Young and Simmonds note, "(…) perceptions of marginality are culturally determined" and as such we must acknowledge current biases to marginal areas while at the same time recognising that individuals in the past would have their own inherent predispositions to acknowledging the marginality of a landscape (Young and Simmonds, 1995, p. 12).

In addition to this use of marginality, many archaeologists have uncritically focused on environmental and climatic factors as inherent values that a landscape possessed, and these reasons contributed to the success or failure of communities (Horning, 2007, p. 358). These environmentally deterministic viewpoint have of course been challenged by a variety of archaeologists (Altenberg, 2001; Coles and Mills, 1998a; Horning, 2007). This author agrees with Coles and Mills that whether or not a landscape is marginal is related to the perception and experience of the individuals that inhabited an area, rather than to any inherent qualities of a region. Though environmental, economic, and socio-political factors do have the power to exclude social groups, these factors are constantly in flux and cultural groups responded by altering or reinforcing settlement and household patterns in a reflexive and fluid manner in order to adjust to being marginal.

### 4.4.2 ADAPTATION TO A NEW LANDSCAPE

A primary assertion of this thesis is that is possible to analyse the changes that occurred when different social groups come into contact with one another, and these alterations are reflected in the household and settlement patterns of the archaeological record of the two study regions/areas. A key facet of understanding cultural change at contact is by understanding how groups adjust to a new and unfamiliar landscape during colonisation of new lands. Incoming populations to north-eastern England during the late Iron Age, Roman, and Early Medieval periods would have had to adapt to new environments by developing and practising new behaviours that would have been influenced by the environment, the cultural norms of their society, and interactions with other social groups exposing them to contrasting ideas. Marcy Rockman argues that while there are many models of understanding colonisation in the archaeological record, relatively few have focused on *environmental knowledge*, described the culmination of prior knowledge and the learning of an landscape (Rockman, 2003, p. 4). Environmental knowledge, according to Rockman, can be grouped into three broad categories: the spatial and physical characteristics of resources (locational), the familiarity with the usefulness of the resources in a region (imitational), and the collective cultural experiences that serve as the backdrop for transforming the environment into a human landscape (social) (Rockman, 2003, pp. 5-6). These three types of awareness combine into the environmental knowledge of an individual or cultural group. Combining the three types of environmental knowledge with the socio-cultural rules and knowledge of a group enables a society to adapt to living in marginal landscapes, and these changes are reflected in the spatial locations settlements are situated and how space is demarcated within communities (Ingold, 2000, pp. 178–181).

### 4.4.3 LANDSCAPES OF SURVIVAL AND DESTRUCTION

Our understanding of past landscapes is a product of the post-depositional forces of survival and destruction on the archaeological record coupled with the methodological abilities to discern these reasons. Wilkinson's the *Archaeological Landscapes of the Near East* adapted Taylor's (1972) and later Williamson's (1998) ideas on landscapes of destruction and survival in his taphonomic model of various zones of preservation and attrition in the Near East (Taylor, 1972; Wilkinson, 2003; Williamson, 1998). He argues that the landscape is a product of progressive loss of landscape features over time due to environmental and human factors, with features preserved as a result of settlements being pushed into marginal areas that were later abandoned due to changes to the environmental or political climates. Landscape features are destroyed when they are located in regions of long-term settlement (Wilkinson, 2003, pp. 41–43). Much of Northumbria can be considered marginal during the Roman and Early Medieval periods, with the NSR remaining a region of sparse settlement through the post-medieval period to today. The YSR, while also rural in character, has witnessed an increasing amount of intensive agricultural production that continues to impact archaeological features (Natural England, 2012a; Powlesland et al., 2006). That said it is apparent through the cropmark and archaeological evidence that both study regions and areas contain large areas of preserved landscapes. Post-depositional agricultural practices (such as ridge and furrow), the expansion of medieval villages, and modern, industrial developments have affected the preserved landscape in each region, although these impacts have been confined to the limited settlements and valley bottoms in both study areas.

Related to our understanding of landscapes of survival and destruction is how the archaeological landscape is identified and interpreted. As Wilkinson notes, no single technique will be able to recover all facets of past archaeological landscapes due to limitations in methods and the processes that have affected the record (Wilkinson, 2003, p. 43). Nonetheless, he advocates using a wide variety of modern computational techniques including aerial and satellite imagery prospection, geophysics, and the incorporation of GIS to traditional techniques of field-walking to build the most complete picture of the past. Powlesland and the Landscape Research Centre used similar ideas of studying the landscape from all possible angles in a long-term research project in the Vale of Pickering that incorporated extensive geophysical surveys, aerial photography flown at different times of the year repeatedly season after season, and the use of LiDAR to investigate the Vale of Pickering. Powlesland argues that understanding the landscape as a series of isolated sites/dots on a map ignores the broad nature and extent of the archaeological landscape of the Vale of Pickering which, although features are not standing upright in the region, are overlain by broad drifts of blown sand that have preserved a densely packed landscape of settlement from prehistory through the Early Medieval period (Powlesland et al., 2006, p. 296).

### 4.4.4 SUMMARY OF LANDSCAPE CONCEPTS

Taken together, Wilkinson and Powlesland's ideas of understanding the evolving landscape using a variety of techniques have influenced the nature and methods of the landscape analysis in order to understand how individuals living in Northumbria reacted to living on the margins. As discussed above, individuals react to living in peripheral landscapes that are environmentally and socially distinct, and a methodology tailored to this understanding has the potential to reveal some of the complexities associated with groups moving into regions and coming into contact with other social groups. Due to these key concepts, this investigation of the landscape focuses on the spatial locations of known built form sites in relation to environmental factors.

## 4.5 GIS ANALYSIS

Geographic Information Systems, or GIS, is an important software package for the examination of the use of space within the archaeological landscape and ArcGIS, the industry standard for GIS and the software program most familiar to the archaeological community, was used. The following section explains the methodology employed for the environmental analysis. Commonly used GIS terms and definitions are included in Appendix A for reference. More detailed GIS techniques employed for the three environmental analyses are discussed in the subsections of this chapter. Connolly and Lake divide the basic functions of GIS into five groups: the acquisition of data, managing both the database and the spatial data, spatial analysis, and visualizing the data (i.e. producing maps and figures) (Connolly and Lake, 2006, pp. 11-12). The following discussion breaks down the environmental analysis methodology into Connolly and Lakes five groups.

### 4.5.1 ACQUISITION OF DATA

Data acquisition includes the primary data collection of any form of digital geographic information obtained as well as data production in the form of map digitization (Connolly and Lake, 2006, p. 12). The archaeological site vector data was obtained from the HERs of Northumberland, North Yorkshire, and the East Riding of Yorkshire. This data included site locations, archaeological findspots, and limited cropmark evidence. Environmental data including elevation maps, soil maps, land classification maps, and information on hydrology were obtained from UK environmental and mapping agencies (Edina Digimaps, the Ordnance Survey, The Geomatics Group, and MAGIC) and from the National Aeronautics and Space Administration (NASA). Finally, soil maps were digitised into vector data in order to understand the relationship between built form locations and the underlying soils.

An important aspect of data acquisition is examining the accuracy and reliability of imported data. Background raster imagery, digital elevation models, and archaeological site locations are all created according to particular guidelines and practices, which influence the final GIS product. This is especially true for the data obtained from the HERs. As noted by the *Development of GIS Data Standards in Historic Environment Records in England*, there are differences between the various HERs in how GIS data are produced, managed, and distributed (Booth et al., 2011) . These variations in quality are more pronounced when examining data from across multiple HER offices, where different collection and production practices are noticeable to the researcher (Booth et al., 2011, p. 18). For example, one HER's policy may be to have a point representing each archaeological site and findspot, while another's could have multiple points in a site that include features (such as house remains). Therefore, it is imperative for the GIS user to understand the *metadata* of every shapefile and feature obtained from other sources, in order to understand the biases of how that data was produced, and how this would affect any analysis (Witcher, 2008, pp. 7–9).

### 4.5.2 DATABASE MANAGEMENT

One of the key strengths of GIS is its ability to combine data from a variety of sources into a single database that can be queried and examined in a variety of ways. Spatial databases in GIS have an advantage over other database types because they can incorporate spatial morphology and topology in ways that traditional databases cannot, thereby allowing more intricate analyses to take place (Connolly and Lake, 2006, p. 34) . GIS has become a standard method of database storage of archaeological data, because it allows, among other functions, the ability to store and manage the locations of resources along with their various attributes. Maintaining this database is essential for the accuracy and reliability of the system. For any GIS project, this one included, a large amount of time must be spent maintaining the relationships between the various forms of data incorporated in the analysis.

### 4.5.3 SPATIAL DATA MANAGEMENT

One of the basic tasks of GIS involves the geographic transformations necessary to combine different forms of data into a single map so that they are correct in scale and projection. Although this can be a fairly mundane task, it is important because if shapefiles are in different coordinate systems, or are projected incorrectly, the data will not align to their proper geographic coordinates, which thereby affects the accuracy and/or reliability of the analysis. During the course of this research, the author had to georectify (or reproject) the multiple forms of data so that they were all in the correct mapping projection and coordinate systems, and therefore could be used in a reliable analysis.

### 4.5.4 SPATIAL ANALYSIS

Spatial analysis includes a variety of GIS functions that "(…) involves the mathematical combination of spatial datasets in order to produce new data that may provide insight into natural and anthropomorphic phenomena" (Connolly and Lake, 2006, p. 13). Spatial analysis techniques range from basic data selection and extraction to complex models incorporating visibility studies and with catchment analysis. For this environmental analysis, two different queries were used, *select by location* and *select by attributes*. These two basic functions of GIS allow a user to select and extract data from shapefiles based upon their spatial location or based on specific characteristics of the vector data within their attribute table. An additional GIS technique used spatial statistics to compare the overall density of the built form sites in each study area compared to the density of sites from each time period, in order to examine differences in how densely settled each region was during differing time periods.

### 4.5.5 DATA VISUALIZATION

The final GIS task outlined by Connolly and Lake is data visualisation. GIS can visually examine spatial data in unique ways including thematically, 3-D reconstructions, and fly-overs (Connolly and Lake, 2006, p. 13). It then can take these and create colourful and informative cartographic outputs. These aid the interpretation of the spatial analysis, demonstrating the results of the analysis in a graphic manner. The visualisations are used to examine spatial positioning on the landscape in relation to topographic features as well as their relationship to thematic land classifications and are then used to create visual displays of the spatial analyses demonstrating the potential linkages between the natural and cultural landscapes.

## 4.6 STATISTICAL ANALYSIS

In their introduction to archaeological quantitative analysis, VanPool and Leonard argue that the importance of statistics to archaeology as it provides "(…) a common language and set of instructions about how to make meaningful observations of the world, how to reduce our infinite database to an accurate and understandable set of characterizations, and how to evaluate differences and similarities" (VanPool and Leonard, 2011, p. 1). This common language enables discussion on the patterns or differences observed during archaeological investigations and it evaluates the significance and accuracy of these observations. In the case of this research, statistical analysis provides quantitative methods to examine the large amount of disparate data produced during the various analyses of the built environment in north-east England between the 1st century BC and 9th century AD. All of the data generated by the landscape and visibility graph analysis are examined statistically to determine whether observed trends are the result of randomness in the data or are statistically significant patterns. Statistics are uniquely suited to evaluate these samples and define their relevance for understanding and making interpretations on these examined past populations, and are used not only in the landscape analysis but also in the visibility graph analysis (Chapter 6) in order to quantitatively examine the results of both investigations.

## 4.7 HISTORIC ENVIRONMENT RECORDS OFFICE DATA

Point data representing the spatial location of archaeological sites were obtained from the HERs in order to investigate how the natural environment affected the spatial arrangement of built form sites. Although this thesis is specifically concerned with the transitional period between the Roman and Anglo-Saxon periods, the Iron Age is included in this analysis to examine changes in settlement resulting from the Roman occupation. It is important to note that the landscape analysis is based purely on the HER data and does not include other types of built form data, such as features recorded by research projects such as the National Mapping Programme (NMP) the Landscape Research Centre's work in the Vale of Pickering. These data sources are not included because of the high cost of obtaining the NMP data and due to the uneven amounts of work recorded in portions of the areas by these different research projects. The variety of recording and cataloguing techniques that produced the recorded data from the three counties includes a series of differing site types across a range of time periods. For example, the Northumberland HER provided all of the sites and monuments in the Milfield Basin study area from the Iron Age, Roman Iron Age, and Early Medieval periods as recorded within their database. In contrast, the North Yorkshire HER provided every recorded archaeological site or monument within the portion of the East Yorkshire study area from every time period. As such a method was devised for extracting the data needed to answer the research question of how the environment affected settlement development and maintenance.

The built form was narrowed to represent the household and settlements/communities. These built forms include point data representing settlements, buildings, outbuildings, enclosures, pit alignments, and other types of construction (such as grubenhäuser). Other forms of data obtained from the HERS, including individual findspots, trackways, hollow ways, cemeteries, burials, and barrows were not included within this analysis. Finally, the built forms were sorted, selected, and extracted based upon time period, with point data outside of the Iron Age, Roman Iron Age, Roman, and/or Early Medieval periods excluded from the analysis.

Once the point data were sorted and extracted based upon the time period and type, the selected data were converted into new shapefiles for each of the three time periods. The results are demonstrated in Table 4.7 below. It is important to note that when the data was attributed to more than one time period, a point was added to each appropriate time period. These new shapefiles yielded remarkably similar numbers of built forms sites within each time period across the two study areas, potentially demonstrating a similar level of density of settlement. Once the data was separated according to time period the environmental analysis could proceed. As mentioned previously, the three forms of environmental analysis included the relationships between the built form point data related to the elevation, proximity to water, and underlying soil/geology. These three aspects of the environment are described in detail below.

TABLE 4.7 Total number of built form sites from each examined time period in the Milfield Basin and East Yorkshire study areas

| | Milfield Basin | East Yorkshire | *Total* |
|---|---|---|---|
| Iron Age | 201 | 143 | *344* |
| Roman or Roman Iron Age | 177 | 162 | *359* |
| Early Medieval | 31 | 31 | *62* |
| *Total* | *409* | *336* | *745* |

### 4.7.1 DENSITY ANALYSIS

A *kernel density estimation* analysis was run on the built form site data to visually detect patterns in the built form data. Kernel density estimation analysis creates a smoothed approximation of the distribution of point data across a bounded area; in this case the built form sites from the three time periods in each study area (Connolly and Lake, 2006, p. 175). This density analysis was performed to examine relative trends in the spatial arrangement of known settlements in the landscape. In this case, the density analysis was performed to chart if there were clusters of certain types of sites were recorded, and if it could be determined these patterns were due to actual trends in the past or due to the archaeological visibility of these resources. Figures 4.7.1.a and 4.7.1.b show the results of the density analysis from each study region based on the spatial location of all the sites together and separated by time period.

FIGURE 4.7.1.a Kernel density analysis results of the Milfield Basin study area

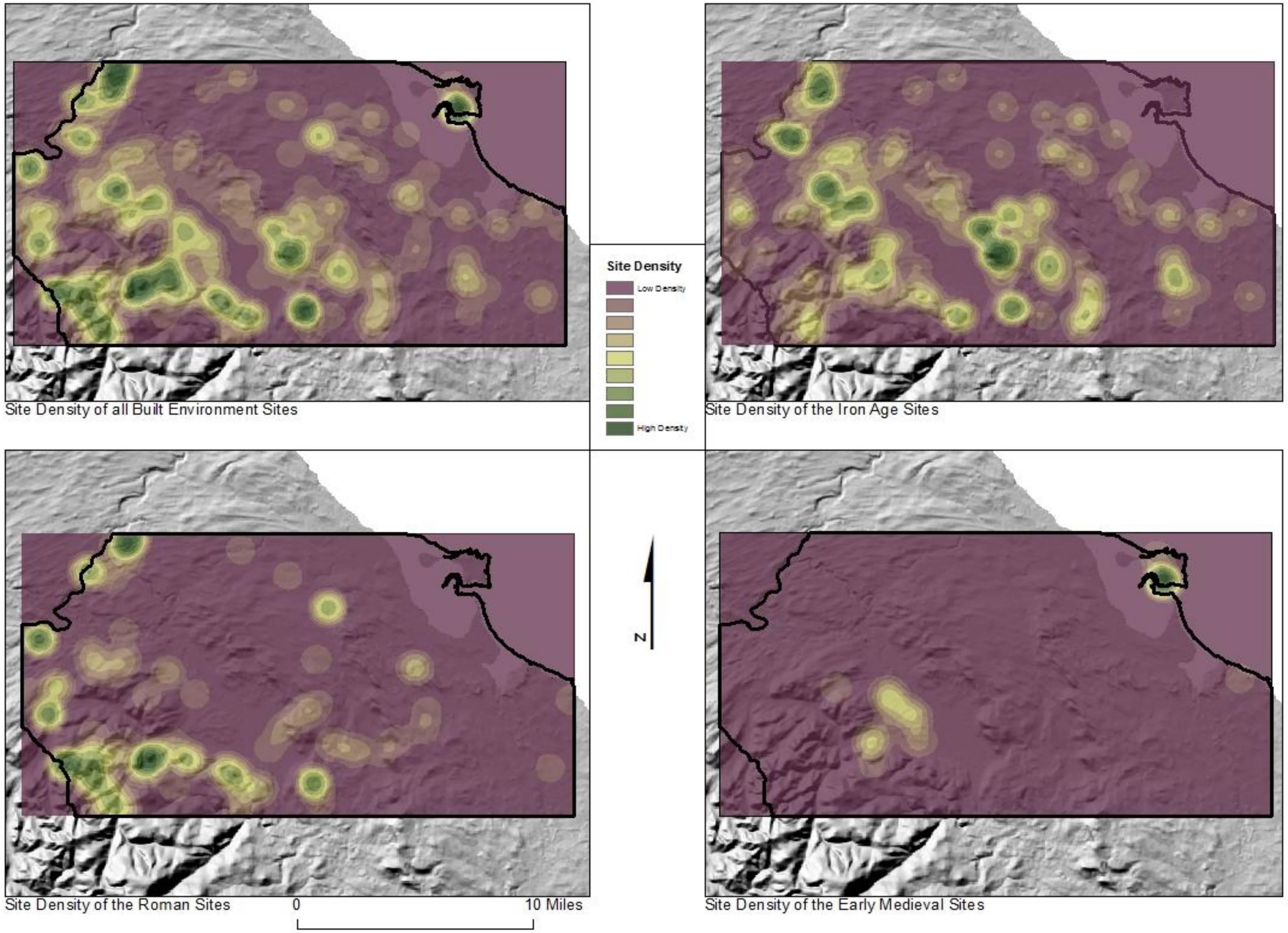
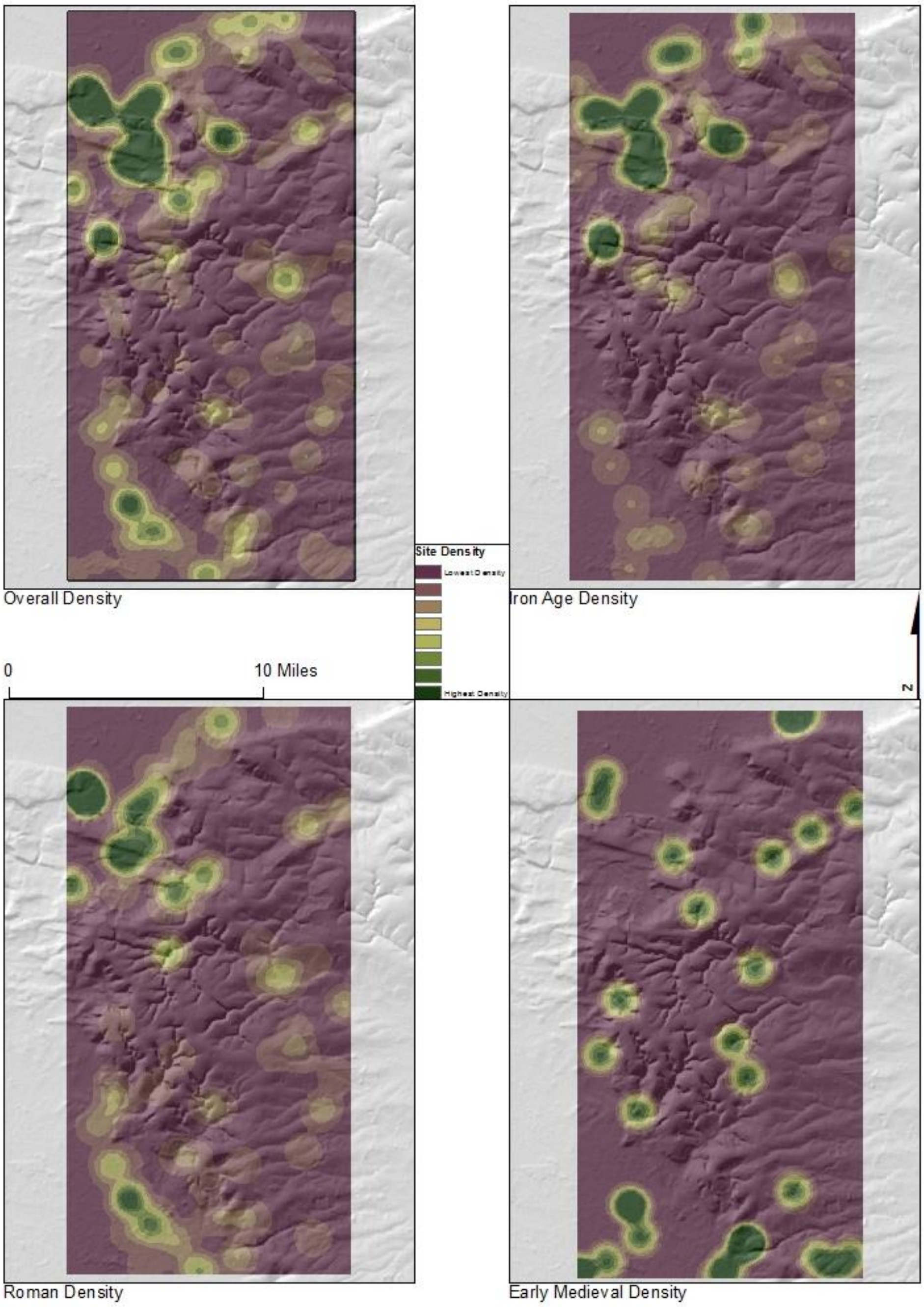


FIGURE 4.7.1.b Kernel density analysis results of the East Yorkshire study area



The results of the density analysis suggest key differences in where built form sites are located in the Early Medieval period within the two study areas, especially in relation to the preceding periods. The Iron Age and Roman period built form sites in both study areas are located in broadly similar areas, but the Early Medieval sites in the Milfield Basin study area appear to be concentrated in specific regions along the coast and in the lowland areas along the River Till. In contrast, the Early Medieval sites in the East Yorkshire study area are located in broadly similar locations to the preceding periods. These trends may be suggestive of differential visibility of archaeological built forms in the two regions, with the Early Medieval settlements much easier to spot alongside the earlier periods in the East Yorkshire study area. However, they may also be indicative of actual differences in the settlement patterns of the different periods. This is addressed in Chapter 7.

## 4.8 TOPOGRAPHIC ELEVATION

Topographic elevation affects settlement location due to its effect on local climate, vegetation, and soil development. The landscape analysis of elevation uses GIS and the HER built form data in order to examine whether there were significant differences between the study regions as well as the time periods in relationship to their topographic elevation. Roberts notes that the historical patterning of settlement across the world follows broad trends in relation to elevation: the mountainous regions have small, often dispersed settlements related to the harsher climates and limited arable soils, the lowlands have nucleated settlements due to the rich agriculture (although these regions have the potential to be flooded quite easily), and the hill regions/interface areas between the highlands and lowlands have generally been seen as attractive areas of settlement as they benefit from being close to the resources of both the highlands and lowlands (Roberts, 1996, pp. 47–48). This is especially true in Britain, where spatial location in relation to topographic elevation can represent a dramatic difference in the amount of rainfall, different climatic conditions, the types of crops that can grow, grazing opportunities for livestock, and the exposure to wind and weather. These environmental factors have historically produced portions of the British landscape that are perceived as marginal, which, in turn, have produced areas of preservation where the archaeological visibility of the past is better than in areas that have witnessed more post-medieval settlement (Williamson, 1998, pp. 6-7). The perceived marginality of a location by the inhabitants or by social groups living outside the area also affects how, why, and where communities developed.

Spatial analysis of where built form sites are located across the landscape in relation to the elevation is essential to understanding patterns of settlement during the Iron Age, Roman Iron Age, Roman, and Early Medieval time periods. Spatial distributions of past settlements rely upon human agency and environmental constraints. As O'Connor and Evans state "The distribution of field archaeology is a part of the past environment, partly as a contribution to its physical structure and partly as a reflection of human activities" (O'Connor and Evans, 2005, p. 132). Elevation affects the seasonality of herbaceous plant growth, which in turn affects when domesticated herds of animals are moved from uplands to lowlands in order to take advantage of the vegetation (Evans, 1978, p. 5). Knowing that seasonality affects the modern farmer poses the question of what impact did elevation have on the placement of settlements in Northumbria during the Iron Age, Roman, and Early Medieval periods? Did the people living in the past know this, or did elevation subconsciously affect settlement placement? If it did, was there a difference between the cultural groups inhabiting the region and where they placed their communities?

Geology, erosion, climate, plant life, and human activities all play a role in shaping elevation. Underlying bedrock and geologic processes such as uplift and erosion determine the elevation, slope, and aspect of the ground surface. Soils are formed from the underlying bedrock, and are often classified based upon elevation differences within a landscape (Halkon, 2008, p. 40; Jarvis, 1984). Climate affects rainfall, which in turn affects the level of erosion. Deposition of sediment through flooding, glaciation, and volcanic eruptions also affect elevation. Finally, and most importantly for archaeology, humans drastically alter elevation through activities such as mining, construction, and irrigation. A thorough description of the processes affecting elevation and the environment are beyond the scope of this thesis, but it is important to understand that elevation, soils, and proximity to water change and evolve over time due to a range of factors.

The two study areas contain diverse topographic features, with each region containing different zones of elevation. Corresponding to these zones are changes in underlying geology/soil as well as the proximity to water, and suitability for settlement. Broadly speaking, the two study regions contain similar landscapes of low-lying regions, rolling hills, and upland areas. The Milfield Basin study area is dominated by the Cheviots, with low-lying areas concentrated along river drainages and the North Sea. The elevation in the Milfield Basin ranges from -1 to 433 metres asl. In contrast, the East Yorkshire study area is dominated by the Yorkshire Wolds, a glacially produced landscape of chalk escarpments, dry valleys, and relatively dry uplands associated with relatively low-lying areas in the Vale of Pickering, the Vale of York, and the Foulness Valley. East Yorkshire's rolling elevation ranges from 3 to 247 metres asl. The study areas also differ in their relative proximity to water, with the Wolds, in particular, relatively devoid of flowing water resources. The different landforms and elevation in the two regions also affect the agricultural, husbandry, and industrial practices performed today, which in turn affects the visibility and recognition of archaeological resources. The climate also affects the activities and settlements of these two regions. Generally speaking, the Milfield Basin study area tends to be colder and slightly wetter than the East Yorkshire area, although both regions have similar climatic profiles in relation to other parts of Britain (Jarvis, 1984, pp. 26-27).

In addition to its role in affecting where settlements were situated by past peoples, environmental factors also play a role in the archaeological discovery of sites. For example, in most of Britain, the local topography affects the rural landscape because certain crops can grow at certain elevations or not at all. In some cases, the higher elevations are turned over to grazing pasture or in very high areas, left as heather moorland (resulting from the deforestation of these areas in early prehistory) (Roberts, 1996). The different types of agriculture (deeper ploughing), animal husbandry, and forestry practised today can affect the archaeological visibility of cropmarks and soilmarks (Caldwell, 2000, p. 185). The current marginality of a particular site location directly affects its discovery, with areas that have little need for development receiving less attention, for example, by developer-funded archaeological research. Finally, and perhaps most importantly, many archaeological settlements are buried beneath current towns and villages and are difficult to find and study.

### 4.8.1 DIGITAL ELEVATION MODELS

There are various forms of data utilised by GIS users to examine elevation. One of the most common is the digital elevation model (DEM). DEMs are produced by interpolating elevation from contour maps (such as the Ordnance Survey or USGS topographic maps), using evidence from LiDAR surveys, and from satellite data. Raster DEMs model elevation for a series of cells arranged in a grid, with each grid point representing a specific elevation. This produces shaded relief imagery representing elevation change across as landscape as well as allowing a variety of spatial queries and analysis (Connolly and Lake, 2006, p. 5). The different methods of producing DEMs result in different degrees of *resolution*. A lower resolution number equates to a finer degree of measurement, and this resolution is measured in arcminutes, which represent the space between sample points in the data file (Connolly and Lake, 2006, p. 101). DEMs produce a model of the ground surface, which is extremely useful when examining site location compared to elevation.

Digital elevation models can produce *thematic* maps. Connolly and Lake (2006, p 16) divide cartography into two broad categories that produce topographic and thematic maps. Topographic maps provide general information on the physical surface of the earth, with good examples produced by the Ordnance Survey. Thematic maps, on the other hand, provide information on a specific subject, and can be broken down into *isarithmic* and *choropleth* maps. Isarithmic maps use lines to connect data (i.e. contour maps) and choropleth maps use colour and shading (Connolly and Lake, 2006, p. 16). In this case, DEMs were used to produce colour-shaded maps representing elevation. DEMs are also used to build three-dimensional relief maps, either using hillshade to represent relief or actually used in a three-dimensional software program such as ArcScene or Global Mapper. Finally, and most importantly, DEMs are essential to perform a variety of spatial analysis techniques useful for archaeological research questions including but not limited to deriving slope, aspect, visibility, movement, and cost surface (Connolly and Lake, 2006, pp. 101-102; Wheatley and Gillings, 2002, pp. 95-96).

### 4.8.2 THE SHUTTLE RADAR TOPOGRAPHIC MISSION

This analysis uses DEMs derived from the Shuttle Radar Topographic Mission (SRTM). In 2000, the space shuttle *Endeavour* collected elevation data for approximately 80 per cent of the globe by using a radar system attached to a long boom in the cargo bay (Connolly and Lake, 2006, p. 71). The mission obtained elevation data at 30-metre resolution across North America and 90-metre resolution across the world that created freely available elevation models for much of the Earth's surface.

The SRTM data was chosen as the DEM source for this thesis due to it being freely available through NASA as well as having excellent elevation resolution across the United Kingdom. This was in contrast to the freely available 30-metre resolution Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data and 30-metre resolution OS Panorama data, which produced 'fuzzy' DEMs of the East Yorkshire study area. Recently, high-resolution elevation models derived from Light Detection and Ranging (LiDAR) flights have become freely available for much of England with 0.5 cm to 2-metre resolution.

Unfortunately there are gaps in this excellent data source in each study region and area, thereby limiting its abilities for this analysis.

### 4.8.3 CONVERSION AND SELECTION

Though raster DEMs are powerful tools in spatial analysis, it is difficult to select built form sites based on their location compared to elevation ranges based solely on the SRTM raster used in this analysis. This is due to the qualities of selecting vector data based on location within raster imagery. Therefore, the SRTM data within each study area was converted to vector data (in the form of polygons) representing 50-metre elevation blocks (such as 0 to 50 metres, 51 to 100 metres, etc.). Once the raster DEM had been converted into vector polygon elevation blocks, it was a relatively simply process to use the ArcGIS function *Select by Location* to define and then extract built forms sites based on where they were located above sea level. These extracted built form sites were made into new shapefiles representing the Iron Age, Roman, and Early Medieval time periods within each elevation block.

## 4.9 ELEVATION ANALYSIS

Once the built form sites had been extracted and made into new shapefiles, they were then examined, compared, and contrasted between the various time periods as well as between the two study regions using the spatial analysis techniques explained above. The following section details the results of this analysis in the two study areas.

### 4.9.1 MILFIELD BASIN ELEVATION ANALYSIS

The majority of the built form sites are located in the lower elevations within the Milfield Basin study area, but there are differences in the spatial locations of the built form sites depending on their attributed time period. Figure 4.9.1.a shows the location of the built form sites compared to the DEM. Table 4.9.1 shows the spatial location of built form sites by elevation and time period, while Figure 4.9.1.b shows how the percentages of the built form sites from each time period compare to one another according to their elevation.

FIGURE 4.9.1.a Built form sites in the Milfield Basin study area.

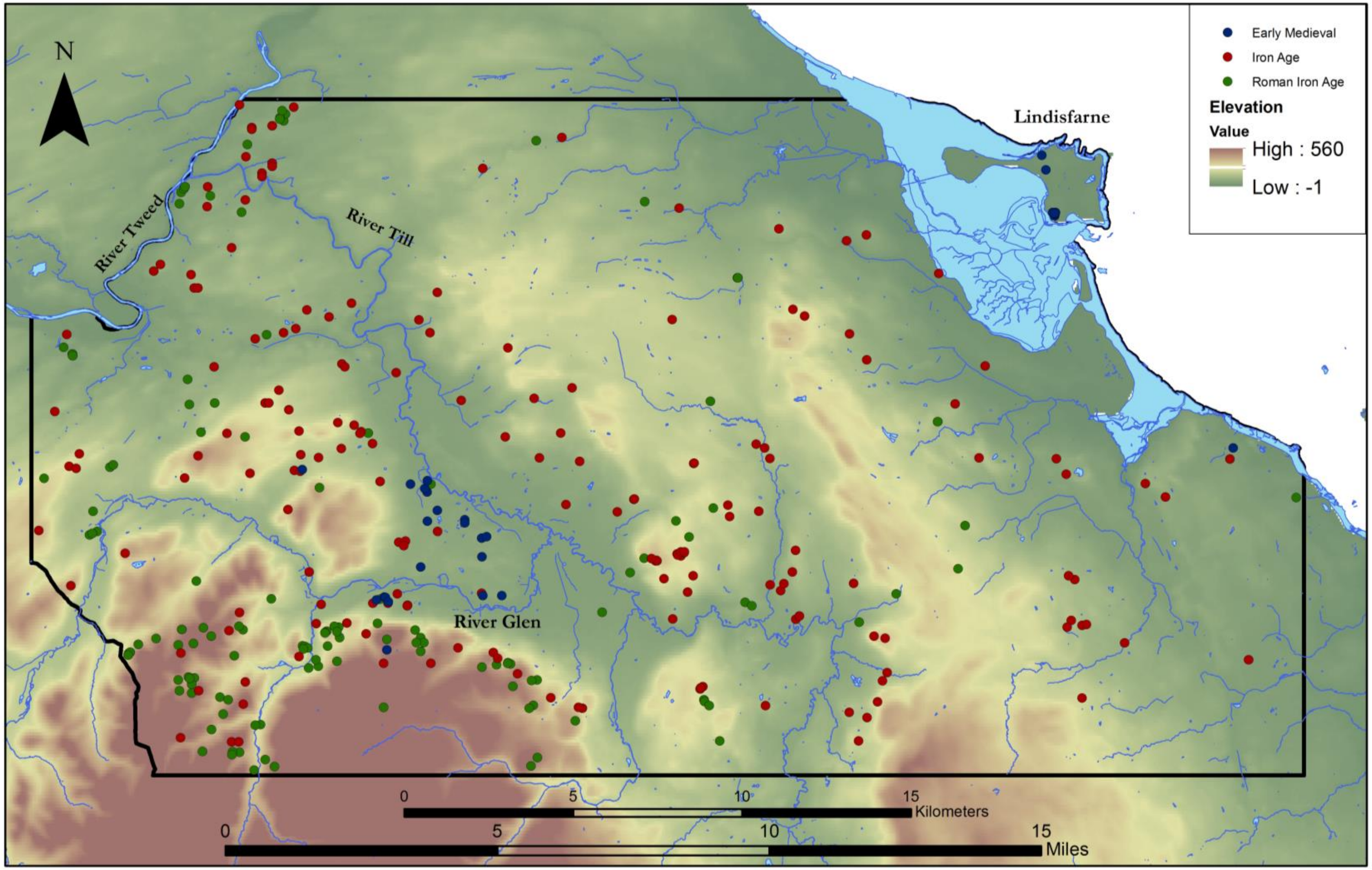
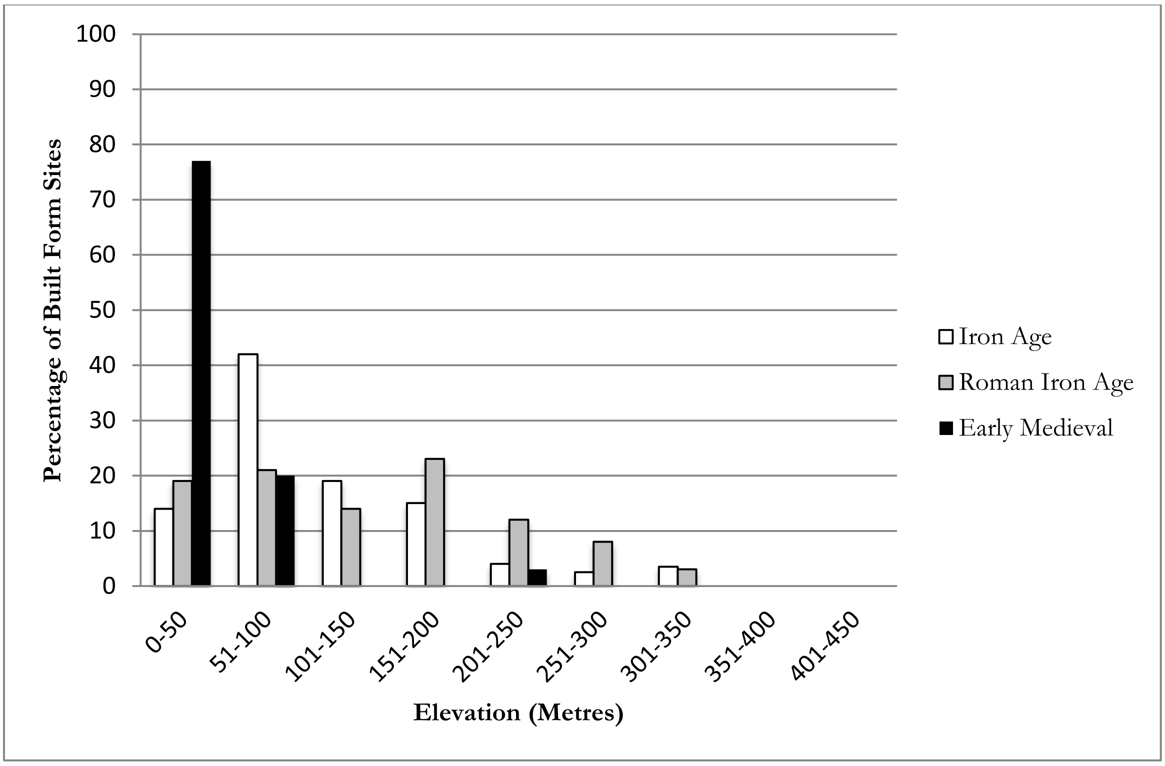


TABLE 4.9.1 Results of the Elevation Analysis in the Milfield Basin study area showing the number of built form sites from each temporal period.

| Elevation (metres) | 0-50 | 51-100 | 101-150 | 151-200 | 201-250 | 251-300 | 301-350 | 351-400 | 401-450 | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| Iron Age | 28 | 85 | 38 | 30 | 8 | 5 | 7 | 0 | 0 | **201** |
| Roman | 34 | 38 | 24 | 40 | 21 | 15 | 5 | 0 | 0 | **177** |
| Early Medieval | 24 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | **31** |
| **Total** | **86** | **129** | **62** | **70** | **29** | **21** | **12** | **0** | **0** | **409** |

FIGURE 4.9.1.b Percentage of built form sites in the Milfield Basin study area based on their elevation




The GIS analysis of the relationship between elevation and spatial location in the Milfield Basin study area reveals a varied spatial patterning across the three time periods in relation to elevation. The majority of the built form sites across the three time periods are located between 0 and 200 metres asl. The Iron Age and Roman Iron Age built form sites appear to have similar percentages, with the exception of the zone between 51-100 metres asl, where approximately 42% of Iron Age sites compared to 21% of the Roman Iron Age sites are located. The Early Medieval built form sites have a very different spatial patterning compared to the previous time periods, with 77% of the built form sites found between 0-50 metres asl.

### 4.9.2 EAST YORKSHIRE ELEVATION ANALYSIS

Like the Milfield Basin study area, the majority of the built form sites in the East Yorkshire study area are located in the lower elevation ranges, with 76% of the sites located between 0 and 100 metres asl. However, unlike in the Milfield Basin, the distribution of built form sites was similar between the three time periods in the East Yorkshire region (Figure 4.9.2.a). Table 4.9.2 shows the breakdown of built form sites based on elevation, and Figure 4.9.2.b, shows the percentages of built form sites in each elevation band.

FIGURE 4.9.2.a Built form sites in the East Yorkshire study area

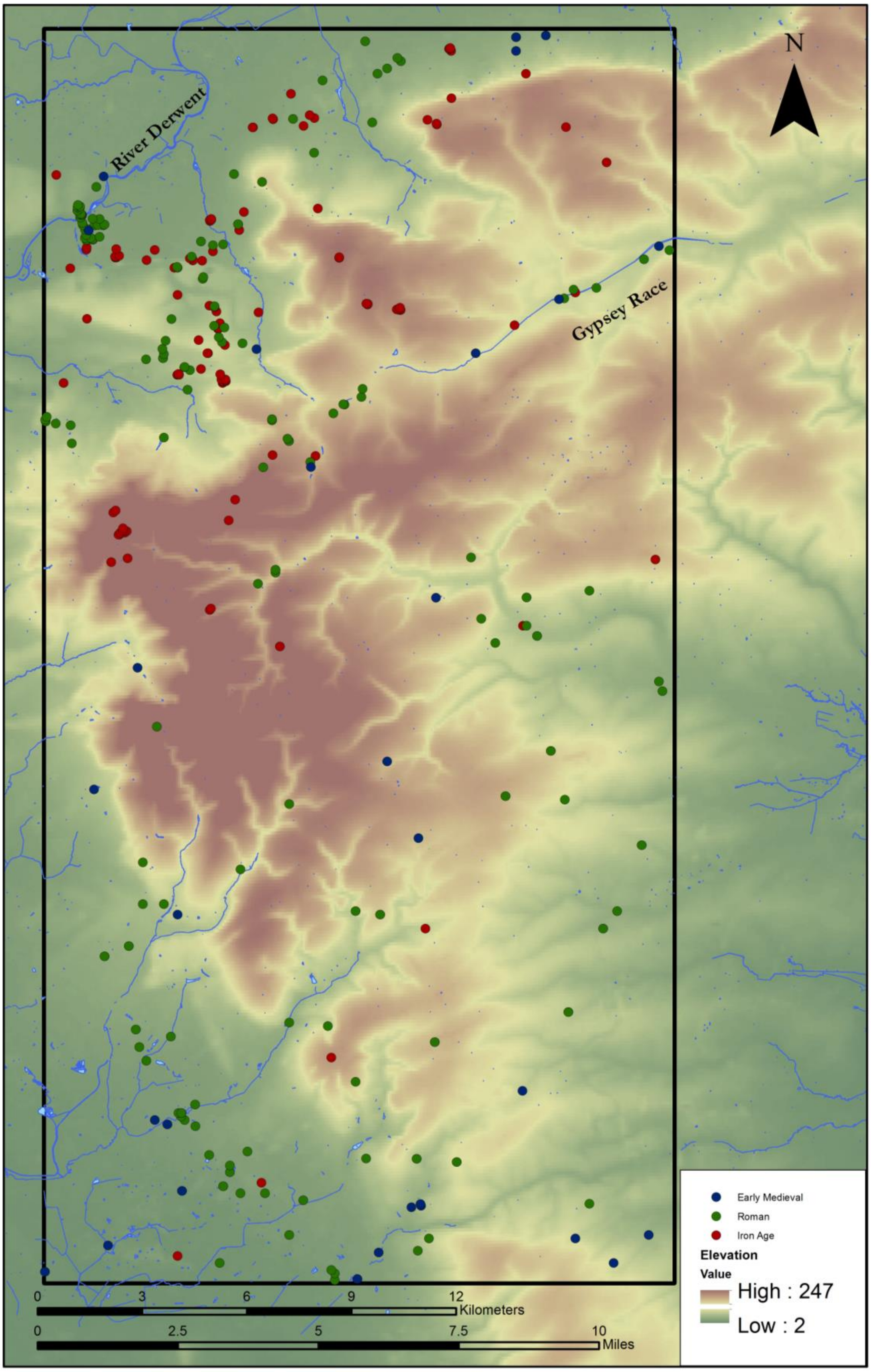
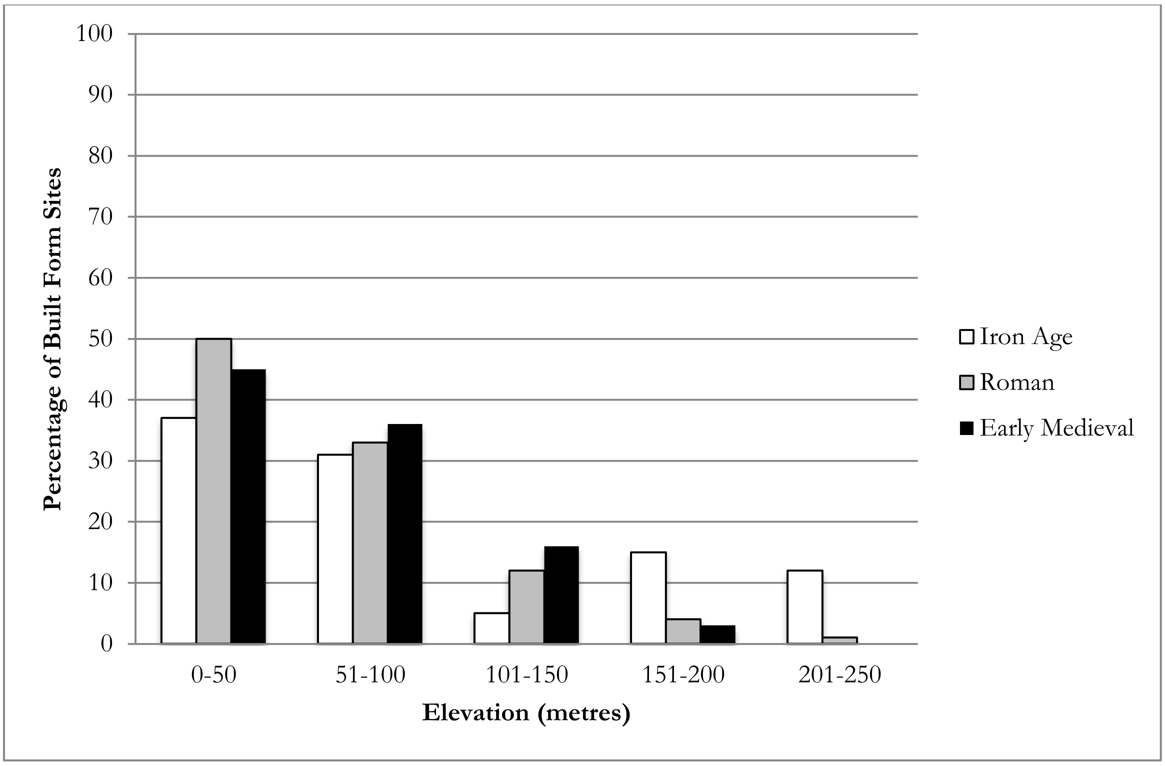


TABLE 4.9.2 Results of the Elevation Analysis in the East Yorkshire study area showing the number of built form sites from each temporal period.

| Elevation (metres) | 0-50 | 51-100 | 101-150 | 151-200 | 201-250 | **Total** |
|---|---|---|---|---|---|---|
| Iron Age | 53 | 44 | 7 | 22 | 17 | **143** |
| Roman | 81 | 53 | 20 | 7 | 1 | **162** |
| Early Medieval | 14 | 11 | 5 | 1 | 0 | **31** |
| **Total** | **148** | **108** | **32** | **30** | **18** | **336** |

FIGURE 4.9.2.b Percentage of built form Sites in the East Yorkshire study area based on their elevation




The GIS analysis of the relationship between elevation and spatial location in the East Yorkshire study area demonstrates a similar patterning across the three time periods. The majority of the built form sites are located between 0 to 100 metres asl, with the percentages of sites falling according to the elevation. The one exception to this pattern is the smaller percentage of Iron Age sites found between 101-150 metres asl as compared to the percentages between 151-200 metres and 201-250 metres asl.

### 4.9.3 SUMMARY OF ELEVATION ANALYSIS

The hilly areas between the upland and lowlands were often considered to be excellent locations for the location of settlements by pre-industrial agricultural societies (Roberts, 1996, p. 47). In the case of the two study areas, this 'hilly zone' appears at a different elevation above sea level, but shares the characteristics of gently rolling topography at the interface of uplands and lowlands. Generally speaking, the Iron Age and Roman Iron Age settlements are in this transitional zone. However, the elevation analysis demonstrates that the Early Medieval built form sites recorded in the Milfield Basin study area are located at different topographic elevations compared to the preceding temporal periods and are often found along the river valley bottoms or along the coastline. This is in contrast to the East Yorkshire Early Medieval sites, which are found in similar elevations as the preceding periods. These patterns suggest differences in either archaeological visibility or in the chosen spatial locations for the built environment of the Early Medieval period in the Milfield Basin.

## 4.10 WATER RESOURCES

Proximity to natural water sources such as rivers, streams, ponds, and springs is important to the development and maintenance of human settlement, with fresh water needed at frequent daily intervals for agricultural crops, animal husbandry, and for drinking and bathing. Roberts notes that the physical location within Britain dictates water availability and supply due to both rainfall and runoff, although Roberts does note that climatic changes can affect the amount of rainfall any given landscape receives (Roberts, 1987, p. 122). The frequency of streams and springs in a region relates to the underlying geology and elevation, as water moves throughout a landscape according to geological permeability and gravity, flowing faster in steeper elevations and pooling in relatively flat landscapes of poor permeability. Water resources also could be accessed through the digging of wells, which undoubtedly aided in the placement of settlements in regions without ready access to water. In addition, even though the sea is not an ideal resource for drinking water, its importance to human settlement as a transportation and trade route as well as access to food cannot be denied. Therefore, an understanding of where settlements are placed in relation to water resources can help lead to an understanding of the spatial placing of settlements during the Iron Age, Roman, and Early Medieval time periods.

### 4.10.1 MASTER MAP

The proximity to water analysis used the digital representation of water from the Ordnance Survey (OS) MasterMap Topography Layer, obtained through the Edina Digimap website, an online clearinghouse of digital mapping data in Great Britain. The OS MasterMap is a "consistent and maintained framework for the referencing of geographic information in Great Britain" that includes over 450 million unique features depicting highly accurate representations of topographic features, aerial imagery, address data, and the road network of Great Britain (Ordance Survey 2010). The water features within OS MasterMap define real-world objects according to their spatial location and size including natural features such as springs, rivers, stream, lakes, etc. as well as manmade features like swimming pools, canals, fountains, and wells (Ordance Survey 2010). The water features in MasterMap are mapped to their actual scale and limits, thereby allowing spatial analysis of their georeferenced locations to the built form locations.

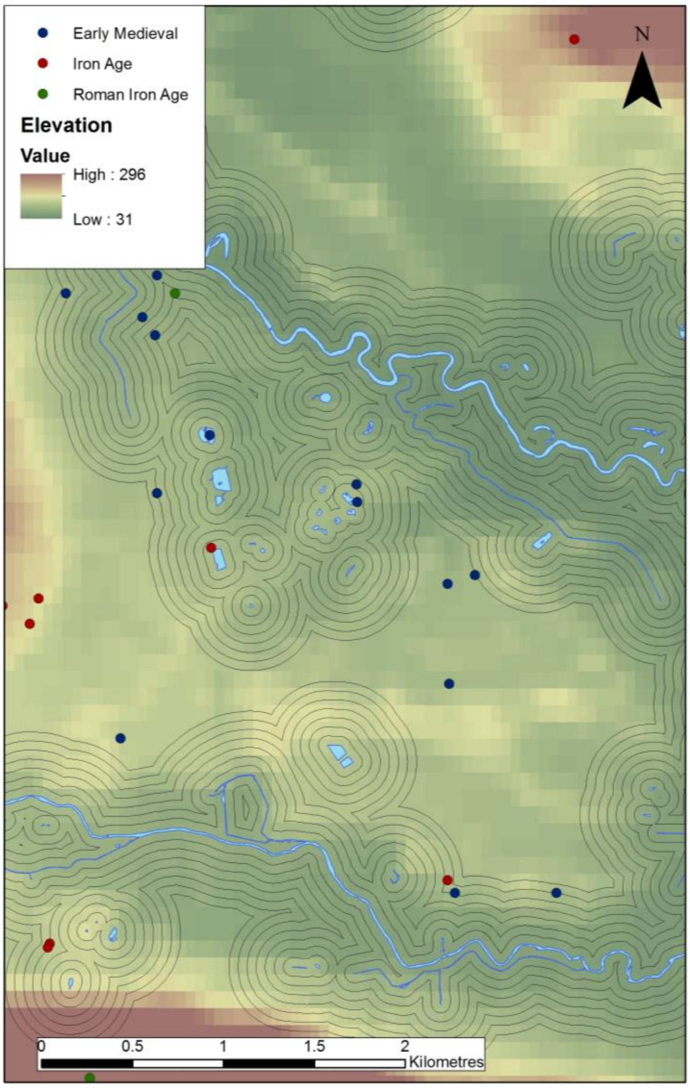
In order to use the OS MasterMap water data in the water analysis, natural water features were extracted from OS MasterMap, excluding the modern, artificial water elements. This data extraction led to a total of 4,437 hectares of water resources in the Milfield Basin study area and 125 hectares in the East Yorkshire study area. It is important to note that the water features within the Milfield Basin include portions of Budle Bay as well as inlets and bays along the North Sea coast. Subtracting these areas leaves 375 hectares of natural water resources within the Milfield Basin study area.

The difference in the total acreage of water resources in the two study regions is a reflection of the characteristics of each study area containing different underlying geology, permeability of the ground surface, climate, and elevation which all affect the development of water resources in each study area. The Yorkshire Wolds is the dominant feature of the East Yorkshire study area, and because of the underlying permeable chalk and topography, there are no major sources of standing water and relatively few drainages running in the Wolds (Natural England, 2012c, p. 2). The chalk aquifer, however, feeds a spring line along the escarpments down to the surrounding areas and feeding water resources in these areas, making the edge of the Wolds an attractor for settlement. In contrast, the broad river valleys along the River Till, River Tweed, and their tributaries dominate the Milfield Basin study area. The differences in the two study areas' access to water undoubtedly affected settlement patterns and the analysis of each area.

## 4.11 PROXIMITY TO WATER ANALYSIS

Once the natural waters were extracted and made into their own shapefiles, the ArcGIS *Buffer* command was used to establish buffer zones at 50-metre intervals around the extent of each water resource. Seven separate shapefiles representing 50-metre intervals around the water sources were created, extending the buffering to 350 metres around each source to determine whether there were any trends at different distances in the location of settlements compared to the water resources (Figure 4.11). Once this was done, the *Select by Location* function was used to define and extract built forms sites based on where they were located within the proximity to water buffer zones. These extracted built form sites were made into new shapefiles representing the Iron Age, Roman, and Early Medieval time periods within each buffer zone.

FIGURE 4.11 Example image of 50-metre buffer zones in the Milfield Basin study area.



## 4.11.1 MILFIELD BASIN PROXIMITY TO WATER ANALYSIS

The distribution of built form sites in the Milfield Basin compared to the buffer zones around the water resources shows an interesting pattern between the three time periods. There did not appear to be any pattern of settlement within any single 50-metre band, with the numbers varying between time periods and distances. What is perhaps most interesting is comparing the percentages of built form sites within 350 metres of water with those further away. Thirty-eight per cent of Iron Age, 36% of Roman Iron Age, and 81% of Early Medieval built form sites were located within 350 metres of water (Table 4.11.1, Figure 4.11.1). The differences in percentages are fairly small between the Iron Age and Roman Iron Age periods, but the Early Medieval is notable in that the overwhelming majority of built form sites attributed to this time period are located within 350 metres of water. Ten of the Early Medieval sites were located on the island of Lindisfarne, and obviously were located near water. Discounting these ten makes the proportion of Early Medieval built form sites within 350 metres 71% rather than 81%, which is still relatively high compared to the other time periods. These results suggest a change in the location of settlements in the Early Medieval period or differences in the archaeological visibility of built form sites between the periods giving preference to Early Medieval settlements close to water resources.

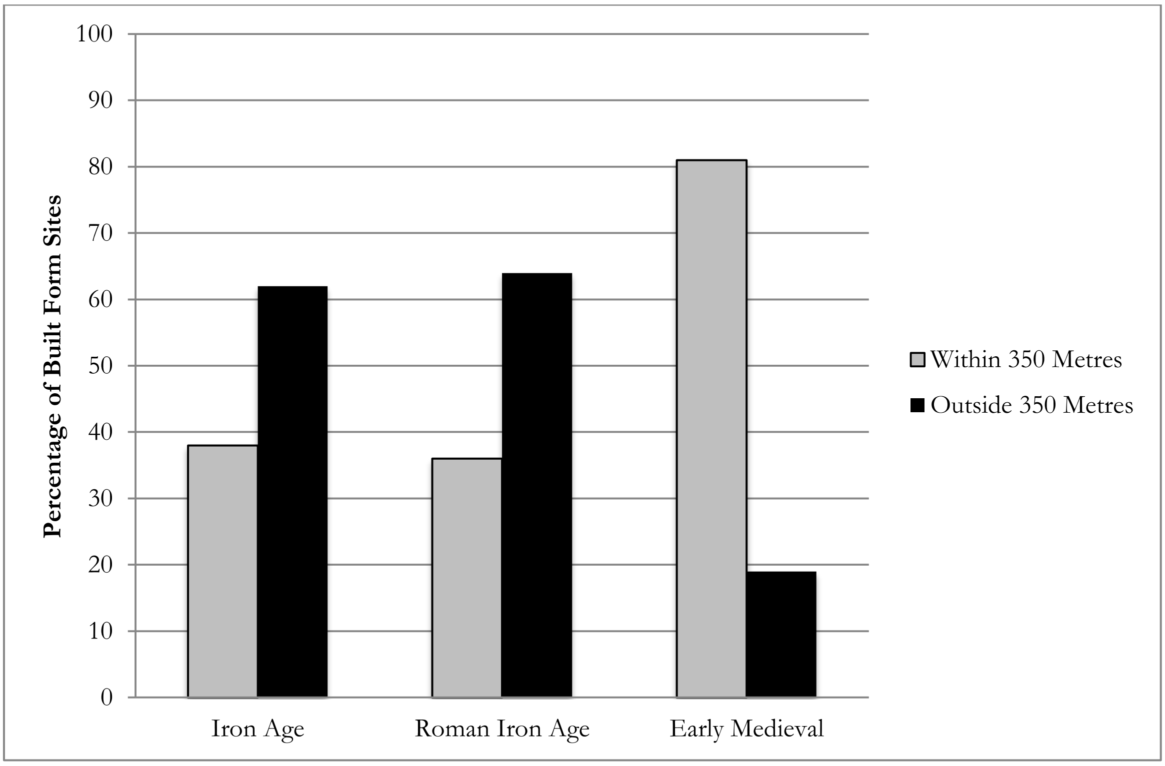
TABLE 4.11.1 Proximity to water analysis in the Milfield Basin study area

| Distance to Water | 0 to 50 m | 51 to 100 m | 101 to 150 m | 151 to 200 m | 201 to 250 m | 250 to 300 m | 301 to 350 m | Above 350 m | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| Iron Age | 5 | 14 | 4 | 12 | 15 | 11 | 16 | 125 | **202** |
| Roman Iron Age | 3 | 9 | 17 | 11 | 11 | 3 | 10 | 113 | **177** |
| Early Medieval | 2 | 1 | 5 | 5 | 3 | 6 | 3 | 6 | **31** |
| **Total** | **10** | **24** | **26** | **28** | **29** | **20** | **29** | **244** | **410** |

A number of studies have shown the importance of water resources for Early Medieval populations that may explain the differences shown above. Petts notes the political, social, and religious importance of the coastal region of northern Northumbria as both an important zone for communication and trade as well as a symbolic region of isolation for hermits and holy men (Petts, 2009, p. 82). In his discussion of the importance of the coastline for

Northumbrian contact and trade, Ferguson notes that the design of Early Medieval vessels may have allowed navigation up river valleys, making inland sites actually part of the coastal system (Ferguson, 2011, p. 288). Therefore the relative importance of waterways for trade, contact, and isolation may explain the clustering of Early Medieval sites in the Milfield Basin study area in close proximity to water resources. The importance of water resources in the Early Medieval period is not confined to Northumbria, as studies in other parts of England have shown the importance of river valleys as foci of Early Medieval settlement – perhaps due to their importance for early colonisation as areas of resource and fertile land (Brookes and Harrington, 2010, p. 38; Brookes, 2007, p. 91; Lund, 2010; Semple, 2008). Thus, there may be multiple reasons for the differences between Iron Age, Roman, and Early Medieval built forms' proximity to water which can only be elucidated through more close scaled and detailed analysis.

FIGURE 4.11.1 Percentages of built form sites in the Milfield Basin study area within and outside of 350 metres of a water resource




## 4.11.2 EAST YORKSHIRE PROXIMITY TO WATER ANALYSIS

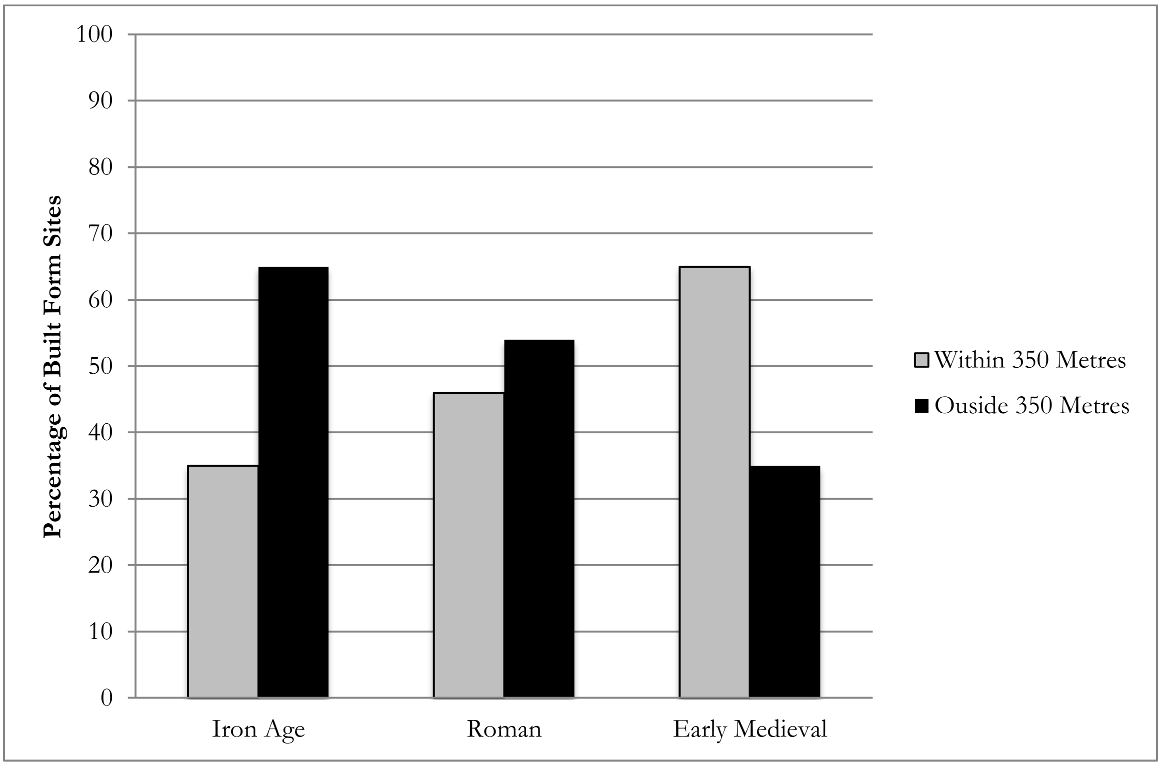
Like the Milfield Basin, the distribution of built form sites in East Yorkshire do not appear to demonstrate any pattern of settlement in any single 50-metre buffer zone of the natural water resources. The percentages within each time period of built form sites located within 350 metres or over 350 metres from water, however, demonstrates a different trend than in the

Milfield Basin study area. The percentages of built form sites within 350 metres of water gradually rises over time, with 35% of Iron Age sites, 46% of Roman sites, and 65% of Early Medieval sites located within 350 metres of water. Although the percentages are closer across the three time periods, the Early Medieval category has the highest percentage of sites within 350 metres of water in a similar manner as in the Milfield Basin. The numbers and percentages are demonstrated in Table 4.11.2 and Figure 4.11.2.

TABLE 4.11.2 Proximity to water analysis in the East Yorkshire study area

| Distance to Water | 0 to 50 m | 51 to 100 m | 101 to 150 m | 151 to 200 m | 201 to 250 m | 251 to 300 m | 301 to 350 m | Above 350 m | **Total number** |
|---|---|---|---|---|---|---|---|---|---|
| Iron Age | 3 | 9 | 7 | 1 | 5 | 11 | 14 | 93 | **143** |
| Roman | 7 | 11 | 13 | 5 | 12 | 16 | 11 | 87 | **162** |
| Early Medieval | 2 | 3 | 8 | 2 | 2 | 2 | 1 | 11 | **31** |
| **Total** | **12** | **23** | **28** | **8** | **19** | **29** | **26** | **191** | **336** |

FIGURE 4.11.2 Percentages of built form sites in the East Yorkshire study area within and outside of 350 metres of a water resource



### 4.11.3 SUMMARY OF PROXIMITY TO WATER ANALYSIS

The results of this proximity to water analysis shows that the Early Medieval built form sites are located closer to water resources in both of the study areas, with the overall percentages of built form sites in the Milfield Basin higher than in East Yorkshire. The main, observable difference is that the proximity to water in the Iron Age and Roman Iron Age periods of time are similar in the Milfield Basin. In contrast there seems to be a gradual growth over time in East Yorkshire with the Early Medieval sites in 350 metres of water being the largest of the three examined temporal periods. This suggests that in the Milfield Basin, the Early Medieval built form sites are being found in very different areas compared with the preceding periods and to the East Yorkshire area. In both areas, the high percentage of Early Medieval settlements in close proximity to water suggests the importance of water for the spatial location of built form sites.

These results are an interpolation based on the current spatial location of the natural water resources within the study areas based on the OS MasterMap data. Water has a tendency to shift its path across a landscape, with streams, rivers, and coastlines changing due to erosion, down-cutting, and meandering. Therefore, it is possible that the Iron Age and Roman sites were located closer to water resources than shown in the analysis. This analysis also does not include historic wells, which would have aided the development of past communities.

Though water resources can move, the general trends shown in the analysis points to the Early Medieval settlements being spatially positioned closer to water than the Iron Age and Roman periods. This pattern of a markedly different pattern of settlement for the Early Medieval period lines up well with the difference in the elevation analysis in the Milfield Basin study area. Likewise, the overall difference in distribution within the East Yorkshire area is similar to the elevation analysis due to the gradual changes in numbers rather than the sharp difference in the Milfield Basin.

## 4.12 UNDERLYING GEOLOGY

The underlying soils and geologic bedrock of a region can affect peoples' ability to inhabit a landscape. For example, waterlogged soil types (i.e. soils containing large percentage of clay, prohibiting drainage) are difficult to plough and grow crops in, as well as being poor areas for grazing animals. In addition, waterlogged areas can breed disease and generally are unpleasant areas to set up settlements. Too much water permeability, however, can make the ground difficult to work as it dries, and can leach out many of the minerals needed for agriculture.

The benefit of understanding the underlying soil type is apparent for the development of communities based on agriculture, and would have been important to the occupants of north-eastern England during the transitional period. Digital representations of the underlying soils and the land classification of the regions were used to examine if geology affected the placement of settlements during Iron Age, Roman Iron Age, Roman, and Early Medieval periods. This soil analysis interpolates the current soil types and the land classification supplied by the MAGIC Online Mapping service of the Agricultural Land Classification data to compare the spatial location of built form sites according to the underlying geology.

### 4.12.1 SOIL ANALYSIS

The northern England sheet of the *Soil Map of England and Wales: scale 1:250000* was scanned and georeferenced within each study area (Soil Survey of England and Wales., 1983). Different polygons were digitised for each soil type mapped in the study areas. Once this was completed, the *Select by Location* function was used to select and extract the built form sites according to their locations within the different soil types. This is demonstrated in Tables 4.12.1.a and 4.12.1.b and Figures 4.12.1.a and 4.12.1.b.

TABLE 4.12.1.a Distribution of built form sites in the Milfield Basin study area compared to underlying soils

| Soil Type | Area (hectares) | Percentage of Total Area | Iron Age | % | Roman Iron Age | % | Early Medieval | % |
|---|---|---|---|---|---|---|---|---|
| Bangor | 66 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dunwell | 1,783 | 2.7 | 18 | 9 | 49 | 28 | 1 | 3 |
| Sandwich | 729 | 1.1 | 0 | 0 | 0 | 0 | 2 | 7 |
| Rivington 2 | 719 | 1.1 | 6 | 3 | 9 | 5 | 0 | 0 |
| Wick 1 | 9,375 | 14.4 | 43 | 21 | 25 | 14 | 5 | 16 |
| Nercwys | 7,408 | 11.4 | 11 | 5 | 1 | 0.5 | 1 | 3 |
| Newport 1 | 2,239 | 3.4 | 9 | 4 | 4 | 2 | 14 | 45 |
| Alun | 2,798 | 4.3 | 5 | 3 | 1 | 0.5 | 0 | 0 |
| Flint | 573 | 0.9 | 1 | 1 | 9 | 5 | 0 | 0 |
| Malvern | 3,585 | 5.5 | 9 | 4 | 16 | 9 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anglezarke | 2,033 | 3.1 | 23 | 11 | 3 | 2 | 0 | |
| Hexworthy | 151 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Earle | 2,055 | 3.2 | 5 | 3 | 14 | 8 | 0 | 0 |
| Dunkeswick | 15,933 | 24.5 | 36 | 18 | 13 | 7 | 0 | 0 |
| Salop | 3,964 | 6.1 | 5 | 3 | 1 | 1 | 8 | 26 |
| Crewe | 847 | 1.3 | 1 | 1 | 0 | 0 | 0 | 0 |
| Brickfield 2 | 3,624 | 5.6 | 30 | 15 | 26 | 15 | 0 | 0 |
| Brickfield 3 | 733 | 1.1 | 0 | 0 | 6 | 3 | 0 | 0 |
| Wilcocks 1 | 1,583 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Enborne | 1,400 | 2.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blackwood | 91 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Winter Hill | 278 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Altcar | 92 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| No Soils | 3,054 | 4.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals** | **65,112** | **100** | **202** | **100** | **177** | **100** | **31** | **100** |

The results of the soil analysis in the Milfield Basin study area suggest differences in where the Iron Age and Roman Iron Age built form sites are found compared to the Early Medieval period sites. In general, the Iron Age and Roman Iron Age built form sites are located on soils that are good for either grazing or agricultural activities as they are loamy soils that, although they can become waterlogged in winter, can be easily cultivated with proper irrigation and management. The largest percentages of Iron Age and Roman Iron Age sites were found on Dunwell and Wick soils that are noted as being used today for agriculture (Jarvis, 1984, pp. 169–170, 302–305). In contrast to the two preceding periods, the Early Medieval built form sites were found on relatively poor soils for agricultural purposes, with the overwhelming majority of sites found on Newport 1 soils and Salop soils. These soil types are relatively poor for cultivation and grazing as they are either waterlogged throughout the year due to high clay content or are so freely draining that they have poor natural fertility (Jarvis, 1984, pp. 249-252, 270-273). Notably, the Dunkeswick soil type, which takes up a very large portion of the study area, has relatively low numbers of sites found within it compared to its size. This soil type runs along the broad sandstone escarpment in the central portion of the study area, and the limited number of sites may be due to limited archaeological visibility. However, this area remains one of the least populated portions of the study area today, implying that although it is fine for agricultural pursuits it has perhaps not witnessed the settlement as other regions in the area.

FIGURE 4.12.1.a Built form sites and underlying soils in the Milfield Basin study area

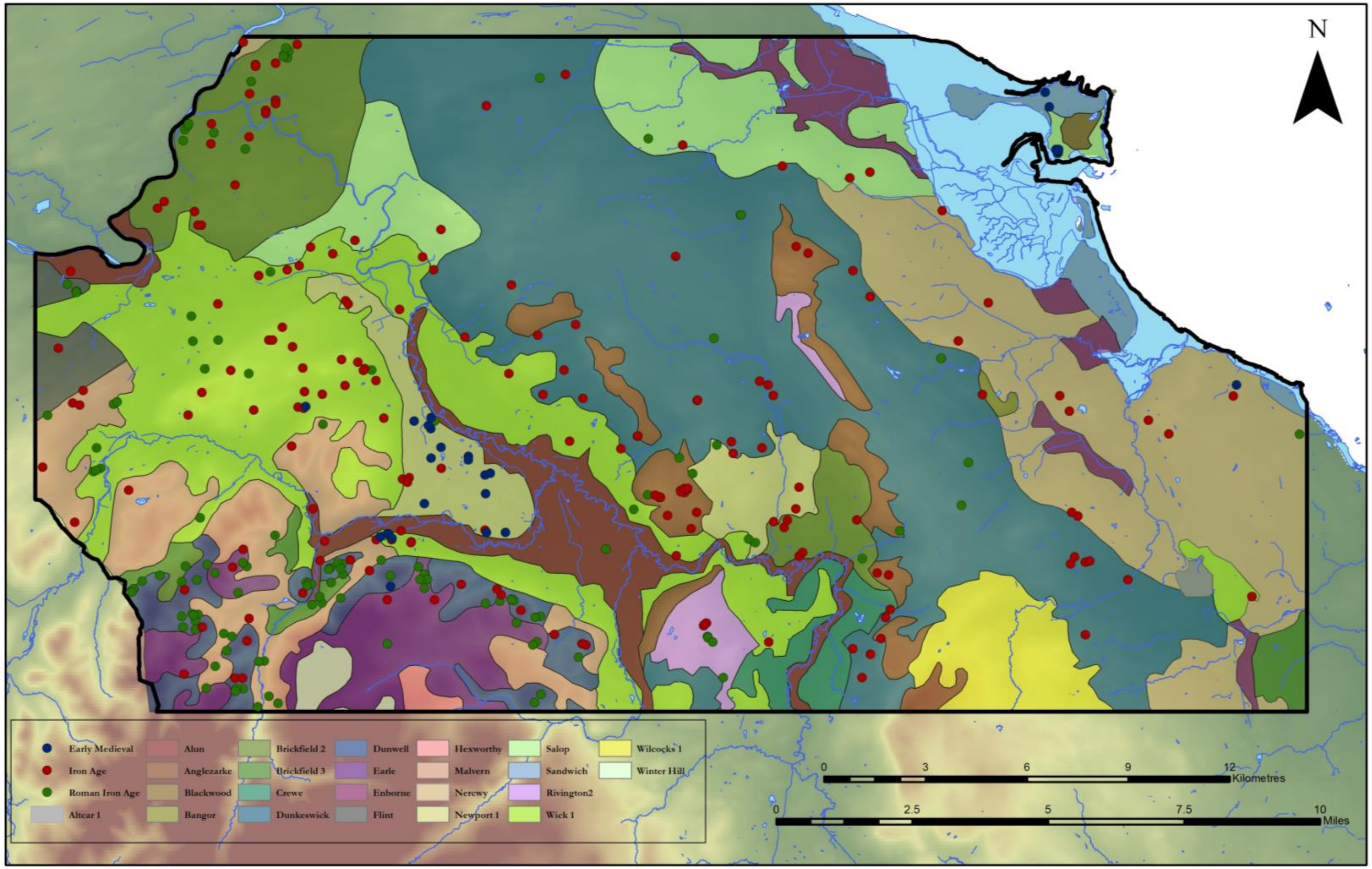
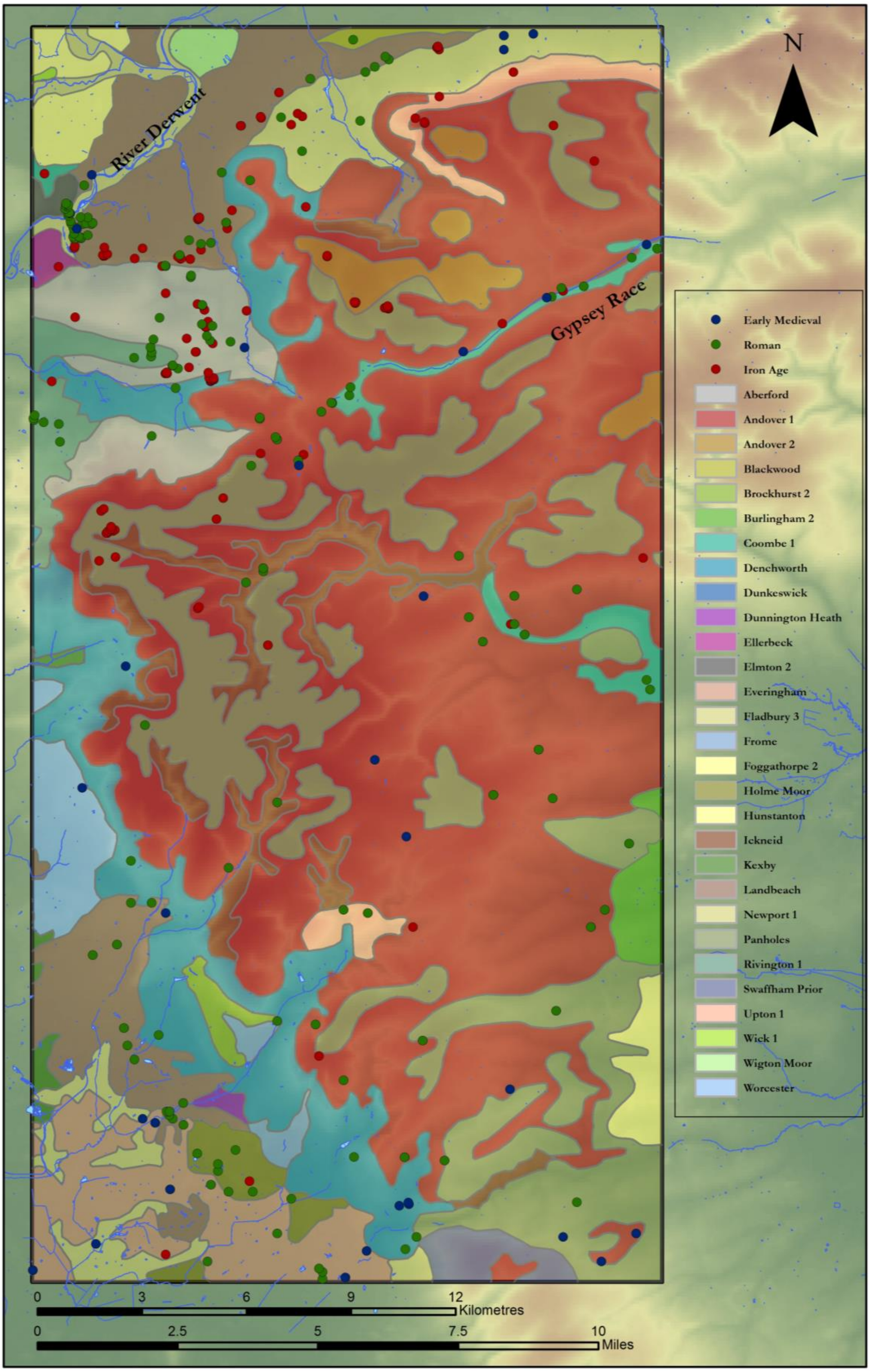


TABLE 4.12.1.b Distribution of built form sites in the East Yorkshire study area compared to the underlying soils

| Soil Type | Area (hectares) | Percentage of Total Area | Iron Age | % | Roman | % | Early Medieval | % |
|---|---|---|---|---|---|---|---|---|
| Icknield | 2,243 | 3.4 | 0 | 0 | 4 | 2 | 0 | 0 |
| Upton 1 | 887 | 1.4 | 4 | 3 | 2 | 1 | 0 | 0 |
| Elmton 2 | 124 | .2 | 0 | 0 | 6 | 4 | 0 | 0 |
| Andover 1 | 2,459 | 38.3 | 19 | 13 | 29 | 18 | 8 | 26 |
| Andover 2 | 1,033 | 1.6 | 6 | 4 | 0 | 0 | 0 | 0 |
| Worcester | 1,015 | 1.6 | 0 | 0 | 0 | 0 | 1 | 3 |
| Aberford | 2,405 | 3.7 | 23 | 16 | 16 | 10 | 1 | 3 |
| Coombe 1 | 892 | 1.4 | 4 | 3 | 9 | 6 | 2 | 7 |
| Panholes | 10,360 | 15.9 | 26 | 18 | 6 | 4 | 1 | 3 |
| Swaffham Prior | 460 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Landbeach | 5,119 | 7.9 | 37 | 26 | 42 | 26 | 2 | 7 |
| Rivington 1 | 822 | 1.3 | 1 | 1 | 12 | 7 | 0 | 0 |
| Ellerbeck | 140 | 0.2 | 1 | 1 | 0 | 0 | 0 | 0 |
| Wick 1 | 19 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Newport 1 | 1,803 | 2.8 | 5 | 3 | 5 | 3 | 3 | 9 |
| Kexby | 157 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hunstanton | 495 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Burlingham 2 | 468 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dunnington Heath | 84 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Holme | 632 | 1 | 1 | 1 | 7 | 4 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Moor | | | | | | | | |
| Dunkeswick | 56 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Brockhurst 2 | 26 | 0.4 | 0 | 0 | 1 | 1 | 0 | 0 |
| Denchworth | 5,374 | 8.3 | 11 | 7 | 5 | 3 | 5 | 16 |
| Foggathorpe 2 | 681 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frome | 266 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fladbury 3 | 1,446 | 2.2 | 1 | 1 | 7 | 4 | 2 | 7 |
| Blackwood | 133 | 0.2 | 0 | 0 | 1 | 1 | 0 | 0 |
| Everingham | 257 | 3.9 | 4 | 3 | 10 | 6 | 6 | 19 |
| Wigton Moor | 216 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals** | **65,112** | **100** | **143** | **100** | **162** | **100** | **31** | **100** |

FIGURE 4.12.1.b Built form sites and underlying soils in the East Yorkshire study area



In contrast to the soil analysis results in the Milfield Basin, the built form sites from the three temporal periods in the East Yorkshire study area all tend to come from soils that are well drained and good for agriculture and grazing. The largest percentages of built form sites from the three periods were found on Andover 1, Landbeach, Everingham, and Panhole soils which were all coarse loamy or fine sandy soils that are excellent areas for agriculture. The results show that unlike in the Milfield Basin, the best-drained soils useful for agriculture were utilised by all of the temporal periods, suggesting that the underlying soil types did have an impact on built form location.

### 4.12.2 LAND CLASSIFICATION

The soils analysis points to there being meaningful differences in where built form sites were positioned in comparison to the underlying geology. However, these results cannot be compared statistically as the soil types are different in the two study areas. Agricultural Land Classification data obtained from the MAGIC interactive map download webpage was used to make statistical comparisons between the two regions and three temporal periods. MAGIC is an interactive webpage incorporating information from a variety of British governmental agencies (MAGIC, 2012). The land classification maps display an assessment of the overall quality of land for agricultural practices, taking into account soil type, climate, and spatial location (Ministry of Agriculture, Fisheries, and Food, 1988, p. 7). They divide all of Britain into different classifications including: Class 1 (excellent quality agricultural land), Class 2 (very good quality agricultural land), Class 3 (good to moderate agricultural land), Class 4 (poor quality agricultural land), Class 5 (very poor agricultural land), and other categories such as urban, non-agricultural (such as golf courses), and water bodies (Ministry of Agriculture, Fisheries, and Food, 1988, pp. 9-10).

Land classification data was chosen to statistically compare the distribution of built form sites in the two study areas related to the underlying geomorphology as it has defined characteristics that are applicable in both regions. That said the land classification data is fairly coarse as it was drawn at a scale covering the whole of Britain. Therefore detailed spatial analyses such as performed below will inherently contain spatial errors. So while it provides a stable platform to statistically compare the two regions, due to the relative inaccuracies that will be inherent in this data, the analysis is best thought of as providing context to the soil analysis described previously.

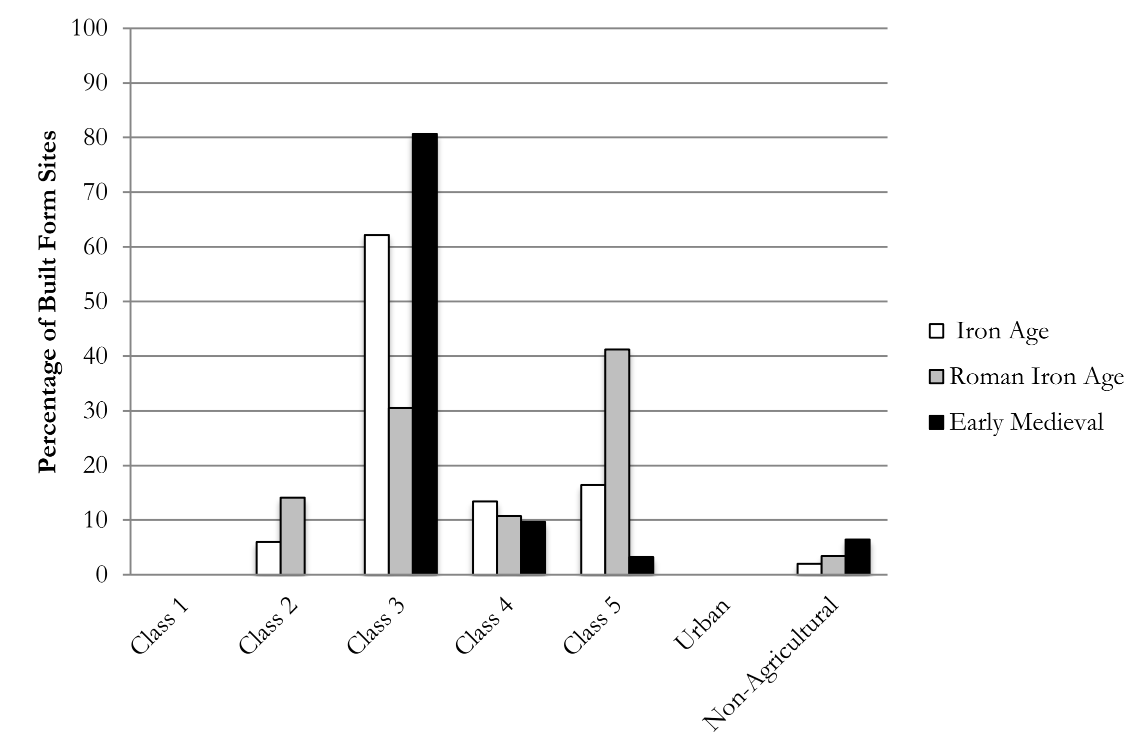
### 4.12.2.1 MILFIELD BASIN LAND CLASSIFICATION ANALYSIS

Table 4.12.2.1 shows the results of the spatial analysis of the location of the built form sites in the Milfield Basin study area compared to the land classification map and Figure 4.12.2.1 shows the percentage of built form sites found within each class. The majority of the built form sites are on good to moderate agricultural land (Class 3), although the highest percentage of Roman Iron Age sites is located on poor agricultural land (Class 5). Many of the Roman Iron Age built form sites are the remains of enclosures and field boundaries extending down the hill slopes from the reoccupied hillforts in the region, which may have affected the analysis as the hill slopes are generally rated as poor agricultural land. Disregarding this, it does appear based on the land classification results that the Early Medieval sites are not positioned on as poor land as the soils analysis demonstrates. However, this analysis does show differences in the patterns between the temporal periods in the Milfield Basin study area.

TABLE 4.12.2.1 Distribution of built form sites in the Milfield Basin study area compared to the land classification map

| | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Urban | Non-Agricultural |
|---|---|---|---|---|---|---|---|
| Iron Age | 0 | 12 | 125 | 27 | 33 | 0 | 4 |
| Roman Iron Age | 0 | 25 | 54 | 19 | 73 | 0 | 6 |
| Early Medieval | 0 | 0 | 25 | 3 | 1 | 0 | 2 |

FIGURE 4.12.2.1 Percentages of built form sites in the Milfield Basin study area based on their location on the Land Classification map



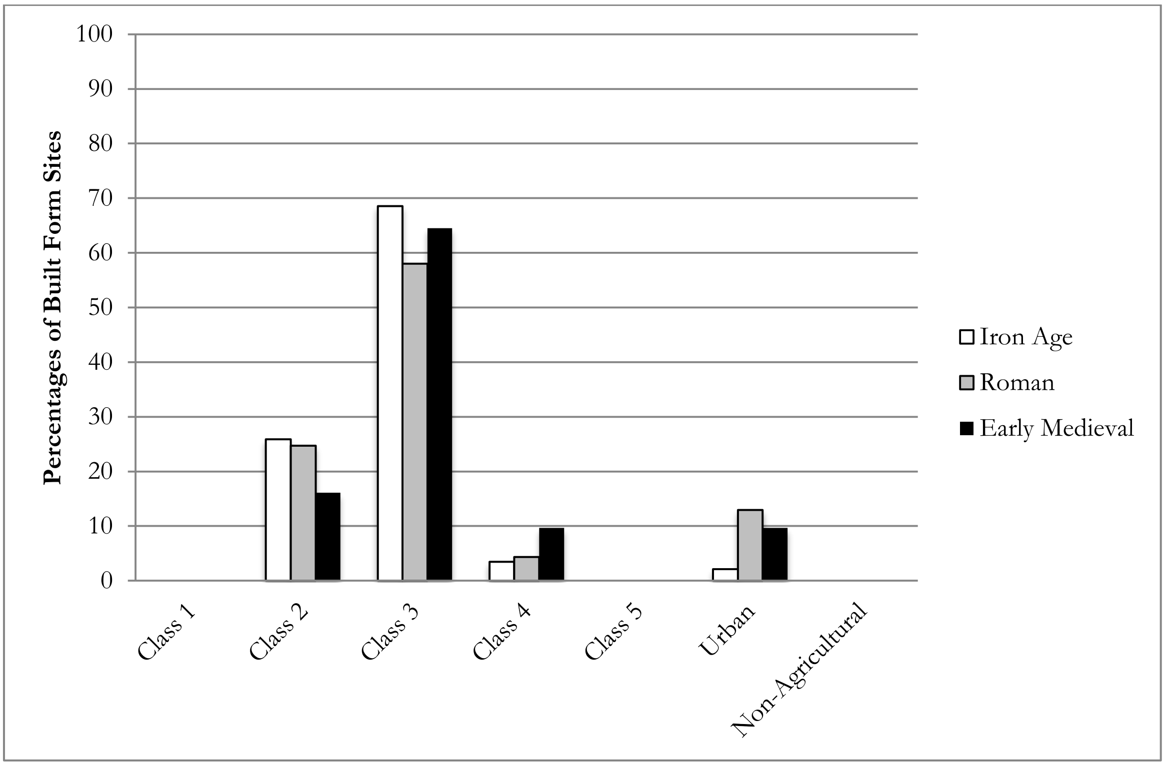

## 4.12.2.2 EAST YORKSHIRE LAND CLASSIFICATION ANALYSIS

Similar to the Milfield Basin data, most of the built form sites from across the three time periods are located in good to moderate soils (Class 3) (Table 4.12.2.2). Figure 4.12.2.2 demonstrates, however, that the built form sites from across the three temporal periods appear to be located on similar land classification categories, especially when compared to the Milfield Basin results (Figure 4.12.2.1). These results again suggest that there is consistency across the temporal periods in the East Yorkshire study area in the spatial location of built form sites compared to the environmental parameters examined by this analysis.

TABLE 4.12.2.2 Distribution of built form sites in the East Yorkshire study area compared to the land classification map

| | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Urban |
|---|---|---|---|---|---|---|
| Iron Age | 0 | 37 | 98 | 5 | 0 | 3 |
| Roman | 0 | 40 | 94 | 7 | 0 | 21 |
| Early Medieval | 0 | 5 | 20 | 3 | 0 | 3 |

FIGURE 4.12.2.2 Percentages of built form sites in the East Yorkshire study area based on their location on the Land Classification map




## 4.12.3 SUMMARY OF SOIL AND LAND CLASSIFICATION ANALYSES

These two complementary analyses indicate that the Milfield Basin and East Yorkshire study regions display different patterns of spatial location in relation to the underlying geology. In this case the soils analysis argues that the Early Medieval sites in the Milfield Basin were positioned on much worse soil than the other periods. The land classification analysis contrasts this, as the Roman Iron Age settlements have their highest percentage of spatial locations in the worst classification of land. The East Yorkshire land classification analysis, once again, shows similar percentages of built form sites from all three periods in the different land classifications. Both forms of analysis imply that the settlement in the Milfield Basin was distinct between the Iron Age and Roman Iron Age on the one hand and the Early Medieval period on the other. The East Yorkshire analyses, on the other hand, implied a consistency in the location of sites were located based on the underlying soils and land classification.

## 4.13 SIGNIFICANCE OF THE LANDSCAPE ANALYSIS RESULTS

The results of the landscape analysis suggest trends and patterns in the arrangement of the Early Medieval sites in the two study areas based on the environmental factors. The Early Medieval built forms in the Milfield Basin area appear to be quite different from the preceding periods with the sites located at lower elevations, closer to water resources, and on differing underlying geology compared to the preceding periods. In contrast the Early Medieval built form sites in the East Yorkshire area appear to be located in similar environmental locales as the preceding periods. One of the issues with interpreting these trends is determining the appropriateness of comparing the Early Medieval patterns to the preceding periods due to the much smaller pool of sites dated to this period in each study area.

In order to further investigate these trends in the data, statistical analysis was employed to determine if these differences in the spatial analysis data were significant. Following a discussion of the statistical results, this section concludes with a discussion of the importance of the landscape analysis and the possible meanings behind the observed patterns. Chapter 7 further explores these results in conjunction with the VGA results to more fully investigate the research questions.

### 4.13.1 STATISTICAL TESTS OF LANDSCAPE ANALYSIS

This thesis has argued that the region north of Hadrian's Wall and outside the main sphere of influence of Roman *Britannia* should have different settlement patterns as compared to Yorkshire due to the variations in culture contact and transmission of ideas on the use of space and place. The statistical tests were chosen to determine if these differences in settlement patterns were significant or due to chance and to examine what affect, if any, did the environmental factors of proximity to water, topographic elevation, and underlying geology have on the spatial patterning of the recorded built form sites. Two tests were chosen to examine the Landscape Analysis results: a *Pearson's Product-Moment Correlation* and an *Analysis of Variance (ANOVA)* test. A correlation test examines the strength of a relationship between two dependent variables, and was an ideal method to scrutinise how the spatial positioning of sites based on the three examined environmental parameters compared to one another (VanPool and Leonard, 2011, p. 221). The ANOVA tests investigated if there were significant differences in the mean location of the sites based on the environmental categories. For detailed descriptions of the statistical equations and definitions used to test both analyses see Appendix B.

#### 4.13.1.1 CORRELATION TEST OF LANDSCAPE ANALYSIS RESULTS

The Pearson's Correlation Coefficient test indicates there are significant patterns of varying strengths in the spatial positioning of the built form sites in the two study areas. Correlation tests were run on the relationship between the landscape analysis results within each time period grouping (i.e. the relationship of the Northumberland Iron Age sites based on their elevation, proximity to water, and underlying land classification) and then these results were compared to one another. The correlation test was used to examine the relationship between a site's spatial location and if there were significant relationships between the elevation, underlying geology, and access to water at that given site. These were then compared to the other examined periods to see if there were patterns in the relationships between the environmental factors and spatial location. IBM SPSS Statistics, the computer software program used to run all of the statistical tests, produced matrices of the test results. These are included along with a detailed description of the correlation tests and equations in Appendix B.

The correlation tests demonstrated that there are strong positive correlations between the spatial location of Iron Age and Roman Iron Age built form sites compared to elevation and underlying geology, moderate relationships compared to the sites' elevation and proximity to water, and weak correlations compared to the sites' underlying geology and proximity to water. There was a less than .001 probability that these correlation coefficients occurred by chance between these two time periods. These significant relationships between the Iron Age and Roman Iron Age are not surprising, as in many cases the Roman Iron Age sites reoccupied previous Iron Age sites, or were located close by. Therefore, these correlation tests confirm the similarities observed in the landscape analyses between the Iron Age and Roman Iron Age in the Milfield Basin.

In contrast, the Early Medieval built form sites in the Milfield Basin have weak positive correlations between elevation and underlying geology and elevation and proximity to water with no relationship observed between the proximity to water and underlying geology. None of the Early Medieval correlation coefficients are considered significant, although this was probably due to the smaller size of the Early Medieval built form data set. Regardless, the correlation matrices of the Early Medieval period shows there are much weaker relationships between the spatial locations of the NSR Early Medieval sites compared to the preceding time periods, indicating that the settlements' relationships in this period differed meaningfully from the preceding periods. While correlation tests do not indicate the cause of these differences, the lack of a relationship between the spatial locations and environmental parameters indicates a distinct settlement pattern compared to the Iron Age and Roman Iron Age, confirming the results observed during the landscape analysis.

The correlation coefficient test of the East Yorkshire landscape analysis results demonstrates there are similar patterns to the relationships of spatial location compared to the environmental factors in this area. The East Yorkshire correlation tests indicated there are weak relationships between the spatial location, elevation, proximity to water, and underlying geology in all three periods. Although there are weak relationships, the similar spatial patterning of weak correlations across the three periods is indicative of consistency in where built form sites from the temporal periods are located and/or identified.

The correlation tests of the Landscape Analysis data were designed to assess the relationships between spatial location and the environmental factors of topography, proximity to water, and land classification. The results of these statistical tests indicate there are relationships and differences in how the environment relates to the spatial location of the *recorded* built form sites in the two study regions. In particular, the correlation tests determined there were stronger relationships between the environmental factors and built form locations in the Milfield Basin than in East Yorkshire. At the same time the Early Medieval sites in the Milfield Basin have very different spatial locations than the earlier time periods as well as compared to the East Yorkshire Early Medieval sites.

It is important to note that these correlations only indicate there is a relationship of some sort between the spatial location and the environmental factors and do not define causality (Field, 2009, p. 127). For example, while the statistical results show that in the Milfield Basin study area there is a strong relationship between Iron Age and Roman Iron Age settlements based on elevation and land classification, these tests do not reveal the reasons this occurred. This is because bivariate correlations consider only two variables, and other factors may have influenced these relationships. In addition, the correlation coefficient cannot describe which variable causes the other to change (Field, 2009, p. 128). Finally, these correlations examine the locations of the recorded sites, which as previously discussed, are themselves the result of limited archaeological investigations and may not be indicative of actual past patterns of settlement. Even though these limitations are important to consider, the results of the correlation tests do provide statistical evidence to back up the observed pattern indicating the Early Medieval settlements in the Milfield Basin study area are located in much different areas than the preceding periods and this is a meaningful difference to the East Yorkshire Early Medieval sites. Using these results along with the ANOVA tests and statistical tests of the VGA results allows an interpretation that minimises the negative attributes of the data.

#### 4.13.1.2 ANOVA TEST OF LANDSCAPE ANALYSIS RESULTS

The reasons behind the differences between the time periods, study regions, and environmental factors are difficult to assess based purely on correlation tests, as there can be a variety of factors that contribute to these relationships. Therefore, an ANOVA statistical test was also run on the landscape analysis results to examine if there were significance in the variation between the mean differences between the time periods and environmental analyses. The ANOVA results tables, along with a description of the test, are available in Appendix B.

The ANOVA results indicate there were significant differences across the spectrum of environmental parameters, time periods, and study areas. In general, the Milfield Basin built form sites tend to display more significant differences in their spatial locations from each other (NSR Iron Age, NSR Roman Iron Age, and NSR Early Medieval) and to the Yorkshire built form sites. The East Yorkshire sites, on the other hand, tend to not have as many significant differences between the analysed time periods. The ANOVA test confirms there were more significant differences in the Milfield Basin region and that the Early Medieval built form sites are significantly more different compared to the preceding periods in the Milfield Basin and to all of the East Yorkshire sites.

#### 4.13.1.3 SUMMARY OF STATISTICAL TESTS OF LANDSCAPE ANALYSIS

The statistical tests of the landscape analysis results were chosen to assess the significance of the relationships between the spatial locations of the built form sites compared to the environmental factors. The landscape analysis has demonstrated that the Early Medieval built form sites in the Milfield Basin have been identified and recorded in very different locales than the Iron Age and Roman Iron age sites as well as to the built form sites in the East Yorkshire study area. In contrast, the Early Medieval sites in East Yorkshire are located in similar locales to the Iron Age and Roman sites. The statistical correlations and ANOVA test show that these observations have a high probability of being genuine and are not due to chance as there are significant differences in settlement patterning in the two regions.

What these tests do not show is what has caused these differences. Correlations do not necessarily demonstrate causality. That said, the correlation and ANOVA test results have shown the significant relationships and differences of where the built form sites have been located compared to environmental factors. The potential reasons for these differences are discussed below.

## 4.14 DISCUSSION OF THE LANDSCAPE ANALYSIS RESULTS

The statistical analysis demonstrates there are significant relationships and differences in the built form locations compared to the environmental factors of elevation, proximity to water, and underlying geology. These can be attributed to a variety of factors broadly falling under the categories of: the archaeological visibility of the sites, the effect of cultural ideas on the adaptation to environmental factors influencing settlement placement and use, or a combination of the two. These relationships and differences will be used to more broadly discuss the variances between the two regions and how this relates to the research question concerning how Roman Britain affected the Early Medieval built environment.

### 4.14.1 ARCHAEOLOGICAL VISIBILITY

The visibility of archaeological resources on the landscape is a product of the loss over time of the physical archaeological resource, the local environmental conditions, and the archaeological techniques, recording practices, and amount of investigations in a region. All of these factors affected both where individuals in the past constructed their built environment as well as how archaeologists have identified these activities. Therefore, the visibility of archaeological resources may be the reason behind the noted differences in the landscape analysis results.

The remains of the archaeological built environment, arguably, have the most profound effect on their identification by archaeologists. Upstanding archaeological remains, such as the stone ramparts of Iron Age and Roman Iron Age hillforts in the Milfield Basin study area are perhaps the easiest type of built form site to identity as they can be found through field walking, aerial photography, and/or working with remote sensing data such as LiDAR and/or satellite imagery (Oswald et al., 2006). Other built form upstanding remains include mounded over walls, hollow ways or dykes, and the remains of ditched enclosures. Early Medieval built forms include features constructed using postholes and trenches, which are not identified as easily as upstanding features. There are relatively few upstanding remains from any of the time periods in either study area, with many of these being located in marginal landscapes of survival where post-depositional processes have not affected their integrity, such as along the crests of the Cheviot Hills. Remote sensing and archaeological fieldwork are the remaining methods for identifying evidence of buried archaeological materials.

Aerial photography of cropmarks has identified settlements from the three examined periods in both study areas. However, these surveys have tended to concentrate in specific areas that produce these forms of evidence; such as the gravel river bottoms of the Milfield Basin or the chalky soils of the Yorkshire Wolds. Other areas that are forested or are in clay landscapes have tended to be avoided due to the limitations of examining these landscapes by aerial reconnaissance. Certain portions of each study area, such as the broad sandstone escarpment to the east of the Till River Valley and the clay soils of Holderness have experienced comparatively fewer archaeological investigations due to their perceived lack of settlement evidence. These areas are starting to be examined, however, as recently available LiDAR surveys can examine the surface of wooded areas and there is growing evidence that claylands are not devoid of past settlements or the cropmark evidence of these features (Crutchley, 2010; Mills and Palmer, 2007). Therefore while these portions of the two study areas may in fact contain fewer built form examples from this period, the archaeological visibility and recording techniques in these areas cannot adequately support that.

Another factor in understanding archaeological visibility is the survival of archaeological resources across the landscape. Williamson noted three broad phases that affected the rural archaeological landscape in Britain: a retreat from the moors, heaths, downs, and Wolds between the late prehistoric and Early Medieval periods, an expansion of arable land during the medieval period, and the transformation of the landscape during the post-medieval period due to enclosure, intensification of agricultural activities, and the development of the pastoral west and arable east divide (Williamson, 1998, p. 15). Following Williamson, the Iron Age and Roman period settlements on the moors, downs, and uplands would be better preserved than the settlements located in the more intensely settled and farmed low lands. This framework shows that the upland regions of the study areas are landscapes of survival, with the archaeological resources better preserved here than in the lowlands.

The final factor in considering archaeological visibility is related to the growth of developer-funded archaeology and large research projects having concentrated the recording of built form sites in certain portions of the study areas. The gravelly basin along the River Till, for instance, has witnessed large open area archaeological investigations due to the development of open-air quarrying, which has uncovered Early Medieval built form sites (for example Cheviot Quarry and Lanton Quarry; Johnson and Waddington, 2008; Stafford and Johnson, 2007). Likewise, the work of the Landscape Research Centre in the Vale of Pickering not only excavated the largest Early Medieval settlement in the north at West Heslerton, but identified large numbers of archaeological sites along the northern edge of the East Yorkshire study area through a systematic geophysical survey of the vale (Montgomery et al., 2005; Powlesland, 1998; Powlesland et al., 1999, 2006). The increased intensity of archaeological research in portions of the two study areas affects the spatial analysis of recorded built form site by concentrating results in these areas.

All of these factors in archaeological visibility are important to consider, thus this landscape analysis has not followed established GIS-trends in analysing the landscape using a 'dots on a map' approach, and does not argue that these patterns represent the actual density of either of the periods' settlement patterns. Instead, by focusing on the known archaeological site locations in comparison to the environmental factors, it is intended that any broad trends in how the known resources compare to the environmental influences would be indicative of how societies in the two study areas interacted with the natural landscape.

### 4.14.2 ADAPTATION TO THE NATURAL LANDSCAPE

Although archaeological visibility is an important factor to recognise and impacted the results of this analysis, it is suggested here that the trends are genuine due to similarities across the density, elevation, proximity to water, and underlying geology analyses. The Early Medieval settlements in the Milfield Basin study area, outside of the main Roman sphere of influence, have a distinct pattern of settlement to the preceding periods in the study area as well as in comparison to the East Yorkshire Early Medieval settlement patterns. If these significant differences are genuine and not a product of archaeological visibility, they may be due to either different cultural reactions to the environment, varying cultural traditions on the positioning of built forms, or a combination of these factors. Rockman noted that environmental knowledge is a key factor for the colonisation of new regions and is a product of the locational properties of a region, the limitational familiarity with the resources of an area, and the social experiences of a group or groups inhabiting a landscape (Rockman, 2003, p. 4). Following this, the incoming populations in both regions would have had their own cultural ideas and norms on how to construct and maintain their built environment and where to position a community or household on the landscape.

The similarities in spatial arrangements in East Yorkshire suggests that these specific areas were ideal for supporting populations, and therefore attracted settlement across the analysed time periods. Incoming groups may have been attracted to these regions based on their own inherent knowledge or due to cultural interaction and transmission of ideas of the local landscape. Likewise, the differences noted in the Milfield Basin may be indicative of the area having multiple zones ideal for settlements, or the native population in the Early Medieval period may have chosen to interact and live among the lowland areas with the incoming migrants in hybridised groups. This is difficult to determine due to limited data presently known on the relative numbers of incoming migrants and native inhabitants in the region. The results also may point to concurrent settlement in different portions of the study area in a form of apartheid, where the incoming Germanic migrants settled in the Milfield Basin river valleys while the native British/Romano-British remained along the hill margins, thus keeping the social groups separate (Woolf, 2007, p. 128). However, without excavation it is impossible to identify if the Roman Iron Age settlements continued in use through the Early Medieval period.

## 4.15 SUMMARY OF THE LANDSCAPE ANALYSIS

The landscape analysis has shown there were meaningful differences in the spatial positioning of Early Medieval built form sites in the Milfield Basin compared to the preceding periods. It also shows there was less variability between the Iron Age and Roman Iron Age settlement patterns in the Milfield Basin, and there were relatively few differences between the periods in the East Yorkshire study area. The distinct patterning in Milfield can be seen in contrast to established thinking of the NSR, where it has been argued that Anglo-Saxon settlements tended to settle near British centres of power (Frodsham, 1999, p. 18; Hope-Taylor, 1977, p. 26; O'Brien, 2011, p. 217; Passmore et al., 2012, pp. 298–299). However, the physical distances between sites may not be large but they are positioned in dramatically different environmental zones as in the case of Yeavering Bell hillfort and the Early Medieval settlement of Yeavering (Ad Gefrin). Though less than a kilometre away from one another, these two sites are located at very different elevations, vary in their proximity to water, and have unique underlying geology. Thus, although relatively close, the Early Medieval settlements in the Milfield Basin are located in their own unique environmental zones. This contrast to the East Yorkshire patterns is perhaps the main strength of this analysis, as the settlement arrangements were remarkably similar between the time periods in each study area. Ultimately, these results provide context for the examination of space within settlements and households discussed in Chapters 5 and 6. Chapter 7 discusses both the landscape and visibility graph analyses and how they reflect one another and address the research question.

# CHAPTER FIVE

# VISIBILITY GRAPH ANALYSIS AND UCL DEPTHMAP

Archaeological investigations at Binchester and Birdoswald Roman forts have demonstrated no breaks in occupation from the Roman to Early Medieval periods, perhaps indicating that gradual cultural transitions rather than sharp breaks or overwhelming conquest characterised Britain following the end of Rome (Ferris and Jones, 2000; Higham, 1993; Wilmott, 2000). As previously discussed, examinations of space and place have the potential to reveal or offer insights into our understanding of the complexities of change that occurred during transitional time periods. Even though more and more settlements with continuity in occupation have been discovered, the challenge for archaeology is recognising transition at sites that do not demonstrate occupational continuity. Researchers that focus on household and settlement archaeology argue that the specific examination of space and place can reveal how communities altered over time, which in turn is illustrative of the alterations in socio-cultural life during transitional periods (Canuto and Yaeger, 2000; Steadman, 1996; Wilk, 1989b). Therefore, variations or continuities in how space and the built environment were defined and used over the *longue durée* have the potential to reflect the complexities of culture contact and modification that occurred between the Iron Age, Roman, and Early Medieval periods in Britain.

This chapter introduces a new methodology to examine space at the level of both individual households and settlements using VGA. Visibility graph analysis quantifies the visual and spatial organisation of the built environment, and provides insight into how these relate to the activities and movements of individuals. It uses ideas based on isovists and graph-based analyses to investigate how the built environment configures space and accessibility according to visibility (Turner, 2001, 2003; Turner et al., 2001). In order to understand how VGA can be used to examine space and place from the 1st century BC to 9th century AD in north-east England, this chapter briefly introduces the methodological difficulties in examining the spatial characteristics of the built environment, how VGA and computational methods can examine these topics, how VGA is related to space syntax theory and architectural visibility, and how new use of VGA can be used to study archaeological settlements. The use of VGA to examine Northumbrian households and settlements is related to the theoretical discussions in Chapter 3 on how the built environment's organisation is a reflection of society's structure.

## 5.1 COMPARISONS BETWEEN TIME PERIODS

Though scholars have focused on space and the built environment in Early Medieval Britain, these studies generally have not quantitatively compared these investigations to similar research on the use of space and place in Roman or Iron Age Britain (for a selection of studies on Iron Age, Roman, and Early Medieval integrations of space and place see: Gosden, 2005; Griffiths et al., 2003; Hamerow, 2002, 2012; Hingley, 1984, 2004, 2007; Moore, 2007; Pope, 2007; Semple, 2011; Tipper, 2004; Ware, 2009). Changes in how settlements were structured can be attributed to either environmental or cultural forces that acted upon how space was viewed and/or utilised by a society. Likewise, continuities in the use of space are reflective of a culture's habitus and indicative of the cultural transmission of ideas on spatial organisation during culture contact and periods of stress, implying that certain spatial aspects of a culture were resistant to change.

Developing a methodology using VGA that can quantitatively compare settlements from different cultural groups, different time periods, and/or different regions is essential for understanding continuities or disruptions in how space and place were designed and utilised in the past. Tahar and Brown (2003) used VGA to examine structures from the five walled towns of the Berber M'zab region in Algeria, made famous by Bourdieu's studies of the region in his work on the habitus, in order to investigate the use of space and its relationship to social relations in M'zab households. They found that the VGA measurements were related to the activities and movements within the structures, and these differed slightly region to region (Tahar and Brown, 2003, p. 56.15). This thesis employs similar methods of analysing and comparing the built environment between regions, but shifts the focus out of structures and into the larger community.

### 5.1.1 DIFFICULTIES OF OBSERVATION

There are difficulties in quantitatively comparing settlements and space between periods and regions due to the ambiguities of space and the morphological form and function of the built environment. In his examination of Iron Age settlements in the Upper Thames Valley, Hingley compared open versus enclosed settlements between the lowland and uplands of the region; finding there were differences in settlement plan based on the social isolation of a group within a neighbourhood (Hingley, 1984, p. 79). Hingley concluded in order to understand built space it is necessary to compare different societies or regions: "It is possible that this approach to the contrasting of varying topologies of space is the only practical strategy in settlement analysis, as the significance of one pattern is relative and can only be understood when contrasted to another" (Hingley, 1984, p. 85). This strategy for comparison between periods and regions is the model used here for understanding space and place.

Different cultural groups would have perceived "empty" space (i.e. the areas between built forms both within settlements and across the landscape) quite differently due to a variety of environmental, socio-economical, and cultural factors. Understanding how space and place would have been perceived during the transitional period by a variety of different social groups is a challenge that is addressed in this thesis by using a technique that quantifies visual space and movement so that settlements from different periods and regions can be statistically compared and contrasted. Instead of concentrating on past perception, this reductive process breaks down space into how we perceive it today to analyse potential patterns or lack thereof. This approach may be seen in contrast to Tilley's phenomenological approach to interacting and entering a landscape in order to understand how it may have been conceptualised and used in the past (Johnson, 2012; Tilley, 1994). The differences in these approaches to the built environment and space are more fully explored in Chapter 7.

## 5.2 VISIBILITY GRAPH ANALYSIS BACKGROUND

Visibility graph analysis examines the visual characteristics of space within structures and urban environments by integrating space syntax theory, Benedikt's notions of the *isovist*, and the small-world networks to "(…) derive a visibility graph of an environment – the graph of mutually visible locations in a spatial layout" (Turner et al., 2001, p. 104). This analysis examines the visual connections within enclosed spaces by determining the inter-visible connections between grid points in a constructed graph. Visibility graph analysis is used here to examine the visual characteristics of space within both settlements and households by expanding the original use and function of the method. The organisation of structural forms within a settlement is considered similar to the visual arrangement of walls, doorways, etc. within buildings. These arrangements of the built environment are culturally constructed in that they structure and are structured by the activities of their inhabitants. A brief introduction to space syntax and the isovist is presented below to provide context to VGA and its importance to archaeological research.

### 5.2.1 SPACE SYNTAX

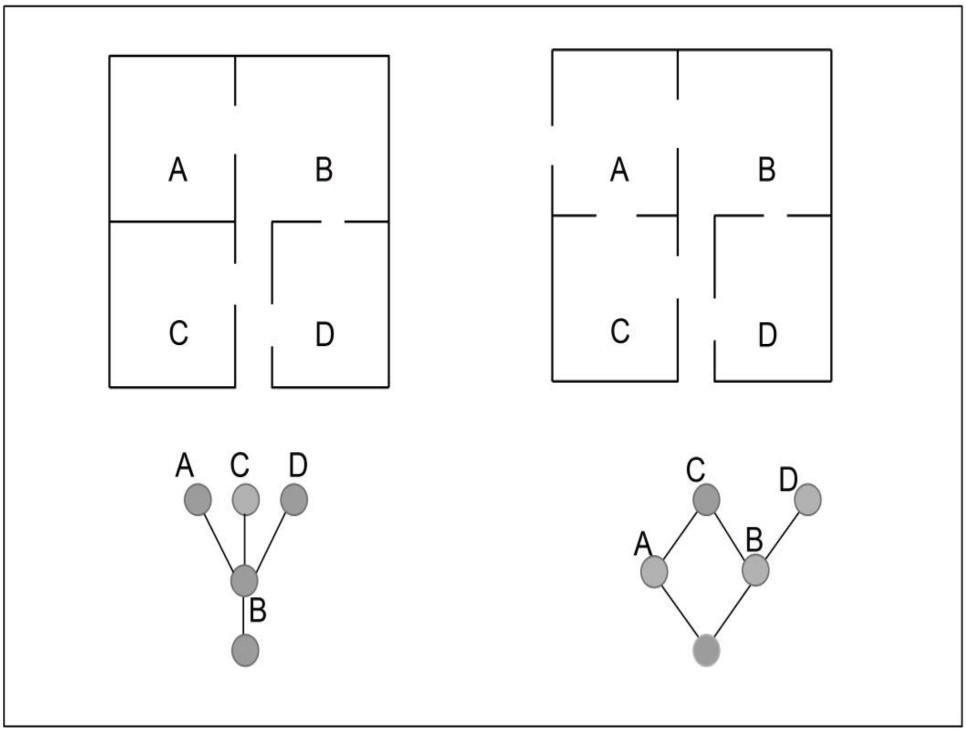
Bill Hillier, Julienne Hanson, and other colleagues at the University College of London Space Syntax Laboratory developed a methodology and theory that analysed the spatial arrangement of buildings and settlements, and this *space syntax theory* hypothesises that there are underlying rules or logic to confined space. These underlying rules are culturally specific, and can be mapped and related to patterns of movement or practice. Hillier and Hanson argue in *The Social Logic of Space* that the main purpose of the built environment is to demarcate and bring order to space (Hillier and Hanson, 1984, pp. 1–2). This configuring of space directly influences social interactions and practices in a reflexive process, implying that the design and function of the built environment has socio-cultural meaning (Ferguson, 1996, p. 11). Configurations of space define how individuals both consciously and unconsciously interact with not only the built environment, but with other individuals in that space (Hall, 1966; Rapoport, 1982). Space syntax constructs "a theory of the socially constructed built environment on the basis of which to address the society and space" (Bafna, 2003, p. 28). Space syntax directly relates to how a culture feels space and the built environment should be demarcated due to environmental and cultural cues, and is inherently a product of socio-cultural interaction. Understanding access and space, therefore, provides insights into how a community interacts within both their environment and with one another.

### 5.2.2 SPACE SYNTAX AS A MODEL TO UNDERSTAND CULTURAL SPACE

Two key ideas underline how space syntax is both a theory and a method for understanding built space. Firstly, space and place do not sit passively in the background, but are active, important, and intrinsic aspects of the human experience. The multitude of ways that individuals move through, interact with, and practice activities within space and the built environment relates to the geometric properties of that location (Hillier, 2005, p. 5). Space syntax patterns the built environment by examining the interactions between linear movements, contact in convex spaces, and the visible fields from given points (known as *isovists*). The second key idea of space syntax is that "(…) human space is not just about the properties of individual spaces, but about the inter-relations that comprise the spatial layout (…)" (Hillier, 2005, p. 5). Understanding the *configuration* of built space and how humans both proceed through and process the complex patterns, relationships, and responses to these spaces is the overall goal of space syntax.

Space syntax quantitatively examines the configurational properties of space using a variety of techniques. Two of these, access analysis and axial maps, have arguably been the most useful for social scientists. "Access analysis is based on syntactic relations and considers the arrangement of spaces as a pattern of permeabilities, that is in terms of the interconnections between spaces (Foster, 1989, p. 41)". Access analysis is often examined using *access maps*, which are representational maps of structures using lines and dots, with the dots representing rooms and the lines representing permeable spaces between the rooms (i.e. doorways). These access maps are justified by placing the carrier space (i.e. entrance to a structure) at the bottom of the map, and assigning a depth value to each space according to the minimum number of steps needed to get to each space. Figure 5.2.2.a is an example access graph showing the differences in how a structure with the same dimensions and room sizes can have a very different accessibility based on the permeable access (Figure 5.2.2).

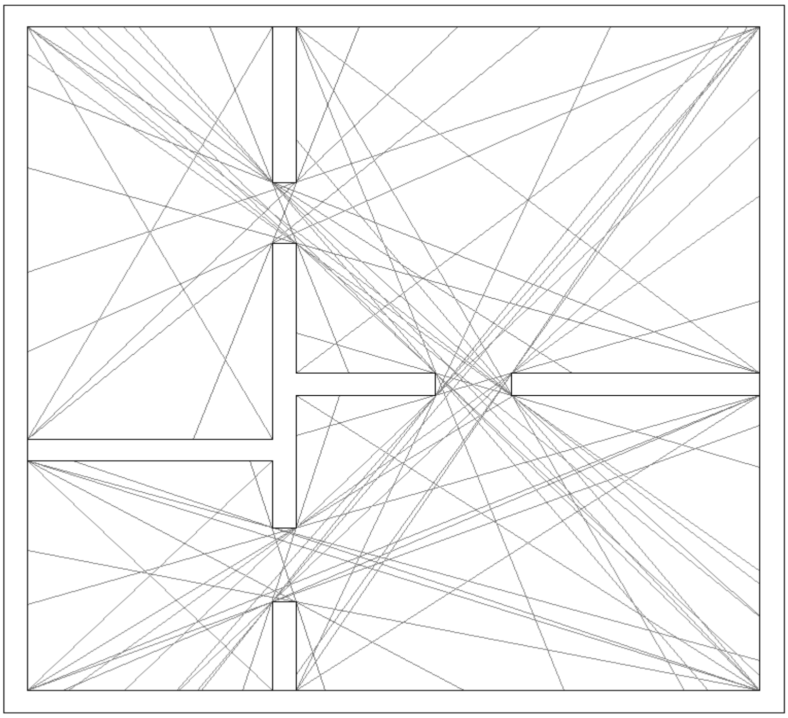
FIGURE 5.2.2.a Justified Access Maps




Access analysis focuses on the configurational properties of structures, but *axial maps* look at the connectivity of space within settlements and urban networks. Axial maps draw the longest line that can proceed through the open space of a plan, then the next longest, and so on until all of the convex spaces of a plan are connected (Hillier and Hanson, 1984, p. 99) (Figure

5.2.2.b). By counting the number of lines in an area, interpretations can be made on the relative complexity of the configurations of built space because the more complex arrangements contain less convex spaces and therefore fewer lines can be drawn. Fewer archaeologists have used axial maps (rather than access analysis) due to the difficulty in using them in a replicable fashion, as different people will draw different number of lines to connect each room (Ferguson did use axial maps in his comparison of Zuni settlement types along with access analysis; Ferguson, 1996, pp. 106-109). Axial maps were attempted for this thesis, and while they are powerful tools to examine the interior of structures, their application was limited at the settlement level because the results between settlements were not replicable. This is probably due to the more open plan of settlements as compared to structures as well as to the larger scale, which affects the ability to produce replicable lines across the numerous settlement types analysed here.

FIGURE 5.2.2.b Example Axial Map



Hillier and Hanson developed mathematical measurements to examine the results of both access and axial analysis. These statistical examinations allow space syntax theory to compare numerous spaces and structures with one another in a quantifiable manner. Space syntax theory incorporates aspects of Durkheim's (1964) notions of mechanical and organic social solidarity into their understanding of the relationship between individuals and the built environment.

> (…) Durkheim had distinguished between two fundamentally different principles of social solidarity or cohesion: an 'organic' solidarity based on interdependence through differences, such as those resulting from the division of labour; and a 'mechanical' solidarity based on integration through similarities of belief and group structure. This theory was profoundly spatial: organic solidarity required an integrated and dense space, whereas mechanical solidarity preferred a segregated and dispersed space (Hillier and Hanson, 1984, p. 18).

Hillier and Hanson relate Durkheim's organic solidarity to symmetrical buildings with more open access and mechanical solidarity to asymmetrical buildings with limited access (Hillier and Hanson, 1984, p. 18-20). Although this approach has been criticised (Ferguson, 1996, p. 21; see section 5.2.4), the ability to link social theory with the detailed examination of the built environment is a strong ability of space syntax theory for archaeological use.

### 5.2.3 SPACE SYNTAX AND ARCHAEOLOGY

Space syntax has a long history of use in archaeology, with studies focusing on how it explains the importance of movement in the built environment and the significance of access (public versus private, restricted versus open). Household archaeologists in particular use access analysis to understand how the built environment influences patterns of behaviour and practice in the past (for examples see Bowser and Patton, 2004; Fairclough, 1992; Ferguson, 1996; Moore, 1996; Steadman, 1996; Van Nes, 2009). These studies have shown that the built environment's scale, morphology, access, and permeability influenced social interaction, and that interpretations on the public and private practices of the past can be inferred from the spatial morphology of a household by access analysis.

One of the earliest and most complete archaeological investigations using space syntax is T.J. Ferguson's (1996) *Historic Zuni Architecture and Society: An Archaeological Application of Space Syntax*. This monograph focuses on the changes that occurred in architectural design, planning, and use during the period of dramatic changes that occurred post-conquest/colonisation in the American southwest. His use of space syntax to examine a transitional period has obvious parallels to the aims of the present research, and shows that examining space and the built environment quantitatively can illuminate how cultural rules on the structuring of the local environment are practised and passed down in times of transitional change. He concludes that space syntax techniques are a powerful analytical tool, but that the theoretical underpinning of space syntax needs to be adapted for archaeological interpretations of the past (Ferguson, 1996, p. 152). The rejection of space syntax's theoretical underpinnings but acceptance of it as an analytical tool is a common theme in archaeological research utilising this method. As Ferguson concluded, "It is exciting to realise that as archaeologists we can adapt this approach to the exigencies of the archaeological record and build an anthropological theory that makes appropriate and beneficial use of space syntax" (Ferguson, 1996, p. 152).

Many archaeologists have followed in Ferguson's footsteps, focusing on the methodological attributes of space syntax theory while using different theoretical backgrounds to interpret the results of axial maps or access graphs. Space syntax has been used to analyse Iron Age brochs (Foster, 1989), the medieval plan of Padua (Valente, 2012), medieval castles (Mathieu, 1999), prehistoric settlements (Cutting, 2003), ethnographic studies of Inuit structures (Dawson et al., 2007; Dawson, 2002), and examinations of Roman cities (Stöger, 2009; Stöger, 2008). The various applications of space syntax demonstrate its usefulness across time periods and regions as a method for understanding space in the past.

### 5.2.4 CRITIQUES OF SPACE SYNTAX

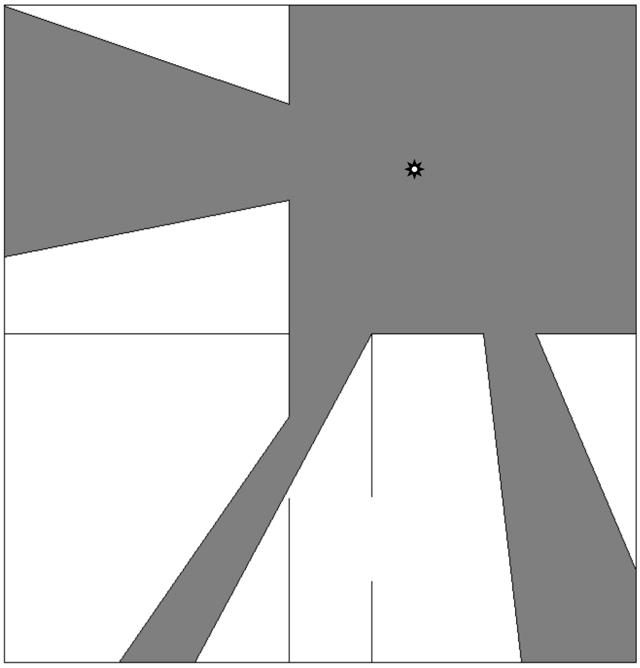
One of the key tenants of space syntax is that of *depth*: the relative exclusivity of one space within a structure that is based upon the deepest space/farthest number of steps from the carrier space (Hillier and Hanson, 1984, p. 181). While this is no doubt generally true, the relative exclusivity of a space does not necessarily need to relate to the least accessible room in a structure or building. As Graves (2000, p. 10) shows, there are examples of spaces within medieval churches with greater 'depth' due to their ritualistic meaning rather than their being the deepest physical space within the structure. Space syntax does not take into account social meaning, instead searching for universal truths of design and use that do not necessarily hold true. For example, the hierarchical roles of seating for dinner in a hall (a Lord's table versus the rest) would have been understood by all of the individuals in a society, but these social roles' spatiality would not leave physical remains to be assessed using space syntax. Graves quite rightly argues that space syntax's rejection of cultural meaning or "dramaturgical definitions" to the use of space limits the theory and its ability to provide nuanced interpretations of the past (Graves, 2000, p. 11). This thesis addresses these limitations by integrating historical and anthropological understandings of space to interpret the transitional built environment in Chapter 7.

Space syntax's reliance on Durkheimian social solidarity has perhaps been the aspect that has received the most criticism (Batty, 2001; Ferguson, 1996; Graves, 2000; Leach, 1978). Hillier and Hanson posit that the Durkheimian concepts of organic and mechanical solidarity underpin the explanatory power of space syntax (Hillier and Hanson, 1984, pp. 18-22, 96-97). However, these concepts have been found to have a heuristic value and weak explanatory importance, therefore limiting their role in explaining gradual, transitional changes to structural space (Ferguson, 1996, p. 149). Yet, as Ferguson (1996) has shown, the techniques and methods of space syntax can be divorced from their theoretical underpinnings and effectively utilised. In addition, the underlying thoughts on the importance of built space in the study of society resonate well with archaeological research on settlements and space, and should not be ignored. These ideas are the most important support of VGA that space syntax provides.

### 5.2.5 THE ISOVIST

Although space syntax underpins the theoretical background of VGA, the primary method of producing graph-based representations of space is constructed using ideas based on the *isovist*. The isovist provides insight on how people move in space and the built environment based upon visual fields, and is an important means of measurement for scholars interested in architectural space. Benedikt proposed using isovist to measure all of the space within an architectural feature from a single generating point (Benedikt, 1979, p. 47; Turner et al., 2001, p. 103). Isovists are typically displayed as polygon shapes that comprise what can be seen or not seen from a given observation point (Figure 5.2.5), and unlike a viewshed analysis, are typically confined to enclosed, architectural space. In addition, isovists do not take into account elevation changes in a ground surface (as architectural floors typically do not have topographic surfaces) so invariably are two-dimensional in shape whereas viewsheds attempt to recreate three-dimensional visibility. Even though there are similarities between the two, isovists differ in that architects almost exclusively use them while viewsheds are employed by a variety of disciplines. Isovists theoretically are three-dimensional in shape, however they are often displayed as two-dimensional plans and are an easily accessible and understood representation of what can be seen from any given point, and therefore a unique and important tool for architects focused on design and use. That said, there are important critiques to isovists that preclude them from being used over established viewshed analysis in archaeological research (section 5.2.7).

FIGURE 5.2.5 Example of an isovist, with all the grey-shaded areas visible from the convergence point in the example structure



## 5.2.6 ISOVISTS AND ARCHAEOLOGY

The isovist is relatively unknown to archaeology. This is partially due to the fact that it shares similar characteristics to viewshed analysis, which has become increasingly popular in landscape archaeology research. In addition, the isovist was developed for the analysis of visibility within modern architectural features and has generally been confined to that field, thereby escaping the notice of archaeologists. That said, there have been a few archaeological applications that have used the isovist, or interior viewsheds, and these have generally been confined to examinations of ecclesiastical space within structures (Graves, 2000; Roffey, 2004). Both Graves and Roffey used isovists to examine relationships between the various movable fixtures of ecclesiastical spaces such as chantry screens, statues, and altars that divide up the space of the structures into zones for different types of devotional and social practices. In these cases, isovists were effectively used to examine how different types of objects that are not actually part of the building fabric can affect visibility, and therefore affect movement, interaction, and experience.

### 5.2.7 CRITIQUES OF ISOVISTS

Although an attractive and easily understood method, isovists are restrictive due to their reliance on a single convergence point, limiting their visual analysis of space to a static point, whereas human interaction with built space is one of movement and interaction. Another limitation is that that there are no theoretical underpinnings to aid in the assistance of interpreting isovists, with their meaning taken to be inherently understood (Turner et al., 2001, p. 104). However, any interpretation of an isovist result are not inherent, but are tied to the interpreter's own innate biases. Space syntax's techniques, on the other hand, were designed to make sure there was testable data from an abstract source. Finally, isovists tend to examine visibility within structures based on walls and doorways, ignoring how furniture, screens, etc. can be used to divide up space. These temporary impediments to visual space would also affect how people move and practice within built space, and need to be taken into account/understood to fully grasp how space is thought about and used.

## 5.3 VISIBILITY GRAPH ANALYSIS

Originally introduced by Braksma and Cook to analyse co-visibility within an airport layout (Braaksma and Cook, 1980), VGA was rediscovered and refined primarily through the work of Alasdair Turner and colleagues at the Space Syntax Laboratory of the University College London (Turner et al., 2001; Turner and Penn, 1999a) In contrast to an isovist, VGA "(…) integratively considers multiple positions in an environment" (Wiener and Franz, 2005, p. 44) by looking at intervisible connections in a grid that covers the layout of an area. This integrative approach is able to examine visibility within built space in a more interactive way than the isovist.

### 5.3.1 DIFFERENCES TO VIEWSHED ANALYSIS

Visibility graph analysis takes the previously discussed ideas of vision and space and expands on the concept by examining visibility and connections from all parts of an area. Although it shares similarities to the commonly known viewshed analysis, VGA differs in that it examines space by focusing on the connections, or *edges*, between grid points in a regularly spaced graphical environment. Viewshed analysis focuses on visibility across the landscape, whereas VGA examines the visual arrangement of space in an area. Viewsheds:

- Use elevation data to determine the visible areas of a landscape from a single location (generating point) based off topographic features limiting visibility.

- The output of a viewshed analysis is single-coloured shapefile that represents all portions of a landscape that are visible from the generating point.
- Cumulative viewshed analysis overlaps the results of multiple viewsheds from different generating points.
- Viewshed analysis focuses on three-dimensional space and the properties of topographic surfaces.

Visibility graph analysis does not reproduce either viewshed analysis or isovists; it instead uses a graph to investigate the connections between grid points that approximate the intervisibility from all points to the others. Visibility graph analysis:

- Determines the portions of an analysed area (i.e. interior of a structure, a settlement) that can see the most other portions of an area AND can be seen by the most other areas.
- It analyses the most and least visible portions of the analysed area from multiple locations (i.e. each grid node in the graph).
- The results of VGA are colour-shaded images representing the most and least visible portions of the analysed structure or settlement.
- VGA works on 2-dimensional plans of settlements and buildings by focusing on how structural elements (walls, doors, buildings, etc.) impede visibility and structure movement and activities.

The unique qualities of VGA make it ideal for testing trends in the spatial organisation of the built environment across temporal periods and between ethnic groups.

### 5.3.2 VISIBILITY GRAPH ANALYSIS IN ARCHAEOLOGY

Visibility graph analysis has been used in a limited manner by archaeologists, focusing on the analysis of visual space within structures. David Chatford Clark (2007) used both VGA and the isovist to examine the visual patterns of space experienced by assembly members in six representative Byzantine churches located in present day Jordan. This allowed Chatford Clark to compare the visual integration of the assembly areas to the sanctuaries in the churches, quantifying and better understanding the spatial relationship and the degree of visual separation between the clergy and the assembly members (Chatford Clark, 2007, pp. 101–102). In their examination of three-dimensional visibility of Late Bronze Age Akrotiri, Paliou et al. used an adapted version of VGA to quantitatively analyse visual fields and access to artistic murals along the internal wall of a structure (Paliou et al., 2011, p. 384). Although the use of VGA in archaeological research has been limited, other social scientists have adapted it to examine space in modern settings. As previously discussed, Tahar and Brown examined the domestic spatial organisation of the Berber people of the M'zab by using VGA to quantifiably examine different housing types to understand change over time in how different private areas are constructed and used within these structure (Tahar and Brown, 2003). According to Tahar and Brown, by investigating the ways in which buildings operate, VGA "maps the Habitus, the divisions and hierarchies between things, persons and practices which construct our vision of the world" (Tahar and Brown, 2003, p. 56.14). The authors argue that buildings frame individuals' ideologies and activities, and by understanding the built environment and Bourdieu's habitus, we can interpret how the "(…) built environment constructs the *real* as spatial ideology" (Tahar and Brown, 2003, p. 56.14). In their view, VGA quantifiably examines the M'zab habitus and its role in the design and use of their built environment.

### 5.3.3 VISIBILITY GRAPH ANALYSIS IN THIS THESIS

This research employs an adapted version of VGA to analyse visual space and movement within archaeological settlements from the transitional period. It does this by treating archaeological sites the same as structures for the purpose of VGA. Visibility graph analysis typically analyses the organisation of space within structures due to the various rooms, walls, and doorways that alter visual perception of a building. By treating an archaeological settlement in a similar manner to a building, the structures themselves, along with fences, walls, and enclosures demarcate the space examined by VGA. This research also employs VGA to examine the interior of archaeological structures in a similar manner as Chatford Clark (2007) to compare and contrast structures to their archaeological settlements. Taphonomically, this research has focused on the archaeological remains of the built environment such as postholes and trenches, stone foundations, walls, fences, enclosure ditches, and rampart remains. More temporary aspects of the built environment, such as tents, cloth walls, and ephemeral fence lines are not included in this analysis. Undoubtedly these temporary built forms affected both movement and visibility and are important components of the built environment. It was felt that a focus on the known features yields valuable insights into the social structuring of the built environment, so therefore the more temporary aspects were not created and analysed. Future research could run simulations using these temporary aspects of the built environment in order to determine their impact on the visual arrangement of space.

## 5.4 *UCL DEPTHMAP*

*UCL Depthmap* is a computer software program designed and programmed by Alasdair Turner to graphically and statistically examine the use of space by processing VGA as well as producing axial maps and isovists. *UCL Depthmap* is one of the primary programs used for conducting VGA, and was the software used in coordination with ArcGIS by this thesis to examine the spatial properties of the transitional built environment. This free for academic research software is provided by The Space Syntax Laboratory at University College London[2], and has been successfully utilised by a variety of social science and humanities research projects to visually analyse space and movement within confined space (Desyllas and Duxbury, 2001; Franz et al., 2005; Penn and Turner, 2001). The following sections chart the development, previous use, and methodology of using *UCL Depthmap* to analyse transitional space.

A user of *UCL Depthmap* can import a plan of a structure or settlements, fill the open spaces of the plan with a grid to construct a visibility graph, and then use the programme to perform VGA in order to calculate how each grid point (node) is connected or not connected to all of the other nodes in the graph (Turner, 2004, p. 1). The programme produces colour-shaded imagery that visually presents the visual connections between different nodes and spaces as well as yielding statistical data in the form of global and local measurements based on the connections in the graph. These results can then be used to compare the spaces between rooms or different plans of structures to analyse which spaces are more integrated or as Hillier and Hanson (1984) describe, more permeable/more public. These features of VGA in *UCL Depthmap* demonstrate its unique abilities to analyse and interpret space and the built environment.

### 5.4.1 USE IN ARCHITECTURAL STUDIES

Architectural scholars have used VGA and *UCL Depthmap* to analyse the visual arrangement of space and how that correlates to the movement and social use of the built environment. In a comparison to the previous analysis of the Tate Gallery (Hillier et al., 1996), Turner et al. found that the visitation rates to specific rooms within the gallery strongly correlated to the visual arrangement of space and demonstrated that there were meaningful relationships between the visually connected areas and the movements of individuals (Turner et al., 2001, p.

[2] Available from the Space Syntax Network at http://www.spacesyntax.net/software/ucl-depthmap/

118; Turner and Penn, 1999b, p. 5). The results of VGA on the Tate Gallery correlated with observations of visitors moving through the gallery. Desyllas and Duxbury compared the results of axial mapping and VGA to a study area around St Giles Circus in Central London and found that the correlation between movement and visibility using VGA was significantly better than using axial mapping, arguing that VGA as a technique provided objective and universally applicable results (Desyllas and Duxbury, 2001, p. 27.12). These examples demonstrate VGA's ability to analyse the visual arrangement of space and the built environment and how it correlates to movement and practice, making it an attractive technique for archaeology. Turner continually refined VGA and *UCL Depthmap*, and scholars at the Space Syntax Laboratory have continued his work, incorporating VGA into space syntax studies and literature and making it a key concept of space syntax studies.

## 5.5 VGA METHODOLOGY IN *UCL DEPTHMAP*

The methodological steps required to use *UCL Depthmap* to analyse both structures and settlements is a somewhat long and involved process requiring detailed steps outlined in the following sections. In order to use it to examine visibility and space within past archaeological settlements, the excavation plans and/or cropmark evidence were accurately georeferenced, digitised, and collated in a geospatial database. This reliance on excavation plans/cropmark evidence could be problematic, particularly on very complex settlements where the phasing is complicated and/or disputed (such as at Yeavering), on settlements based purely on cropmark evidence (such as the Butterwick-type settlements), or on work that has not been fully published (such as at Thing/Paddock Hill). As such, where possible, multiple avenues of research were combined to justify the phasing of settlements used by the site. The various steps to using *UCL Depthmap* are discussed below.

### 5.5.1 GEOREFERENCING

In order to use *UCL Depthmap* and VGA, the dimensions and shape of the archaeological features within each settlement needed to be georeferenced so that the representations of the features refer to the correct spatial position on the Earth's surface. Georeferencing transforms a scanned paper map so that it fits to the real-world spatial location by identifying ground control points that match positions on a referenced base map or aerial imagery. All excavation plans and cropmark evidence used in this thesis were scanned at high resolution (at least 500 dpi) and imported into ArcGIS to preserve the scale and dimensions of the sites. Then the imported image was geometrically transformed to match the referenced base image.

In most cases, numerous maps were scanned and georeferenced for each settlement in order for all aspects of the spatial location and shape of the excavated structures be digitised to a high accuracy.

### 5.5.2 DIGITISING

Digitising "refers to the process of transferring analogue information to a digital format" (Conolly and Lake, 2006, p. 80) and can be performed in a wide variety of software packages using a variety of techniques. This thesis employs a process known as *heads-up* digitising where scanned and georeferenced paper maps are digitally traced using a mouse, creating shapefiles of the archaeological features. Each feature was linked to a database containing a variety of information including feature type, name, and other essential data from the excavation reports. All of the examined settlements were digitised, with the exception of West Heslerton, which was kindly shared by Professor Dominic Powlesland as digital shapefiles.

### 5.5.3 METHODOLOGY

Not all of the archaeological features from the excavation plans were digitised, due to the overall goals focusing on structural remains that define the visual arrangement of space. Excluded features included graves, pits of indeterminate origin or date, features from non-applicable time periods, and features that were unidentified by the excavators/authors. Heads-up digitising is an in-depth process that requires time and patience. Many of the sites required days, if not months of work in order to accurately georeference and digitise their data. At Yeavering (Ad Gefrin), for example, over 3,000 individual features were accurately digitised to their correct spatial size and location, a process that took over 160 hours. This time was needed to accurately transform and capture the spatial dimensions of the archaeological features from the plans.

Although every effort was made to accurately georeference and digitise the settlements, spatial errors inevitably occur during the process due to digitising and georeferencing errors. Spatial errors are compounded by a variety of factors including but not limited to the accuracy of the excavation plans, the scale and resolution of the plans, and user error during georeferencing and digitising. Spatial errors were limited by using defined and accepted steps of digitising from Burrough and McDonnell including: registering to the same coordinate system (in this case the British National Grid), manually digitising points, lines and polygons, cleaning up the lines and junctions of all the features, visually checking the digitised results, removal of excessive nodes, building topologies, creating entity identifiers, and linking the data to the appropriate attribute tables (Burrough and McDonnell, 1998, p. Fig. 4.8). The author used the same version of GIS, ArcGIS 10.0 to digitise all of the features.

A potential source of error is this methodology's reliance on the physical demarcations of space that could be discerned from excavation or remote sensing. Other, more ephemeral and archaeologically-invisible demarcations of space such as wall hangings, screens, or furniture within structures, and planted hedges, trees, temporary fences, or temporary structures in the settlements would have left little to no impact on the archaeological record, and therefore could not be examined using VGA. The presence of these more ephemeral demarcations of space would of course have affected how the built environment was viewed and used, and will be addressed during the discussion of these settlements. While we cannot be sure what temporary boundaries would have been in place within structures, VGA can provide comparable quantitative data of how the known boundaries of settlements and structures would have affected movement and practice.

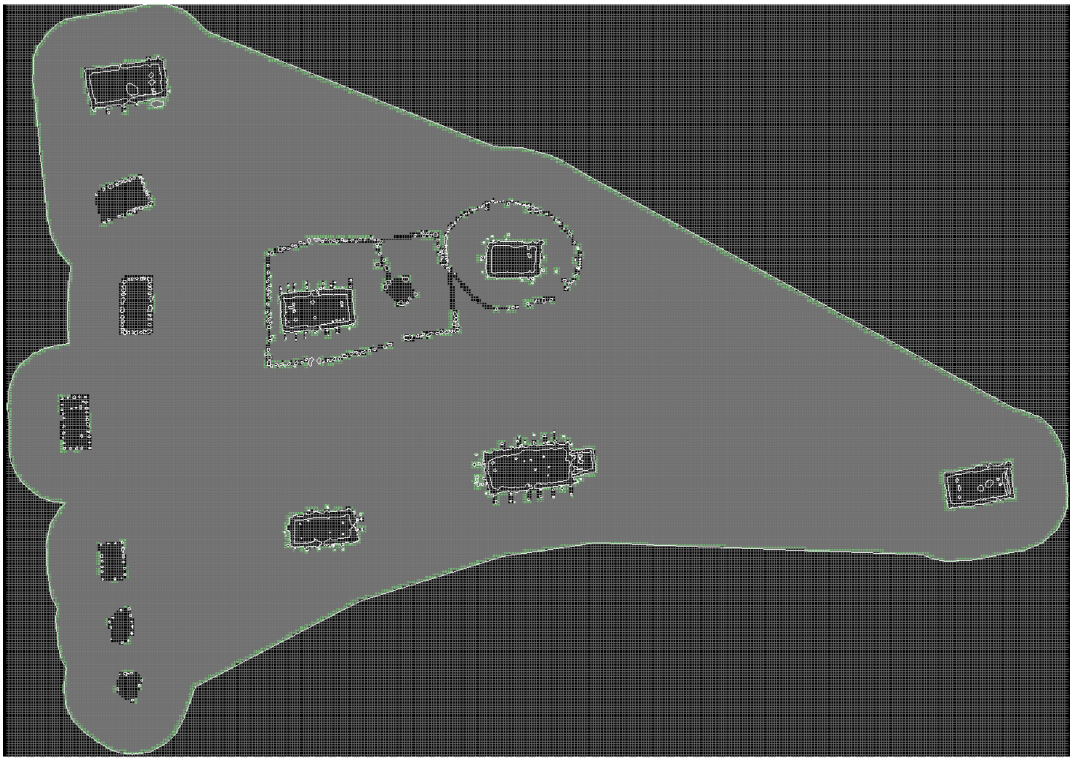
### 5.5.4 EXPORTING THE PLAN

Upon completion of the digitisation of the excavation plans of a settlement, an arbitrary boundary was drawn approximately 20 metres from all of the features (discussed in detail in section 5.6.1). The shapefiles of the archaeological features and the arbitrary boundary were converted into *AutoDesk* drawing exchange format (.dxf) files, as this is the format that *UCL Depthmap* accepts. This transformative process maintains the shape and spatiality of the features digitised in ArcGIS. The converted shapefiles of the settlement features and boundary line were then imported into *UCL Depthmap*.

### 5.5.5 CONSTRUCTING AND POPULATING THE GRID

Once a settlement layout was imported into *UCL Depthmap*, a rectilinear grid was constructed that overlaid the entire plan a spacing of one-metre, which allowed a fine resolution and an acceptable processing speed (Turner, 2001, p. 2, Figure 5.5.5). Care was taken to establish the grid spacing, as too large lost resolution and meaning, and too small increased the processing speed exponentially to the point where running the analysis became unmanageable. Generally speaking, 1-metre grid spacing was used to examine the settlements, and this spacing was decreased when analysing the interiors of structures. A flood-fill algorithm command was used to fill the space within a settlement or structure that was not interrupted by the physical features of the settlement (i.e. walls, fence lines, ditches, etc.). The parts of a settlement interrupted by physical features were blacked out of the graph and not analysed, thereby blocking the visibility in the graph. Though this fill command does an excellent job within rectilinear structures, the command struggles with the open spaces and curved features prevalent within archaeological settlements and required fine-tuning filling and un-filling of grid spaces to accurately include any physical impediments to the VGA. On the larger sites, this task was quite time consuming, and decisions had to be made on which squares to fill or remove to accurately reflect the perceived spatial organisation of the settlements. These decisions were handled on a case-by-case basis, with the filling or un-filling of spaces chosen to most accurately reflect the built space of the settlement or structure according to the excavators of the site.

FIGURE 5.5.5 Example of grid spacing of an analysed settlement in *UCL Depthmap* (Thirlings, NSR)



## 5.5.6 THE VISIBILITY GRAPH

The next step was creating a visibility graph of the constructed and populated grid. *UCL Depthmap* attempts to connect the visible locations from each populated grid location to all of the other locations, processing the grid node by node and storing the results for each analysis in a database (Turner, 2001, p. 3). Each node in the graph has its own unique number of connections to the other vertices in the graph, known as the *vertex's neighbourhood*. *UCL*

*Depthmap* displays the vertex neighbourhood using a colour range from indigo for low values of connection through blue, cyan, green, yellow, orange, red, and magenta for high values (Turner, 2001, p. 3). This colour scale is based on mathematical equations derived from space syntax theory on small-world networks related to how nodes are connected to one another.

### 5.5.7 RUNNING VISIBILITY GRAPH ANALYSIS

Once the visibility graph is constructed, a variety of analyses such as step depth, axial maps, and agent analysis can be run on a graph. For the purposes of this research, VGA was performed on the visibility graphs. Prior to beginning VGA, a user has the option to examine global measurements, local measurements, or a combination of both. Global measurements analyse and provide the shortest path from each vertex to all of the other vertices in the graph while local measurements focus on the relationship between each vertex to its connected vertices (Turner, 2004, p. 14). Three categories of global measurements were used for this thesis because they have been shown to be the most useful for analysing the visual organisation of space (Turner, 2004, pp. 14–15).

In addition to their analytical utility, global measurements were chosen for the pragmatic reasoning that they are processed quicker over larger areas than local measurements. This was important because some of the larger sites, such as West Heslerton and Yeavering, took over 70 hours of processing time per phase at the global measurement level, and would have extended over a hundred hours for the local measurements. At the conclusion of VGA, a variety of measurements are produced, with each result producing a colour-shaded graph and a variety of statistical data.

The three broad categories of global measurements used here are integration, entropy, and mean depth. *UCL Depthmap* calculated the average data scores for these global measurements. These measurements are derived from space syntax studies of space, and are described in detail below:

*Mean depth* calculates the fewest number of turns required to connect each grid point in the graph to all of the other points. The shortest path or least number of turns to proceed through the graph is calculated from each node. These calculations are added and divided by the total number of vertices within the graph to give a mean depth score for each node (Turner, 2004, p. 14).

*Integration* examines how visually connected each grid point is to all of the other points, and approximates the relative "depth" or permeability of a point to all of the other points. Turner states that integration is an important measurement as it is a normalised version of mean depth and has been found to correlate well with pedestrian movement (Turner, 2004, p. 14). Normalisation forces different systems to be comparable by forcing values into a certain range.

*Entropy* refers to the overall complexity of a visibility graph by calculating the distribution of depths within the graph. Entropy was developed as a measurement because *UCL Depthmap* appeared to be prioritizing open spaces, and by analysing the distribution of locations close to a node, a relative measurement of complexity could be met (Turner, 2004, p. 15, Turner 2001, p. 7). Two measurements of entropy were examined for this thesis, the standard and relativised.

Figure 5.5.7 is an example of a simple schematic of a structure and the results of the three types of global measurement. As shown in the example, the doorways and walls affect the visual organisation of the space. Using these three categories of measurement, the VGA of the structure represents the visual integration, spatial ordering, and permeability of a structure, or in the case of this thesis, of an archaeological settlement. The average global measurements of Figure 5.5.7 are shown in Table 5.5.7.

FIGURE 5.5.7 Example plan (A) and *UCL Depthmap* measurements of Visual Integration (Tek) (B), Visual Entropy (C), Visual Relativised Entropy (D) and Visual Mean Depth (E)

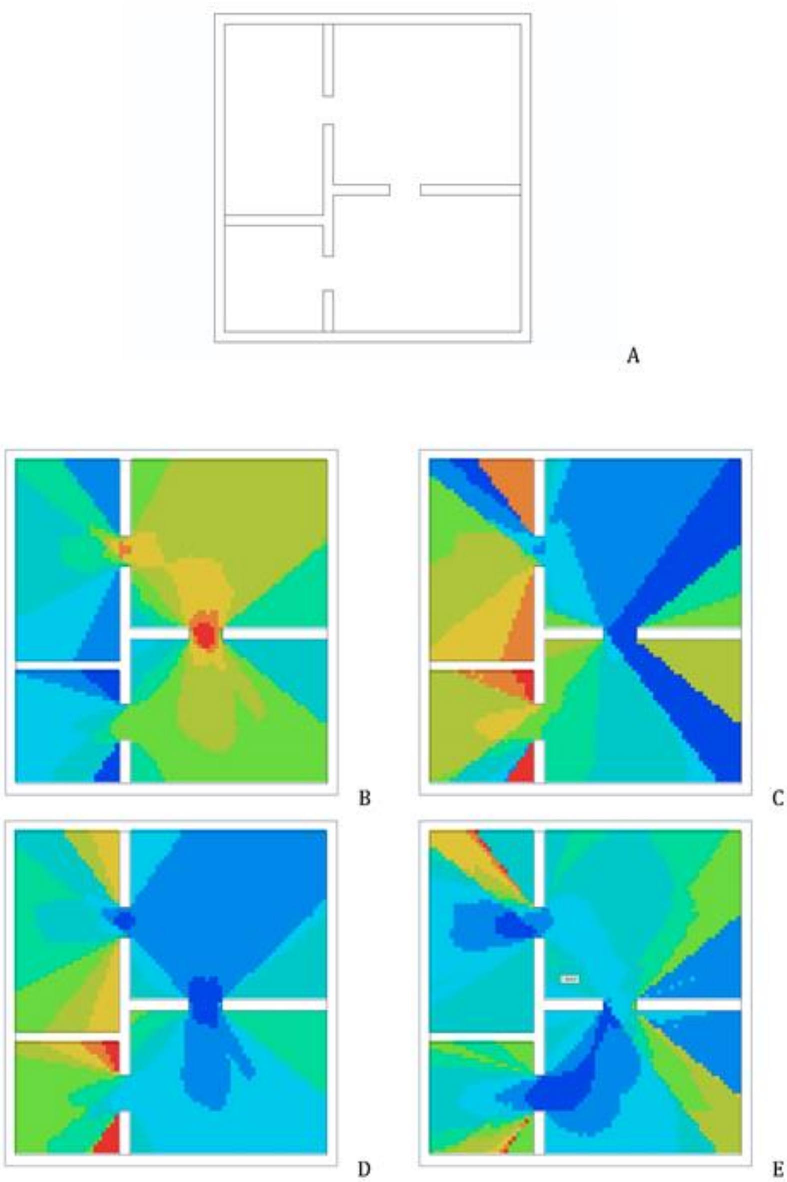



TABLE 5.5.7 Average global measurements of the example plan

| | Visual Entropy | Visual Integration (Tek) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Example Structure | 1.26767 | 0.960817 | 1.7213 | 2.03812 |

Figure 5.5.7 and Table 5.5.7 display the four global measurements used by this thesis. The Visual Integration (Tek) (B) measurement shows the most visually integrated areas as red and the least as dark blue. Visual Entropy (C) and Visual Relativised Entropy (D) on the other hand show the areas in red as the most complex and the areas in dark blue the least. Finally, Visual Mean Depth (E) represents how many turns would be needed to progress through the graph, with red equalling the most and dark blue the least.

The measurements from the example structure are relatively similar across the integration, entropy, and mean depth scores, reflecting the relatively simple layout, integration, and depth of the structure. Turner et al. demonstrated similar using VGA to a previous study of the occupancy of spaces in the Tate Gallery, and showed that areas in the structure that are more visually connected received more foot traffic due to the links between visibility, movement, and occupancy (Hillier et al., 1996; Turner et al., 2001, p. 118). Taking this as a cue, the areas that are the most visually connected in the example structure, i.e. the areas that are most visible from all the rooms (Figure 5.5.7), would probably receive the most foot traffic (in this case the liminal spaces/doorways between the rooms). This suggests that VGA can be used to determine the parts of structures that are most visible and therefore would potentially receive the most movement of individuals, based purely on visibility. While this is fairly obvious on this small and simple structural plan, this example shows the benefits to archaeologists that can use this type of information to make informed decisions about the excavation and interpretation of settlements.

This relationship between the measurements in archaeological settlements from different regions and periods is the primary interpretive tool used by this thesis to address the design, demarcation, and use of space between regions during the transitional period. The average data scores for these global measurements are calculated for each of the settlements as well as a selection of the structures in order to make comparisons between the periods, regions, and site types.

## 5.6 BOUNDARIES

Visibility graph analysis in *UCL Depthmap* runs on the basis of *enclosed* space, as it was designed to analyse structures. This is a problem when analysing Early Medieval settlements within Northumbria, as these typically were not bounded by walls or enclosures (Powlesland, 1997, p. 115). Though formal structural boundaries were typically not evident, this does not imply that there were no conceptual boundaries separating Early Medieval communities from the 'natural/outside' world. That said, conceptual boundaries are difficult to reconstruct, and therefore an arbitrary boundary was established at many of the settlements analysed by this thesis. Where possible, the topographic landscape of a settlement was used to establish the arbitrary boundary, such as at Yeavering where the elevated landform the site was positioned was used to define the boundary.

### 5.6.1 ARBITRARY BOUNDARY TEST

If there were no obvious landform boundaries, an arbitrary boundary was established around each settlement prior to the analysis in *UCL Depthmap*, as the program cannot run VGA on unbounded space. A test of the arbitrary boundaries at different distances was run at the Early Medieval settlement at Thirlings in the NSR. Five different boundaries at 10-metre intervals were drawn from 10 to 50 metres from the archaeological features. The average global measurements of integration, mean depth, and entropy at Thirlings, as well as the Connectivity scores are shown in Table 5.6.1.

TABLE 5.6.1 Results of boundary test of Thirlings

| Thirlings | Connectivity | Visual Integration (Tek) | Visual Mean Depth | Visual Entropy | Visual Relativised Entropy |
|---|---|---|---|---|---|
| 10 metre | 5665.38 | 0.986447 | 1.58332 | 0.939223 | 2.21215 |
| 20 metre | 8825 | 0.992678 | 1.54914 | 0.954828 | 2.16611 |
| 30 metre | 12848 | 1.0069 | 1.50961 | 0.963919 | 2.11905 |
| 40 metre | 17572.1 | 1.00845 | 1.47385 | 0.963037 | 2.08396 |
| 50 metre | 22979.3 | 1.01562 | 1.44262 | 0.955766 | 2.05872 |

The Connectivity scores relate to the connections recorded in the analysis between nodes, and increase with the boundary size, demonstrating that there are more grid points to calculate. Although Connectivity is not useful to statistically compare results between settlements, the graphical imagery of this measurement provides the most accessible and easily understood graphical results of the process and is used here to demonstrate the visual connections in the analysed settlements and structures. The other scores are statistically examined using a paired *t*-test. The two-tailed p-value equals 0.3556, and the difference between the 10-metre and 50 metre is considered *not statistically significant*. This test was repeated at three of the phases of settlement at Yeavering, and again the differences in the global measurements are considered not statistically significant. However, the differences between the global measurements increase the greater the distance of the boundary from the features, and the processing time in *UCL Depthmap* increases exponentially. The differences are considered not statistically significant and therefore an arbitrary distance of 20-metres was chosen for all of the settlements that were not formally enclosed by either artificial features or by natural landforms.

## 5.7 TEST OF THE SETTLEMENT METHOD IN VGA

The primary concern with adapting VGA to test settlements is whether or not it is a viable utilisation of the method and software, as it was designed to analyse interior space. In order to determine if VGA could be used to evaluate settlements, a test of the methodology was designed to compare VGA at the settlement and structural levels. Due to VGA previously demonstrating its ability to gauge human movement and the use of space within structures (Turner et al., 2001), this test compares the results of VGA conducted on archaeological structures and their settlements. If the differences between the settlement and structures are limited or if there is a similar pattern of difference across settlements, this would be an appropriate methodology

### 5.7.1 SETTLEMENTS CHOSEN FOR VGA TEST

Three phases of occupation at the Early Medieval royal centre of Yeavering and the Roman fort at Housesteads were used to test the method. These two settlements were chosen to test the methodology in different time periods and settlement types. In addition, both sites were chosen because their structures contained internal differentiation demarcating different uses of space (something most Early Medieval structures do not have), were located relatively close to one another, and had mostly complete excavation records detailing the spatial layout of the settlements and their structures. Figure 5.7.1.a shows the location of the two analysed settlements, and Figure 5.7.1.b shows the spatial plan of each settlement. It is noted here that these tests and the later use of VGA on settlement plans are reliant entirely upon the excavators' plans and their phasing of the sites. There are potential weaknesses here as, for example, the phasing of Yeavering has been criticised as inaccurate due to the unknown relationship between structures in different portions of the site (Scull, 1991). Where the phasing is potentially poor or unknown (such as at cropmark-derived settlements) it has been noted in the discussion of the results.

FIGURE 5.7.1.a Locations of Housesteads and Yeavering

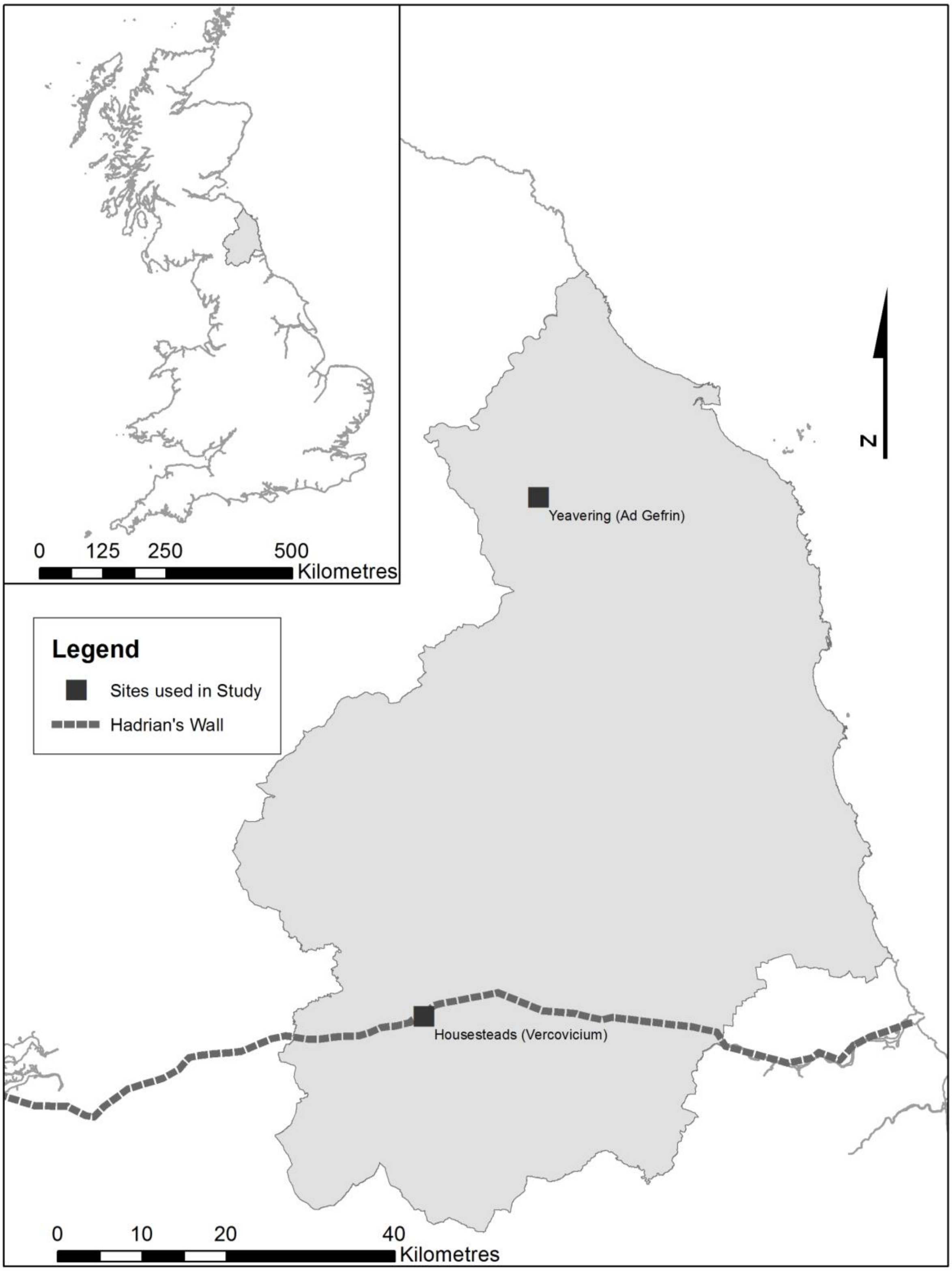
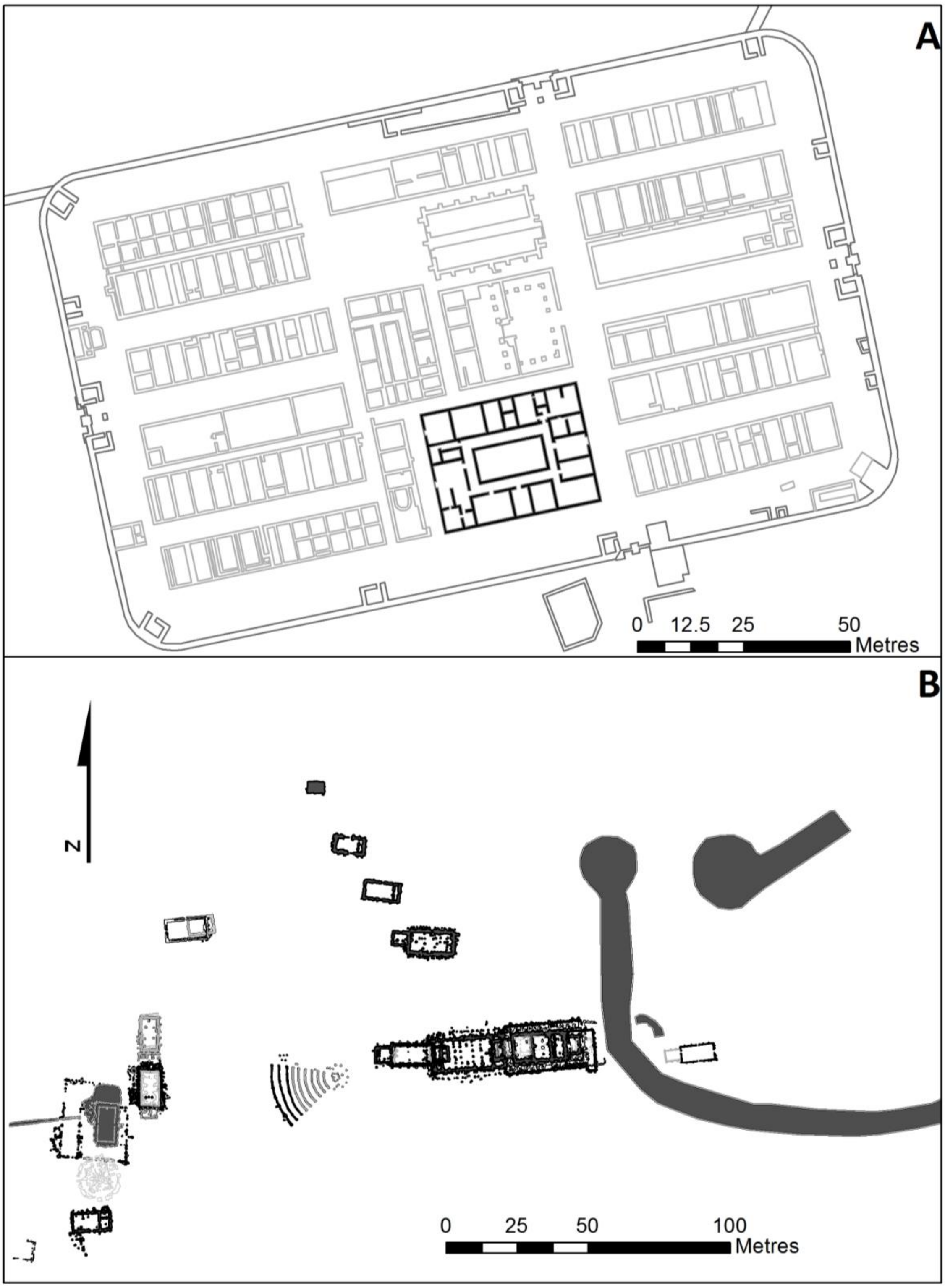


FIGURE 5.7.1.b: Excavation plans of Housesteads (A) and Yeavering (B)



### 5.7.2 HOUSESTEADS (VERCOVICIUM)

One of the forts along Hadrian's Wall, the Roman fortress at Housesteads has undergone a variety of excavations during both antiquarian and modern times revealing one of the largest and most complete Roman forts in Britain (Rushworth, 2010). Originally designed for an infantry cohort of approximately 800 men, the fort was built in the 2nd century and used through to the end of the 4th century AD. Positioned approximately halfway along the wall in what is today Northumberland, the fortress was arranged in a typical plan for a Roman fort in Britain, with a headquarters (*principia*) and commanding officers house (*praetorium*) occupying the central part of the fort and surrounded by barracks and granaries (Figure 5.7.1.b). To the south of the fort walls lay a civilian settlement, and Hadrian's Wall runs along and is incorporated into the northern wall of the fort.

Due to the extensive antiquarian and archaeological excavations, much of the interior remains of the fort and civilian settlement have been exposed (Rushworth, 2010, p. 15). The *praetorium* and *principia* are two of the largest structures at the fort, and also had the most complex internal divisions at the fort based on the structural remains. The georeferenced and digitised plans of Housesteads used in this test were taken from *Housesteads Roman Fort: The Grandest Station: Excavation and Survey at Housesteads, 1954-1995* (Rushworth, 2010, p. 6). Visibility graph analysis was performed on the praetorium, principia, and the entirety of the interior of the fort.

### 5.7.3 YEAVERING

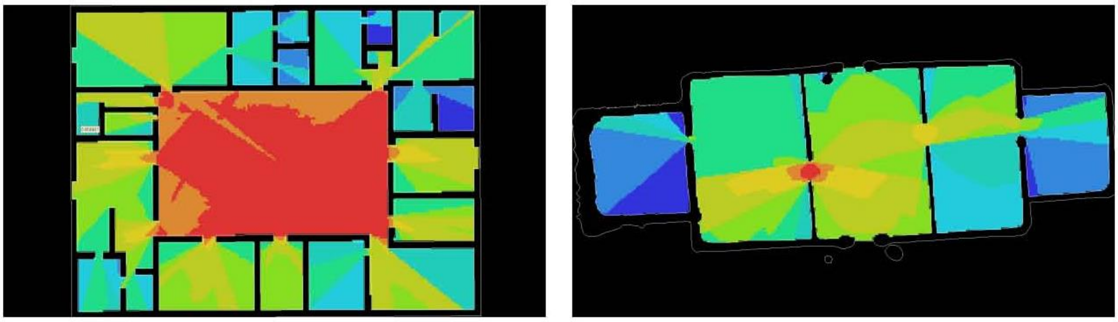
The group of Early Medieval structures known as Yeavering, excavated by Brian Hope-Taylor (1977), has been interpreted as a royal vill and the likely remains of *Ad Gefrin* as described by Bede (*EH* 2:14). The site is located below the prominent Iron Age hillfort on Yeavering Bell on a broad landform above the River Till. The settlement includes the remains of large halls, numerous graves, a large enclosure, and the unique Building E - a large, rounded-triangular shaped structure interpreted as an amphitheatre or grandstand (Hope-Taylor, 1977, pp. 119–122) (Figure 5.7.1.b). Hope-Taylor described six distinct phases of settlement at Yeavering beginning in the early 6th century AD based on stratigraphy and the style of the structures (Hope-Taylor, 1977, pp. 151–168). For additional information on the phases and structures at Yeavering, see Chapter 6.

Between 1953 and 1962, Brian Hope-Taylor led a team of excavators in exposing all of the cropmark evidence of Yeavering observed through aerial photography. Due to the extensive excavations of Yeavering, and the careful phasing by Hope-Taylor, the spatial dimensions and layout of the settlement are excellent and useful for comparative analysis. The phasing at Yeavering has been critiqued as inaccurate, particularly concerning the Great Enclosure's relationship with the other structures/phases (O'Brien, 2005, pp. 149–152) and the designation of Phase I as British rather than related to an Anglian tradition (Hope-Taylor, 1977, pp. 154-157; Scull, 1991, p. 58). While these are valid concerns, O'Brien and Scull acknowledge additional archaeological work is required prior to a reassessment of the phasing. Since no additional excavation work examining the site's stratigraphy has occurred, Hope-Taylor's original structural phasing and plans were used for this assessment. A more thorough examination of these concerns is described in Chapter 6. Three of the structural phases at Yeavering and seven of the excavated structures from these phases were examined using VGA for this test. These three phases were chosen because they contained structures with internal differentiation in the form of posts or presumed walls.

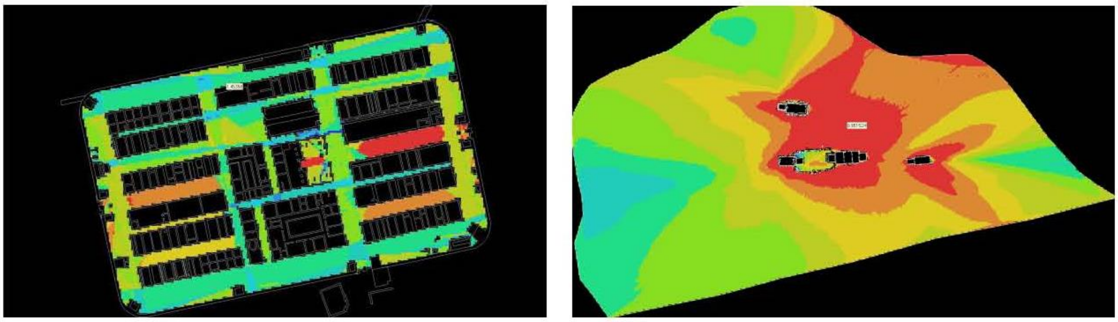
### 5.7.4 VISIBILITY GRAPH ANALYSIS OF HOUSESTEADS AND YEAVERING

Both settlements were georeferenced, digitised, and exported to UCL Depthmap as previously described. The average global measurements from the structures of each phase of occupation were calculated and the median of these calculations were compared to the overall settlement scores, with the exception of the single structure analysed in Yeavering Phase IIIab. Figure 5.7.4 shows representative results of VGA on Housesteads, Yeavering, and their structures that demonstrates the differing spatial patterning and use of space as well as the areas of increased or decreased depth (described by Hillier and Hanson (1984) as the areas that are public or private). The complete results are located in Appendix D. The spatial positioning and layout of settlements are at least partially due to cultural norms and ideas; the VGA measurement illustrations are important tools in interpreting how and why settlements were organised.

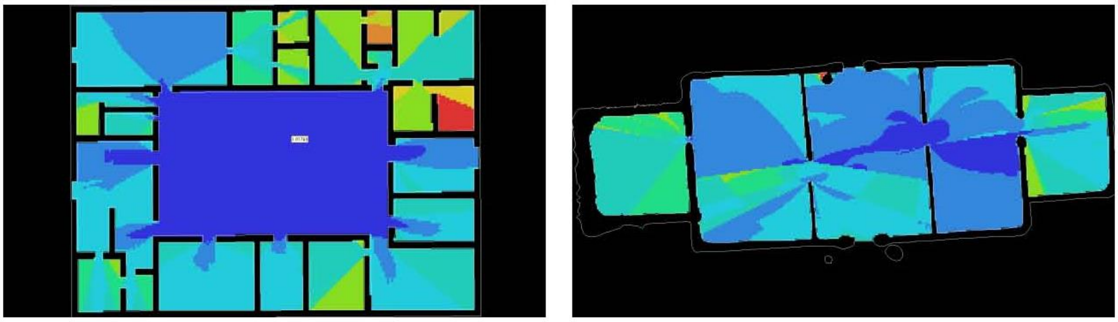
FIGURE 5.7.4 Representative VGA measurements of the Visual Integration (Tek) (A), Visual Entropy (B), Visual Relativised Entropy (C), and Visual Mean Depth (D) measurements from Housesteads (B,D), its praetorium (A,C), Yeavering Phase V (B,D), and Building A3B (A,C). The red areas in examples A and B are the portions of the plans that have the most visibility. The darkest blue areas on examples C and D have the most visibility.



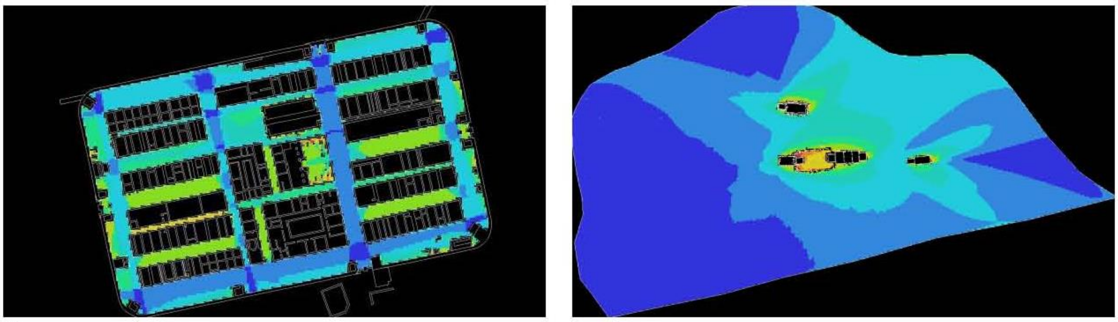
A



B



C



D

Whilst the colour-shaded imagery produced by *UCL Depthmap* provides illustrative and accessible results, the global measurement numerical measurements provide more distinct insight into the use of space within the settlements and structures. Table 5.7.4 shows the average global measurements for Housesteads, Yeavering, and their structures. A note on the results of VGA; the multiple decimal places are included as the actual differences between the averages are small if rounded, and therefore the extra decimals are included to aid understanding of the variation in the results.

TABLE 5.7.4 Average global measurements of VGA performed on Housesteads and Yeavering

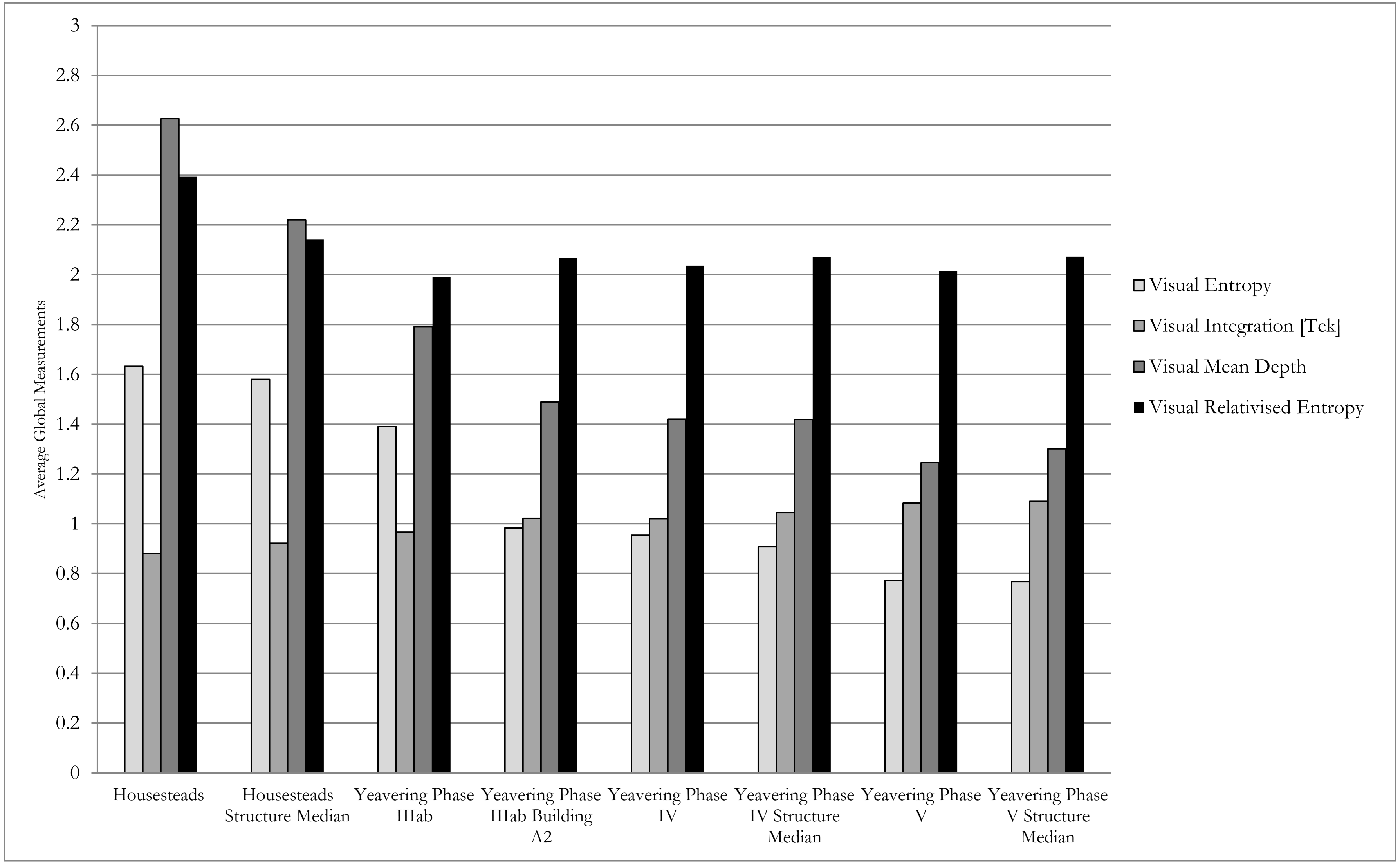
| | Visual Integration (Tek) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|
| Housesteads | 0.880636 | 1.6323 | 2.39365 | 2.62638 |
| Housesteads Structure | 0.901994 | 1.77287 | 2.17489 | 2.5112 |
| Yeavering Phase IIIab | 0.965922 | 1.39071 | 1.98952 | 1.79164 |
| Phase IIIab Structure | 1.02116 | 0.982733 | 2.06619 | 1.48915 |
| Yeavering Phase IV | 1.02061 | 0.95463 | 2.0357 | 1.41955 |
| Phase IV Structures | 0.933958 | 1.511505 | 2.12054 | 2.15142 |
| Yeavering Phase V | 1.0625 | 0.8268295 | 2.09138 | 1.349665 |
| Phase V Structures | 1.08961 | 0.768156 | 2.07198 | 1.301 |

## 5.7.5 ANALYSIS OF RESULTS

Generally speaking, the global measurements at Housesteads display higher scores in entropy and mean depth and lower integration scores than the phases and structures at Yeavering (Figure 5.75). These measurements reflect the differences in the morphological layout of the two settlements and their structures. Higher entropy and mean depth scores, in general, relate to greater spatial complexity of structures and settlements, and therefore it appears logical that Housesteads would have higher scores in these categories than Yeavering due to the relative density and complexity of both the settlement and the interior of the Housesteads structures. Likewise, the integration scores should be and are lower at Housesteads, because the relative density of its layout limits the visible grid connections within the settlement and structures compared to the more open plan of Yeavering.

The most intriguing factor of this test is the remarkable similarity of the global measurements between the settlements and their tested structures. These similarities are shown in Figure 5.7.5, with the median measurements of the structures compared to the settlement measurements. Not only are the measurements similar between Housesteads and its structures and Yeavering and their structures, but also they follow similar patterns of data dispersal as well as patterns of low integration/higher entropy and vice versa. These results suggest that the VGA results are indicative of the actual properties of visibility and spatial organisation at the settlements, as they follow similar patterns between phases and structures within each settlement.

FIGURE 5.7.5. Median global measurements returned from VGA of Housesteads and Yeavering



## 5.8 STATISTICAL ANALYSIS

Although these patterns appear obvious, the results were statistically compared in order to determine if there were meaningful differences between the mean global measurement scores of Housesteads, Yeavering, and their structures. Two different statistical tests were used to examine the results: the Analysis of Variance (ANOVA) test and the independent *t*-test. These tests compare the means of normally distributed data, with the t-test more suited to comparing two sample means, and the ANOVA test suited to examining more than two means (VanPool and Leonard, 2011, p. 153).

The two statistical tests test the null hypothesis of $H_0 = \overline{Y_1} = \overline{Y_2} = \overline{Y_3} \ldots$, where $\overline{Y}$ equals the average (mean) of the global measurements. The significance level used for these tests was 95% ($\propto = 0.05$). As the data from both sites and their structures was normally distributed and parametric, the ANOVA test and *t*-test were appropriate to examine if a) the differences between the site measurements and the structures are similar and if so, b) are the differences between the Roman and Early medieval built environments different?

### 5.8.1 ANOVA TEST OF YEAVERING AND HOUSESTEADS RESULTS

ANOVA is used to examine whether there are significant differences between the examined structures and their overall sites, as it is an overall test of whether group means differ. The null hypothesis is that the global measurement scores *are roughly equal to one another*, i.e. there is no significant difference between the overall site measurement and their structures. Tables 5.8.1.a and 5.8.1.b are generated from running ANOVA in *IBM SPSS Statistics v. 20*. Table 5.8.1.a's significance column (shaded in grey) does not have any scores ≤ 0.05. Therefore we *fail to reject the null hypothesis* and can reasonably accept that the VGA global measurements of Housesteads, the praetorium, and principia are similar. Table 5.8.1.b shows the results of ANOVA test on the three phases of settlement and structures examined at Yeavering. Again, there are no significance scores ≤ 0.05, so therefore we *fail to reject the null hypothesis* and can accept that the VGA global measurements of Yeavering are similar. The results of this statistical test demonstrates that the observed similarities between Housesteads and its structures and Yeavering and its structures are meaningful and probably not due to chance.

TABLE 5.8.1.a ANOVA results table comparing the global measurements of Housesteads, the praetorium, and the principia

| | | Sum of Squares | df | Mean Square | F | ***Sig.*** |
|---|---|---|---|---|---|---|
| Entropy | Between Groups | .002 | 1 | .002 | .025 | ***.900*** |
| | Within Groups | .075 | 1 | .075 | | |
| | Total | .077 | 2 | | | |
| Integration | Between Groups | .001 | 1 | .001 | 1.471 | ***.439*** |
| | Within Groups | .001 | 1 | .001 | | |
| | Total | .002 | 2 | | | |
| Mean Depth | Between Groups | .110 | 1 | .110 | .649 | ***.568*** |
| | Within Groups | .170 | 1 | .170 | | |
| | Total | .280 | 2 | | | |
| Visual Relativised Entropy | Between Groups | .043 | 1 | .043 | 18.441 | ***.146*** |
| | Within Groups | .002 | 1 | .002 | | |
| | Total | .045 | 2 | | | |

TABLE 5.8.1.b ANOVA results table comparing the global measurements of the different phases of settlement at Yeavering and its structures

| | | Sum of Squares | df | Mean Square | F | ***Sig.*** |
|---|---|---|---|---|---|---|
| Entropy | Between Groups | .074 | 2 | .037 | .351 | ***.714*** |
| | Within Groups | .846 | 8 | .106 | | |
| | Total | .920 | 10 | | | |
| Integration | Between Groups | .005 | 2 | .003 | .629 | ***.558*** |
| | Within Groups | .032 | 8 | .004 | | |
| | Total | .037 | 10 | | | |
| Mean Depth | Between Groups | .045 | 2 | .022 | .222 | ***.806*** |
| | Within Groups | .808 | 8 | .101 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Total | .853 | 10 | | | |
| Visual Relativised Entropy | Between Groups | .002 | 2 | .001 | 1.030 | ***.400*** |
| | Within Groups | .009 | 8 | .001 | | |
| | Total | .011 | 10 | | | |

## 5.8.2 INDEPENDENT T-TEST OF YEAVERING AND HOUSESTEADS RESULTS

The ANOVA test demonstrated that the variance between the global measurement means was not statistically significant. Therefore, an independent *t*-test compared the overall means of Housesteads and its structures with Yeavering's phases and structures to determine if VGA identified differences between two very different settlement types. The null hypothesis was that the mean global measurements would be roughly the same between Housesteads and Yeavering, and the alternative hypothesis was that they were different. Levene's Test for Equality of Variance demonstrated there was homogeneity of variance in every category except Visual Relativised Entropy. The significance column has scores that are all less than 0.05, except for Visual Relativised Entropy, where the sig. score was 0.187 because the variances cannot be assumed to be equal in this case. Therefore we *reject the null hypothesis* for three of the four measurements, and the difference in how space is arranged and used between Housesteads and Yeavering is considered significant, as shown in Table 5.8.2.

TABLE 5.8.2 Independent samples test results table comparing the global measurements of Housesteads and Yeavering

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | ***Sig. (2-tailed)*** | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| Entropy | Equal variances assumed | 1.133 | *.308* | 3.041 | 12 | ***.010*** | .57103248 | .18775229 | .16195539 | .98010958 |
| | Equal variances not assumed | | | 3.924 | 5.036 | **.011** | .57103248 | .14552017 | .19775561 | .94430935 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Integration | Equal variances assumed | 1.599 | *.230* | -3.208 | 12 | ***.008*** | -.11947700 | .03724101 | -.20061818 | -.03833582 |
| | Equal variances not assumed | | | -4.686 | 7.080 | **.002** | -.11947700 | .02549389 | -.17962223 | -.05933177 |
| Mean Depth | Equal variances assumed | .255 | *.623* | 4.149 | 12 | ***.001*** | .83043364 | .20015377 | .39433604 | 1.26653123 |
| | Equal variances not assumed | | | 3.560 | 2.705 | **.045** | .83043364 | .23326907 | .04015209 | 1.62071519 |
| Visual Relativised Entropy | Equal variances assumed | 19.322 | *.001* | 3.823 | 12 | **.002** | .17005121 | .04448579 | .07312501 | .26697742 |
| | Equal variances not assumed | | | 1.953 | 2.054 | ***.187*** | .17005121 | .08708119 | -.19532131 | .53542374 |

The statistical analysis of the global measurements indicates that the observed patterns are meaningful; the structures are similar to their overall settlement in how visual space was patterned and the sites were different from one another. Both the observed patterns and statistical analysis validate using VGA to investigate the use of space across past archaeological settlements as well as within structures.

## 5.9 SUMMARY

The household has been argued as the setting for the development and maintenance of society (Wilk and Rathje, 1982). The physical demarcations of interior space in a structure encourage or discourage particular behaviours and practices that are then maintained and reinforced by the practices and activities of the inhabitants of the structure (Bourdieu, 1977, p. 3; Aslan, 2006, p. 134). Since the structural formation and use of a household reflects cultural norms and practice, the archaeological household has been interpreted as reflecting the organisation of the community and larger society (Canuto and Yaeger, 2000). The results of the test at Housesteads and Yeavering reinforce this idea, as the differences of the global measurements between the settlements and the structures are small and considered not statistically significant.

The connectivity and complexity of divided space within the structures is similar to the use of space within the overall settlements. Housesteads, according to VGA, is less visibly integrated and has a more complex ordering than Yeavering, which was constructed in a less dense and more open plan. These scores are reflective of different cultural ideas on the structuring and use of space. These differences are not surprising, due to the variances in function between a military fort on the Roman frontier as opposed to an Early Medieval royal centre. However, this test demonstrates that VGA provides data that can be comparatively and analytically used to examine the past.

The similar complexity of space in the structures and settlements supports the idea that the way in which groups design, construct, and use their households reflects the similar ideas and structuring of space in settlements/communities (Canuto and Yaeger, 2000; Fairclough, 1992; Wilk and Rathje, 1982). This test of the use of VGA and UCL Depthmap at settlement level demonstrates that the division and use of space within settlements and structures are similar to one another, which has broad implications for the study of the past using VGA as a methodology not only in transitional Britain, but also across regions and time periods.

Even though VGA has been successfully used to examine the use of space in archaeological structures, it has not been used to examine space within settlements. This thesis posits that settlements from the transitional period can be examined like structures by VGA in that the positioning of buildings, fence-lines, ditches, enclosures, etc. is similar to how the internal walls, stairwells, and furniture structure the space within buildings albeit at different scales. Social scientists from a variety of fields have long argued that the built environment is more than its physical components and that how the built environment is formed and used reflects how societies think about space while at the same time reinforcing societal boundaries (Aslan, 2006; Bourdieu, 1977, 1973; Hall, 1966; Rapoport, 1982; Seibert, 2006). The home can be seen as the setting for the development and maintenances of social structure, with its physical features that divide interior space encouraging particular activities that are then maintained and reinforced by the daily practices of the inhabitants of that dwelling (Aslan, 2006, p. 134). Since the spatial formation of a household reflects the structural formation of a society, the archaeological household has been interpreted as reflecting the organisation of the community and larger society. Therefore it is appropriate to treat the organisation of a settlement in a similar manner to a structure using VGA. The question, however, is whether or not it is an appropriate methodology to examine settlements.

This methodology was chosen for a variety of factors. First and foremost was a desire to make comparisons quantitatively between not only different time periods, but also different regions and different settlement types. Using VGA to examine settlements the same way VGA is used to examine structures provides this data in both illustrative and statistical manners. In order to understand if there is was any continuity in the spatial organisation of settlements between Iron Age, Roman, and Early Medieval Britain in what is today north-eastern England, it was important to design and use a methodology that provides measurable and comparative evidence rather than observational. This chapter has shown that VGA can examine the visual arrangements of space at Housesteads and Yeavering and that the results are culturally constructed and can be used to compare how the built environment was visually organised. However, this methodology relies upon good, detailed plans of settlements and that potentially excludes known sites with poor plans, thus biasing the results towards certain site types. In order to mitigate this limitation, a wide variety of site types were examined from both regions (see Chapter 6). This novel approach to VGA will be used to investigate trends and continuities in how settlements were organised and used between c. 100 BC-AD 800 in order to address what affect, if any, did the spatial organisation in the Iron Age and Roman periods have on the Early Medieval built environment.

# CHAPTER 6

# VISIBILITY GRAPH ANALYSIS RESULTS

Chapter Six details the results of the VGA using *UCL Depthmap* on archaeological settlements from the two study regions north and south of Hadrian's Wall. Thirty-one settlements are analysed using VGA in order to statistically investigate trends or patterns in the arrangement and use of space within communities. Fifty-two phases of settlement and the interiors of 18 buildings are analysed from the 31 settlements in order to compare how space was defined, developed, and used within and outside of the boundaries of Roman Britain during the 1st century BC to the 9th century AD. The site plans and resulting visibility graphs of each measurement are located in Appendix D in the order they are discussed in the text.

The settlements chosen from the NSR and YSR for VGA have been selected using two factors: completeness of their settlement plan, and more importantly, their importance for understanding spatial patterns in the built environment, their use, and how they changed over time. Visibility graph analysis works best when examining archaeological settlements with more complete plans of houses and structural features. This means that this analysis is skewed towards site plans based on open-area excavations or cropmark evidence. The second factor was addressed in detail in Chapter 5, and together these two aspects guided the selection of settlements and structures analysed using VGA. The selected settlements from the two regions can be broadly separated by time period, by type, and by means of discovery

As with the landscape analysis, the three time periods examined using VGA are the Iron Age, Roman, and Early Medieval periods. The Iron Age sites are included in the VGA for two reasons. Firstly, because it is hypothesised that the previous influence of the Roman occupation affected the later Early Medieval settlement, it is felt that this may have also occurred during the transition from Iron Age to Roman Britain. Secondly, Iron Age settlements are included to identify continuities of the use of space and place over the *longue durée*. The inclusion of Iron Age settlements allows an analysis of continuities or disruptions in how the built environment was organized and used from approximately 100 BC–AD 800. These questions are addressed by analysing Iron Age settlement in the two study areas using

VGA to determine if there were similarities in the spatial organisation of space between Iron Age through Early Medieval Northumbria.

The Roman period has been labelled in this thesis as the Roman Iron Age in the NSR to acknowledge the temporal dating of the settlements occurring between the 1st and 5th centuries AD and the limited amounts of Romano-British material culture in this region. The Roman Iron Age is a more appropriate term for settlements dating to the Roman period in the northern study region due to the comparatively limited cultural contact between the native Britons of the region (the *Votadini*) and the Roman Empire to provincial Britain south of the wall (Hunter, 2007, p. 20; Passmore et al., 2012, pp. 261–264). Hunter argues that the material evidence found dating to the late Roman Iron Age period in northern Britain was the result of contact and trade with Roman Britain (Hunter, 2010, p. 104). Although the people living north of Hadrian's Wall were directly affected by the Roman colonisation of Britain, they received different degrees of interaction and acculturation as compared to Britain south of Hadrian's Wall; the contact was of a much different nature and hypothetically had less impact on the spatial patterning of settlements.

Early Medieval settlements examined using VGA included sites dated from the 5th through 8th centuries. It was hoped this broad range would demonstrate change over time or broad continuities of spatial organisation in Early Medieval settlements. The arrangement of the built environment at the settlement level depends on a variety of factors, and in the case of the Early Medieval period was most likely based on traditional viewpoints brought with immigrants that was altered due to interaction with the previous inhabitants of Britain. The following sections provide a brief description of each settlement, its importance for the analysis, their dates, and their type of settlement.

## 6.1 TECHNIQUES OF RECORDING ARCHAEOLOGICAL SETTLEMENTS

The settlements chosen for VGA include sites that have been recorded based on excavation and extensive earthwork surveys as well as settlements that have been mapped using remote sensing techniques. These different methods of recording have implications for understanding of the spatial morphology of these settlements and affects how VGA is processed and understood. The different methods are discussed below, and their effect on the VGA results is fully explored in Chapters 7 and 8.

### 6.1.1 EXCAVATION

The most common forms of past spatial layouts used by this analysis are plans and maps recorded during the excavation of archaeological sites. In order for VGA to work well in analysing past settlements, a clear understanding of the spatiality of past sites was needed. Therefore excavated settlements have been chosen, when possible, over other forms of evidence. Even though it was the most common form of site analysed, certain styles of excavation are necessary for VGA to work effectively. Specifically, the exposure of large areas detailing as much the sites as possible proved to be the most beneficial. 'Keyhole' trenches typically do not reveal enough of the spatial layout of past settlements to be of much use in VGA, although these trenches combined with cropmark and geophysical evidence along with detailed earthwork surveys can be used to reconstruct the past arrangement of structural space at settlements. This reliance on open excavation plans limits the number of usable sites, as research-led large-scale excavations have decreased over the last quarter century. Fortunately, large-scale excavations have not disappeared, as development activities that impact large amounts of land, such as quarrying or road construction, have led to the discovery and excavation of large settlements (such as at Lanton and Cheviot Quarries; Johnson and Waddington, 2008; Stafford and Johnson, 2007). This methodology utilising VGA presents a strong argument for exposing more land when excavating Early Medieval sites in order to examine the spatial layout more thoroughly as well as to identify features from the period that often escape notice during remote sensing surveys.

### 6.1.2 EARTHWORK SURVEYS

Many of the Iron Age and Roman Iron Age settlements examined by VGA for this research were mapped through extensive earthwork surveys conducted by English Heritage for the *Discovering our Hillfort Heritage* project in Northumberland National Park (Oswald et al., 2006). An earthwork survey "(…) provides useful information on the *form* and *condition* of earthworks; it is also extremely good at identifying the *chronological relationships* of the elements of the landscape to one another" (English Heritage, 2007, p. 3). Earthwork surveys map upstanding features and develop the phasing of past settlements and landscapes. Although earthwork surveys are excellent at ascertaining the form of visible remains, earthwork surveys have obvious limitations; the focus on upstanding features limits its usefulness to certain built form types and/or time periods. In the case of the Northumberland hillforts analysed using VGA, such surveys are often the only archaeological work that has been conducted on these sites.

### 6.1.3 AERIAL, SATELLITE, AND LIDAR REMOTE SENSING

A variety of remote sensing techniques can be used to identity and interpret settlement patterns. Cropmarks and soilmarks represent the effects on the ground surface of underlying archaeological features that can be identified through remote sensing techniques. These various patterns are identified by aerial reconnaissance surveys when differences in vegetation growth (cropmarks) are observed thanks to the presence of archaeological remains (Evans, 2007, p. 16). LiDAR reveals changes in topographic expression, with dips and rises in the micro-topography of the landscape revealed and interpreted as archaeological features (Crutchley, 2010). Remote sensing has been significant in revealing the extent of the buried landscape of the Iron Age, Roman, and Early Medieval periods in both of the study regions analysed.

There are issues in identifying sites using these remote sensing techniques due to the time of year the photo was taken, the underlying soil moisture, the different agricultural methods obscuring visibility, the overlying vegetation affecting the accuracy of the LiDAR, the differences in soil colour all affect the visibility of archaeological features, and the characteristics of the archaeological features themselves making them invisible to remote sensing techniques (Crutchley, 2010, p. 19; Evans, 2007, p. 17). In addition to the difficulties collecting remote sensing data, there are issues analysing settlement plans defined from remote sensing in VGA due to the nature of the evidence. These settlements are extremely difficult to phase chronologically and almost impossible to interpret the functional use of the settlements. Therefore all of the remotely mapped features attributed to a specific time period based on stylistic appearance are used for VGA, which undoubtedly includes features and structures from different phases. Though all of the remote-sensing settlements analysed by VGA are compared to the excavation and earthwork survey settlements, it is probable that VGA could produce very different results for these types of settlements.

Reconnaissance flights since the 1950s have revealed a large number of archaeological features in both study regions, with many sites only identified and interpreted through aerial reconnaissance. Following the Second World War, Dr Kenneth St Joseph began a series of aerial reconnaissance flights over Northumbria and recorded archaeological features for approximately 40 years (Gates, 2012, p. 62). The large amount of cropmark evidence identified and recorded by St Joseph included henges, Iron Age hillforts, Romano-British farmsteads, and Early Medieval settlements including the palace complexes at Milfield, Yeavering, and Sprouston (Gates, 2012, p. 62; Hope-Taylor, 1977, p. 4; St Joseph, 1981, p. 191).

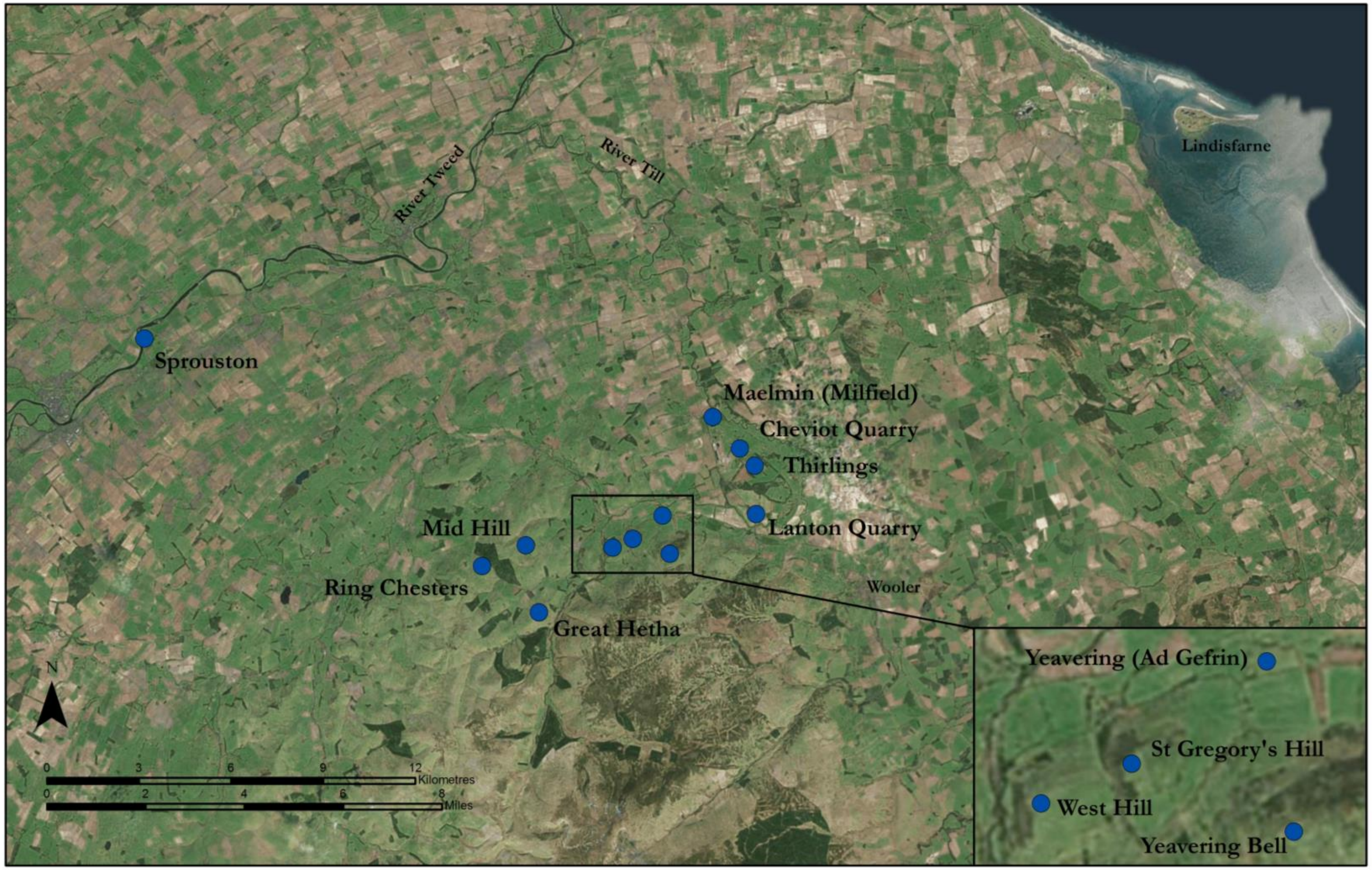
Similar aerial photography flights were conducted over much of Yorkshire, with particular emphasis paid to East Yorkshire by the Landscape Research Centre and English Heritage. Dominic Powlesland has led research in the Vale of Pickering that has combined aerial photography, LiDAR surveys, and extensive geophysical survey work to examine more than 200 square kilometres (see the LRC Digital Atlas at http://thelrc.wordpress.com/lrc-digital-atlas). This has revealed a densely packed landscape from prehistory through the present, and has demonstrated that the Early Medieval site of West Heslerton was just one of series of Early Medieval settlements positioned across the Vale of Pickering (Powlesland et al., 2006, p. 292). The Royal Commission on the Historical Monuments of England (later merged with English Heritage) produced an extensive mapping programme of the landscape of the Yorkshire Wolds. This work produced a highly detailed map of the archaeological landscape that was phased by morphological and typological characteristics (Stoertz, 1997, pp. 11–12).

## 6.2 NORTHUMBERLAND STUDY REGION

The sites in the NSR used for VGA are broadly concentrated in the Cheviot Hills and in the river valleys of the Till and Tweed. With the exception of Sprouston, all of the settlements analysed were located within the boundaries of the Milfield Basin study area used for the landscape analysis. This is partially due to archaeological work having been concentrated in this area due to the easier recognition of sites due to good quality cropmarks on the gravel soils of the basin (Gates and O'Brien, 1988; Hope-Taylor, 1977; O'Brien and Miket, 1991) as well as due to the quarrying of these gravels exposing archaeological evidence (Johnson and Waddington, 2008; Stafford and Johnson, 2007). Broad portions of the Milfield Basin study area used in the landscape analysis, specifically along the coast of the North Sea, do not have any settlements suitable for examination using VGA due to the method's reliance on examining vision and movement blocked by walls and structures. This discrepancy is probably related to the large amount of archaeological research conducted in the above-mentioned areas, rather than an actual gap in the archaeological record. Many of the settlements examined during the landscape analysis along the North Sea Coast have not received adequate archaeological attention (such as on Lindisfarne/Holy Island) or have not revealed significant settlement remains (such as Bamburgh Castle). The Iron Age and Roman Iron Age settlements were selected from a series of hillforts in the Cheviots while the Early

Medieval settlements were from the gravelly river valley bottoms. These sites have settlement plans suitable for VGA. This is because their features have been adequately planned or been completely excavated. Most of the hillforts have upstanding features while the Early Medieval settlements are recognisable due to good quality cropmark evidence. In addition, excavations stimulated by the quarrying of these river gravels has revealed Early Medieval rural settlement in the Milfield Basin at sites such as Cheviot Quarry and Lanton Quarry (Johnson and Waddington, 2008; Stafford and Johnson, 2007).

FIGURE 6.2 Settlements analysed using VGA from the NSR.



### 6.2.1 IRON AGE SETTLEMENTS FROM THE NORTHUMBERLAND STUDY REGION

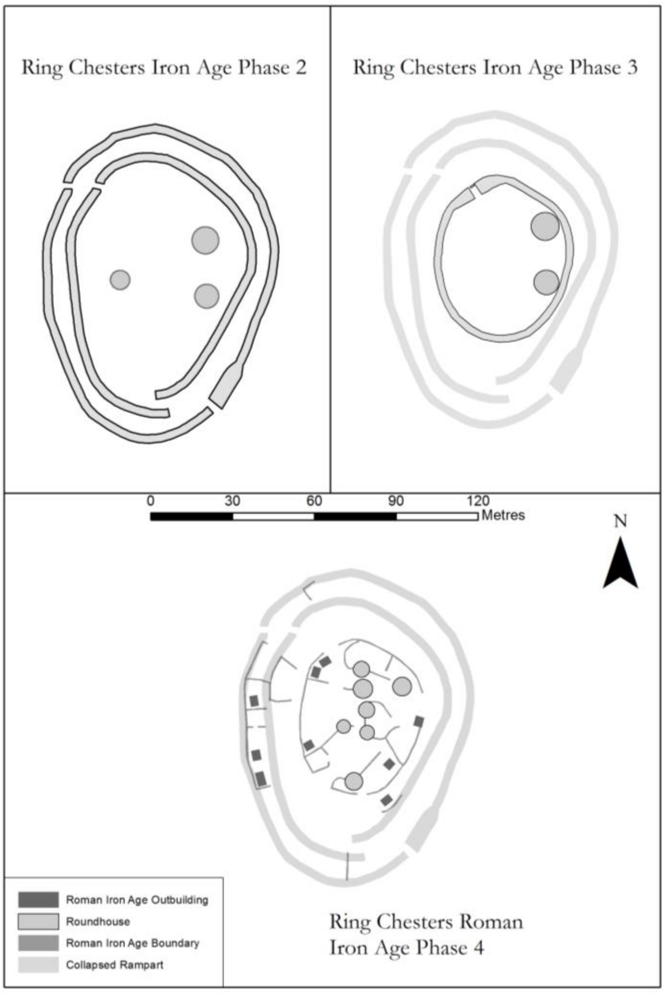
The sites examined using VGA dating to the Iron Age from the NSR are all hillforts located in the Cheviot Hills overlooking the College Valley in what is today Northumberland National Park. Hillforts are often considered the defining settlement type of the Iron Age, with famous sites from southern England including Maiden's Castle in Dorset and Danebury in Hampshire. The hillforts from the NSR are much smaller than those of southern England, and generally can be thought of as small farmsteads as opposed to the large communities of the south (Oswald et al., 2006, p. 8). Much of the information known about the many hillforts from the NSR can be attributed to the work of George Jobey, who examined and mapped almost every hillfort in Northumberland National Park and in the Scottish Borders (Oswald et al., 2006, pp. 26–27). Jobey claimed that many of the Iron Age hillforts occupied the same location as earlier prehistoric settlements, and remained occupied during the Roman Iron Age (Jobey, 1965). His research remains the definitive examination of Northumberland hillforts, and has inspired a new generation of archaeologists to examine the many hillforts of the region. Lowland Iron Age settlements from the NSR have not been examined using VGA due to the limited amount of research that has been conducted on them as well as to the general similarities between lowland and upland Iron Age settlements in the NSR. For example, the multivallate 'hillfort' at Kyloe contains two external ditched enclosures of a similar size to the smaller hillforts identified in the Cheviots (PastScape, 2014). However, the aerial photographs that identified the Kyloe site did not detect any internal differentiation within the enclosures, and no additional archaeological investigations have been performed there to examine the site. Thus, the present research concentrates on the hillforts in the Cheviots due to their representativeness of settlements in the region and the amount of archaeological work at the forts that have revealed the plans of the sites.

All of the hillfort settlements discussed below were re-examined during the *Discovering our Hillfort Heritage* research project sponsored by English Heritage, the Northumberland National Park Authority, the Universities of Newcastle and Durham, and the Northumberland Archaeological Group. This initiative conducted earthwork surveys of all of the hillforts in the Park, and found that many of these settlements were reoccupied in the Roman, Medieval, and post-medieval periods, demonstrating that these monuments were important aspects of the landscape long after the Iron Age. The English Heritage survey produced highly detailed plan maps of the hillforts, descriptive phasing of the occupations and interpretations on how these hillforts fit into the wider landscape.

#### 6.2.1.1 RING CHESTERS HILLFORT (NT 8670 2891)

Also known as Elsdon Burn Camp, Ring Chesters Hillfort demonstrates four phases of occupation, with the earliest three phases attributed to the Iron Age and the fourth to the Roman Iron Age (Figure 6.2.1.1). The fort overlooks the College Valley, approximately 3 kilometres from the village of Shotton (Figure 6.2). The earthwork survey identified evidence of a single rampart during the earliest phase of occupation, however the internal use of the fort during this phase was not identifiable (Oswald et al., 2006, p. 60). The second phase of occupation was an oval-shaped bivallate fort with three roundhouse structures. In phase three, a circular-shaped inner rampart was added to the fort, although the number of structures reduced to two (Oswald et al., 2006, p. 60). The Roman Iron Age phase is discussed in section 6.2.3.

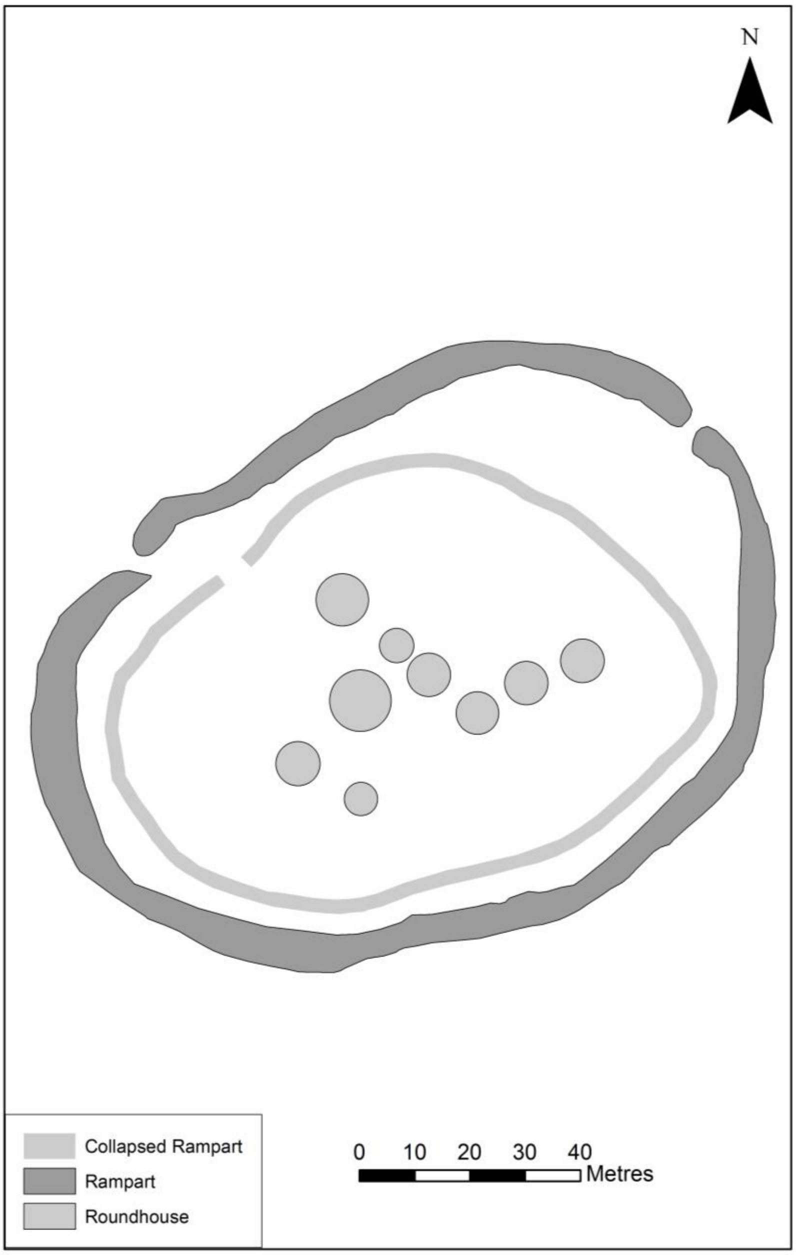
FIGURE 6.2.1.1 Ring Chesters Hillfort



### 6.2.1.2 GREAT HETHA HILLFORT (NT 8856 2740)

Great Hetha Hillfort overlooks the College Valley approximately 1 kilometre southwest of the village of Hethpool (Pearson, 2001, p. 1; Figure 6.2.1.2). The upstanding earthworks were examined by English Heritage in 2000: this survey determined Great Hetha has three identifiable stages of development that all were dated to the Iron Age based upon their form and topographic setting (Pearson, 2001, p. 23). Only one of the Iron Age phases of the settlement was analysed, as the internal arrangement of structural space was similar in the fort across the three phases. This phase contained nine roundhouses enclosed by two stone ramparts.

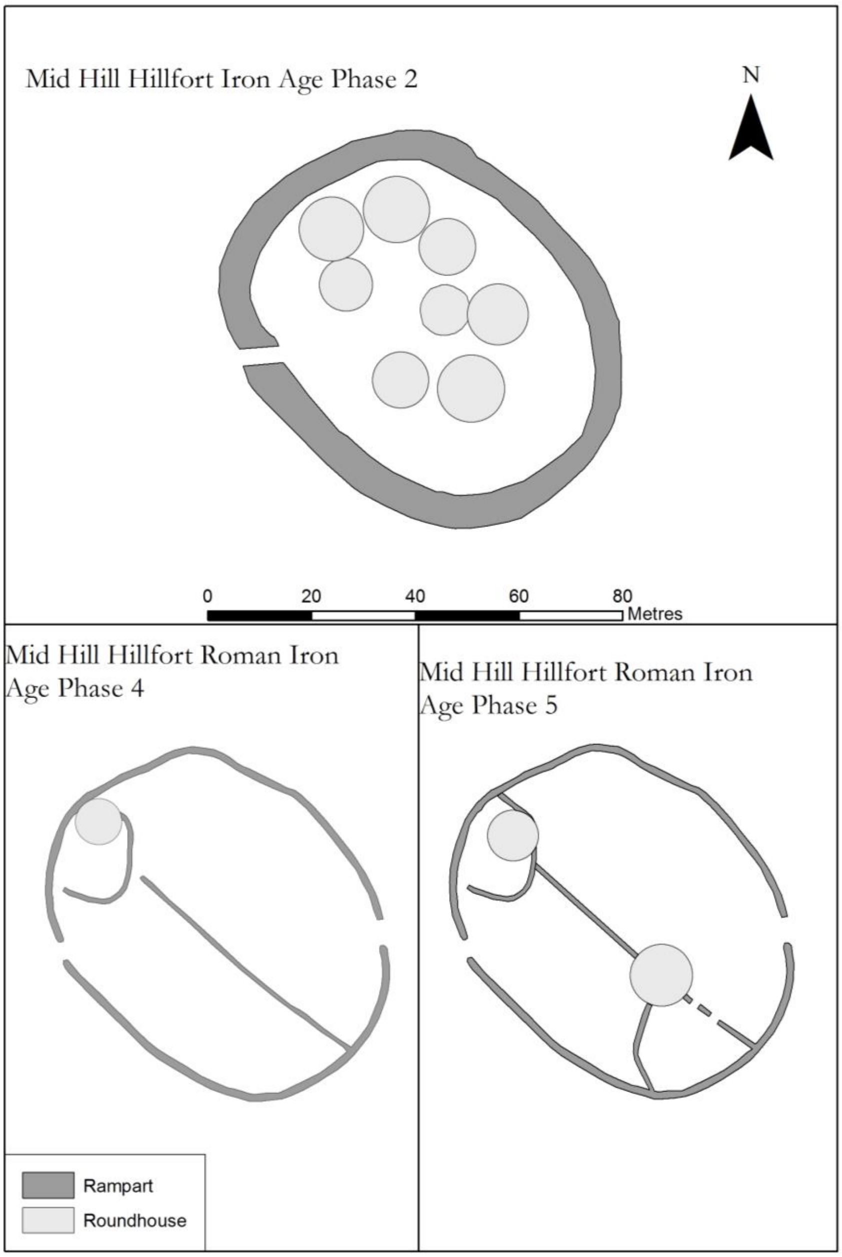
FIGURE 6.2.1.2 Great Hetha Hillfort



### 6.2.1.3 MID HILL HILLFORT (NT 8813 2959)

Located approximately 3 kilometres southwest of Kirknewton and overlooking the College Valley, the hillfort at Mid Hill was a stone-built, oval-shaped univallate hillfort (Oswald et al., 2006, p. 107). At least six phases of settlement were noted at the hillfort, of which three are related to the prehistoric period, two to the Roman Iron Age, and one to an unknown stage following the Roman Iron Age (Figure 6.2.1.3). The two Iron Age phases of the fort were very similar in size and shape, with the main change occurring to the construction of the northern rampart of the fort. In total, eight roundhouse-style huts were noted within the single stone rampart, which contained an entrance to the west.

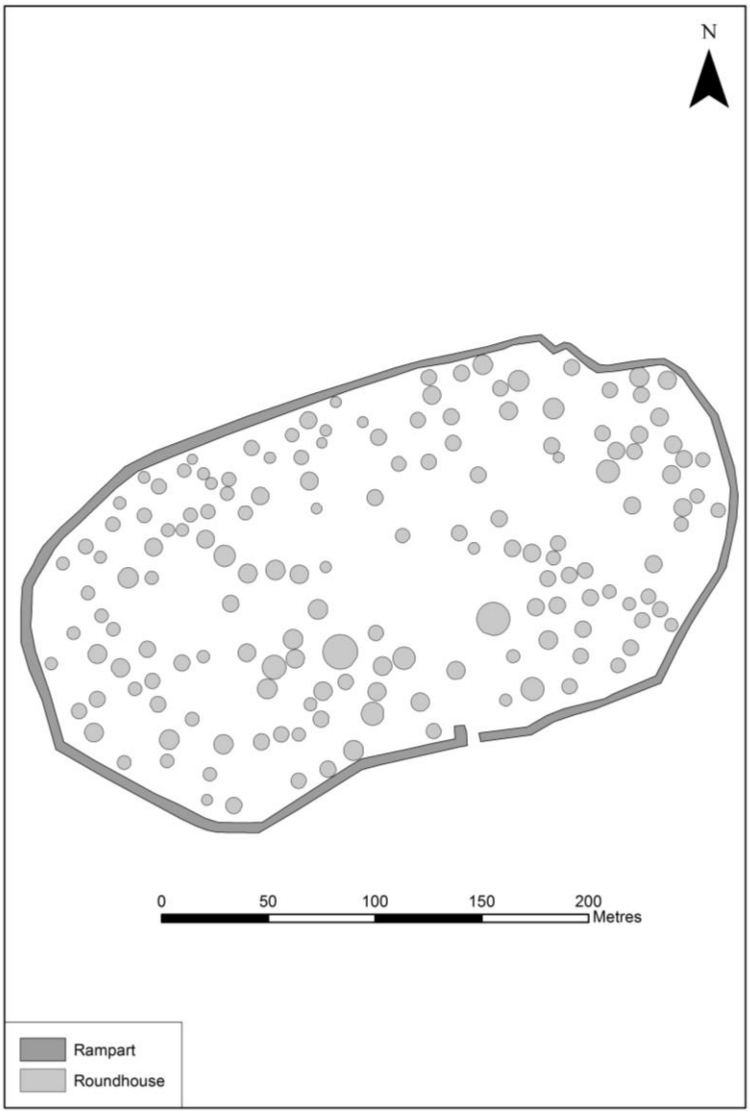
FIGURE 6.2.1.3 Mid Hill Hillfort



### 6.2.1.4 YEAVERING BELL HILLFORT (NT 9280 2930)

Situated approximately 6 kilometres west of Wooler, Yeavering Bell is the largest hillfort in Northumberland at 5.6 hectares, whereas the other hillforts analysed in the NSR enclose an area smaller than a hectare. The site contains evidence of at least 125 roundhouses (Pearson, 1999, p. 17, Figure 6.2.1.4). The substantial remains of a stone banked enclosure bound the hut platforms, with a main entrance to the south, and other possible entrances to the north, east, and west. Yeavering Bell is an isolated hilltop containing two rounded peaks of unequal height within the stone enclosure of the hillfort. Due to the spatial location of the peak and its distinct shape, Yeavering Bell can be seen from some distance, and may have been accorded special importance from the Neolithic though to the medieval period and beyond (Oswald et al., 2006, p. 99).

FIGURE 6.2.1.4 Yeavering Bell Hillfort



Unlike the other hillfort settlements discussed above, Yeavering Bell has seen a relatively large amount of research spanning three centuries of antiquarian and scientific archaeological research (Oswald and Pearson, 2005, p. 100). Even so, there remain many questions on the phasing, continuity, and function of the settlement. George Tate's 1862 publication on the fort was one of the first descriptions that disputed earlier, fanciful ideas of the fort using field evidence including excavation (Tate, 1862). George Jobey recorded 125 house platforms within the fort, made an accurate plan of the site, and made interpretations on the styles of the buildings and the function of the annexes on the western and eastern ends of the fort (Jobey, 1966, pp. 97–98). The next main investigation of the site was by Brian Hope-Taylor, who excavated an unknown number of test trenches concurrent with the excavations of the nearby Early Medieval settlement at Old Yeavering. Hope-Taylor's work at Yeavering Bell was briefly discussed in the excavation report of Yeavering, where he established a date range for the hillfort extending from the end of the 1st millennium BC to the end of the 1st century AD (Hope-Taylor, 1977, pp. 6–9).

The English Heritage earthwork survey of Yeavering Bell confirmed Jobey's results (i.e. the of structures) while at the same time pointing out that the 'annexes' on the western and eastern ends were actually evidence of two phases of settlement at the site (Pearson, 1999, p. 26). The survey confirmed there was little evidence of chronology or phasing of the internal use of the hillfort, as there was no cross-cutting of hut platforms (Pearson, 1999, p. 30). Interestingly, the saddle area in the centre of the hillfort between the two small hillocks was devoid of structures, perhaps indicating it was reserved for some special activity (Oswald and Pearson, 2005, p. 114). It is possible, if not probable, that all of the roundhouses were concurrently occupied as none appeared to crosscut. If they were not occupied at the same time, the implication is that the previous roundhouse locations affected newer construction and use and thus affected the use of space within the settlement.

### 6.2.2 VISIBILITY GRAPH ANALYSIS OF IRON AGE SETTLEMENTS IN THE NORTHUMBERLAND STUDY REGION

As discussed in Chapter 5, four global measurements have been chosen for this analysis based on their suitability for assessing how the built environment and use of space affect visibility and movement (Chapter 5, Section 5.5.7). These measure the fewest number of turns needed to traverse a grid (mean depth), how connected each grid point is to all the others (integration), and the complexity of a visibility graph (entropy and relativised entropy). The hillfort ramparts and the roundhouses define the use of space and visibility inside these settlements.

Figure 6.2.2.a shows representative examples of the VGA results on the five settlements and demonstrates that the most visible and least complex areas of the settlements were near the entrances to the forts while the least visible and most complex areas were around the roundhouses. Table 6.2.2 and Figure 6.2.2.b show the results of VGA on the Iron Age settlements, along with the average and median scores from the sites. More detailed Figures of each measurement are included in Appendix D, which includes bar charts and all of the visibility graphs of each measurement for each settlement, phase, and structure analysed by VGA. The complete data measurements of all the settlements and structures analysed by VGA are included in Appendix E. Since the median and mean scores are close to one another across the global measurements, it implies that the examined settlements, even though different in shape, scale, and size, broadly display a similar use of space. A detailed analysis and discussion of the VGA results follows in Chapter 7.

TABLE 6.2.2 Visibility Graph Analysis results on Iron Age settlements from the NSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Ring Chesters Phase 2 | 1.58089 | 0.912741 | 2.19084 | 2.18247 |
| Ring Chesters Phase 3 | 2.02642 | 0.850416 | 3.0382 | 2.3968 |
| Great Hetha | 2.20997 | 0.856241 | 3.2687 | 2.36519 |
| Mid Hill Phase 2 | 1.18396 | 0.952491 | 1.73925 | 2.12672 |
| Yeavering Bell | 0.978984 | 0.927777 | 1.991 | 2.5327 |
| ***Median*** | **1.58089** | **0.912741** | **2.19084** | **2.36519** |
| ***Mean*** | **1.5960448** | **0.8999332** | **2.445598** | **2.320776** |

FIGURE 6.2.2.a Connectivity measurements of Iron Age settlements analysed in the NSR (not to scale).

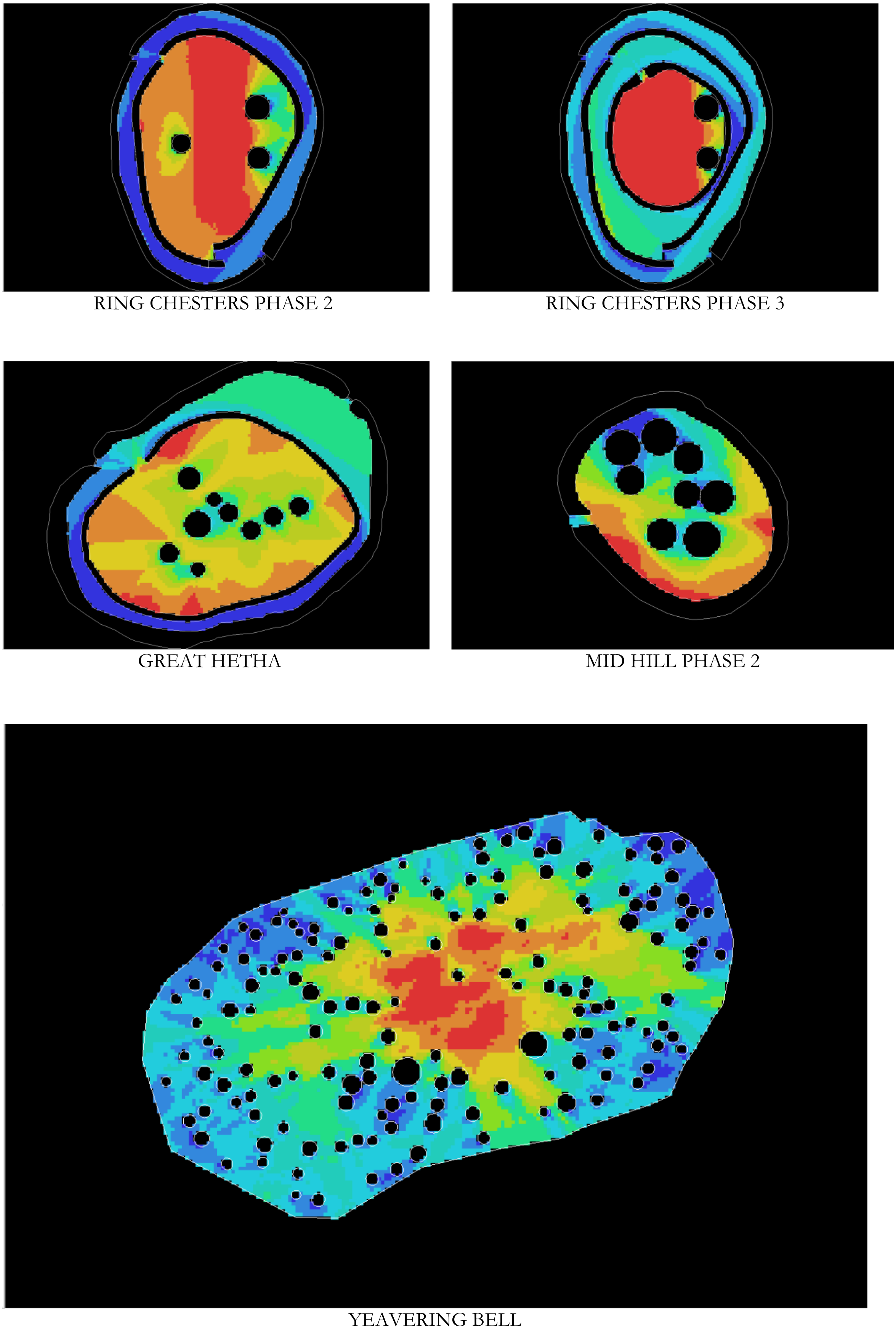
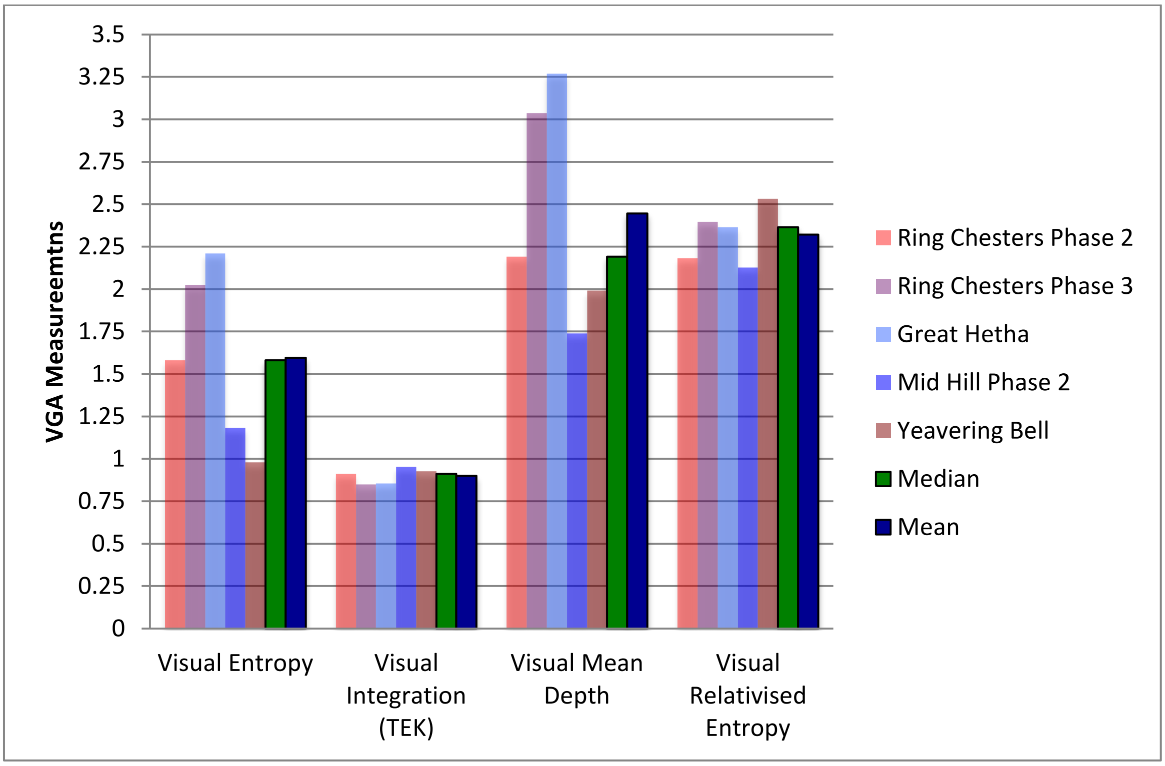


FIGURE 6.2.2.b Visibility graph analysis results on Iron Age settlements from the NSR




Although the VGA results show similarities between the Iron Age settlements, one difference is that the visual entropy and visual mean depth measurements at Mid Hill and Yeavering Bell hillforts appears quite different from Ring Chesters and Great Hetha hillforts' measurements. The most likely reason for this discrepancy is that Mid Hill and Yeavering Bell contains a single rampart, while Ring Chesters and Great Hetha contain two or more ramparts. The additional rampart particularly affects these two measurements due to the added complexity of these structural forms affecting space and movement that would be needed to move through multiple ramparts.

### 6.2.3 ROMAN IRON AGE SETTLEMENTS FROM THE NORTHUMBERLAND STUDY REGION

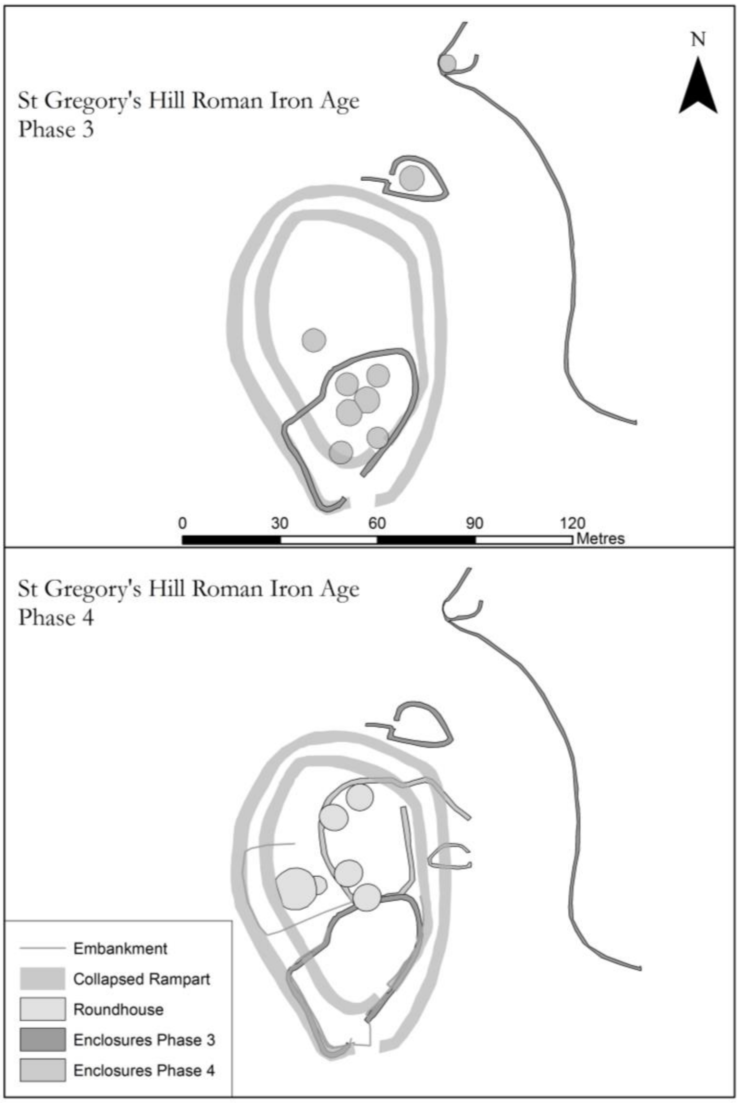
The campaigns of Gnaeus Julius Agricola expanded the boundaries of Rome far to the north of the study region into present-day Scotland, and for a period of approximately 80 discontinuous years, the NSR was part of Roman *Britannia*. Due to the construction and later reoccupation of Hadrian's Wall and its importance as a boundary, the area north of the wall mainly developed outside of the Empire and "(…) the Iron Age lived on, after a fashion, developing along its own path like a prehistoric parallel universe" (Oswald et al., 2006, p. 4). This period of time, where the Roman Empire shaped and overshadowed much of Britain while generally not directly affecting the areas to the north of Hadrian's Wall, is referred to as the Roman Iron Age.

Jobey believed that the Roman Iron Age represented continuous occupation from the Iron Age through the Roman period in the border region (Jobey, 1965). Current research argues that a considerable amount of time elapsed between the Iron Age occupation of the hillforts and the Roman Iron Age reoccupation (Oswald and Pearson, 2005; Oswald et al., 2002, 2000, 2006a, p. 107). …..This is based on the fact that the Roman Iron Age structures and boundaries often crossed the Iron Age ramparts and structures, implying that these features had collapsed/were not as visible on the landscape. Furthermore, the Roman Iron Age built forms employed different construction techniques and styles to the Iron Age hillforts. This contrasts with recent work on the Northumberland coastal plain (further south of the NSR) at the late-Iron Age settlements at Pegswood Moor and East/West Brunton where it has been argued that these settlements were directly impacted by the Roman presence (Hodgson et al., 2012; Proctor, 2009). The English Heritage earthwork surveys identified the Roman Iron Age as different due to the construction of additional enclosures demarcating the internal use of space inside the hillforts. Many of the Iron Age hillforts in the Cheviots were reoccupied during this period. The Roman Iron Age settlements were chosen to examine the differences with the preceding hillforts of the Iron Age. In addition, these settlements had adequate earthwork plans to allow VGA to be performed. Other Roman Iron Age settlements from the study region, such as the recently investigated Flodden Hill rectilinear enclosure, do not have complete enough plans to adequately run the analysis (Passmore et al., 2009, pp. 223–243).

#### 6.2.3.1 ST GREGORY'S HILL HILLFORT (NT 9160 2978)

St Gregory's Hill is located along the north-eastern boundary of the Cheviots, approximately 500 metres south and overlooking the village of Kirknewton. The hillfort is named after the parish church dedicated to Pope Gregory the Great (Oswald et al., 2002, p. 2). Although the general form and location of the monument date the hillfort to sometime in the Iron Age (700 BC to AD 50), the English Heritage survey determined that the hillfort was reoccupied during the Roman Iron Age, and was later reused during the medieval and modern periods as well (Oswald et al., 2002, p. 31). The internal use of the bivallate hillfort during the Iron Age was not possible to discern from the earthwork survey due to stone robbing and ploughing. The Roman Iron Age settlement, however, showed two phases of settlement with Phase 3 containing three enclosures and nine roundhouse-type structures and Phase 4 (the scooped enclosure complex) containing trackways, enclosures, and five roundhouses (Oswald et al., 2002, p. 31; Figure 6.2.3.1). The collapsed ramparts of the Iron Age hillfort partially structured the development of the later Roman Iron Age settlement, with portions of the ramparts presumably visible as they were incorporated into the design of the fort. However, due to the overlapping of the rampart by the Roman Iron Age structures in many places, the authors concluded that there was not continuity in settlement between the Iron Age and Roman phases (Oswald et al., 2002, p. 32).

FIGURE 6.2.3.1 St Gregory's Hill Hillfort

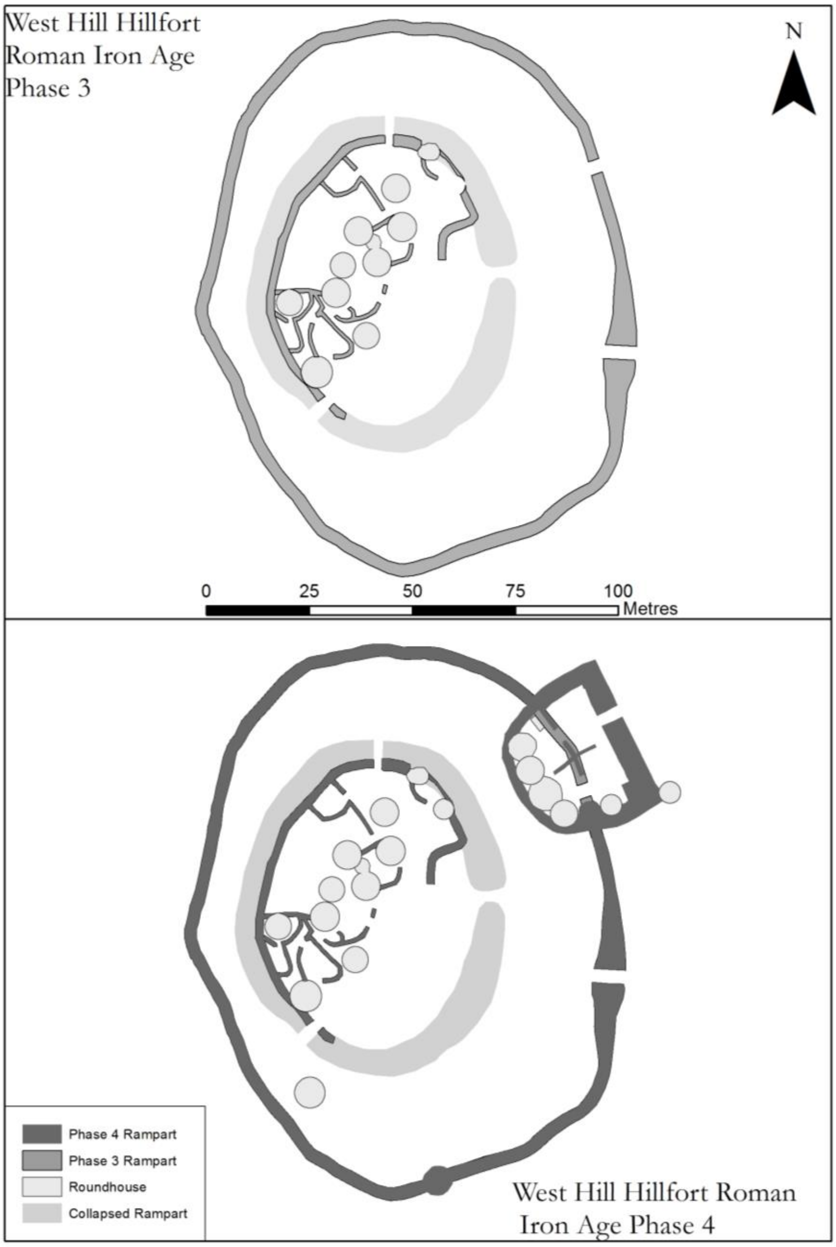



## 6.2.3.2 WEST HILL HILLFORT (NT 9096 2951)

West Hill Hillfort is located approximately 1 kilometre south-west of the village of Kirknewton on a hill overlooking the Milfield Plain to the northeast and St Gregory's Hill and Yeavering Bell to the east (Oswald et al., 2000, p. 3; Figure 6.2.3.2). Although there were Iron

Age antecedents to the hillfort, the English Heritage survey argued that the visible traces of structural evidence at the site dated to the Roman Iron Age (Oswald et al., 2000, p. 13). Two phases of settlement occurred during this period at West Hill, although an exact date for these phases is unknown at this time due to the limited archaeological research that has occurred at the hillfort.

FIGURE 6.2.3.2 West Hill Hillfort




Roman Iron Age (Phase 3) contained ten roundhouse structures and three possible structures. By this point in time the Iron Age rampart had collapsed. An enclosure bank slightly larger, ovoid, and roughly the same shape as the Iron Age rampart was built along the summit of the hill at a distance of approximately 12-35 metres outside the original rampart (Oswald et al., 2000, p. 15). Even though the original ramparts had collapsed by the Phase 3 occupation, they still must have been somewhat visible as the settlement was defined by the original rampart, with additional boundaries dividing the interior of this space between the structures (Oswald et al., 2000, p. 22, 2006, p. 86, see Figure 6.2.3.2).

The boundaries of the hillfort were expanded during Phase 4 with the addition of a D-shaped enclosure along the north-eastern edge of the Phase 3 enclosure embankment. This D-shaped enclosure housed six roundhouse structures and three roughly rectangular buildings that were densely packed within the enclosure. An additional roundhouse structure also was added to the ten roundhouses within the Phase 3 rampart (Oswald et al., 2000, pp. 17–19).

#### 6.2.3.3 MID HILL HILLFORT (NT 8813 2959)

The two Roman Iron Age phases of occupation at Mid Hill hillfort utilised the collapsed rampart of the Iron Age hillfort while changing the internal use of space in the hillfort (see Figure 6.2.1.3). The collapsed rampart was reused as a boundary during the Roman Iron Age, although new entrances were developed and used that differed in location from the previous Iron Age phases. Phase 4 contained one roundhouse structure, an associated enclosure, and a NW/SE running boundary through the centre of the hillfort. An additional roundhouse and enclosure was added to the hillfort during Phase 5, further demarcating the internal use of space in the fort (Oswald et al., 2006, pp. 106–107).

#### 6.2.3.4 RING CHESTERS HILLFORT (NT 8670 2891)

During the Roman Iron Age, the character of Ring Chesters hillfort changed dramatically (see Figure 6.2.1.1). The ramparts of the bivallate hillfort had collapsed, however evidence of these boundaries must have been visible as the Roman Iron Age period boundaries followed the shape of the previous fort (Oswald et al., 2006, p. 60). Seven roundhouse-shaped structures as well as associated yards and subdivisions of the interior were noted during this phase, adapting the previous hillfort to a very different use of space. The internal boundaries and enclosures at Ring Chesters were built at a much grander scale than the other Roman Iron Age hillforts from the Northumberland study region.

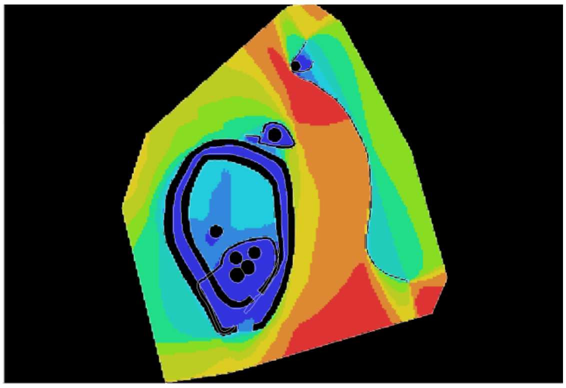
### 6.2.4 VISIBILITY GRAPH ANALYSIS OF THE ROMAN IRON AGE IN THE NSR

The global measurements of the Roman Iron Age are summarised in Table 6.2.4 and shown in Figures 6.2.4.a and 6.2.4.b. Comprehensive figures are available in Appendix D. Like the Iron Age settlements, the median and average scores of the measurements are similar across the different settlements and phases, implying a comparable demarcation and use of space during this period at these sites. The measurements are also remarkably similar to the Iron Age settlements (see Figure 6.2.2.6), which is probably due to the fact that all of the Roman Iron Age settlements were located at hillforts previously established during the Iron Age. Their global measurements do tend to be more visually integrated and less visually complex than during the Iron Age, implying an increased differentiation of space. These different scores demonstrate that even though the settlements are located in the same locations, the Roman Iron Age witnessed a slight change in how the sites were utilised. These changes are discussed in detail in Chapter 7.

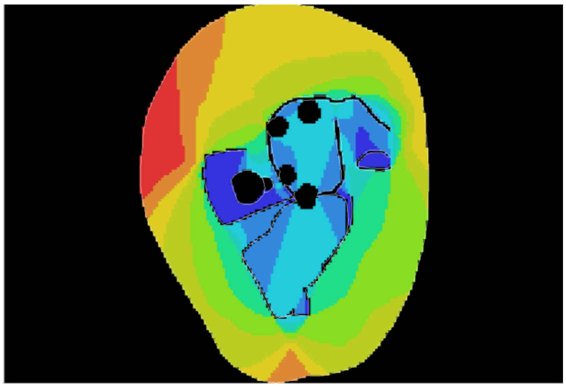
TABLE 6.2.4 Visibility Graph Analysis measurements on Roman Iron Age settlements from the NSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| St Gregory's Hill Hillfort Phase 3 | 1.46267 | 0.962899 | 2.04614 | 2.14121 |
| St Gregory's Hill Hillfort Phase 4 | 1.43399 | 0.934217 | 1.97078 | 2.09405 |
| West Hill Hillfort Phase 3 | 1.56586 | 0.919928 | 2.08981 | 2.07346 |
| West Hill Hillfort Phase 4 | 1.59633 | 0.914055 | 2.15003 | 2.09196 |
| Mid Hill Hillfort Phase 4 | 1.35955 | 0.961867 | 1.71777 | 1.9693 |
| Mid Hill Phase 5 | 0.681193 | 1.17211 | 1.26681 | 2.11032 |
| Ring Chesters Hillfort Phase 4 | 1.96991 | 0.853546 | 2.99452 | 2.33289 |
| ***Median*** | **1.46267** | **.934217** | **2.04614** | **2.09405** |
| ***Mean*** | **1.438500429** | **0.95980314** | **2.033694286** | **2.11617** |

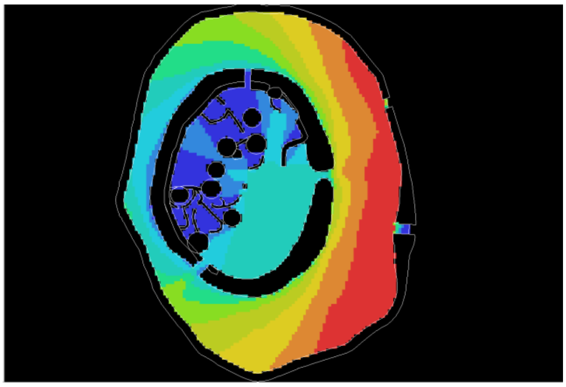
FIGURE 6.2.4.a Connectivity measurements of Roman Iron Age settlements from the NSR (not to scale)



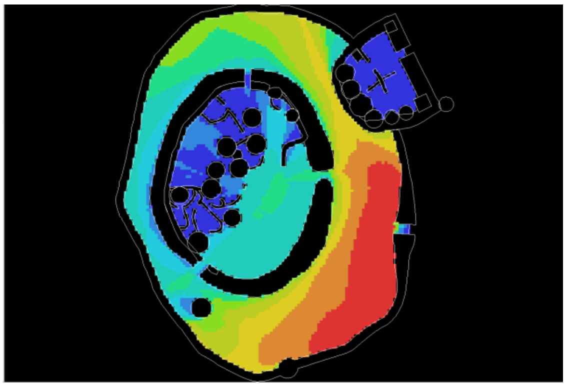
ST GREGORY'S HILL PHASE 2



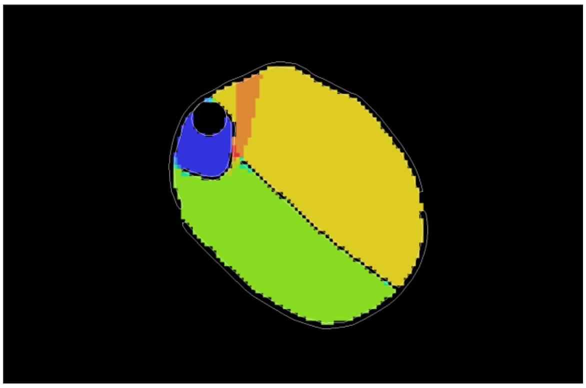
ST GREGORY'S HILL PHASE 3



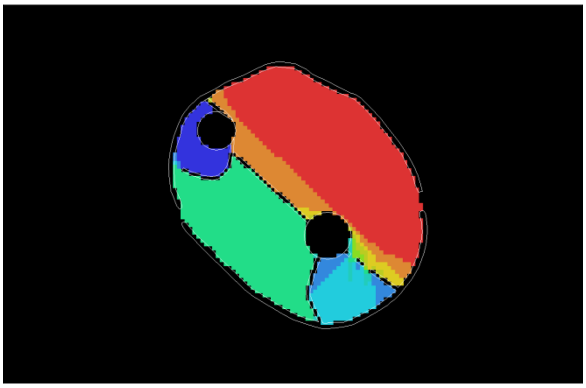
WEST HILL PHASE 3



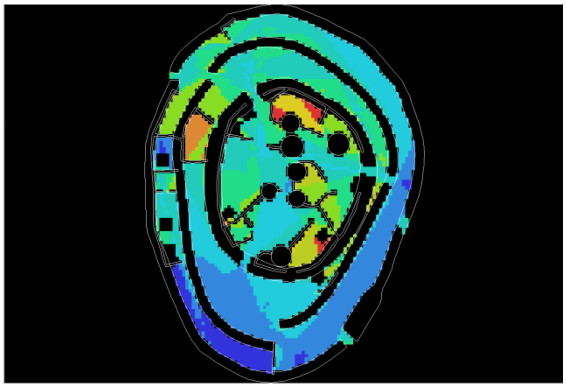
WEST HILL PHASE 4



MID HILL PHASE 4

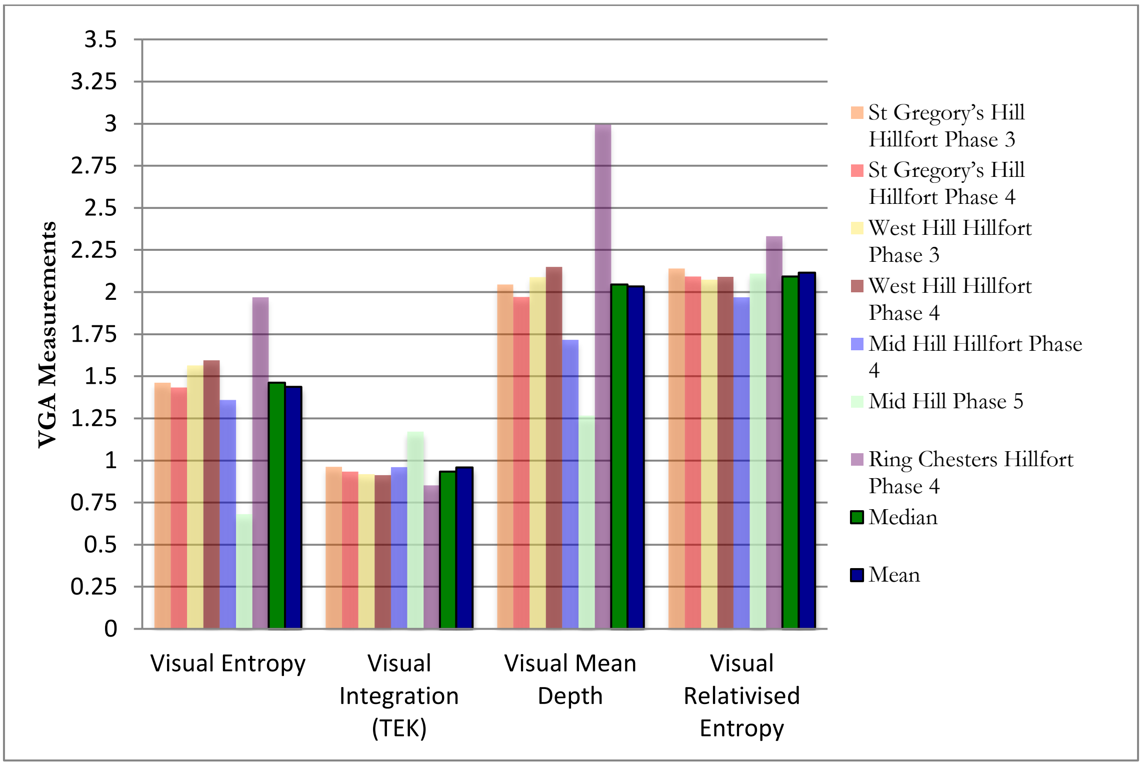


MID HILL PHASE 5



RING CHESTERS PHASE 4

FIGURE 6.2.4.b Visibility graph analysis results on Roman Iron Age settlements from the NSR



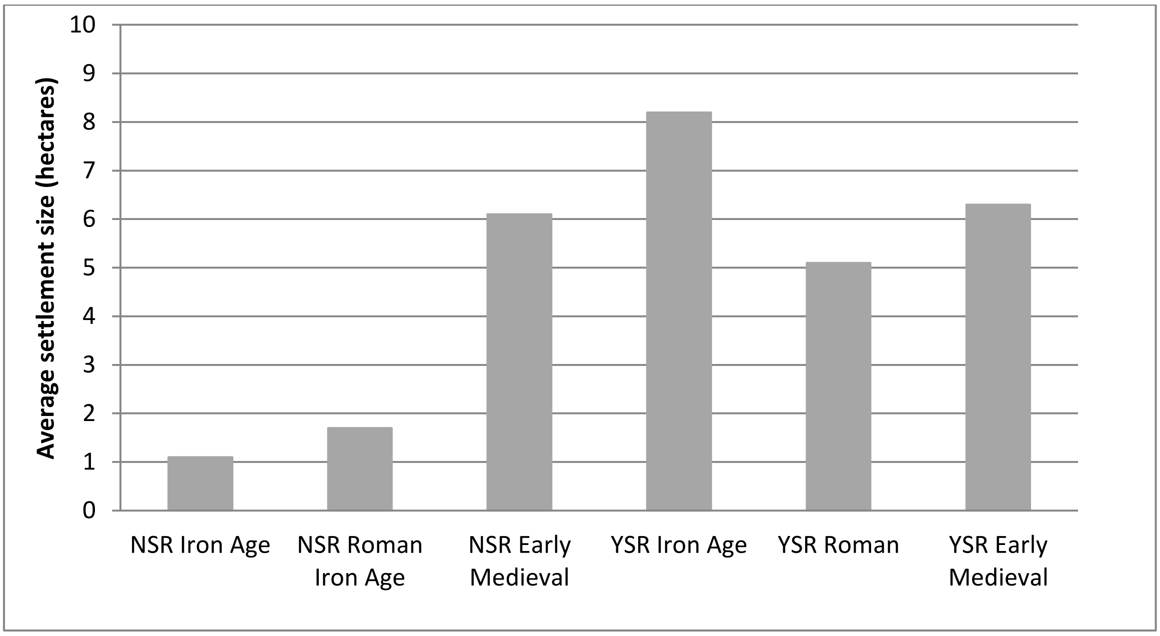

Although the global measurement scores from the Roman Iron Age settlements were similar to one another, the hillforts at Mid Hill and Ring Chesters differed from St Gregory's Hill, West Hill, and the overall median/mean scores. Both Mid Hill and Ring Chesters' spatial layout changed more dramatically from the Iron Age to Roman Iron Age than the other hillforts, with internal boundaries separating these settlements into discrete areas. As none of these sites have been excavated, it is difficult to determine what the function was for these enclosures. Nonetheless, the increased number of internal boundaries signifies a change in how the space and the built environment were developed, used, and/or thought about.

The internal use of space within structures was not examined for any settlements from the Roman Iron Age in the NSR due to the inability of the earthwork surveys to distinguish any differentiation within the structures. This is not to say that roundhouses did not have formalised activity areas that divided internal space into functional areas, but these did not leave physical remains of structural demarcation, so they were not analysed using VGA.

## 6.2.5 EARLY MEDIEVAL SETTLEMENTS FROM THE NORTHUMBERLAND STUDY REGION

The Early Medieval settlements selected for VGA from the NSR differed in shape, style, and location from the analysed Iron Age and Roman Iron Age settlements, and were generally located in river valley basins associated with the Rivers Till and Tweed and their tributaries, as opposed to the Cheviot hilltops. As discussed in the landscape analysis (Chapter 4), there were significant differences in the spatial locations of Early Medieval settlements in the Milfield Basin/NSR, implying a different settlement pattern that appears to prefer lower elevations and a greater access to water resources. The Early Medieval settlement plans, unlike the Iron Age and Roman Iron Age sites, were based on excavations or aerial reconnaissance surveys. For the most part, the Early Medieval settlements are not bounded by defensive walls or enclosures, and were spread out across a much broader area than the more compact hillfort settlements of the Iron and Roman Iron Ages. Where boundaries do occur, they often come in the form of fenced or ditched enclosures that partially bounded portions of the sites. In addition, the style and materials of the structures is very different, shifting from roundhouses to rectangular, timber-framed structures and sunken-featured buildings. Figure 6.2.5 shows the size of the analysed settlements from the Iron Age, Roman Iron Age, and Early Medieval periods in the NSR and the YSR. The enclosed hillforts were the smallest analysed settlements used in this research, and contrast with the NSR Early Medieval as well as the settlements in the YSR.

FIGURE 6.2.5 Average size (hectares) of the analysed settlements in the NSR AND THE YSR




Two Early Medieval settlements identified only through cropmark evidence are also included in the VGA analysis of the Northumberland study region. These two sites have extensive plans based on the aerial photographic evidence. Cropmarks do not show all of the features within a settlement, and it is difficult to discern phasing purely based on this type of evidence. In addition, only certain types of feature display cropmarks based on the type of feature, the underlying geology, the overlying vegetation, and the relative size of the feature. "Experience shows that on many soils, only disturbances larger than a certain minimum size promote crop-marks, while smaller features may not be seen at all save under very favourable conditions" (St Joseph, 1981, p. 194). Regardless of the problems associated with using cropmarks in VGA, generally speaking the spatial arrangement of the sites was identified in the cropmark evidence. In addition, many fine examples of Early Medieval settlement in both regions are only based on aerial evidence or another form of remote sensing, and therefore it was felt these needed to be included in the analysis. The Early Medieval settlements analysed in VGA are described in detail below.

#### 6.2.5.1 YEAVERING/AD GEFRIN (NT 926 304)

Arguably the most important settlement in the NSR examined using VGA, the Early Medieval royal vill at Yeavering (also referred to as Ad Gefrin and Old Yeavering) is historically and archaeological significant to Early Medieval studies. As discussed in Chapter 5, the Early Medieval *villa regia* at Yeavering, interpreted by Hope-Taylor as the royal centre Bede refers to as *Ad Gefrin* is located where the foothills of the Cheviots meet the Milfield Basin approximately 1 kilometre east of the village of Kirknewton and to the north of and overlooked by Yeavering Bell (Hope-Taylor, 1977, pp. 5–6).

Brian Hope-Taylor led the excavations at Yeavering from 1953-1962. Large portions of the 'whaleback' terrace north of Yeavering Bell and above the River Glenn were excavated to identify the cropmarks noted by St Joseph in 1949 (Hope-Taylor, 1977, p. 4; O'Brien, 2011, p. 209). Other features outside of the excavation boundaries were known to Hope-Taylor at the time of publication (1977, p. 5), and subsequent studies revealing that the Early Medieval built environment landscape at Yeavering was much more extensive than Hope-Taylor believed. Nonetheless, the excavated features at Yeavering are quite extensive and have become, as O'Brien describes "(…) the definitive archaeological expression of the architecture of early medieval kingship in England in much the same way that Sutton Hoo expresses its burial rites" (O'Brien, 2011, p. 207). The key features of the built environment are:

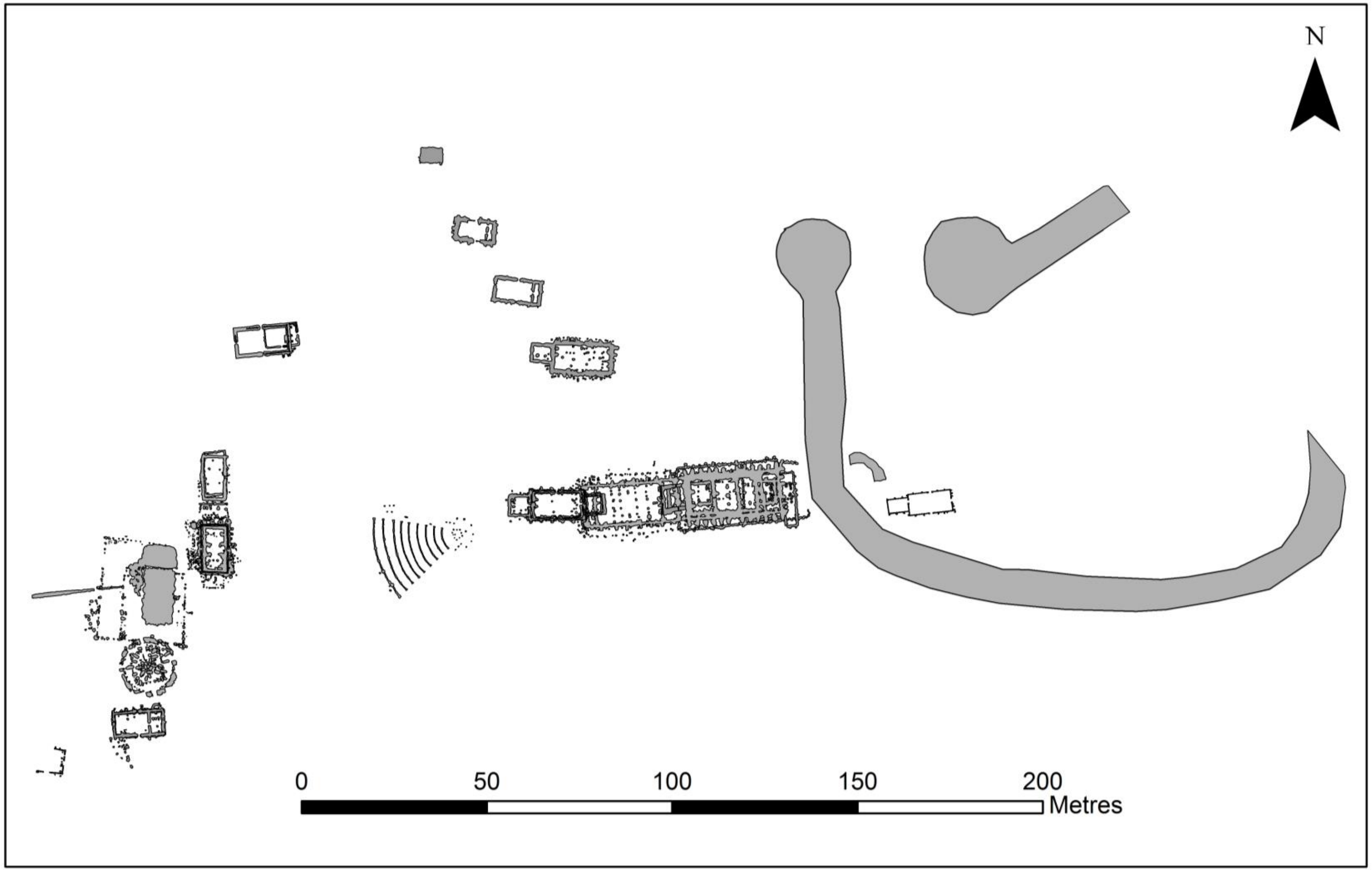
- The large double-palisaded enclosure dubbed the *Great Enclosure* by Hope-Taylor (1977, p. 78) sits along the eastern edge of the terrace. Due to limitations on time and funding, very little of the Great Enclosure was excavated, concentrating in the western circle of the entrance works and near Building B, a later structure built over and through the enclosure (Hope-Taylor, 1977, p. 80, Fig. 33). The Great Enclosure's function has been extensively debated, including defensive fortifications, a stock enclosure, and a region of ideological significance (O'Brien, 2005). Future research on the enclosure, including excavations of the interior, is needed to provide more adequate analysis of the feature.

- The unique Building E, in the approximate centre of the settlement, consisted of nine concentric-arc trenches that have been interpreted as an auditorium, perhaps for the site of open-air Christian conversion/services. This timber-framed, almost stadium like structure could have seated approximately 150 (in the early phase) to 300 people (in later phase of development) (Hope-Taylor, 1977, pp. 119–122; O'Brien, 2011, p. 208). Hope-Taylor argued that the shape of the structure focused the attention of the "audience" on the small dais, which would have had room for a single speaker in front of a large wooden post (Hope-Taylor, 1977, p. 161)

- Four of the timber-framed buildings (A2, A4, A3a, A3b) were dubbed great halls due to their large size. Associated with these structures were smaller buildings at the opposite end of a fence-lined 'courtyard' enclosed space (A1a,b,c). Other timber-framed structures on the west and north ends of the site were of a similar construction style, but built to a smaller scale and were dubbed Lesser Halls (Buildings C1-4, D1-D3) (Hope-Taylor, 1977, pp. 125–147, 150; O'Brien, 2011, p. 210).

- Besides the structural remains, there were large inhumation burials to the east and western sides of the site (Hope-Taylor, 1977; O'Brien, 2011, p. 210). These two groupings were clustered around two prehistoric ring ditches, suggesting these were still visible on the landscape during the Early Medieval period and deliberately reused.

FIGURE 6.2.5.1All phases of occupation at Yeavering (Ad Gefrin)

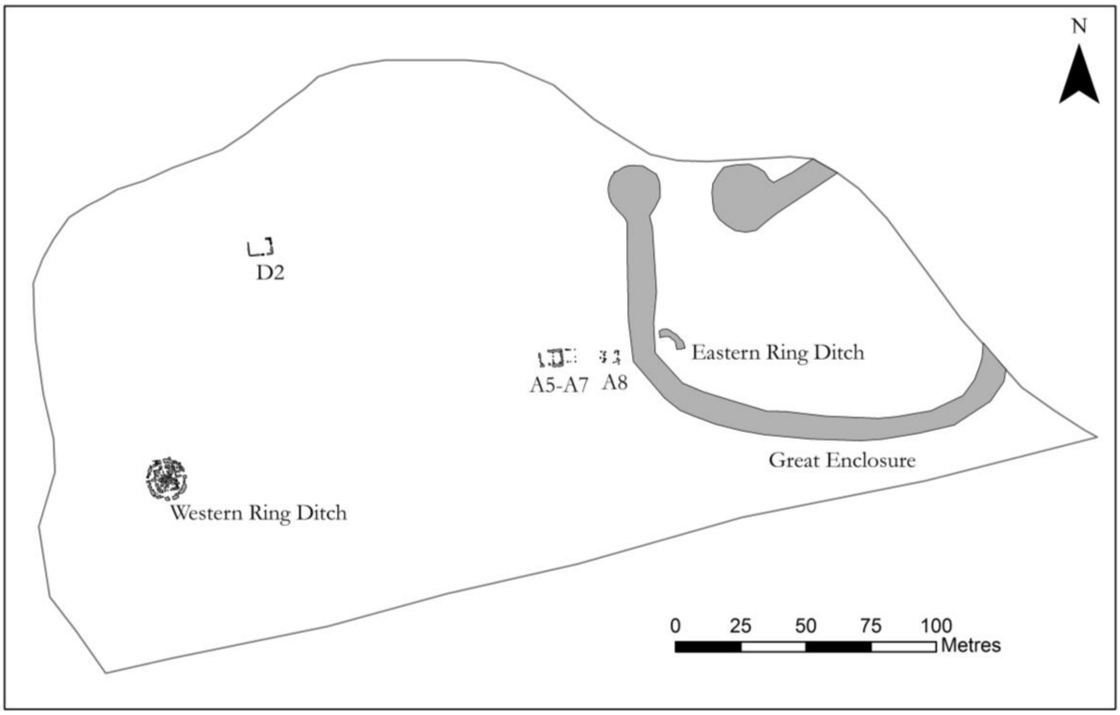


Hope-Taylor identified six chronological phases based on stylistic differences in the structures as well as on the stratigraphic relationship between the excavated features (Hope-Taylor, 1977, p. 152, Fig. 72). In total, eight construction styles were identified at the settlement based upon the structural differences in size, framework, doorways, and construction technique. These styles, along with two different fires that razed the settlement, allowed Hope-Taylor to construct the relative dating and phasing of the settlement that was used for the VGA of the site. The phasing was key to Hope-Taylor's interpretation of Yeavering as being the location of culture-contact between the native Britons and the Anglo-Saxons because he felt that a number of features began earlier than the 5th century. This contact led to a hybrid-culture that developed "a harmonious relationship between the native population and a minute, governing Anglo-Saxon elite, itself susceptible and responsive to formative influences from its British environment" (Hope-Taylor, 1977, p. 282). Scholars have debated Hope-Taylor's phasing, especially in the earliest Post-Roman phases. While it has been critiqued, Hope-Taylor's phasing is used in this thesis due to its highly detailed nature as well as the lack of an accepted redefined phasing (O'Brien, 2011; Scull, 1991). The following details each phase as well as the buildings that are examined by VGA. These buildings were chosen to compare the results of the settlement analysis to the interior of a structure, and each of these buildings had internally differentiated spaces.

#### 6.2.5.1.A PHASE I (POST-ROMAN BRITISH)

By the time of the earliest post-Roman phase at Yeavering, c. AD 550, Hope-Taylor estimated that the Great Enclosure had been constructed (Figure 6.2.5.1.a). In addition, structures A5-7, A8, D-6, and the adjustments to the Western and Eastern Ring Ditches had been made. This phase of settlement at the site arguably was the sparsest, and Hope-Taylor attributes it to the indigenous British. Chris Scull has questioned this, and pointed out the many similarities of the Phase I structures to structures at the nearby Early Medieval site of Thirlings. If this is so the Phase I structures are a similar date to the Phase II structures, which alters the spatial layout of the site (Scull, 1991, p. 58). Scull notes that a revisit to the site would be needed to confirm this hypothesis, and therefore the layout and phasing devised by Hope-Taylor was used for this analysis.

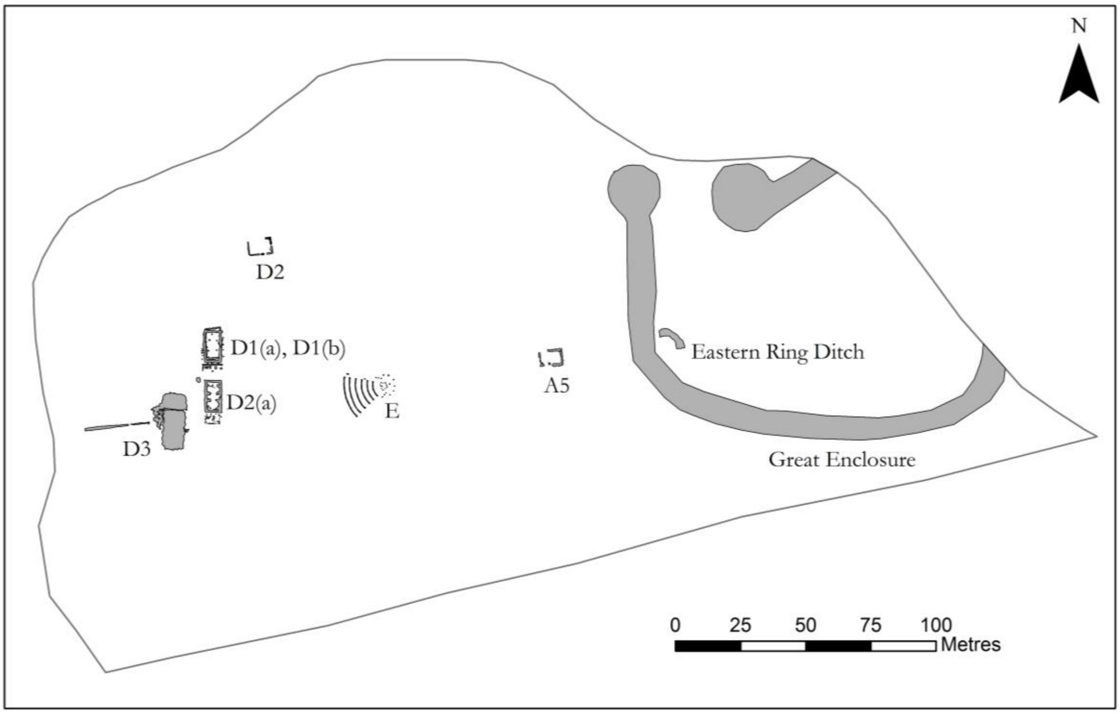
FIGURE 6.2.5.1.a Phase I (Post-Roman British) at Yeavering




### 6.2.5.1.B PHASE II

The earliest phase of Building E, the auditorium-like structure, date to this period. Two hall-like structures, D1 and D2(a) were constructed and used during Phase II and according to Hope-Taylor, were different from the later halls at the settlement due to their construction style and orientation north-south as opposed to east-west (Figure 6.2.5.1.b). Building D3 was also constructed during this period, and was used as a kitchen supplying activities in D1 and D2(a) (Hope-Taylor, 1977, p. 158). Figure 6.2.5.1.b shows the layout of the settlement during this period, including how the new halls replaced the use of the Western Ring Ditch while the Eastern Ring Ditch was still in evidence beside the Great Enclosure.

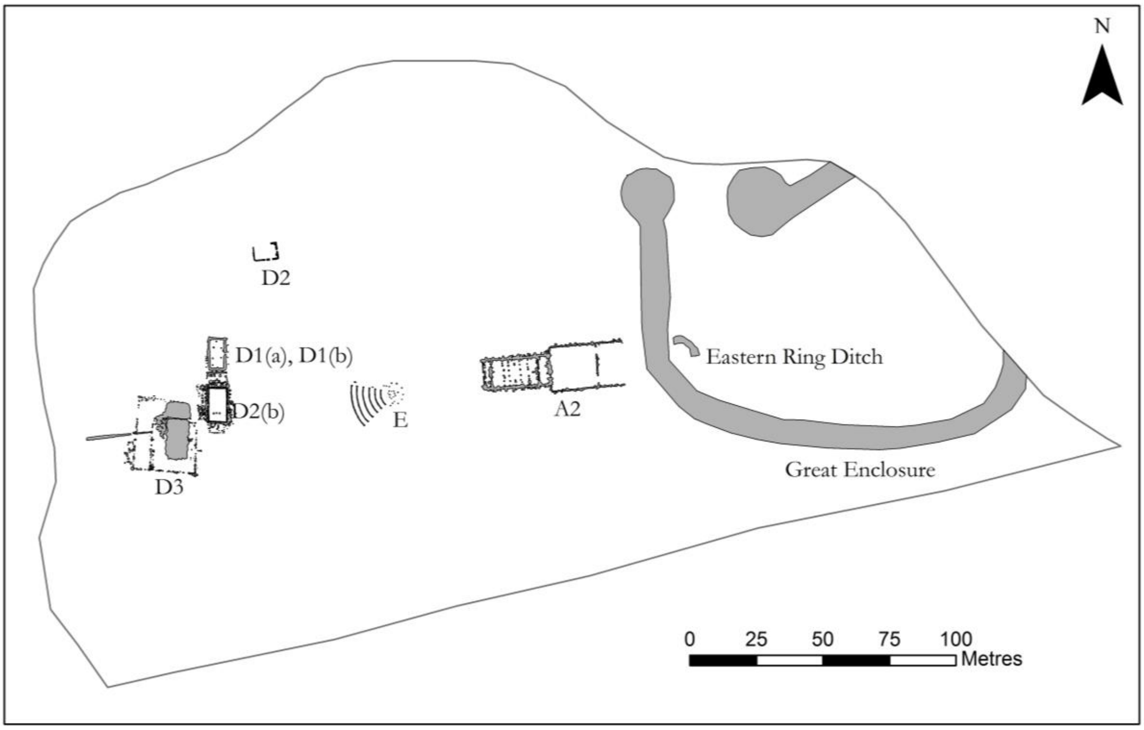
FIGURE 6.2.5.1.b Phase II at Yeavering




### 6.2.5.1.C PHASE IIIAB

Due to the development of larger and more elaborate structures during this phase, "(…) the character and status of the township are first plainly declared; and here also is the beginning of that striking massiveness and precision in construction" (Hope-Taylor, 1977, p. 161). During this phase, building D2(b) was constructed at D2(a), preserving its earlier functional shape while making it larger. Contemporary burials were clustered around the southern end of D2(b), emphasising its importance for ritual (Hope-Taylor, 1977, p. 158, Figure 6.2.5.1.c). Building E continued to be in use, and building A2, the first of the great halls, was constructed along with its associated palisade.

FIGURE 6.2.5.1.c Phase IIIab at Yeavering



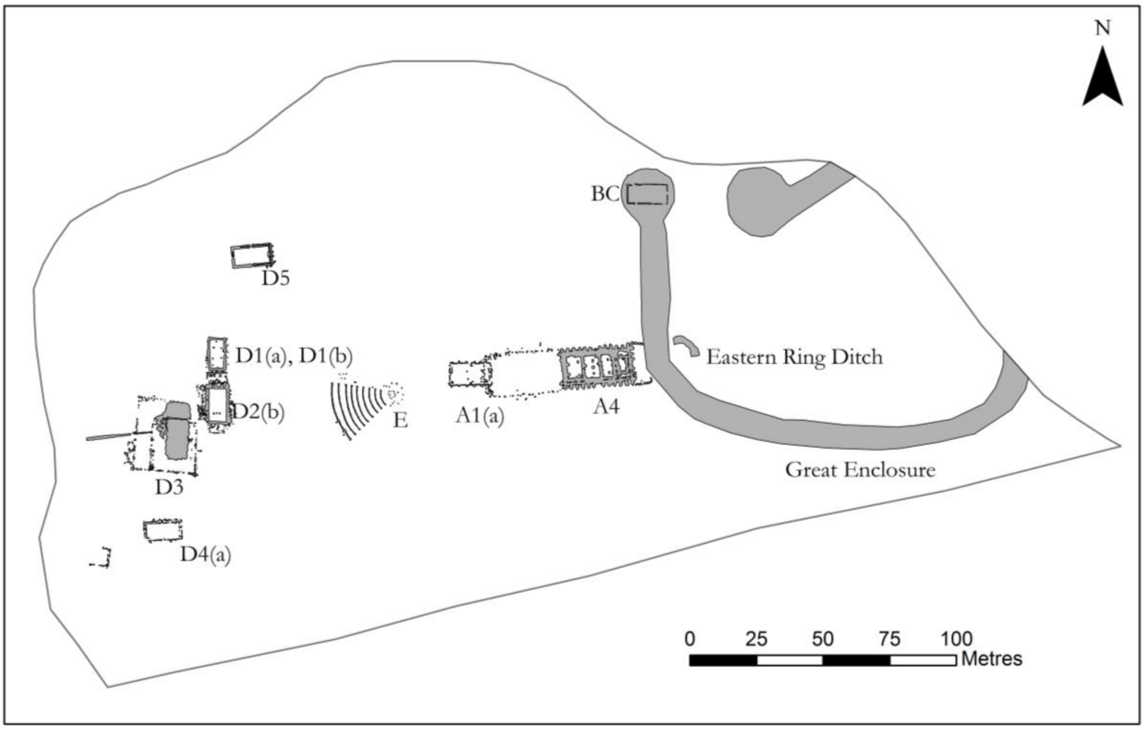

## 6.2.5.1.D BUILDING A2, PHASE III

This building, the first of the great halls at Yeavering, was internally faced with plaster and had two axial passageways that divided the interior (Figure 6.2.5.1.d). A small grouping of post-holes may have represented a chair or throne near the open area of the main passage, and the building's associated palisade may have had a variety of functions, such as a paddock for horses or tents for soldiers (Hope-Taylor, 1977, p. 161). As described in Chapter 5, this structure was analysed using VGA to compare the overall use of space during Phase IIIAB with the internal differentiation and use of space within a structure.

## 6.2.5.1.E PHASE IIIC

Yeavering grew between IIIab and IIIc, with the enlargement of capacity at Building E, the rebuilding of the Great Enclosure in a more elaborate and style, the replacement of Building A2 by the larger A4, and the addition of other minor halls (Figure 6.2.5.1.e). Building A4 was constructed along a similar axis to A2 in the location of the former structure's enclosure. Two fenced enclosures extended away from Building A4; one connecting the eastern elevation to the Great Enclosure and one connecting to Building A1(a), which replaced Building A2. In addition, hall D5 and BC were constructed, with BC being located in one of the circular entrance-works of the Great Enclosure. Finally, Building D4(a) was built south of the small grouping of structures containing Buildings D1, D2, and D3. Figure 6.2.5.1.e shows the plan of Phase IIIC. One of two fire events that occurred during the life of the occupation of Yeavering ended Phase IIIC.

FIGURE 6.2.5.1.e Phase IIIc at Yeavering



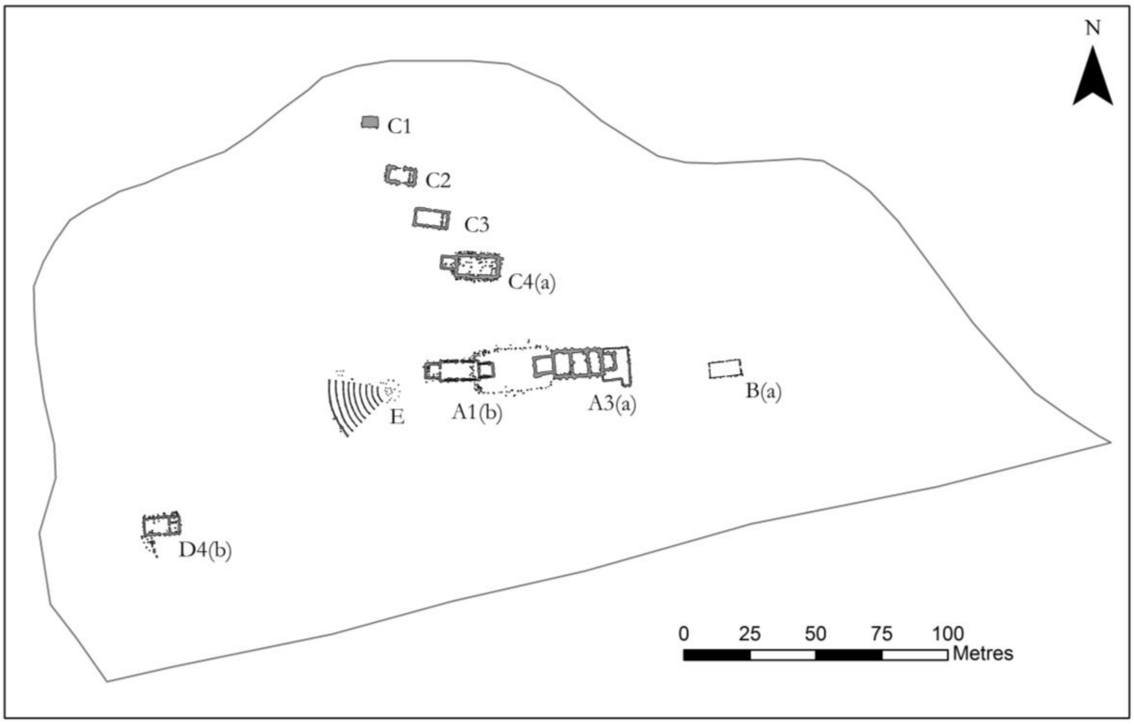

### 6.2.5.1.F BUILDING A4, PHASE IIIC

The largest of the halls constructed at Yeavering, Building A4 was built later than A2 and while it bore similarities to that hall, it contained only two rooms along the western and eastern elevations (Hope-Taylor, 1977, p. 60, Figure 6.2.5.1.f). Six internal posts divided the interior, and entrances were positioned in the structure along the north, south, east, and west. This structure was analysed in visibility graph analysis to compare the use of space within the structures with Phase IIIC.

### 6.2.5.1.G PHASE IV

The rebuilding of Yeavering during Phase IV after the fire ended Phase IIIC included the construction of new halls that and the rebuilding of Building E (Figure 6.2.5.1.g). "The new halls were constructed in a new style strongly suggestive of external influence; but Building E, the ravages of fire repaired, remained for a while to dominate the new pattern as it had the old" (Hope-Taylor, 1977, p. 164). Buildings D1, D2, and D3 go out of use with the construction of Building B, within the location of the now defunct Great Enclosure, serving as the new "temple" and centre of burial. Along with the reconstruction of Building E, the two great halls of Buildings A1(b) and A3(a) were built in the location of A4 and A1(a). While similar in size and scope, and connected by an enclosed palisade, the internal differentiation of the buildings was much different during this phase, indicating a different use of space. Along with the changes to the internal differentiation, the Great Enclosure disappears which dramatically changes the visibility in the site and the ability to move through the settlement's space. Hope-Taylor implies this phase was discarding the hybrid British past and embracing the Anglo-Saxon. A second fire consumed the entire township and ended this phase of settlement.

FIGURE 6.2.5.1.f Phase IV at Yeavering




6.2.5.1.H BUILDING C4(A), PHASE IV

Building C4(a) was part of a small complex of structures in Area C constructed on a diagonal line extending northwest from the great hall of A3(a) (Figure 6.2.5.1.h). The largest of these structures, C4(a) was a rectangular structure with a small square-shaped room along the western elevation. This room had an offset doorway to the opposite entrance to the building, and there were internal posts supporting the roof.

6.2.5.1.I BUILDING A1(B), PHASE IV

Connected to Building A3(a) by an enclosure, this rectangular structure had two smaller square-shaped annexes on the western and eastern elevations on the western and eastern elevations of the building (Figure 6.2.5.1.i).

#### 6.2.5.1.J BUILDING A3(A), PHASE IV

Built over Building A4 and of a similar scale, there are important internal differentiations to Building A3(a) that are indicative of a change in how space was thought about and used during this phase of settlement. Discussing this change, Ware states that:

> From Phase IV the emphasis is placed much more strongly on controlling interior space. The exterior enclosures in Area A disappear. Partitions and annexes, creating a series of separate spaces with access closely controlled from the centre of the building characterise structures A3(a) and A3(b) in Phases IV and V (Ware, 2009, p. 158).

The internal partitions in Building A3(a) and offsetting of doorways breaks the line of site between spaces in the structure, and would have directed movement in particular ways containing meaning to the individuals entering and using the space (Figure 6.2.5.1.j). Ware argues that this formalising of the spatial organisation of A3(a) and later A3(b) was reflective of the changes to the social and political transformations of Anglo-Saxon society in the 7$^{th}$ century (Ware, 2009, p. 159). Due to the key role of the hall in Early Medieval society linking multiple classes together, changes to how this space was organised may demonstrate changes in societal class and roles.

#### 6.2.5.1.K BUILDING D4(B), PHASE IV

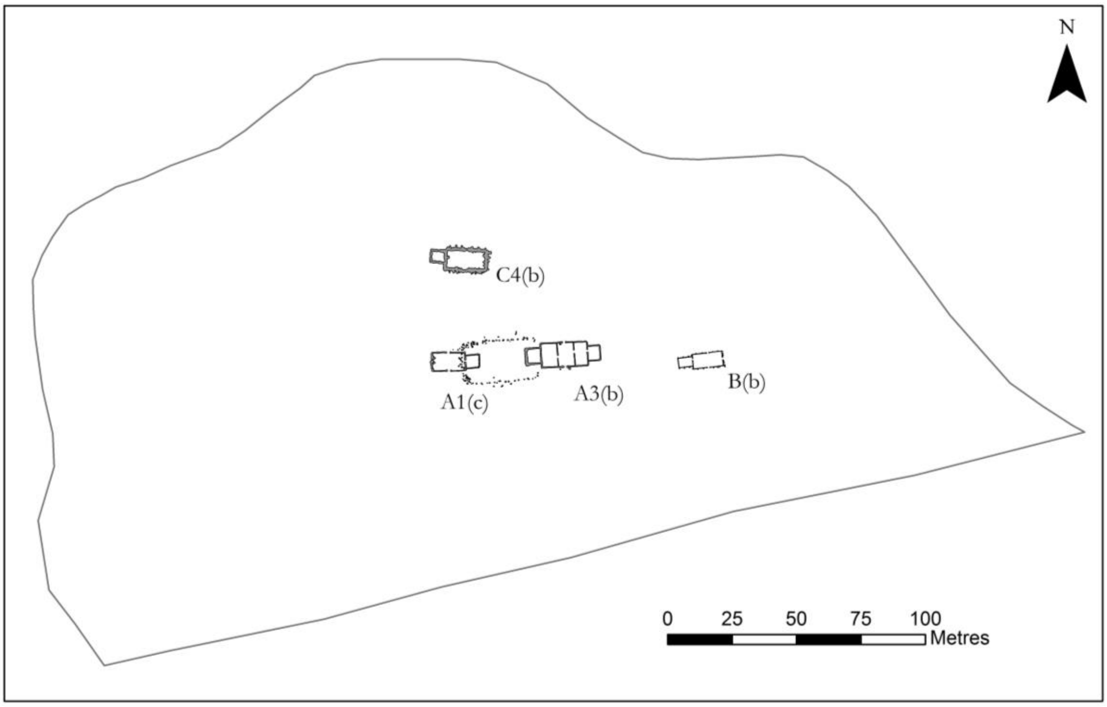
Building D4(b) was built south of the structural complex of D2 and D3, which by Phase IV had disappeared (Figure 6.2.4.1.k). Like the other structures from this phase, there was more internal differentiation in Building D4(b) than in the preceding phases of settlement. The structure was divided into two spaces, with the western room larger than the eastern. A partition wall further subdivided the eastern room, and the outside doorway into the space was offset from the internal door to the western room.

#### 6.2.5.1.L PHASE V

Four structures were rebuilt after the devastating fire that ended the Phase IV settlement on the similar footprints of preceding buildings (Figure 6.2.5.1.l). The rebuilding on the footprints of preceding buildings indicates an importance to these spatial locations, and is in contrast to the settlement shift model seen at other Early Medieval settlements. Structures

C4(b), B(b), A3(b), and A1(c) were clustered in the approximate centre of the terrace. Although the halls were still quite large and impressive, the smaller number of structures, as well as their cheaply made, plank-clad style implies that the settlement had started to decline. This was the final phase of occupation at the site, and the royal centre presumably moved to Milfield after Yeavering was abandoned. Three of the four buildings from this phase were analysed.

FIGURE 6.2.5.1.l Phase V at Yeavering




### 6.2.5.1.M BUILDING B(B), PHASE V

Building B overlays the Great Enclosure, and is constructed to the east of the great halls (Figure 6.2.5.1.m). Interpreted as a Christian church due to the large number of graves found around the structure, Building B(b) was a rectangular building similar in shape to Building C4(a) described in the previous section with a small square-shaped annex along the western elevation (Hope-Taylor, 1977, p. 73).

### 6.2.5.1.N BUILDING A1(C), PHASE V

Constructed on a similar alignment to the other A1 structures and connected by an enclosure to Building A3(b), Building A1(c) was smaller than the preceding buildings, and had a different spatial orientation and style (Figure 6.2.5.1.n). It had a small square-shaped annex along the eastern elevation of the building. This structure was the only building at Yeavering that had a small, added annex along the eastern elevation; the other structures with a single additional room were along the western elevations.

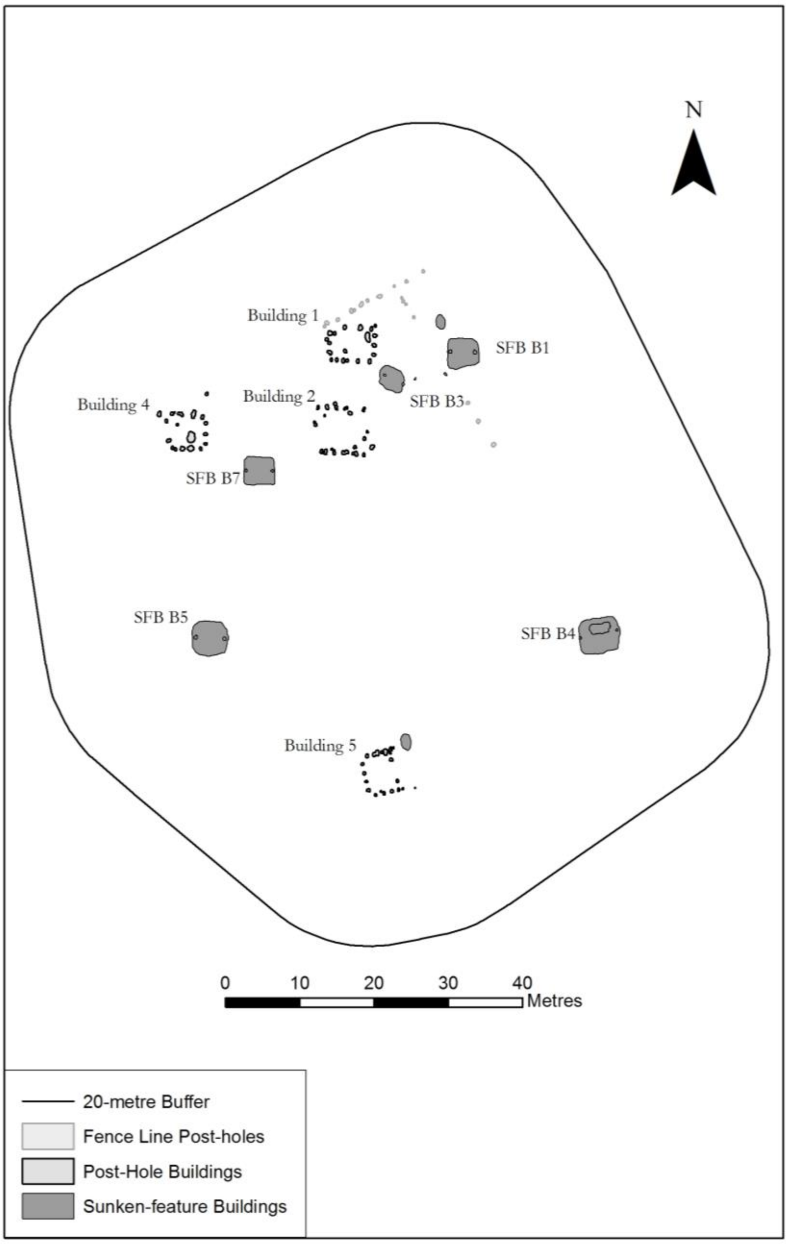
#### 6.2.5.1.O BUILDING A3(B), PHASE V

Similar in size and shape to Building A3(a), the main difference in the spatial orientation of Building A3(b) was the offset doorways and internal partitions (Hope-Taylor, 1977, p. 151; Ware, 2009, p. 158, Figure 6.2.5.1.o). The doorways were more offset than in Building A3(a), and altered the internal visibility so that no room was entirely visible from the other. This change further delineated the space, and would have affected and structured the movement and activities within the building.

### 6.2.5.2 LANTON QUARRY (NT 9564 30602)

Prior to extraction at Lanton Quarry, archaeologists from Archaeological Research Services, Ltd (ARS) excavated approximately 9.5 hectares of land and exposed evidence of Neolithic, Bronze Age, and a small Early Medieval settlement (Stafford and Johnson, 2007, p. 10). The site is located approximately 5 kilometres north of Wooler, and the Early Medieval portion of the site included seven grubenhäuser (SFBs as labelled by the authors), four post-in-ground rectangular buildings, two post-in-ground fencelines, a pit, and associated artefacts (Stafford and Johnson, 2007, p. 79, Figure 6.2.5.2). This small grouping of structures and fencelines is interpreted as a small rural settlement, and based on structural similarities was thought to date to a similar period as Thirlings and Lanton Quarry. It is unknown if this grouping represents the full extent of the settlement, or if other features are located outside of the quarry excavation area.

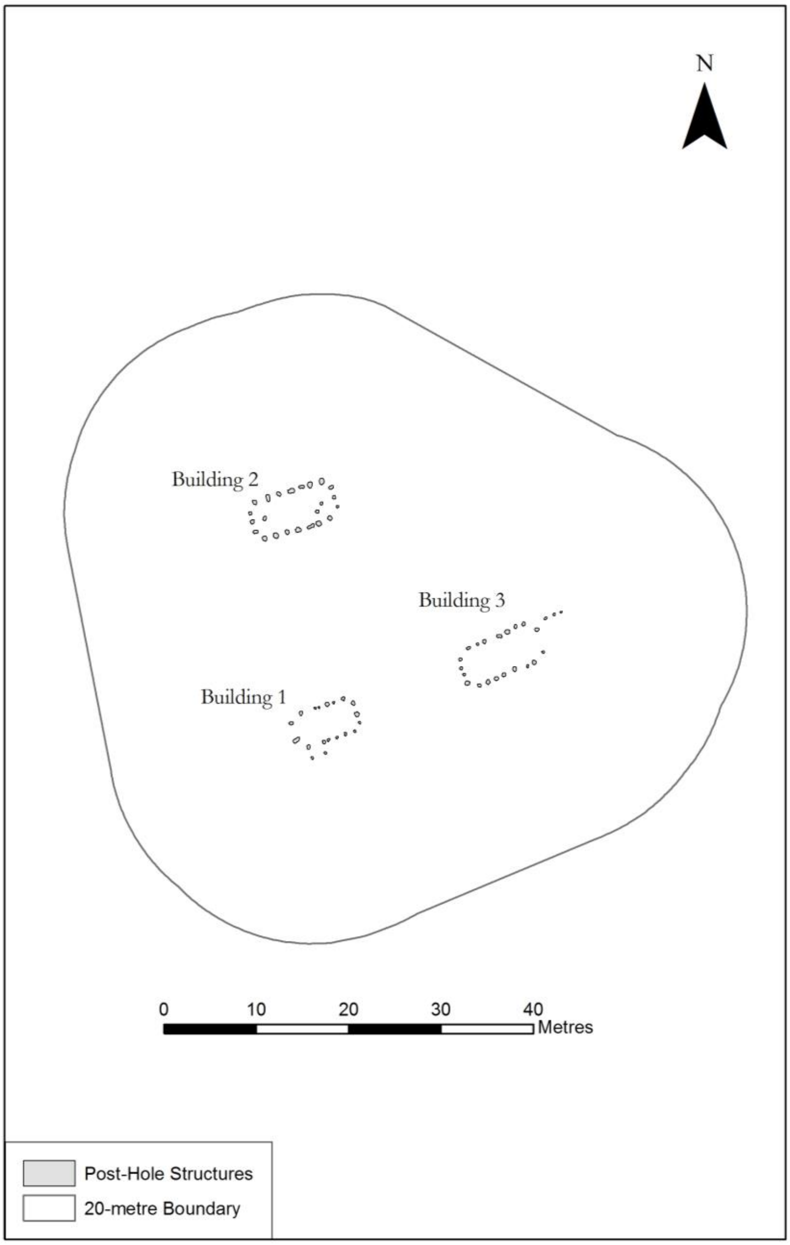
FIGURE 6.2.5.2 Lanton Quarry




## 6.2.5.3 CHEVIOT QUARRY (NT 95210 32715)

In advance of extraction at Cheviot Quarry, located to the north of Lanton Quarry and south of Milfield, ARS exposed prehistoric and Early Medieval settlement evidence (Figure 6.2.5.3). The Early Medieval evidence included three rectangular post-in-ground structures arranged in a triangular layout roughly 15 metres apart (Johnson and Waddington, 2008, p. 157). Although no artefactual evidence was found, radiocarbon dating of barley seeds associated with the postholes yielded a calibrated date of AD 330-570 (Johnson and Waddington, 2008, p. 174). This grouping represents a small rural farmstead.

FIGURE 6.2.5.3 Cheviot Quarry

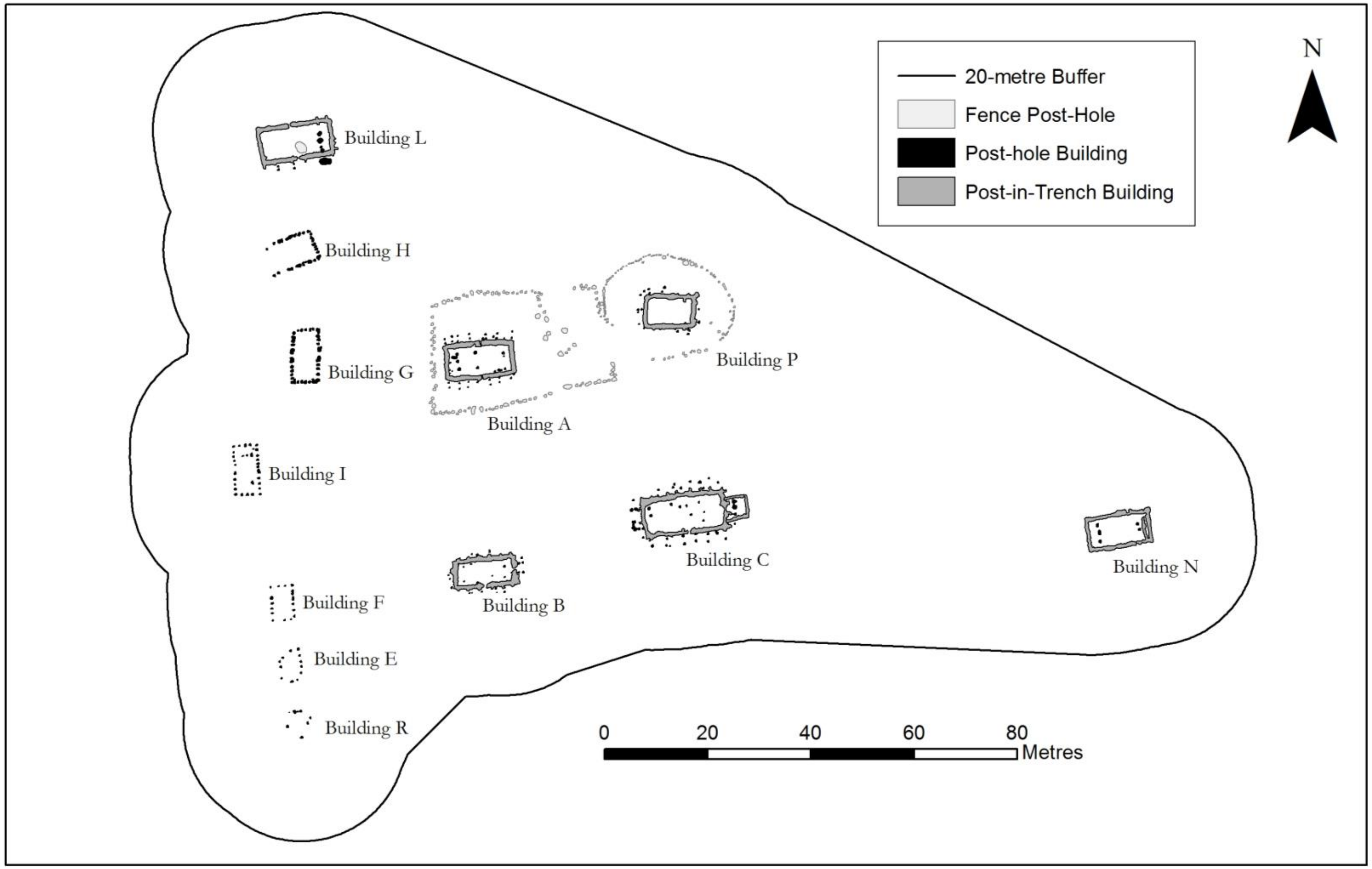



## 6.2.5.4 THIRLINGS (NT 95673 32131)

The Early Medieval settlement of Thirlings, located approximately 5 kilometres north of Wooler and within 3 kilometres of the Early Medieval settlements of Yeavering and Maelmin, was originally identified through cropmark evidence of six rectangular-shaped structures (Figure 6.2.5.4). Excavations led by Colm O'Brien and Roger Miket in the 1970s and 1980s focused on the cropmark evidence and identified the remains of six continuous trench buildings aligned roughly east/west, six post-in-ground buildings, and two post-in-ground enclosures surrounding two of the structures (O'Brien and Miket, 1991, pp. 57, 61). The excavations cleared off the plough-soil mechanically from an area surrounding the observed six rectangular cropmarks and attempted to extend beyond these areas to find evidence of enclosure, which was not observed. However, the authors noted other nearby cropmarks, potentially grubenhäuser, indicating that the excavated settlement may be only a portion of the overall site (O'Brien and Miket, 1991, p. 61).

Radiocarbon dating of the settlement provided a calibrated date of 539-599 AD, with the authors arguing that the structural evidence at Thirlings represents a single phase with all of the buildings and enclosures in use simultaneously (O'Brien and Miket, 1991, p. 88). The, different construction styles of post-in ground and post-in trench remains, however, may be indicative of chronological development at the site relating to different phases (Hamerow, 2012, p. 24; Passmore et al., 2012, p. 298). This settlement was analysed as a single phase in alignment with the excavators' ideas, because none of the structures overlapped one another implies an arrangement of structural space incorporating all of the structures, even if they were not occupied at the same time. Although similar stylistically to the structures at Yeavering, the scale of the structures and their layout at Thirlings appears more similar to the settlements at Lanton and Cheviot Quarry. Leslie Alcock has suggested that Thirlings may have been a subsidiary settlement supplying agricultural produce to the kingly residences at Yeavering and Milfield, a model that Thirlings' excavators felt explained its position in the social hierarchy of Bernicia (Alcock, 1988; O'Brien and Miket, 1991, p. 90). Buildings C, N, and A were all post-in-trench constructions, while Building I was a post-hole construction. These buildings are chosen as representative examples of the internal household differentiation that occurred at Thirlings.

FIGURE 6.2.5.4 Thirlings



#### 6.2.5.4.B BUILDING C, THIRLINGS

The largest structure at Thirlings, Building C was a post-in-trench construction and built with the largest timbers at the site (O'Brien and Miket, 1991, p. 65, see Figure 6.2.5.4). Building C was a rectangular shaped structure with an eastern square-shaped annex. Although the largest building at the site, it was much smaller than the great halls of Yeavering, and aligns more closely in size to Building C4(a) at Yeavering. Buildings C, N, and A were aligned roughly east-west

#### 6.2.5.4.B BUILDING N, THIRLINGS

Building N was built on the same alignment as the other post-in-trench structures, but was built much further (65 metres) to the east of the main structural complex (O'Brien and Miket, 1991, p. 69). A small partition extended north from the southern wall approximately 0.6 metres from the eastern elevation of the structure, and three posts divided the western wall into another small area (see Figure 6.2.5.4).

#### 6.2.5.4.C BUILDING A, THIRLINGS

Building A was located in the centre of the structural complex within a rectangular enclosure (O'Brien and Miket, 1991, p. 61). Internally, a line of postholes partitioned off the western end of the structure into a different zone for habitation or activities (see Figure 6.2.5.4).

#### 6.2.5.4.D BUILDING I, THIRLINGS

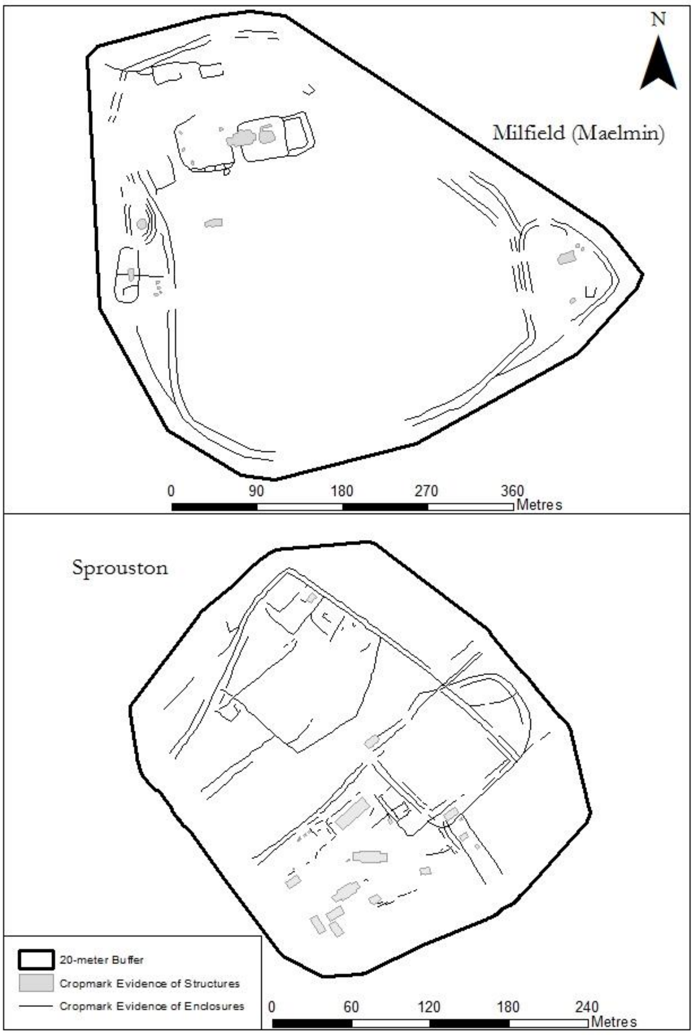
This rectangular building shared similarities with Building C by having a partition wall extending from the southern wall along the eastern edge of the building (O'Brien and Miket, 1991, pp. 74–75; see Figure 6.2.5.4). Unlike the other analysed structures, Building I was constructed entirely using post-holes and timbers, and was aligned roughly north-south as opposed to east-west.

It can be argued that the other small Early Medieval settlements found in the region, such as at Lanton and Cheviot Quarry, were similar in size, shape, and style as Thirlings and these settlements were important to the economic and political power of the royal vills at Yeavering and Milfield. Based on the supposed interrelationship between these subsidiary settlements, Yeavering, and Milfied there should be similarities in how the inhabitants of these settlements viewed and used their space and built environment that can be discerned by VGA.

### 6.2.5.5 MILFIELD/MAELMIN (NT 941335 33731)

Along the eastern boundary of the village of Milfield is one of the archaeological settlements identified by aerial photography of cropmarks (Figure 6.2.5.5) by St Joseph in 1948. The cropmarks at Milfield were examined by St Joseph and others, first mapped by Hope-Taylor and later cartographically refined by Gates and O'Brien (Gates and O'Brien, 1988, p. 3; Hope-Taylor, 1977, p. p 13, fig. 7). "The identification of the place-name Milfield with the Anglian palace or *villa regia* known to Bede as Maelmin (or Melmin) is well known (…)" (Gates and O'Brien, 1988, p. 2), and the cropmark evidence at Milfield has been widely accepted as the evidence of Maelmin. Bede noted that the royal centre of Ad Gefrin (Yeavering) was abandoned by the later Northumbrian kings and moved to Maelmin (*EH* 2:14). Gates and O'Brien (1977, p. 3) identified some of the cropmark evidence at the site as a large enclosure, buttressed timber halls, an outlying palisade, and various pits and potentially 40 grubenhäuser surrounding the settlement.

FIGURE 6.2.5.5 Milfield/Maelmin and Sprouston



#### 6.2.5.6 SPROUSTON (NT 75893 36308)

The cropmark evidence at Sprouston was also identified by St Joseph during aerial surveys in 1964, and was interpreted as an Early Medieval settlement of a similar time period to Yeavering Phase IV, based on typological similarities of Sprouston to Yeavering and Milfield (St Joseph, 1981, p. 198). The settlement is approximately 3.5 kilometres northeast of Kelso along the southeast bank of the River Tweed in Roxburghshire, and the cropmark evidence extends across roughly 8 hectares (St Joseph, 1981, p. 191, see Figure 6.2.5.5). Sprouston shares similarities with Yeavering and Maelmin in that it appears to have a large enclosure, timber halls, an associated cemetery, and is located on a similar geographic locale of arable land situated on a river valley bottom (St Joseph, 1981, p. 198). St Joseph (1981, p. 198) interpreted Sprouston as a settlement of a "more modest kind" based on its size and the lack of mention by Bede as compared to Ad Gefrin and Maelmin. Although interpreted as a settlement of less status/size of Yeavering and Maelmin, this still quite large complex demonstrates that the NSR witnessed extensive habitation during the Early Medieval period.

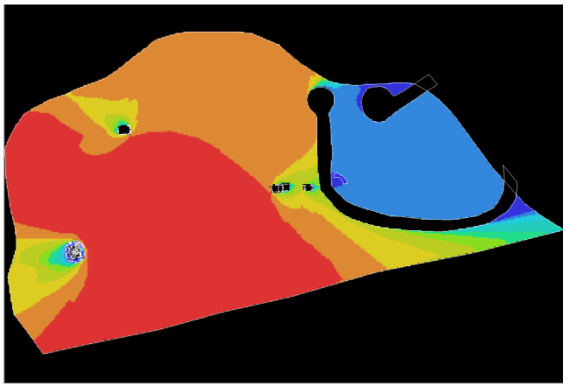
### 6.2.6 VISIBILITY GRAPH ANALYSIS OF EARLY MEDIEVAL SETTLEMENTS IN NORTHUMBERLAND STUDY REGION

The results of VGA conducted on the Early Medieval settlements from the NSR are shown in Tables 6.2.6.a and Figures 6.2.6.a and 6.2.6.b. Figure 6.2.6.a shows representative differences in the VGA measurements, while Figure 6.2.6.b charts these differences. As in the Iron Age and Roman Iron Age settlements, the median and average scores of the measurements are similar, implying a standard pattern of demarcation and use of space in the Early Medieval period. There is, however, more variability in the measurement scores across the phases and settlements during the Early Medieval period, which possibly reflects differences in the morphology and scale of the settlements as well as differences in recording techniques of the Early Medieval sites. Sprouston and Milfield are the main outliers in the VGA results. Their drastically different global measurement scores, particularly visual entropy and visual mean depth, are related to the fact that the plans used for VGA are based on cropmark evidence recorded during aerial survey. Based on this evidence, it is difficult to determine phasing of features, and it is probable that many of the included features were not related to the same occupational phase. That said, the integration and entropy measurements at Sprouston and Milfield align well with the other settlements, implying that some aspects of the use of space are reflected in their plan.

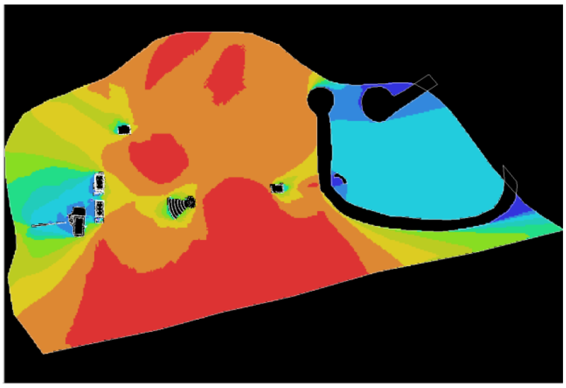
TABLE 6.2.6.a Visibility Graph Analysis of Early Medieval Settlements in the NSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Yeavering Phase 1 | 1.13247 | 1.0072 | 1.56686 | 2.01936 |
| Yeavering Phase II | 1.29297 | 0.9815665 | 1.68864 | 1.98659 |
| Yeavering Phase IIIab | 1.39071 | 0.965922 | 1.79164 | 1.98952 |
| Yeavering Phase IIIc | 1.40498 | 0.95719 | 1.84771 | 2.02527 |
| Yeavering Phase IV | 0.95463 | 1.02061 | 1.41955 | 2.0357 |
| Yeavering Phase V | 0.77163 | 1.08252 | 1.2455 | 2.0149 |
| Lanton Quarry | 0.8949 | 1.05197 | 1.34943 | 2.01571 |
| Cheviot Quarry | 0.780001 | 1.11444 | 1.23974 | 2.00197 |
| Thirlings | 0.954828 | 0.992678 | 1.54914 | 2.16611 |
| Milfield (Maelmin) | 1.5222 | 0.970253 | 1.72882 | 2.12713 |
| Sprouston | 2.14 | 0.870432 | 3.42754 | 2.4405 |
| ***Median*** | 1.13247 | 0.992678 | 1.56686 | 2.01936 |
| ***Mean*** | 1.203574455 | 1.001343773 | 1.714051818 | 2.074796364 |

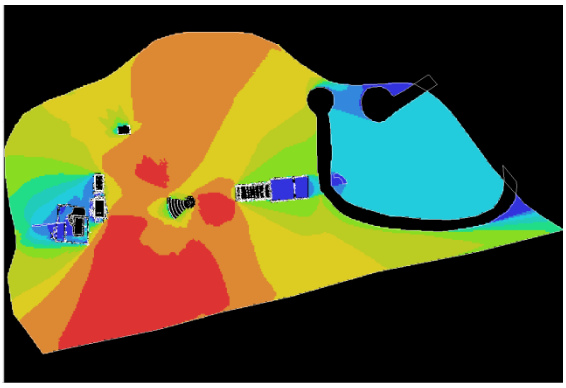
FIGURE 6.2.6.a Connectivity measurements of Early Medieval settlements analysed in NSR (not to scale).



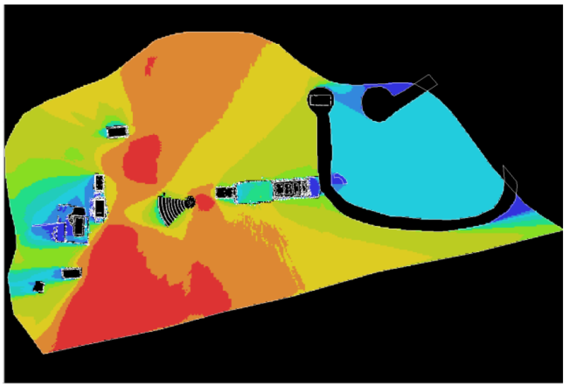
YEAVERING PHASE I



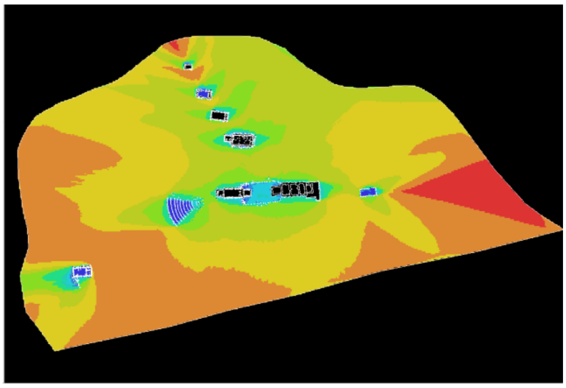
YEAVERING PHASE II



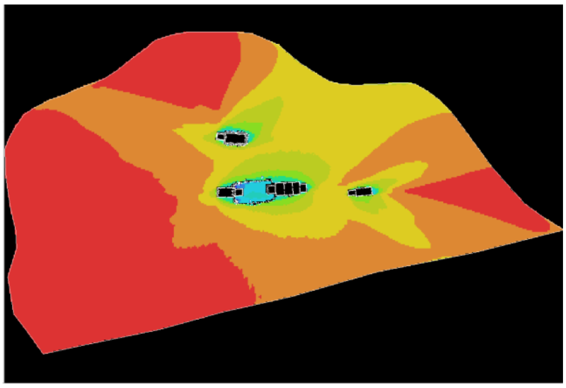
YEAVERING PHASE IIIab



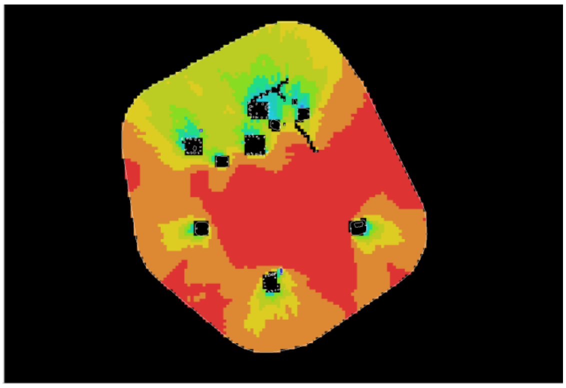
YEAVERING PHASE IIIc



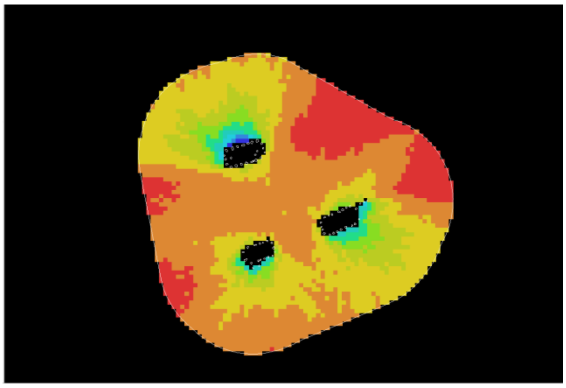
YEAVERING PHASE IV



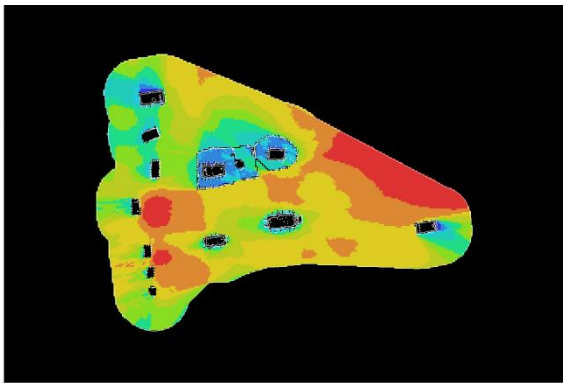
YEAVERING PHASE V



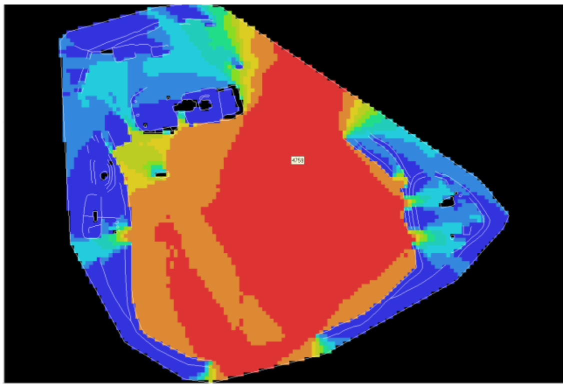
LANTON QUARRY



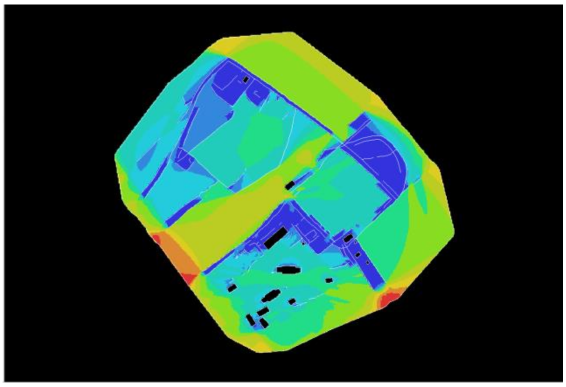
CHEVIOT QUARRY



THIRLINGS

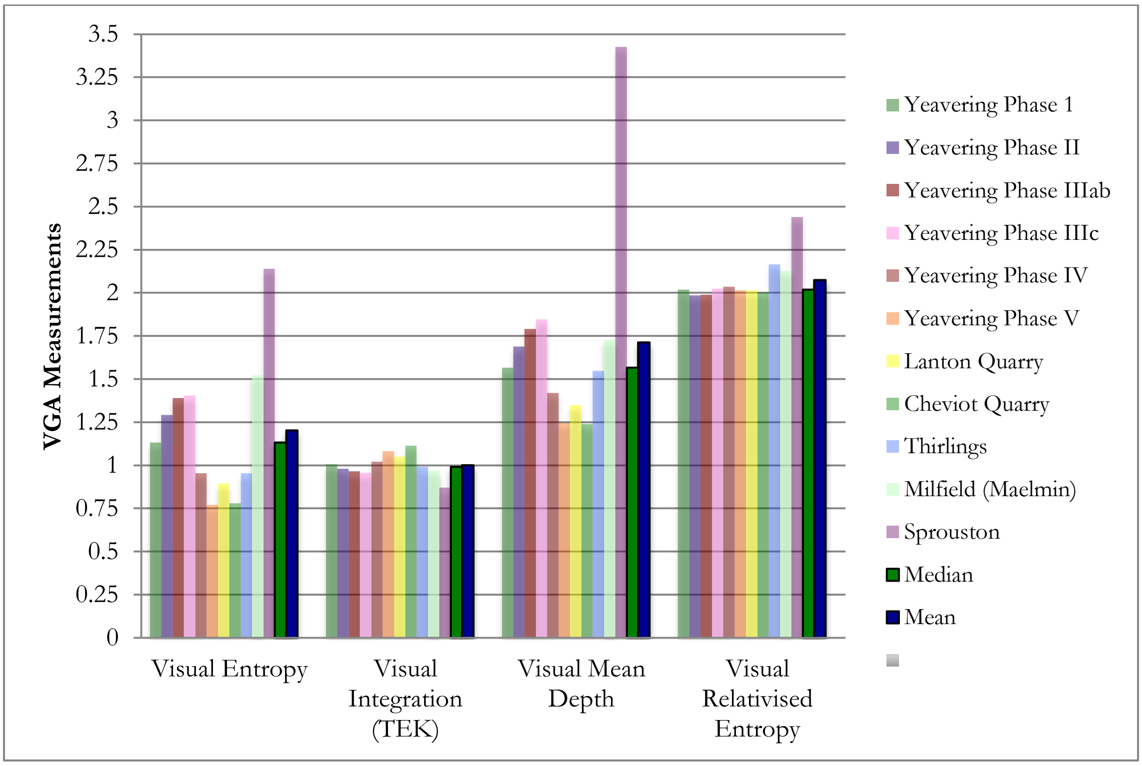


MILFIELD (MAELMIN)



SPROUSTON

FIGURE 6.2.6.b Visibility graph analysis results on Early Medieval settlements from the NSR



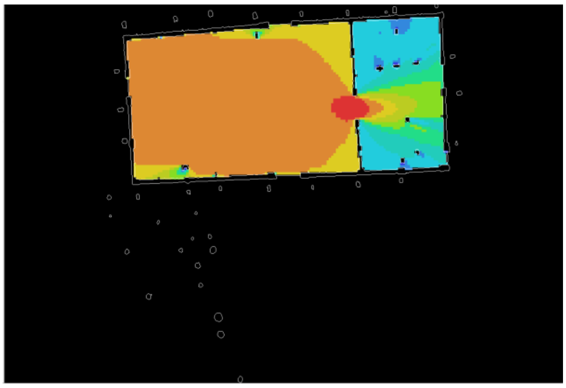

Overall, the Early Medieval settlements from this region were the most visually integrated and the least visually complex of the three periods analysed in the Northumberland study region (Figure 6.2.6.a). This is probably due to the morphological shape, scale, and style of the settlements that reflect a difference in Early Medieval settlement from the Iron Age and Roman Iron Age periods. Ramparts or enclosures did not enclose the Early Medieval settlements, and instead only partially bounded portions of settlements or were used for other purposes such as stockholding. The structural evidence from these sites tends to be more spread out, making them more visually integrated and presumably easier to move around in.

Unlike the examined Iron Age and Roman Iron Age settlements, the Early Medieval settlements contained structures with internal differentiation of space. A sample of these structures from Yeavering and Thirlings are also examined using VGA to compare the visual arrangement and use of space at the household and settlement levels. The results of this analysis are shown in Table 6.2.6.b, and the differences are shown in Figures 6.2.6.c and 6.2.6.d

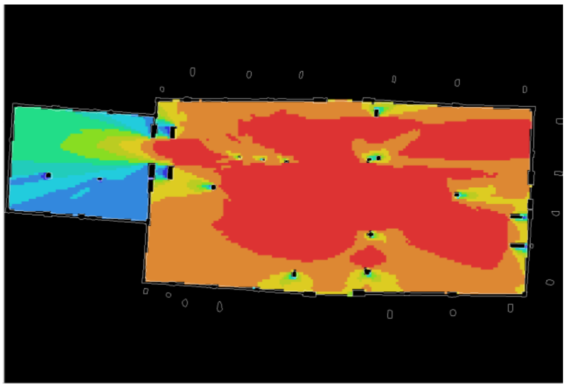
TABLE 6.2.6.b Visibility Graph Analysis of Early Medieval buildings in the NSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Yeavering Building D4(b) | 0.82365 | 1.0636 | 1.35824 | 2.08296 |
| Yeavering Building A3(a) | 1.513 | 0.928609 | 2.06438 | 2.10909 |
| Yeavering Building C4(a) | 0.830009 | 1.0614 | 1.34109 | 2.06067 |
| Yeavering Building A1(b) | 0.985884 | 1.02839 | 1.47853 | 2.04916 |
| Yeavering Building B(b) | 0.739554 | 1.10355 | 1.28265 | 2.0788 |
| Yeavering Building A1(c) | 0.768156 | 1.08961 | 1.301 | 2.07198 |
| Yeavering Building A3(b) | 1.52488 | 0.93483 | 2.00246 | 2.04719 |
| Yeavering Building A(4) | 0.82901 | 1.05314 | 1.35214 | 2.07276 |
| Thirlings Building A | 0.74688 | 1.11477 | 1.23703 | 2.02725 |
| Thirlings Building C | 0.494173 | 1.21085 | 1.16012 | 2.1649 |
| Thirlings Building N | 0.263345 | 1.42619 | 1.07983 | 2.28468 |
| Thirlings Building I | 0.719369 | 1.13015 | 1.27615 | 2.0856 |
| ***Mean*** | **0.853159167** | **1.095424083** | **1.411135** | **2.094586667** |
| ***Median*** | **0.795903** | **1.076605** | **1.321045** | **2.07578** |

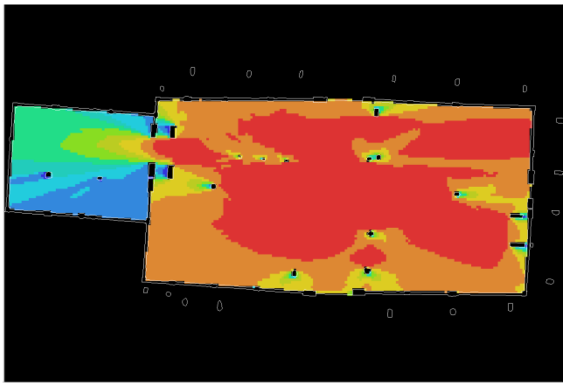
FIGURE 6.2.6.b Connectivity measurements of Early Medieval buildings analysed in NSR (not to scale).



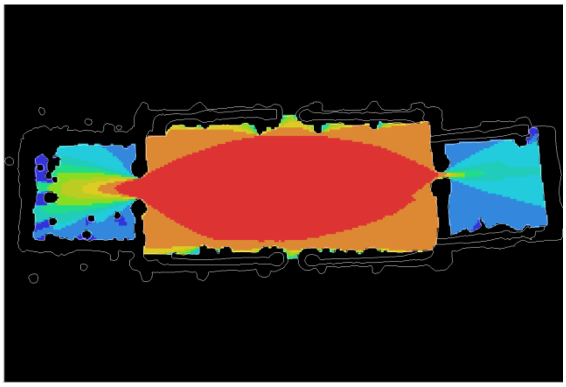
YEAVERING BUILDING D4(b)



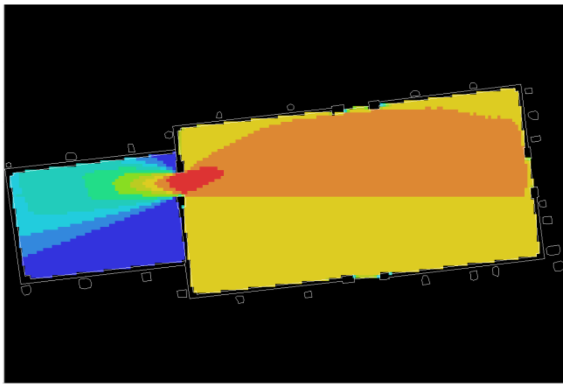
YEAVERING BUILDING A3(a)



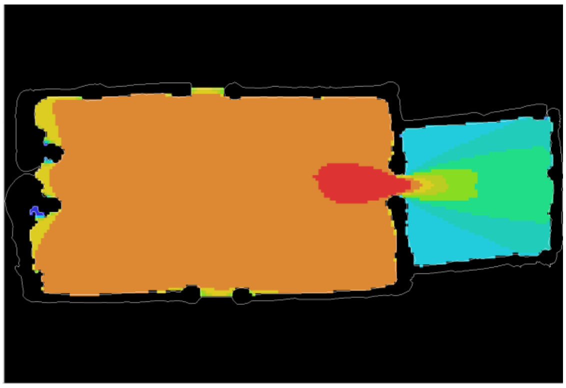
YEAVERING BUILDING C4(a)



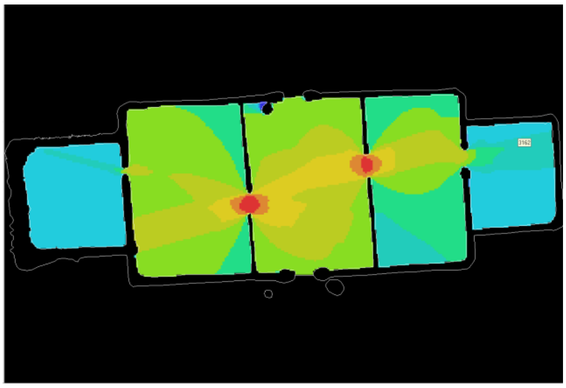
YEAVERING A1(b)



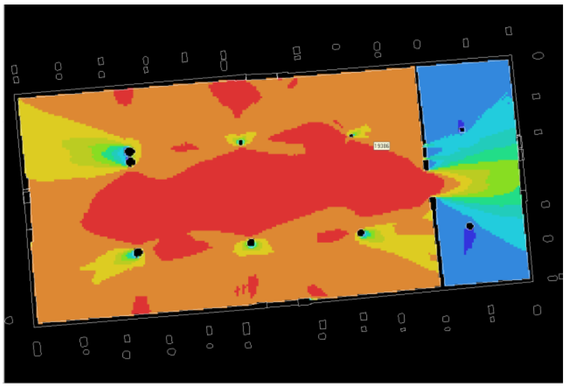
YEAVERING BUILDING B(b)



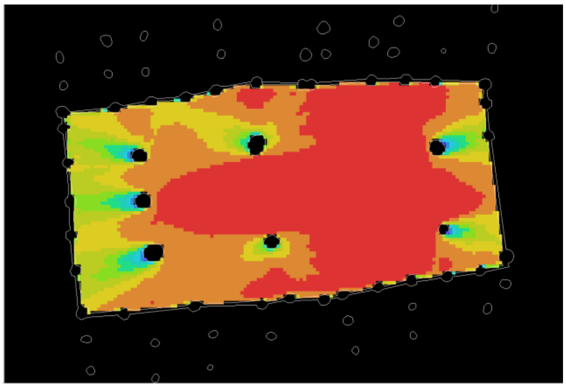
YEAVERING BUILDING A1(c)



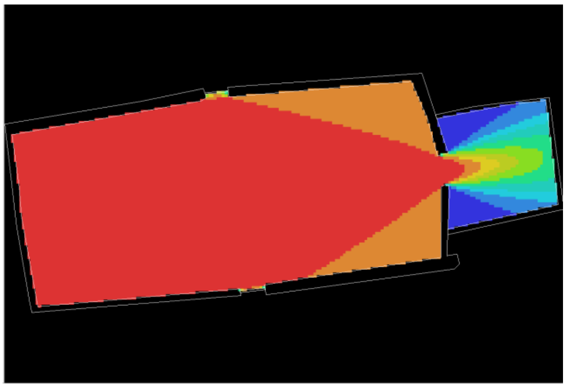
YEAVERING BUILDING A3(b)



YEAVERING BUILDING A4

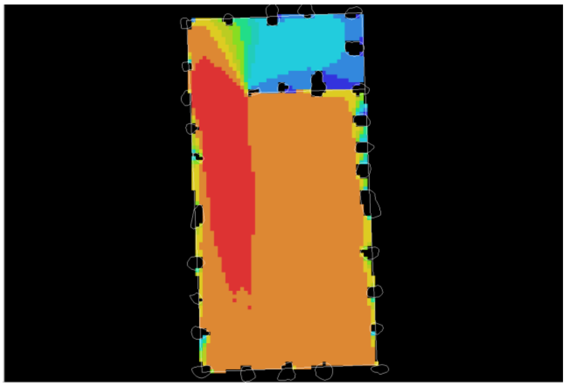


THIRLINGS BUILDING A



THIRLINGS BUILDING C

THIRLINGS BUILDING N



THIRLINGS BUILDING I

FIGURE 6.2.6.d Visibility graph analysis results on Early Medieval structures from the NSR

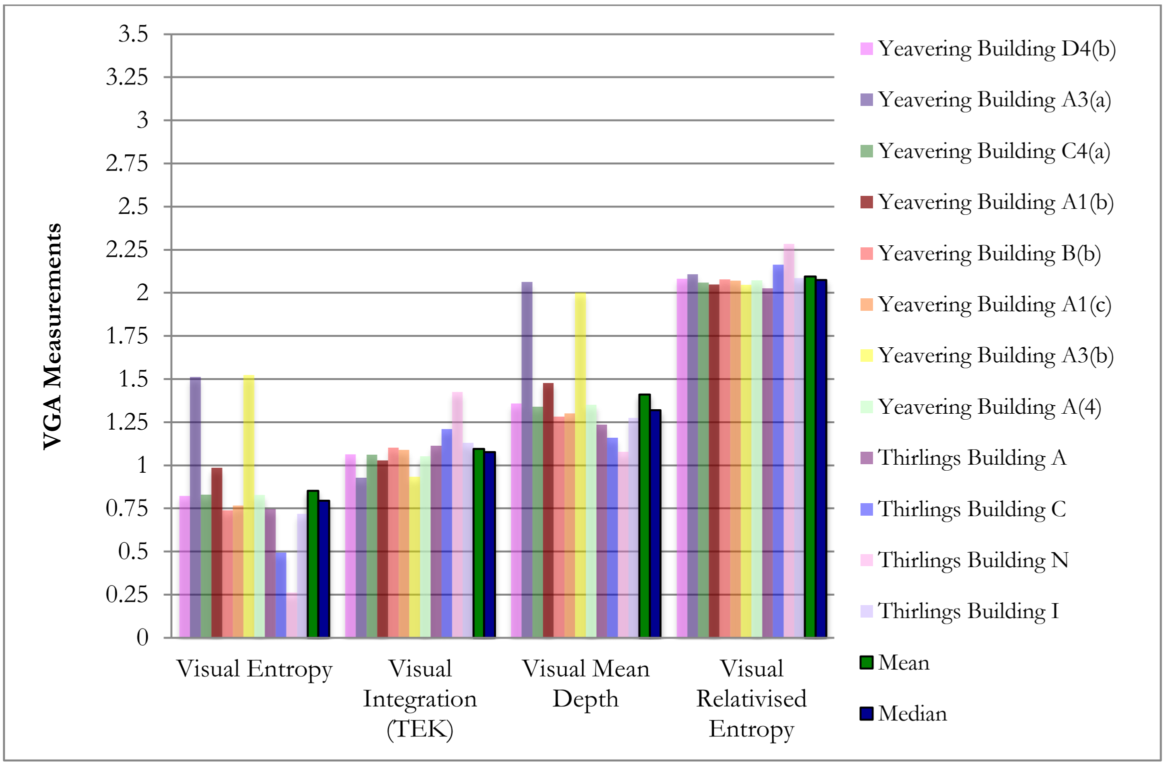
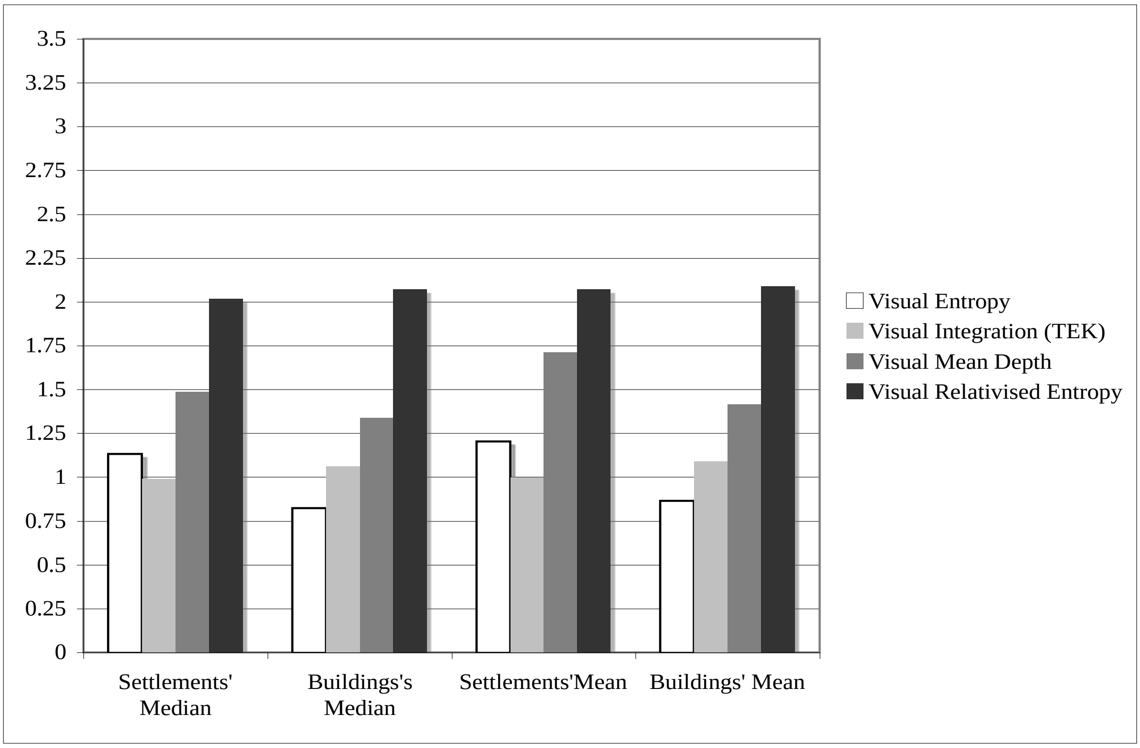



Figure 6.2.6.d demonstrates that, in general, there are more similarities between the Early Medieval structures across periods and settlements. The structures were examined to compare the visual arrangement of space in the settlements compared to the interior of structures. Figure 6.2.6.e shows the comparison of the average and median scores of all the Early Medieval settlements and structures form the NSR. The results are similar to the testing of the method in Chapter 5 at Yeavering and Housesteads, and demonstrate the similarity in how the Early Medieval period's settlements were visually organised. These results demonstrate a similarity in how settlements and structures were visually arranged in Early Medieval Northumberland. This is more fully explored in Chapter 7.

FIGURE 6.2.6.e Comparison of the average and median scores of Early Medieval settlements and structures from the NSR




## 6.2.7 SUMMARY OF VISIBILITY GRAPH ANALYSIS IN NORTHUMBERLAND STUDY REGION

In general, the Iron Age and Roman Iron Age global measurements are more similar to one another than to the Early Medieval settlements (Table 6.2.7 and Figure 6.2.7). Visual Entropy measures the complexity of a visibility graph by calculating the distribution of depths within a graph. Figure 6.2.7 shows that the Early Medieval period sites have the lowest visual entropy scores, followed by the Roman Iron Age and Iron Age. These measurements imply that the spatial organisation in the Early Medieval period was less visually complex than in the preceding periods. The visual integration measurement examines how visually integrated each node in a graph is to all of the nodes. A higher visual integration score implies a lower degree of visual complexity, and this score often is the inverse to visual entropy. In this case, the Early Medieval period has the highest integration measurements followed by the Roman Iron Age and Iron Age; implying a more open plan. Visual mean depth measures the fewest number of turns required to connect each grid point to all the other visible points in a graph. The lower average and median score, the fewer turns needed to move through a spatial layout and therefore the less complex an environment. Again, Early Medieval settlements from

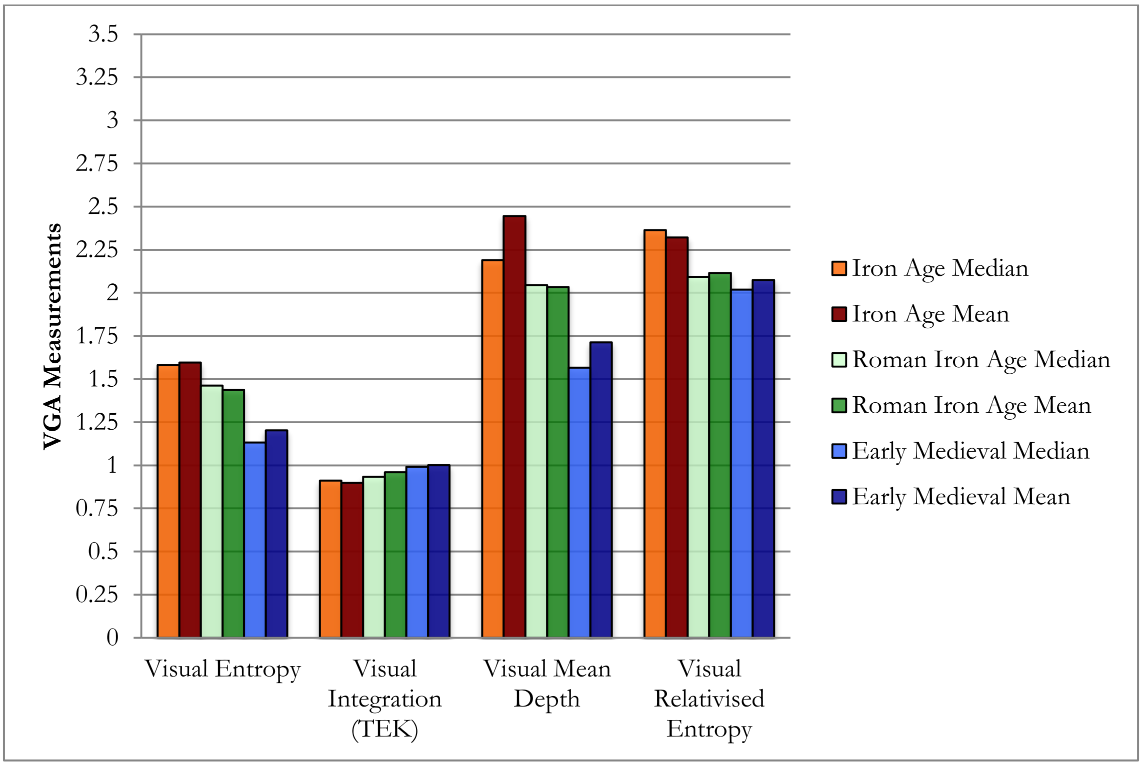
Northumberland are the lowest, followed by the Roman Iron Age and Iron Age. The final measurement, visual relativised entropy is similar to visual entropy, but is adjusted by 'smoothing' out the data of a visual entropy measurement. Like the Visual Entropy measurements, the higher the score, the more visually complex an area while the lower scores indicate a less visually complex space. Again, these results demonstrates that the Iron Age hillforts are the most visually complex, while the Early Medieval settlements are the least.

The trends in the data align with expectations, as many of the Roman Iron Age settlements were reoccupied Iron Age hillforts, so even though their spatial layout changed over time, the overall layout remained similar. Furthermore, it could have been expected that the Iron Age and Roman Iron Age measurements would align with these settlements being more visually complex and less integrated than the Early Medieval settlements due to the presence of more tightly defined enclosures. These results do show that the Early Medieval period settlements are quite different from the preceding periods in the NSR, corresponding to the landscape analysis results in Chapter 4, which demonstrates a different spatial pattern across the landscape in the Early Medieval period. That said, one of the strengths of this methodology is its ability to compare quantitative data across regions as well as temporal periods; these comparisons will be discussed later in this chapter as well as in Chapter 7.

TABLE 6.2.7 VGA measurement comparisons from the NSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Iron Age Median | 1.58089 | 0.912741 | 2.19084 | 2.36519 |
| Iron Age Mean | 1.5960448 | 0.8999332 | 2.445598 | 2.320776 |
| Roman Iron Age Median | 1.46267 | 0.934217 | 2.04614 | 2.09405 |
| Roman Iron Age Mean | 1.438500429 | 0.95980314 | 2.033694286 | 2.11617 |
| Early Medieval Median | 1.13247 | 0.992678 | 1.56686 | 2.01936 |
| Early Medieval Mean | 1.203574455 | 1.001343773 | 1.714051818 | 2.074796364 |

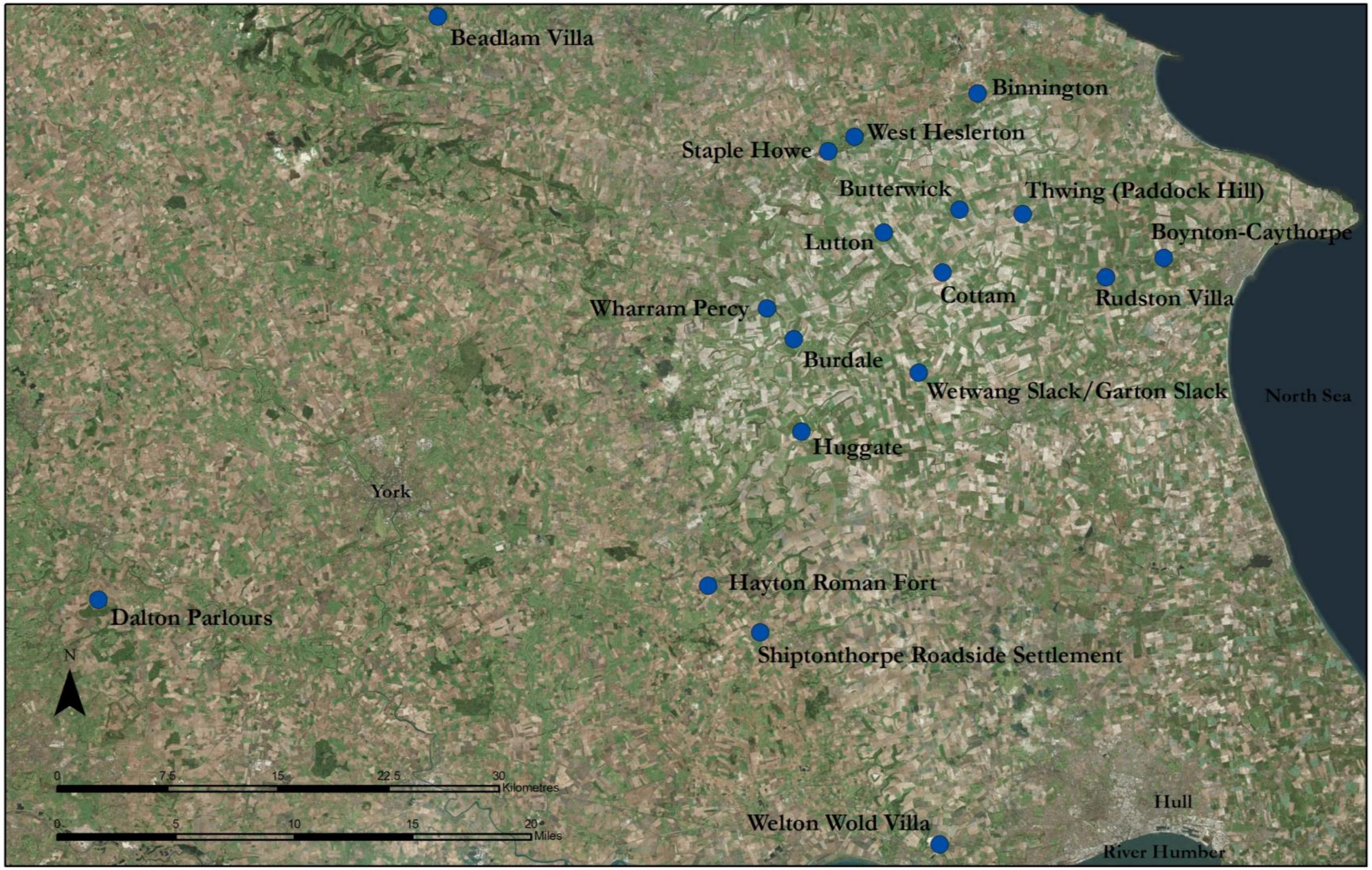
FIGURE 6.2.7 Comparison of the VGA results from the NSR settlements




## 6.3 YORKSHIRE STUDY REGION

The sites selected and examined south of Hadrian's Wall in the YSR are predominantly located within the Eastern Yorkshire study area used in the landscape analysis (Figure 6.3). There are a few sites, however, that are located outside of this area, although still within the "boundaries" of the kingdom of Northumbria. These sites have been chosen because they were excellent representations of period and type-sites, and thus were included in the analysis. Geographically, the settlements analysed by VGA in the YSR are positioned on a variety of topographic landforms, ranging from the rolling chalk uplands of the Yorkshire Wolds to the broad valley bottoms of the Vale of Pickering, the Vale of York, the Fullness Valley, and Holderness.

FIGURE 6.3 Settlements analysed using VGA from the YSR.



## 6.3.1 IRON AGE SETTLEMENTS FROM THE YORKSHIRE STUDY REGION

Yorkshire has experienced a relatively large amount of archaeological research on the Iron Age that has focused more on burial sites than on settlements. This is at least partially due to the fact that unlike upland regions of Britain, Iron Age features in this region are discovered either as cropmarks, through chance discoveries, or due to development-funded investigations (Halkon, 2013, p. 89). Catherine Stoertz (1997) has identified a broad chronology of settlement types in East Yorkshire. The earliest phase, from the first half of the 1st millennium BC included palisaded compounds such as Grimthorpe and Staple Howe. More open settlement plans followed, such as at Wetwang Slack. The latest phase included rectilinear enclosures, often referred to as 'ladder-settlements' due to their shape were common in the late Iron Age and in the Roman period. The majority of structures were roundhouses, regardless of the settlement-type (Halkon, 2013, p. 112).

### 6.3.1.1 DALTON PARLOURS (SE 4027 4453)

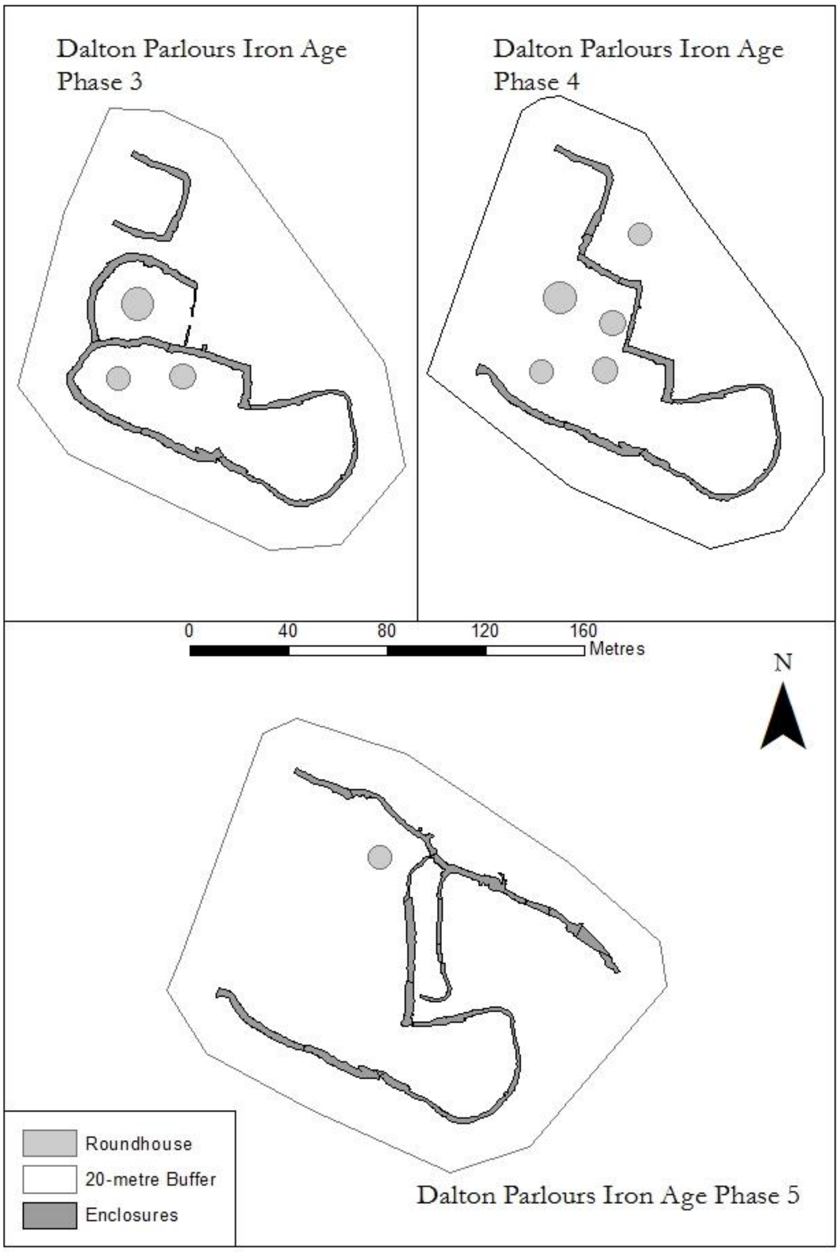
Excavated by the Archaeology Unit of the West Yorkshire Metropolitan County Council in the late 1970s, Dalton Parlours is a multi-period site containing a palisaded Iron Age settlement that was later overlain by a Roman villa. It is located in West Yorkshire about 4 kilometres south of Wetherby (Wrathmell and Nicholson, 1990, p. 1). The settlement is the furthest away from the East Yorkshire study area, and was chosen for the analysis to examine the differences between Iron Age and Roman use of space at the same archaeological site.

Eight roundhouses, numerous enclosure ditches, and trenched palisades were discovered during the rescue excavations at Dalton Parlours that exposed 1.43 hectares (3.5 acres) by mechanical and hand excavation (Wrathmell and Nicholson, 1990, p. 3). In his discussion of the site, Stuart Wrathmell concluded there were five phases of Iron Age settlement at the site during which no more than five of the roundhouses could have been occupied at the same time (Wrathmell, 1990, pp. 275–279). Three of the phases of Iron Age settlement were analysed using VGA, which charted the shifting use of different roundhouses and changes to the enclosure patterns (Figures 6.3.1.1.a - 6.3.1.1.c). The first two phases of settlement are not examined, as their spatial characteristics were not as well defined.

Even though the limited numbers of 1st and 2nd century AD artefacts found at the site point to a break in occupation between the Iron Age and Roman periods, the authors argue that nearby crop mark evidence suggests a shift in settlement during the late Iron Age, and the

Roman villa was constructed next to the existing settlement (Wrathmell, 1990, p. 279). Therefore Dalton Parlours does not represent a direct continuity between the Iron Age and Roman periods.

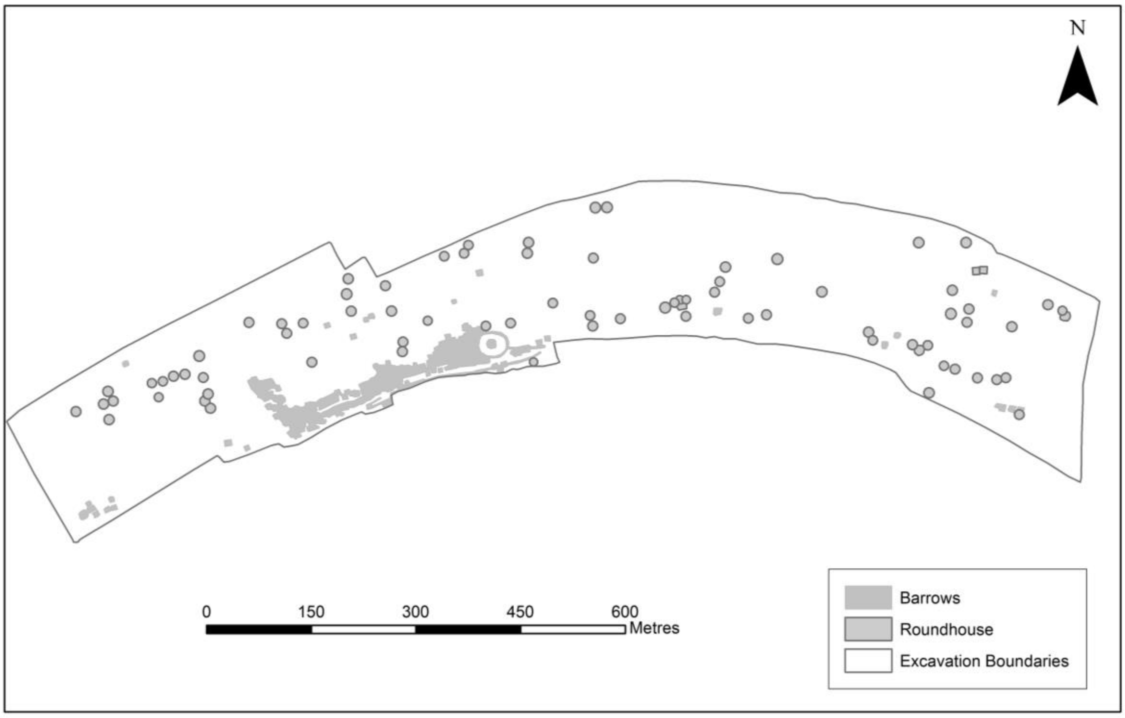
FIGURE 6.3.1.1 Dalton Parlours Iron Age occupation phases




## 6.3.1.2 WETWANG SLACK/GARTON SLACK (SE 9460 6015)

Excavations between the villages of Garton-on-the-Wolds and Wetwang during the 1960s and 1970s prior to quarrying activity revealed archaeological materials from the Neolithic through post-medieval period, with remarkable settlement and funerary evidence from the late-Bronze Age through early Roman periods. The excavations extended for 1.8 kilometres in an arc along the valley floor and contained funerary and settlement evidence from throughout the Iron Age and early Roman periods (Brewster, 1980). The funerary evidence at the site was the distinctive square-shaped barrows of the Arras Culture and were mainly grouped in the south-western corner of the excavation (Dent, 1983a, p. 5). The settlement evidence consisted of approximately 80 roundhouses, granaries, ditched enclosures, and field boundaries (Dent, 1983, p. 4). One phase of settlement was examined from the site dating to the late Iron Age (where the square barrow tradition was abandoned) (Figures 6.3.12.a and 6.3.1.2.b).

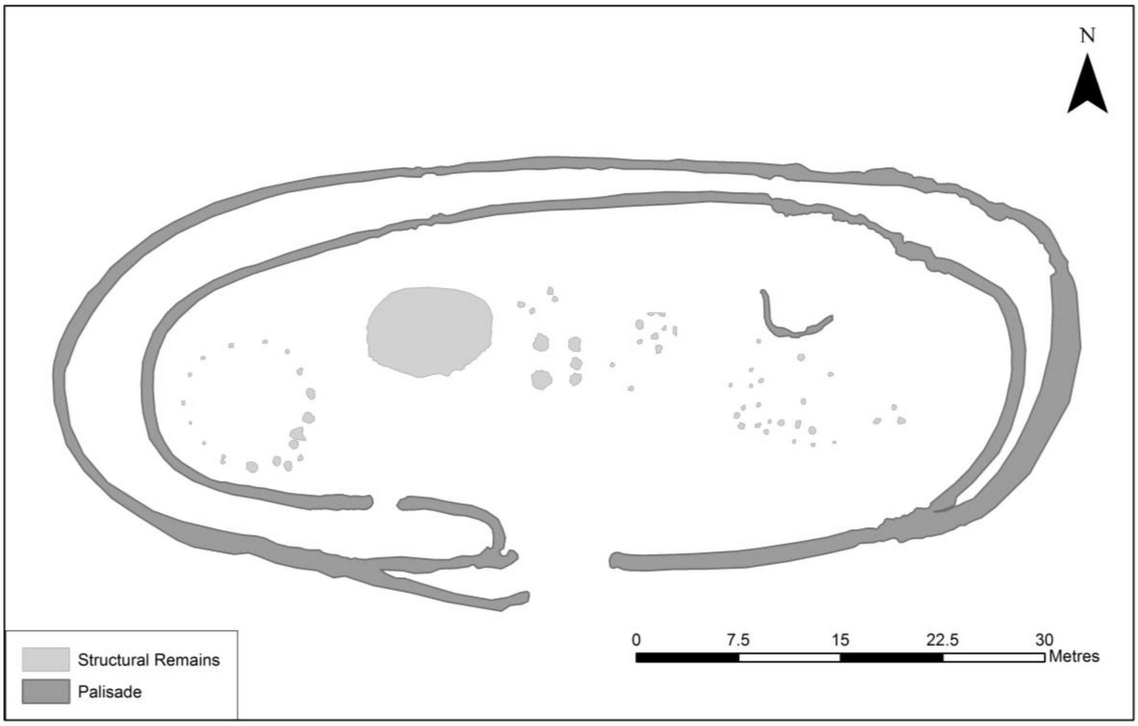
FIGURE 6.3.1.2 Wetwang Slack/Garton Slack




## 6.3.1.3 STAPLE HOWE (SE 8985 7496)

The early Iron Age palisaded settlement at Staple Howe, located along the northern slopes of the Yorkshire Wolds to the southwest of the village of West Heslerton, was excavated by T.C.M. Brewster in the 1950s (Brewster, 1963). This settlement was positioned on the chalk-knoll of Staple Howe, and included the remains of a small farmstead of at least three huts and a four-posted structure interpreted as a granary or tower within an oval-shaped timber palisade (Brewster, 1963, pp. 20-57, Figure 6.3.1.3). Though dated to the early Iron Age, Staple Howe was included in this analysis as it was one of the few examples from the southern study region of a hilltop settlement, with the other Iron Age settlements not enclosed by palisade or enclosures along the crests of hills such as those in the northern study region. It was also chosen to examine shifts in the use of space from the early through late Iron Age and to compare this to the Early Medieval re-use of the late-Bronze Age Earthwork of Paddock Hill, Thwing.

FIGURE 6.3.1.3 Staple Howe



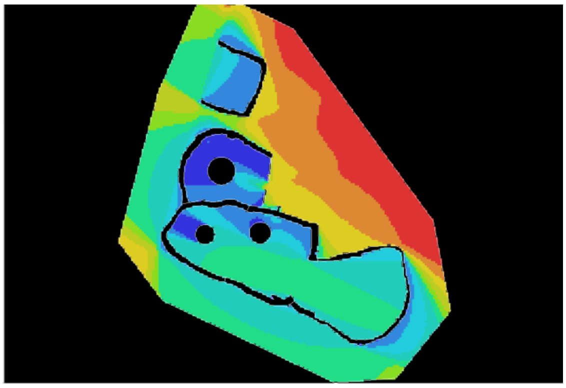

## 6.3.2 VISIBILITY GRAPH ANALYSIS OF IRON AGE SETTLEMENTS IN THE YORKSHIRE STUDY REGION

The results of VGA conducted on the Iron Age settlements from the YSR are shown in Table 6.3.2 and Figures 6.3.2.a and 6.3.2.b. As with the NSR analysis, representative images from *UCL Depthmap* are illustrated below with more comprehensive imagery collected in Appendix D. In general, the VGA measurements are similar across the different analysed settlements, and it appears that the analysed settlements share a pattern of demarcation and use of space. Staple Howe is the outlying measurement, and this probably due to the different enclosure at the settlement compared to Dalton Parlours and Wetwang Slack.

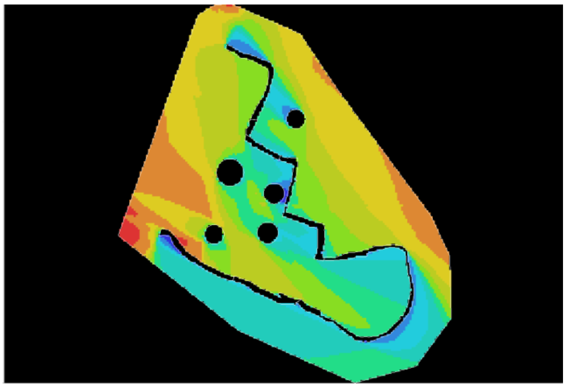
TABLE 6.3.2 Visibility Graph Analysis of Iron Age Settlements in YSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Dalton Parlours Iron Age Ph. 3 | 1.00109 | 0.971291 | 1.8553 | 2.05964 |
| Dalton Parlours Iron Age Ph. 4 | 1.49366 | 0.923463 | 2.09052 | 2.14943 |
| Dalton Parlours Iron Age Ph. 5 | 1.73355 | 0.916186 | 2.22 | 2.05093 |
| Wetwang Slack IA | 1.39435 | 0.928263 | 2.10365 | 2.23768 |
| Staple Howe | 1.92403 | 0.875145 | 2.57112 | 2.21651 |
| ***Median*** | 1.49366 | 0.923463 | 2.10365 | 2.14943 |
| ***Mean*** | 1.509336 | 0.9228696 | 2.168118 | 2.142838 |

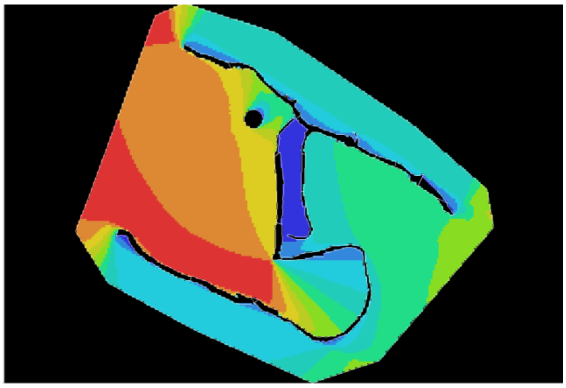
FIGURE 6.3.2.a Connectivity measurements of Iron Age settlements from YSR (not to scale)



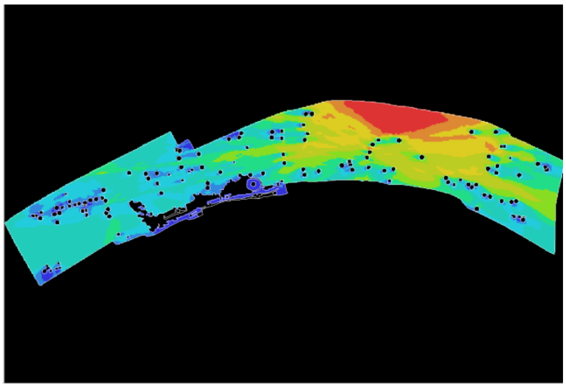
DALTON PARLOURS PHASE 3



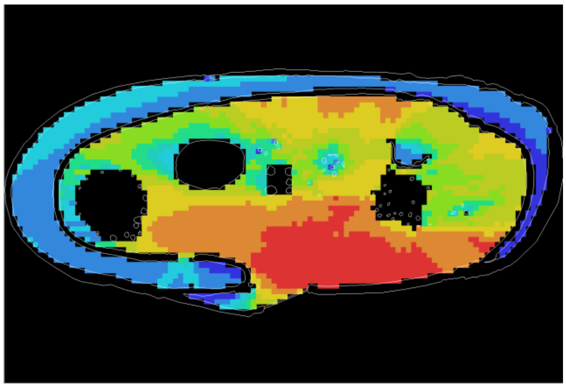
DALTON PARLOURS PHASE 4



DALTON PARLOURS PHASE 5

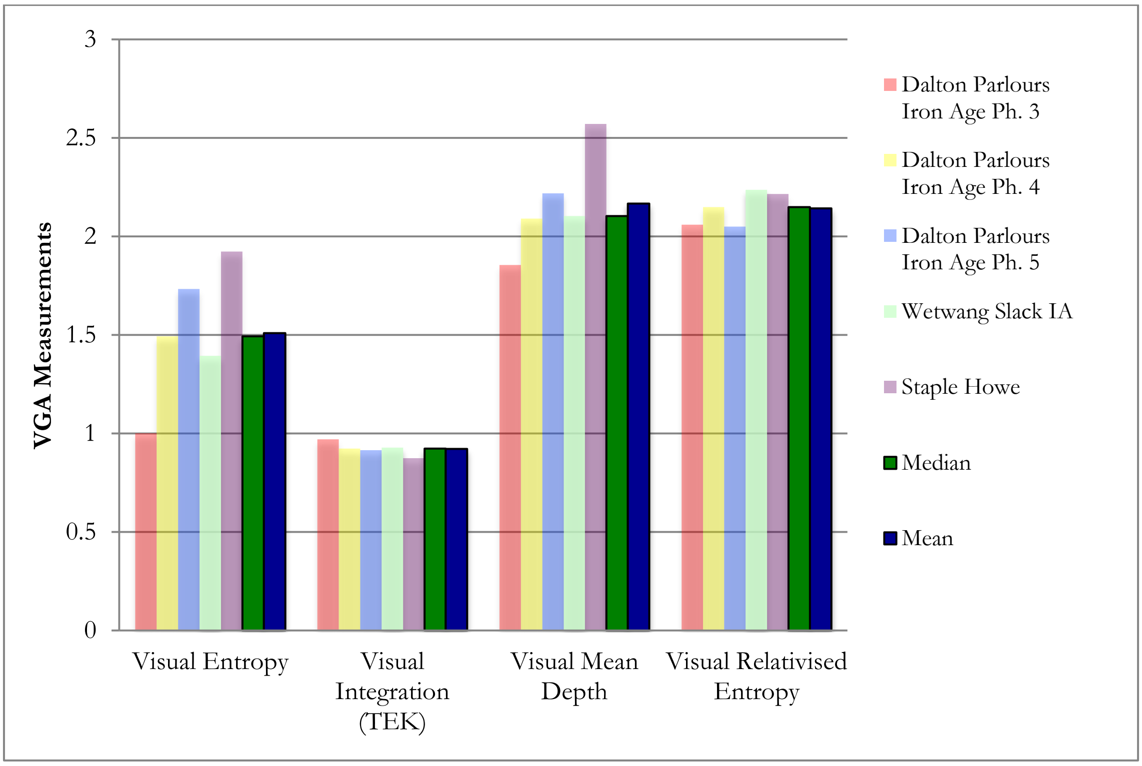


WETWANG/GARTON SLACK



STAPLE HOWE

FIGURE 6.3.2.b Visibility graph analysis results on Iron Age structures from the YSR




## 6.3.3. ROMAN SETTLEMENTS FROM THE YORKSHIRE STUDY REGION

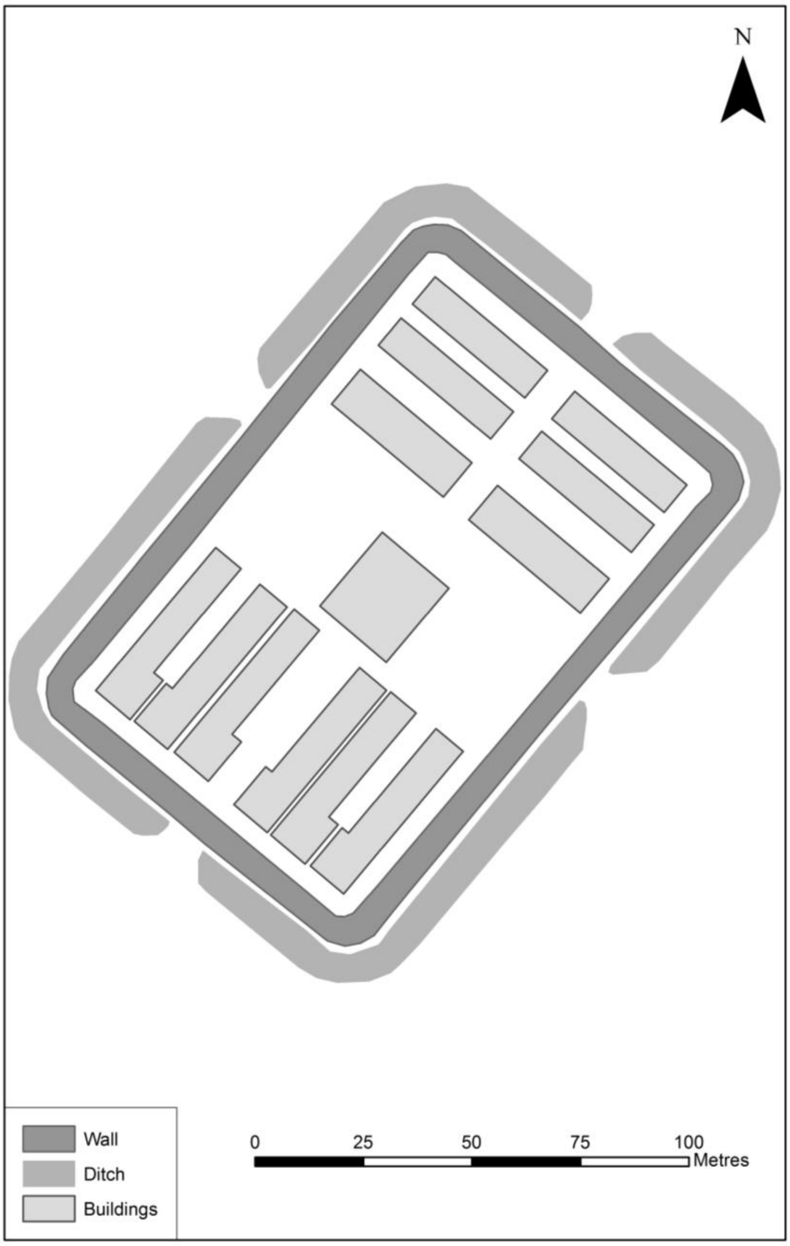
The first Roman interaction with the native population of Yorkshire occurred in the 1st century AD when the Roman army moved into the area and established a series of fortifications and roads (Ottaway, 2003, p. 125). The relationship between the incoming Romans and Parisi has traditionally been thought of as relatively peaceful, as compared to some other areas of Britain. That said, the Roman army's presence was felt at the forts of Brough, Hayton, and Malton (Halkon, 2013, p. 120-125). What is today East Yorkshire became an important region of Roman Britain due to its agricultural resources as well as it being a transportation and trade hub due to the nearby Humber Estuary. *Eboracum* (York) was the site of a major legionary fort and associated settlement, becoming one of the most important settlements in Roman Britain, and a road was constructed between York, Hayton, and Brough (Faull, 1974, p. 2; Halkon, 2013, p. 121; Ottaway, 2004, pp. 1–3). The Humber Estuary was an important port during the Roman period, with ships transporting goods from the continent to Britain, supplying the Roman centres at York and upward to the military fortifications along the frontier. East Yorkshire was an agricultural centre for Roman Britain with the villa economy of the Wolds supplying much of the grain and agricultural produce for the legions stationed along Hadrian's Wall (Halkon, 2013, pp. 182-184).

The indigenous inhabitants of the Yorkshire study region were exposed to a much greater degree of interaction and acculturation with Rome than the populace of the NSR. The impacts of this interaction are visible in the archaeological record, with settlements displaying a transitional phase extending from the Iron Age into the Roman period, such as the development and use of 'ladder-settlement' enclosures. Welton Wold Villa is a good example of a 'hybridised' Yorkshire settlement, with a traditional Roman built form feature, the villa, coexisting with an Iron Age-type roundhouse. Shiptonthorpe contained evidence of Roman style rectangular structures constructed using indigenous techniques and materials. This Romano-British culture would have been the group that encountered and interacted with the later Germanic immigrants of the Early Medieval period. A variety of settlement evidence from across the YSR was chosen for VGA in order to examine whether there are commonalities of the visual arrangement and use of space across different built environment types in the Roman period (Figure 6.3.3).

#### 6.3.3.1 HAYTON ROMAN FORT (SE 816 454)

Cropmark evidence of the Roman fort at Hayton was first identified by St Joseph in 1974 and consequently partially excavated in 1975 (Johnson et al., 1978, p. 57). The remains of the fort are located southwest of the village of Hayton, divided by a modern unnamed road. The fort lies at a right angle and about 300 metres southwest of Ermine Street, the Roman road that connected York and Brough (Figure 6.3.3.1). It is positioned in a group of cropmarks interpreted as Iron Age roundhouses and grubenhäuser (Johnson et al., 1978, p. 58). Two defensive ditches enclosed the fort, and trench excavations at the fort revealed the remains of ramparts, a barrack, and gatehouses. Through these finds, the excavator developed a probable layout of the fort that was used in VGA (Johnson et al., 1978, pp. 76–77). The fort was interpreted as being temporarily occupied during the Flavian period, and probably abandoned sometime in the early 2$^{nd}$ century, possibly due to the establishment of the legionary fortress at York, the general pacification of the local populace, and the need for troops along the frontier (Johnson et al., 1978, p. 80). The landscape at Hayton has been revisited recently in a joint project between the Universities of Hull and Southampton, with forthcoming publications explaining the transition of Hayton between the Iron Age and Roman periods. The Roman settlement at Shiptonthorpe, approximately 5 kilometres to the southeast of Hayton probably post-dated the construction and use of the fortress at Hayton.

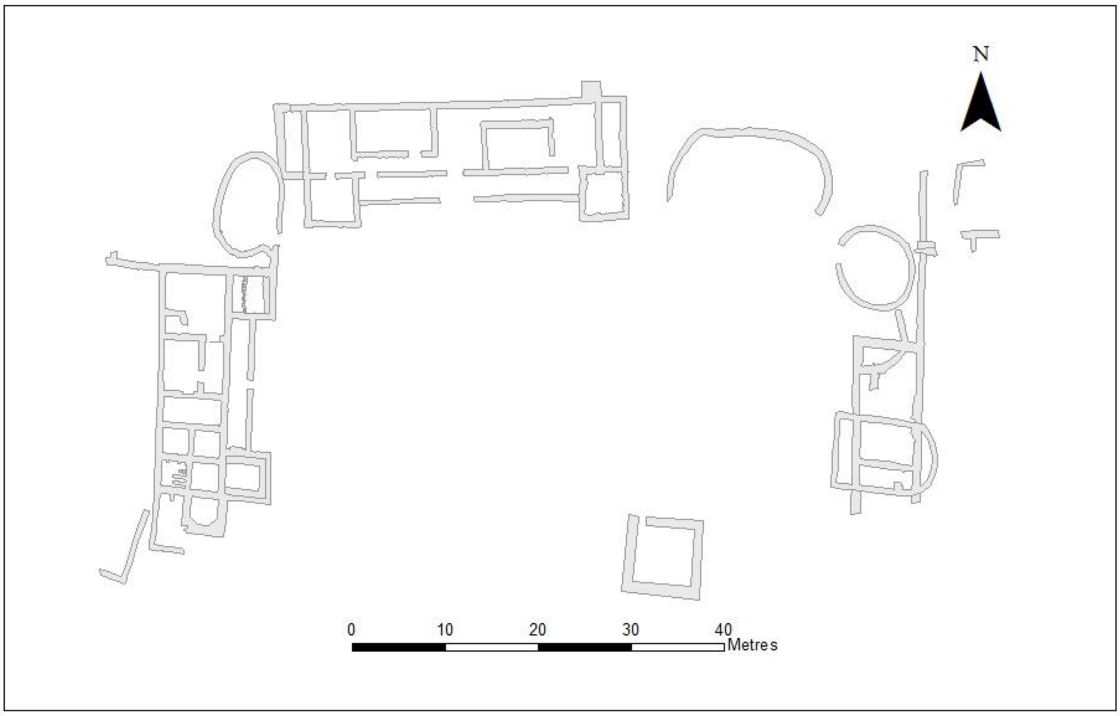
FIGURE 6.3.3.1 Hayton Roman Fort




## 6.3.3.2 BEADLAM VILLA (SE 6342 84312)

Excavations during the late 1960s and early 1970s approximately 1 kilometre west of the village of Beadlam revealed the remains of one of the northernmost villa complexes excavated in Britain (Neal and Allen, 1996, p. 1). The villa sits on a relatively flat landform above the River Riccal along the western boundaries of the Vale of Pickering, and contains nine buildings arranged in a three-winged complex around a presumed courtyard (Neal and Allen, 1996, pp. 41–43, Figure 6.3.3.2). The settlement has been chosen for analysis due to the excellent excavation and geophysical plans of the site and its environs. Although the lack of excavation beneath the buildings due to conservation efforts makes the interpretation of the room phases and use speculative, coin finds at the villa date its occupation through the late fourth and into the early fifth century (Neal and Allen, 1996, p. 44). The site has been interpreted as a prosperous rural villa and part of a network of villas in the region such as Rudston and Langton villas that presumably supplied the Roman centres of Malton and York.

FIGURE 6.3.3.2 Beadlam Villa



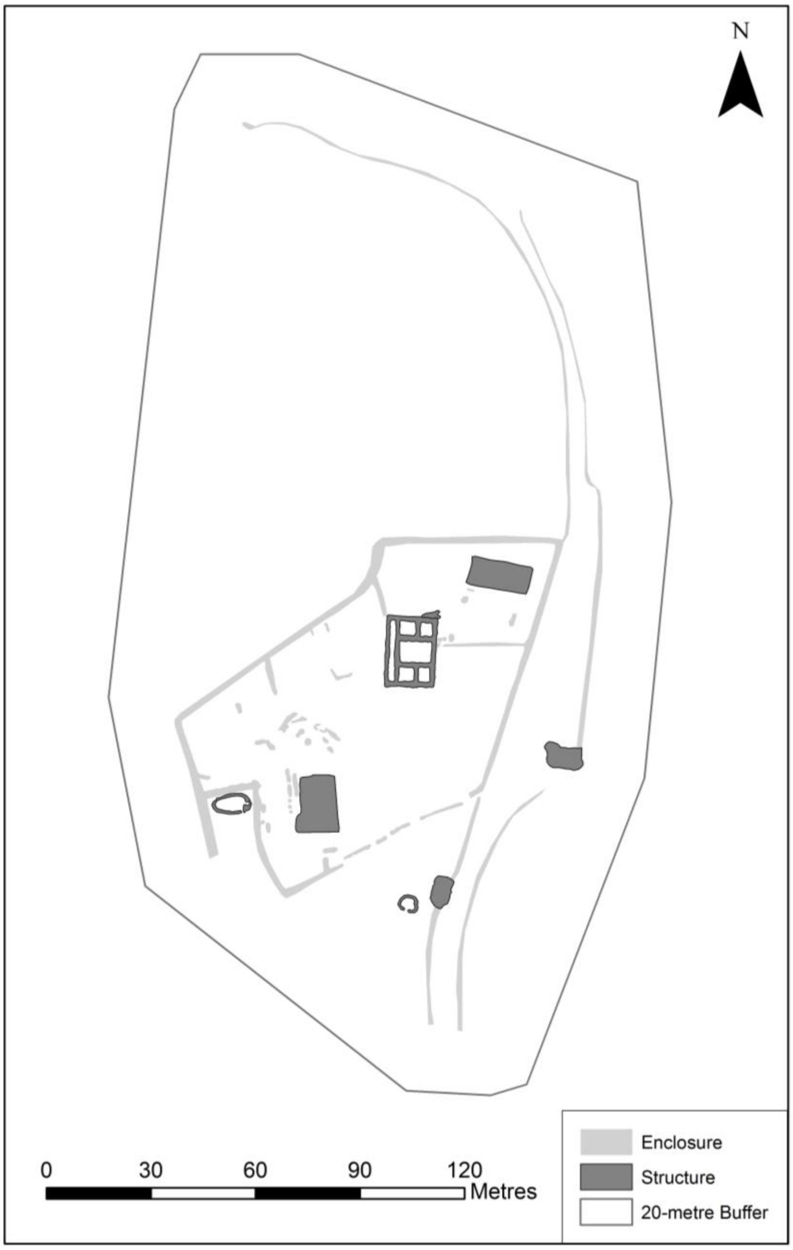

## 6.3.3.3 WELTON WOLD VILLA (SE 974 279)

Aerial photographs taken by St Joseph identified the villa at Welton Wold approximately 5 kilometres northeast of Brough-on-Humber. Rescue excavations undertaken in the 1970s prior to quarrying exposed a large villa complex dating from the early 2nd through mid-4th centuries (Mackey, 1999, p. 21). Positioned northeast of Brough-on-Humber in the Yorkshire Wolds, the site was interpreted as having four phases of settlement spanning the Pre-Roman occupation (Phase 1), the construction and use of the early villa in the early 2nd century (Phase 2), the change in economy in the later 3rd century (Phase 3), and the decline of the villa in the mid-4th century (Phase 4) (Mackey, 1999, p. 21). Due to the large excavation, the environs of the villa were excavated, exposing field boundaries, outbuildings, and crop driers. The changing temporal phases of activity drastically changed the use and orientation of space at the site, with various field boundaries and outbuildings coming in and out of use depending on the phase. The excavator attributed the site to Romanized native Britons of the Parisi tribe, and attributed the decline of the site to raiders in the early 5th century related to the breakup of the Roman Empire (Mackey, 1999, p. 31).

Two of the chronologic phases, Phases 3 and 4, were examined using visibility graph analysis (Figures 6.3.3.3.a and 6.3.3.3.b). Phase 1 and Phase 2 were not used due to a limited understanding of the spatial differentiation compared to the final two phases. The overall settlement at Phase 3 and 4 were examined, as well as the immediate environs around the principal building of the villa.

FIGURE 6.3.3.a Phase 3 Welton Wold Villa

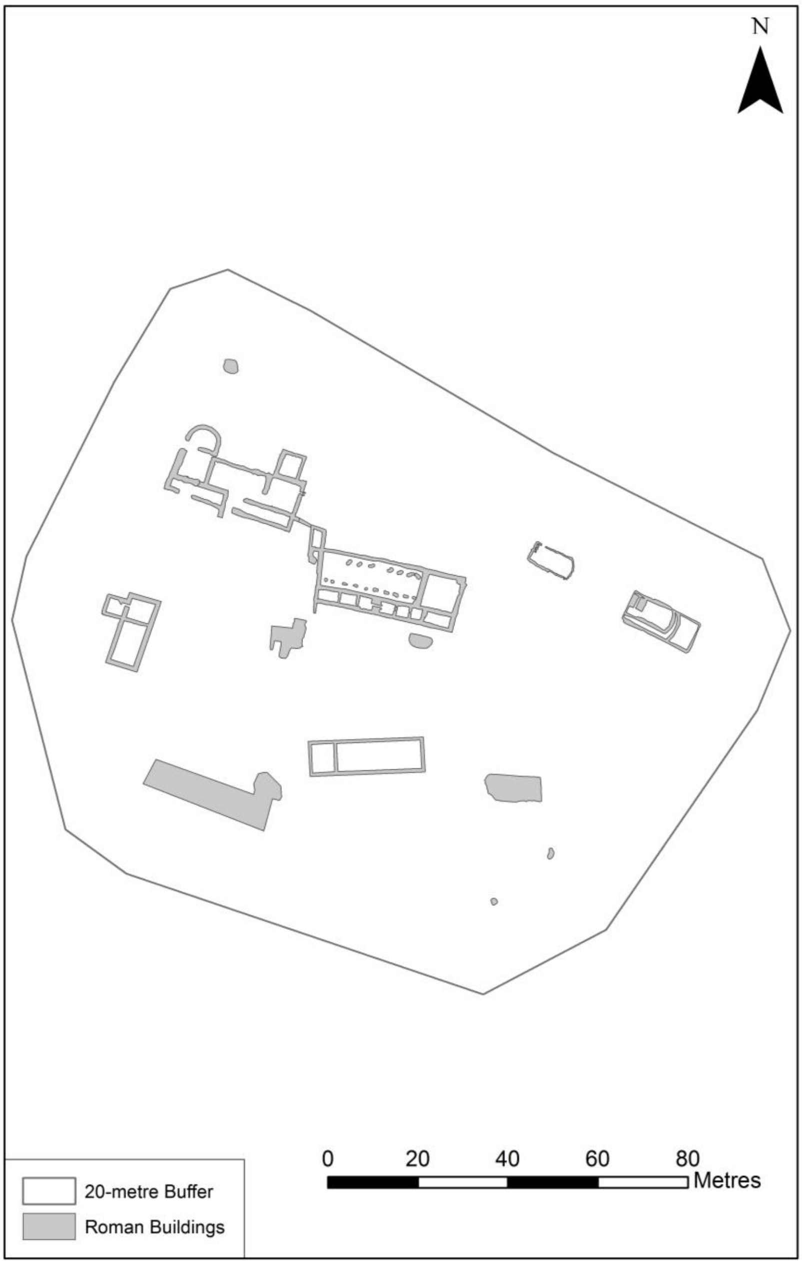
FIGURE 6.3.3.b Phase 4 Welton Wold Villa




### 6.3.3.4 DALTON PARLOURS (SE 4027 4453)

The excavation at Dalton Parlours identified the remains of an Iron Age settlement overlain by a Roman villa in West Yorkshire. The villa complex included a winged corridor principal building, two bath houses, domestic and agricultural outbuildings, wells, and enclosures (Figure 6.3.3.4). The previous occupation during the Iron Age appears to have influenced the construction and location of the villa, with many of the enclosure ditches delineating or structuring the locations of the Roman buildings (Wrathmell, 1990, p. 279). Many of the Iron Age ditches were either recut or reused by the occupants of the villa, indicating that at least some evidence of the previous occupation was visible and affected the layout and use of the site during the Roman occupation. The villa occupation at the site extended from approximately AD 200 through AD 370 based upon ceramic and numismatic artefactual evidence. It was felt that the main structures of the villa complex did not change significantly during the occupational life of the farmstead. The villa was interpreted as the home of a high-status family based on the scale of the villa and the artefactual evidence containing a high proportion of silver and copper artefacts as well as the remains of painted plaster wall coverings (Wrathmell, 1990, p. 282).

FIGURE 6.3.3.4 Dalton Parlours Roman Villa

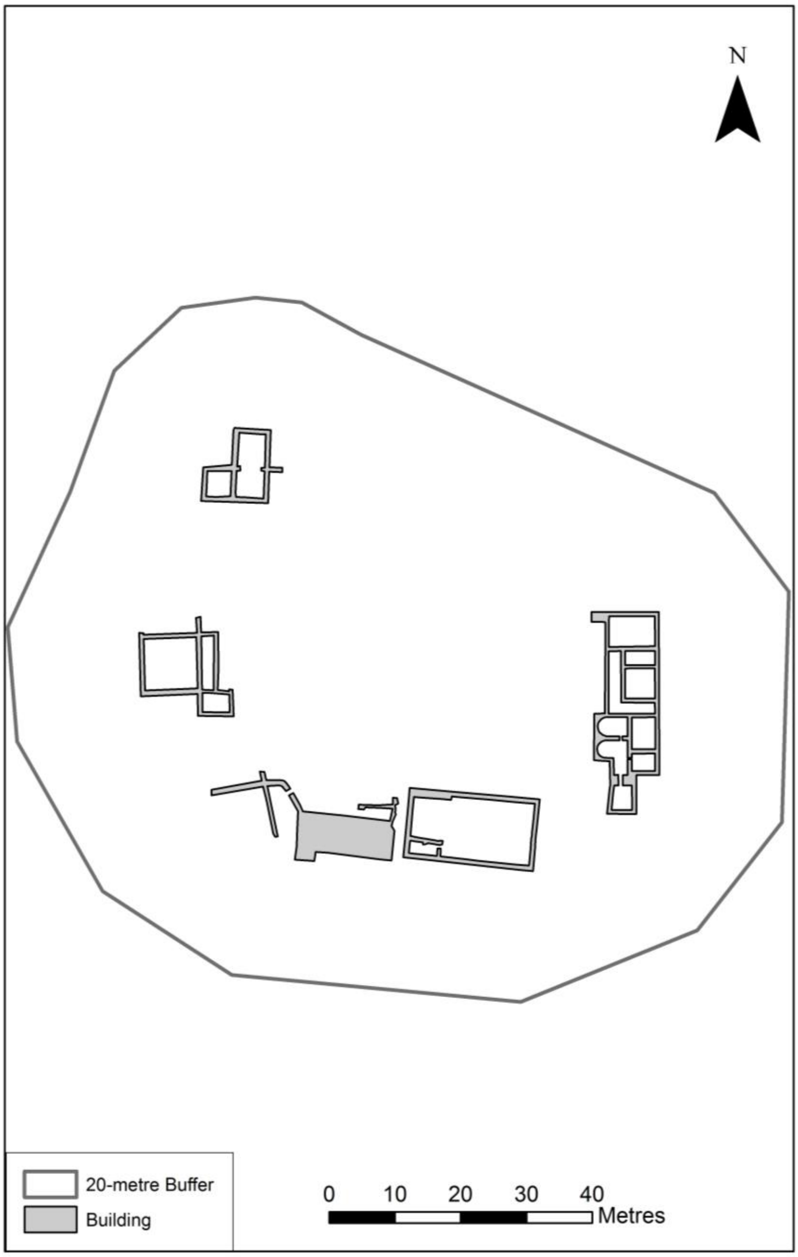


### 6.3.3.5 RUDSTON ROMAN VILLA (TA 0894 6671)

The complex of buildings that make up Rudston Roman Villa are approximately 0.8 kilometres southwest of the current village of Rudston and less than a kilometre from the Gypsey Race (one of the few flowing water sources in the Wolds) (Stead et al., 1980, p. 1, Figure 6.3.3.5). Originally discovered in the early 19th century, ploughing in 1933 exposed mosaic floor tiles and led to the discovery of the courtyard villa complex. Excavations throughout the 1930s uncovered many portions of the villa site and exposed some of the most elaborate mosaic floors and painted wall plaster fragments from the north of England. The excavations were finally reopened in the 1960s, after a long disruption due to the outbreak of the Second World War.

The settlement abuts two sides of Kilham Lane, and portions of nine buildings were uncovered during the long excavation process dating from the 3rd/4th centuries. Although the villa site yielded a large amount of information, the complete extent of the settlement was not excavated and only a partial plan of the complex is understood at this time (Stead et al., 1980, p. 34). A series of Iron Age ditches criss-crosses the site, pointing to the possibility of a longer continuity of settlement at the site than just the Roman Period. The later Roman construction greatly disturbed the previous settlement, making interpretations on the previous period difficult (Stead et al., 1980, p. 35). The mosaic floors and painted wall plaster point to the site inhabitants having a higher standard of living compared to other villa sites in the region, such as at Beadlam where the mosaics and plaster was of a poor quality (Neal and Allen, 1996, p. 44).

FIGURE 6.3.3.5 Rudston Roman Villa

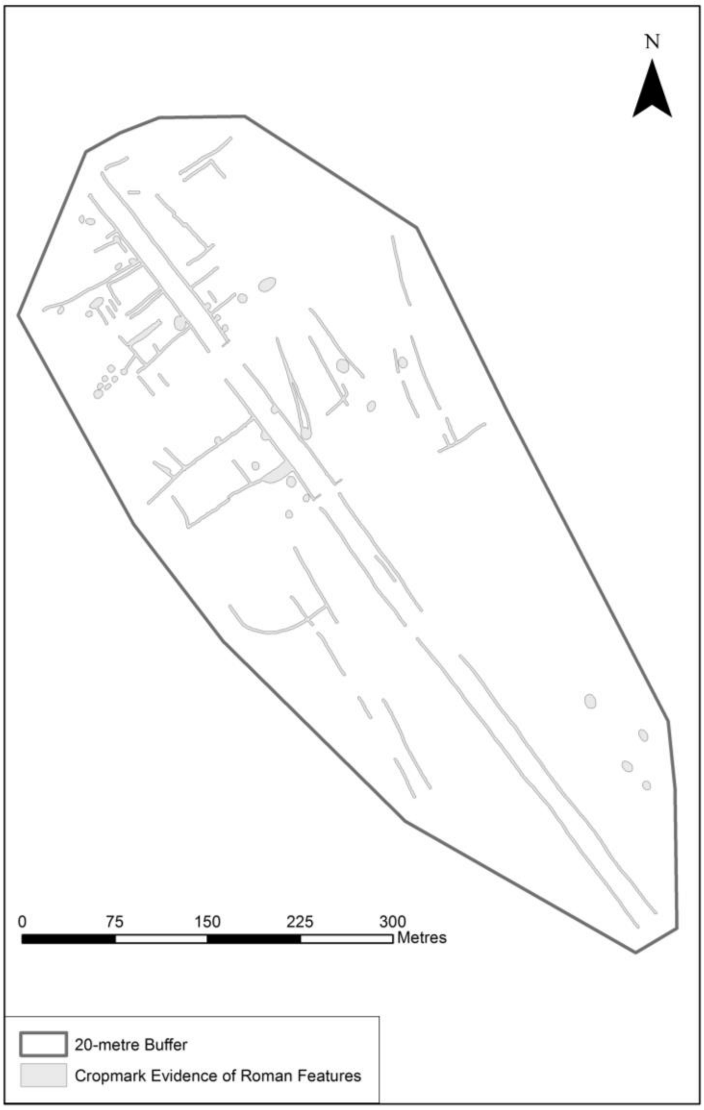



## 6.3.3.6 SHIPTONTHORPE ROADSIDE SETTLEMENT (SE 852 424)

The Romano-British linear settlement at Shiptonthorpe is located near the eastern boundary of the Vale of York within sight of the Yorkshire Wolds, approximately 2.5 kilometres west of Market Weighton (Millett et al., 2006, p. 5). The roadside settlement straddled the Roman road running from Brough-on-Humber to Eboracum (York), and appears to have been a series of farm-like enclosures constructed in an indigenous style, presumably by individuals that came to Shiptonthorpe to support the construction and use of the road in the second century (Millett et al., 2006, p. 306).

The settlement was investigated in the late 1980s and early 1990s by the East Riding Archaeological Society and by the Department of Archaeology, Durham University. Through fieldwalking, metal detection survey, trial trenching, and aerial photography the settlement plan of ditched enclosures and structures surrounding the path of the road was developed. The complex of enclosures resembled the 'ladder-settlement' type so common throughout East Yorkshire. Unlike many of the Roman period settlement analysed in this text, the structural evidence at Shiptonthorpe was predominantly built out of timber (Millett et al., 2006, p. 310).. Although the architectural make-up of the site can only be discussed based on three structures found in one of the trenches, it appears that over the site's history, the structural elements transitioned from more roundhouse-shaped buildings to rectangular hall-like structures, implying changes to cultural ideas on the use of space and the built environment (Millett et al., 2006, pp. 310-314).

FIGURE 6.3.3.6 Shiptonthorpe Roadside Settlement



### 6.3.3.6.A STRUCTURE 3.3, SHIPTONTHORPE ROADSIDE SETTLEMENT

This structure shares similarities to many Early Medieval halls in both size (c. 8 metres by 21 metres) and shape (Figure 6.3.3.6.a.) This timber-framed aisled rectangular structure replaced two roundhouse-type buildings and is "broadly of the aisled form which is comparatively well known in Roman Britain having a distribution across southern and eastern England" (Millett et al., 2006, p. 311). Pairs of timber posts spaced 2 to 2.5 metres apart divided the internal space into ten bays. Internal differentiation was difficult to determine due to truncation, although a hearth and infant burial were identified in the approximate centre of the structure. The building was analysed in comparison to the overall settlement in VGA to examine similarities or differences in how the built environment at Shiptonthorpe was organised.

## 6.3.4 VISIBILITY GRAPH ANALYSIS OF ROMAN SETTLEMENTS FROM THE YSR

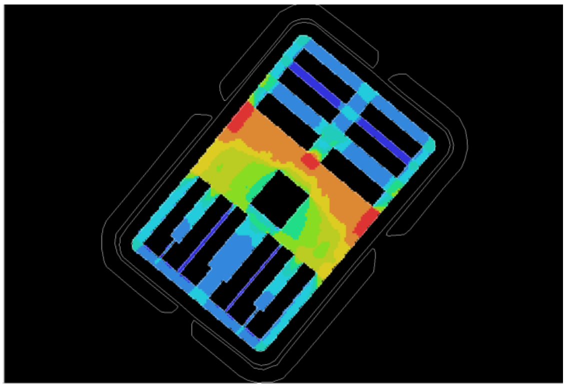
The results of VGA conducted on the Roman settlements from the YSR are shown in Table 6.3.4 and Figures 6.3.4.a and 6.3.4.b. The median and average scores of the Roman VGA measurements are similar, implying a similarity in how space was demarcated and used during the Roman period in Yorkshire. Although the median and mean scores are similar, there is much more variance between the settlements in Roman Yorkshire than in Roman Iron Age Northumberland (see section 6.2.3). This is probably due to the broader range of settlement types in the YSR as compared to the reoccupation of hillforts in the NSR during the Roman Iron Age.

TABLE 6.3.4 Visibility Graph Analysis of Roman Settlements in YSR

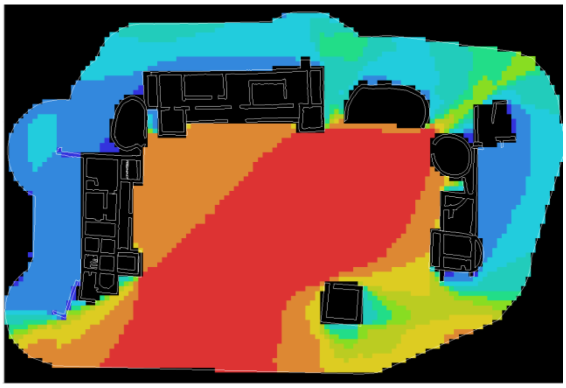
| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Hayton Fort | 1.4218 | 0.914738 | 2.12157 | 2.22242 |
| Beadlam Villa | 1.27501 | 0.953433 | 1.7852 | 2.07969 |
| Welton Wold Phase 3 | 1.91839 | 0.923205 | 2.81367 | 2.24102 |

| | | | | |
|---|---|---|---|---|
| Welton Wold Phase 4 | 1.68452 | 0.90671 | 2.43595 | 2.2609 |
| Welton Wold Villa Ph3 | 1.56097 | 0.93143 | 2.04482 | 2.04272 |
| Welton Wold Villa Ph 4 | 1.24413 | 0.970705 | 1.71754 | 3.1702 |
| Dalton Parlour Roman | 1.01419 | 0.9749 | 1.64441 | 2.2033 |
| Rudston Villa | 0.976993 | 0.998073 | 1.53602 | 2.12857 |
| Shiptonthorpe | 1.50415 | 0.912142 | 2.26457 | 2.25651 |
| ***Median*** | 1.4218 | 0.93143 | 2.04482 | 2.22242 |
| ***Mean*** | 1.400017 | 0.942815111 | 2.040416667 | 2.289481111 |

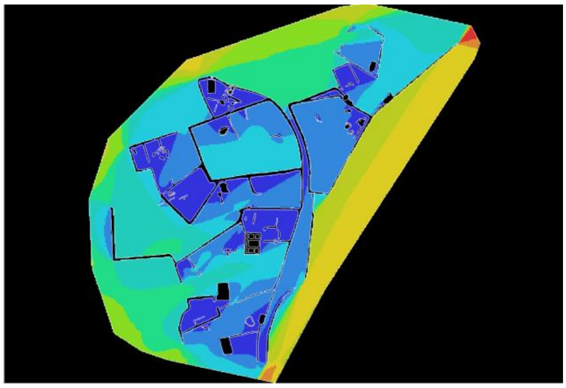
FIGURE 6.3.4.a Connectivity measurements of Roman settlements analysed from YSR (not to scale)



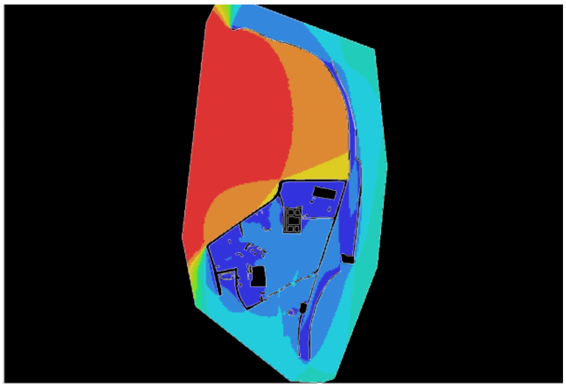
HAYTON FORT



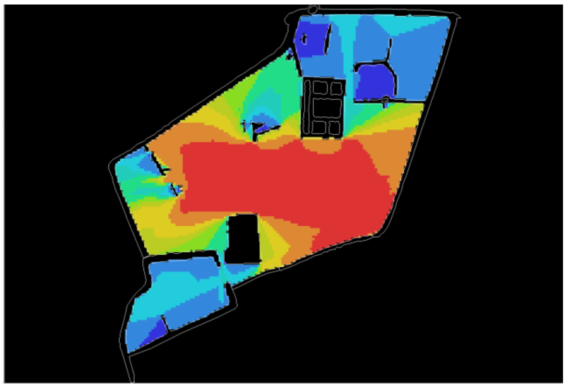
BEADLAM VILLA



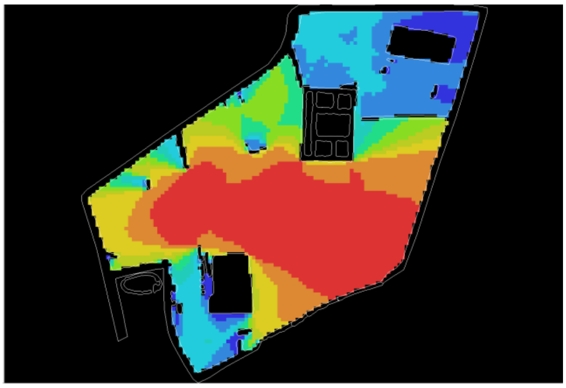
WELTON WOLD PHASE 3



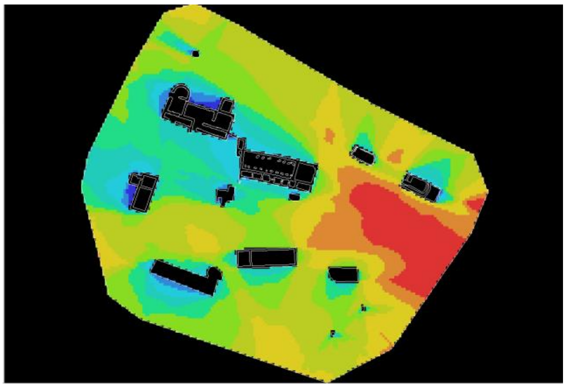
WELTON WOLD PHASE 4



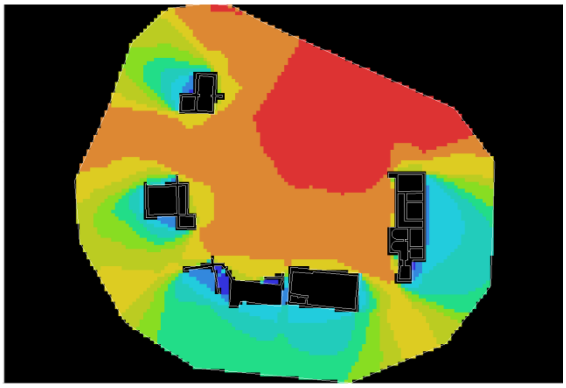
WELTON WOLD VILLA PHASE 3



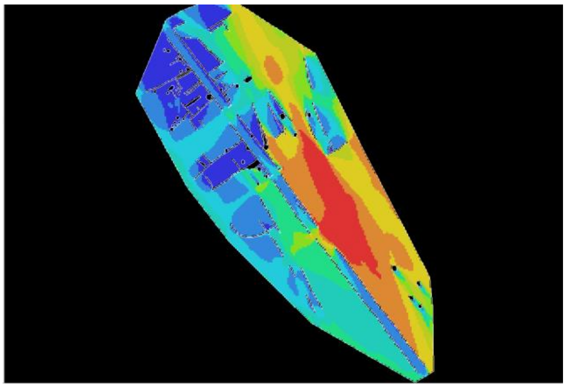
WELTON WOLD VILLA PHASE 4



DALTON PARLOURS VILLA

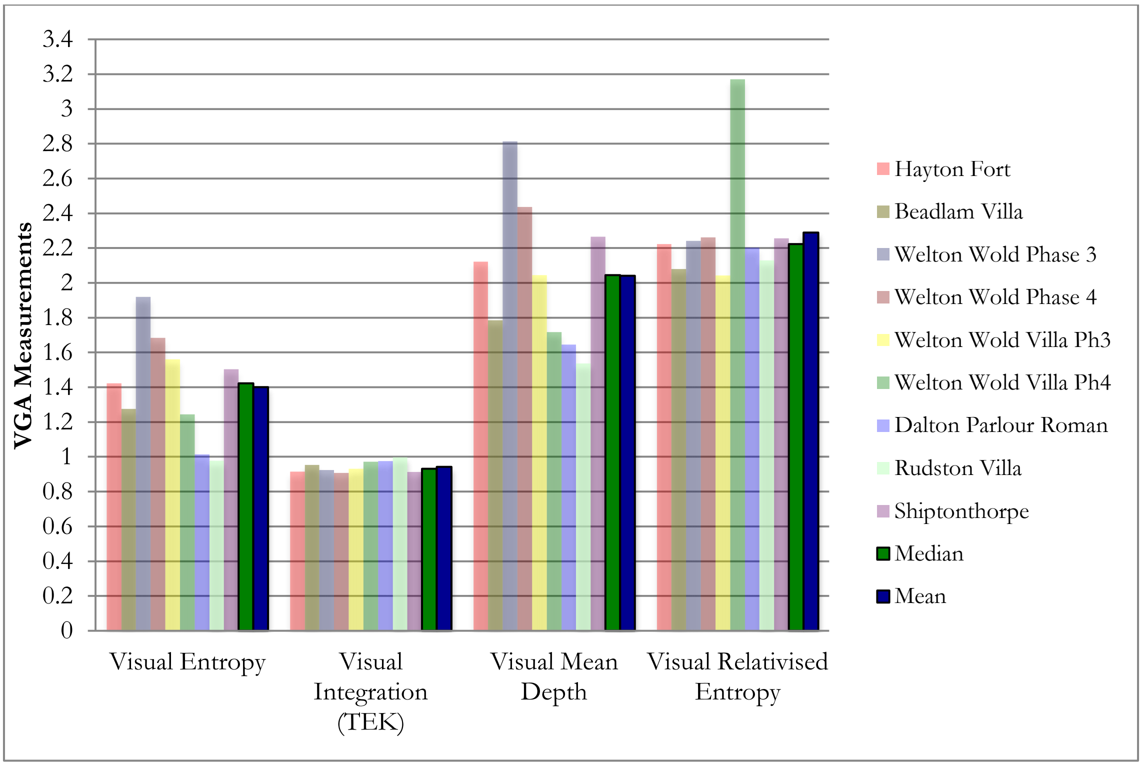


RUDSTON VILLA



SHIPTONTHORPE ROADSIDE SETTLEMENT

FIGURE 6.3.4.b Visibility graph analysis results on Roman settlements from the YSR



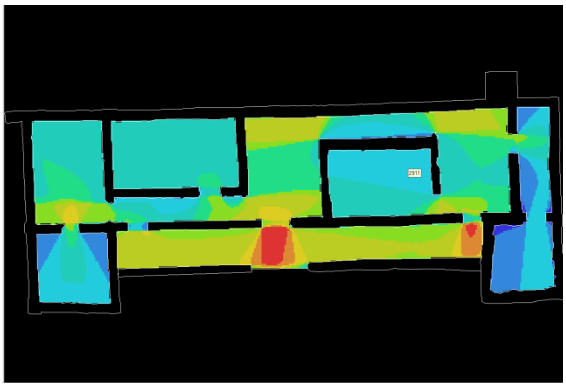
## 6.3.5 VISIBILITY GRAPH ANALYSIS OF ROMAN PERIOD BUILDINGS FROM THE YORKSHIRE STUDY REGION

A sampling of Roman structures from the YSR is examined using VGA in a similar manner as the Early Medieval structures form the NSR. The results of this analysis are shown in Table 6.3.5 and Figures 6.3.5.a and 6.3.5.b. The average and median scores of the buildings in comparison to the average and median settlement scores of the Roman settlements in the YSR are shown in Figure 6.3.5.c.

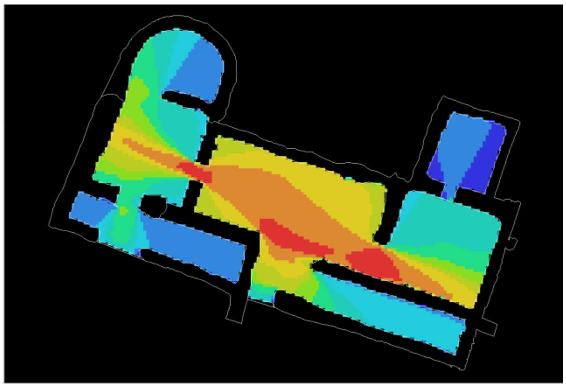
TABLE 6.3.5 Visibility graph analysis of Roman Buildings in Yorkshire Study Area

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Beadlam Villa Building 1, Phase 2 | 1.99027 | 0.887251 | 2.75877 | 2.1921 |
| Dalton Parlours Roman Phase, Main Building | 1.62319 | 0.913978 | 2.15061 | 2.06444 |
| Shiptonthorpe, Structure 3.3 | 0.943059 | 0.970688 | 1.66487 | 2.2863 |
| ***Median*** | 1.62319 | 0.913978 | 2.15061 | 2.1921 |
| ***Mean*** | 1.518839667 | 0.923972333 | 2.191416667 | 2.180946667 |

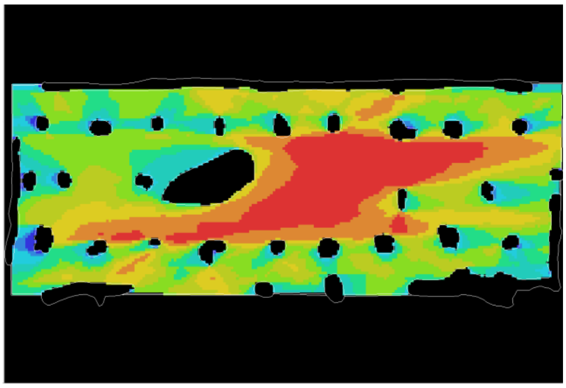
FIGURE 6.3.5.a Connectivity measurements of Roman Buildings analysed from YSR (not to scale)



BEADLAM VILLA MAIN BUILDING, PHASE 2

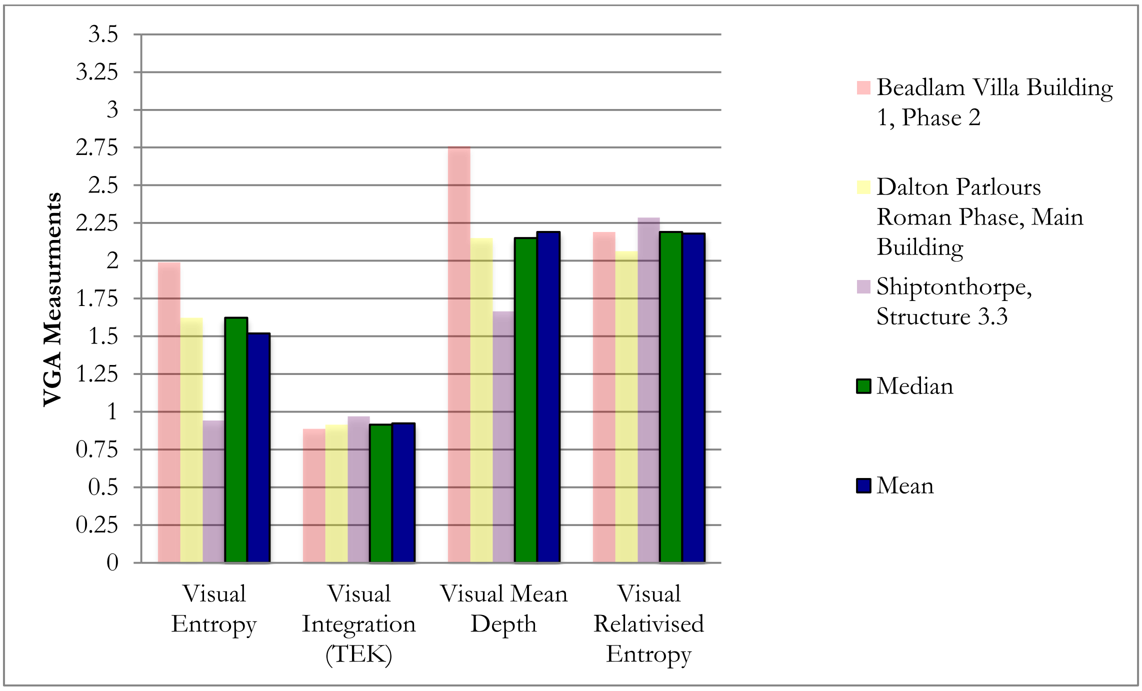


DALTON PARLOURS ROMAN PHASE, MAIN BUILDING



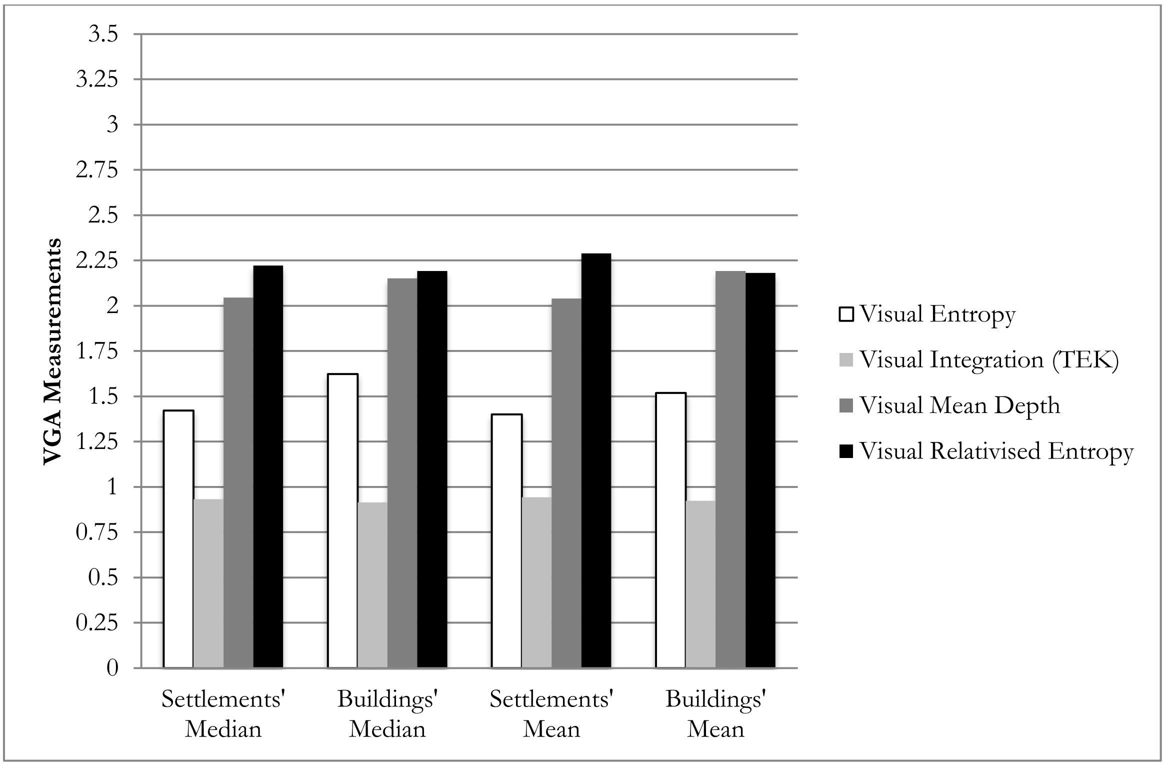
SHIPTONTHORPE ROADSIDE SETTLEMENT, STRUCTURE 3.3

FIGURE 6.3.5.b Visibility graph analysis results on Roman buildings from the YSR



In general, the internal arrangement of the three Roman structures varies more so than the Early Medieval settlements in the NSR, although they still shared many similarities. The Roman structures are examined to compare the visual arrangement of space in the settlements as compared to the interior of structures. Figure 6.3.5.c shows the comparison of the average and median scores of all the Roman settlements and buildings from the YSR. This is similar to the testing of the method in Chapter 5 at Yeavering and Housesteads, and demonstrates the similarity in how the Roman period's built environment was organised visually. These results demonstrate a similarity in how settlements and structures were visually arranged in Roman Yorkshire. This is more fully explored in Chapter 7.

FIGURE 6.3.5.c Comparison of the average and median scores of Roman settlements and buildings from the YSR




## 6.3.6 EARLY MEDIEVAL SETTLEMENTS FROM THE YORKSHIRE STUDY REGION

The Early Medieval settlements in the YSR differ in shape and style from the settlements in the Iron Age and Roman periods. However, there was much more continuity of spatial location than the Early Medieval sites in the NSR, as the examined Early Medieval settlements were located in similar topographic and environmental locales as the examined Iron Age and Roman settlements in the YSR. The Early Medieval structural evidence from the YSR was similar to the built forms in the NSR with rectangular buildings and grubenhäuser of comparable form and dimensions evident. The arrangement of the built environment, however, was different and utilised different types of enclosures and boundaries compared to the examined settlements in Northumberland.

#### 6.3.6.1 WEST HESLERTON (SE 917 763)

Excavations near the small village of West Heslerton from 1978 through 1995 identified one of the largest multi-period settlements excavated in Britain. A large Early Medieval settlement and its associated cemetery as well as features from the prehistoric, Roman, and post-medieval periods were examined during the excavations (Powlesland, 2000, 1998, 1997; Powlesland et al., 1999). Located roughly halfway between the coast and the market town of Malton, the excavated settlement lay along either side of a spring-fed stream on a mixture of underlying sands and chalky soils. Quarrying activities exposed an Anglian cemetery in 1977, which led to the rescue excavations of the cemetery between 1978 through 1986. This led to the establishment of the Heslerton Parish Project to provide a research framework for the excavations and eventually, the discovery and assessment of an associated settlement in 1986 (Haughton and Powlesland, 1999; Powlesland, 1998). The exposed Early Medieval features at West Heslerton spread out over an area of more than 20 hectares (Powlesland et al., 1999, p. 57, Figure 6.3.6).

At this time the results of the excavation have not been fully published, but a variety of interim reports and articles have argued that West Heslerton, while sharing structural uniformity to buildings found at other Early medieval settlements such as Thirlings and Cowdry's Down (Powlesland et al., 1999, p. 59), follows a different model of development and use to the large excavated Anglian settlements of southern Britain. In contrast to the prevailing model of settlement shift (Hamerow, 1993, 1991; West, 1986), Powlesland argues that West Heslerton was established in the early 5$^{th}$ century as a large, planned settlement or 'proto-type town' (Powlesland 1997, p. 110; 2003, p. 35).

Along with the site being one of the largest excavated settlements from the period, it is unique in that it was the setting of one of the most extensive applications of computers in the field along with detailed environmental and artefactual studies that have produced "(…) perhaps the most significant spatially referenced data set for a site of this period" (Powlesland et al., 1999, p. 57). The excavation identified at least 220 structures, including 130 grubenhäuser and 90 post-hole buildings (Powlesland, 1998, p. 1.3; Powlesland et al., 1999, p. 59). The excavator has identified functional zones within the settlement including a housing zone in the northeast, a craft zone in the northwest, an agricultural zone in the centre of the site, and a multi-functional zone in the south (Powlesland, 2000, pp. 22–24). The associated cemetery was located to the northeast of the settlement. The settlement itself demonstrated different uses of space, with the northern half unenclosed and spread out, while the southern half was bounded by multiple enclosures, resembling the Butterwick-type enclosures discussed later in this chapter. This differential use of space was one of the primary reasons, along with the artefactual evidence, for implying different functional zones within the settlement (Powlesland 2000, pp. 22-24).

The importance of West Heslerton to understanding the use of space within Early Medieval settlements, both in the YSR as well as across Britain is undeniable. Three different aspects of the settlement were analysed using VGA (Figures 6.3.6.a-6.3.6.c). The entirety of all the Early Medieval built form features, the Housing Zone in the north-eastern portion of the site, and the distribution of all the grubenhäuser were analysed using VGA to compare differences between aspects of the settlement and to highlight the dissimilar arrangements of structural space.

FIGURE 6.3.6.1.a West Heslerton

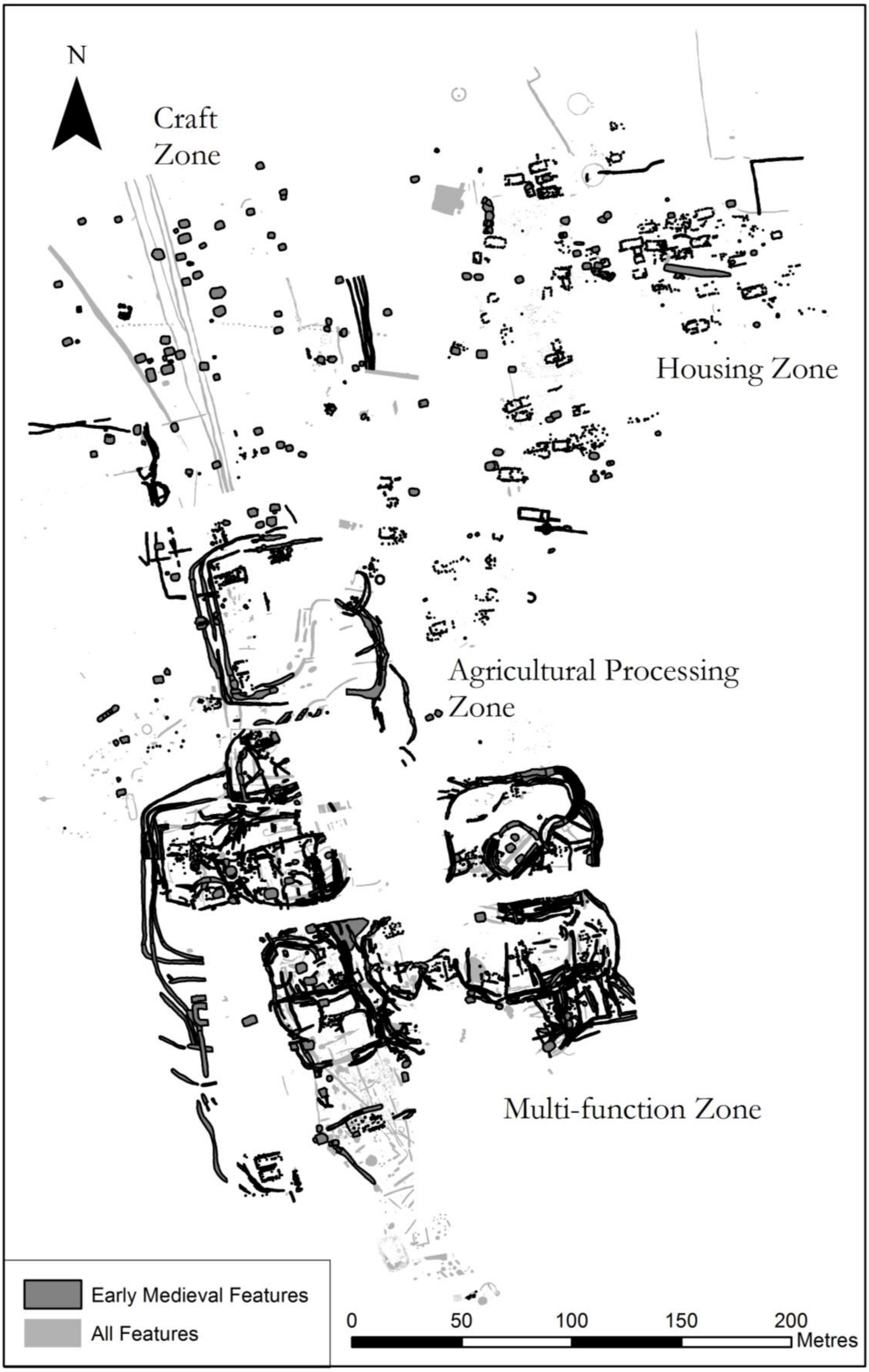


FIGURE 6.3.6.1.b West Heslerton Housing Zone

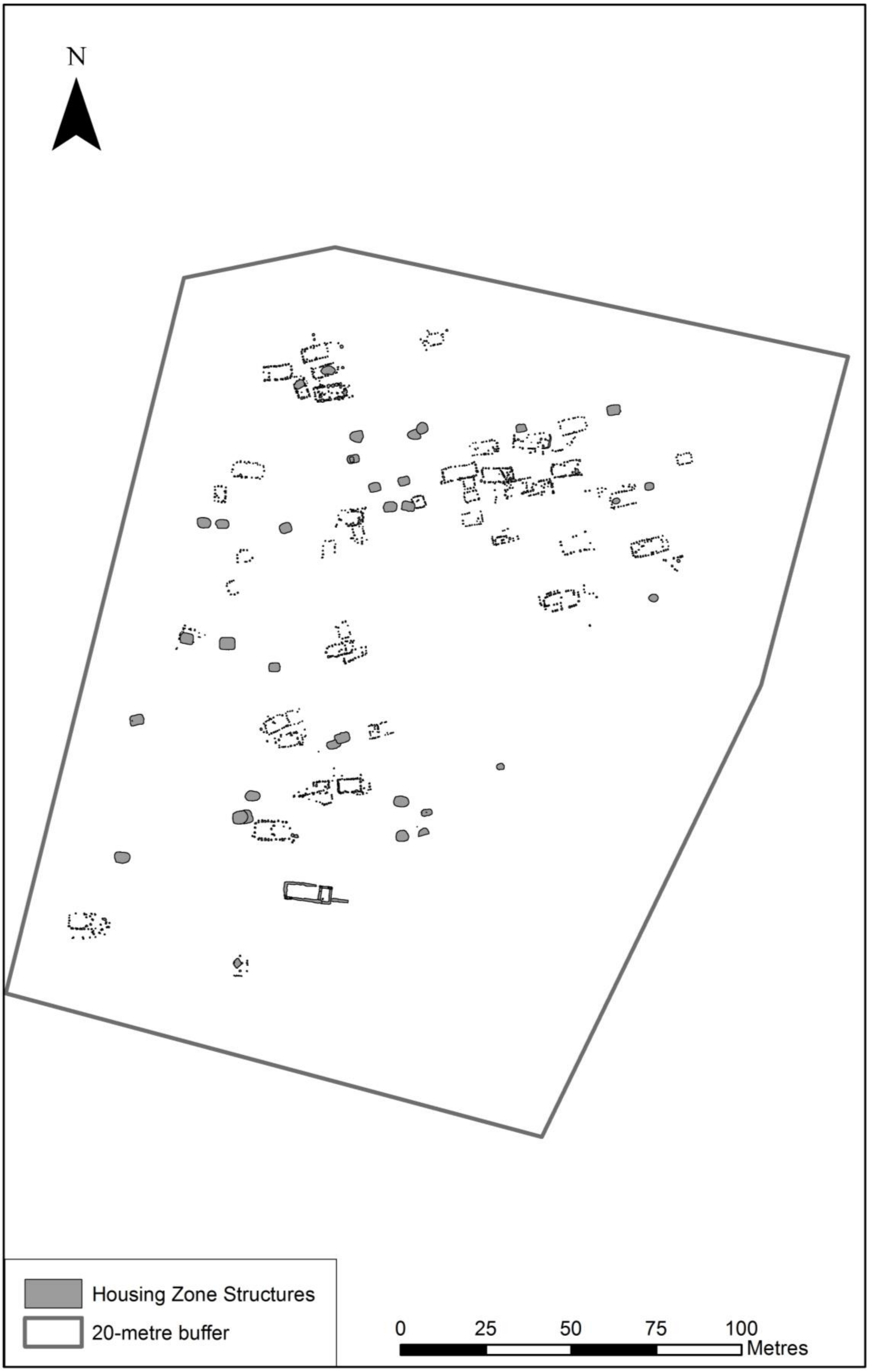
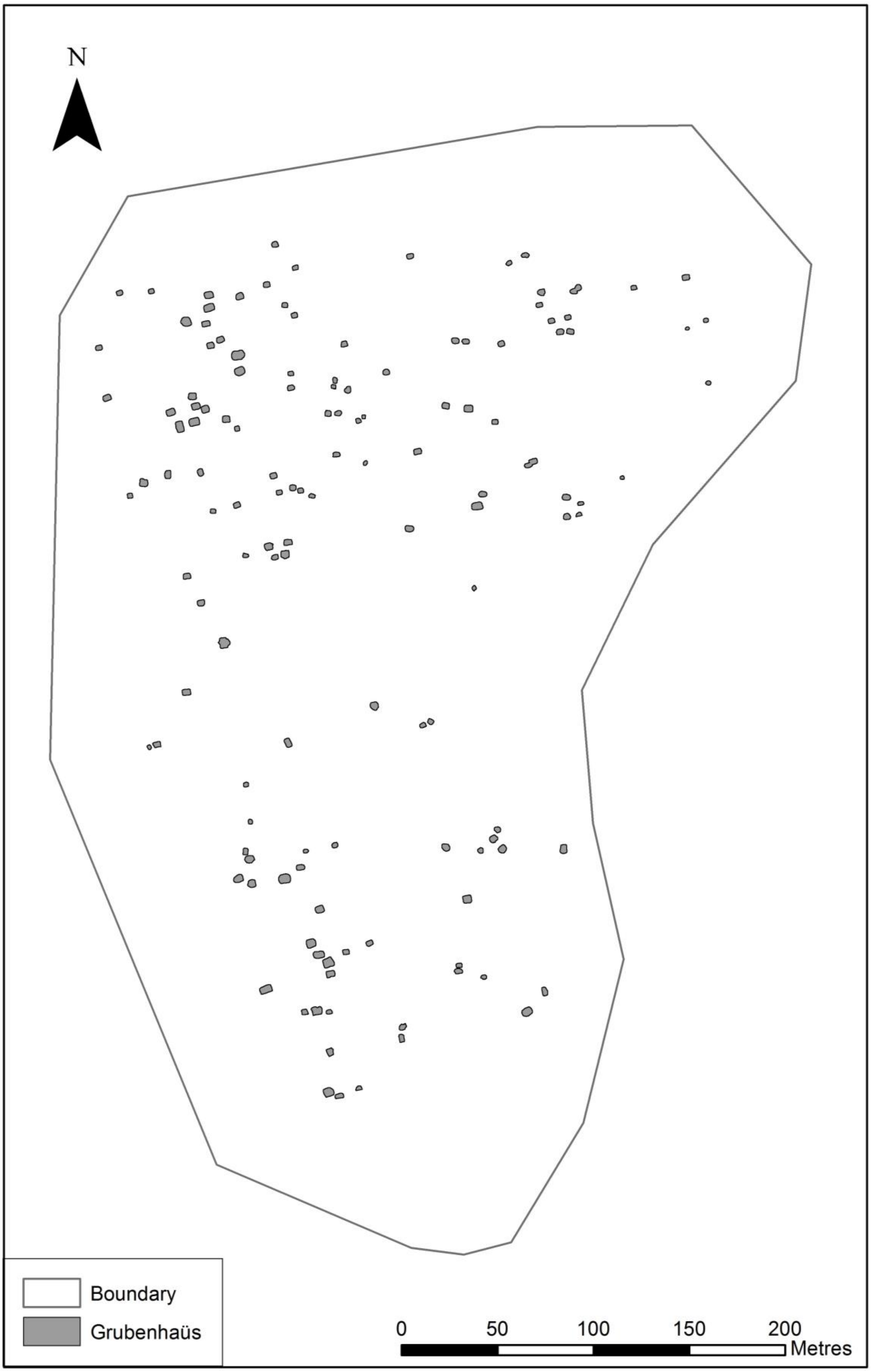


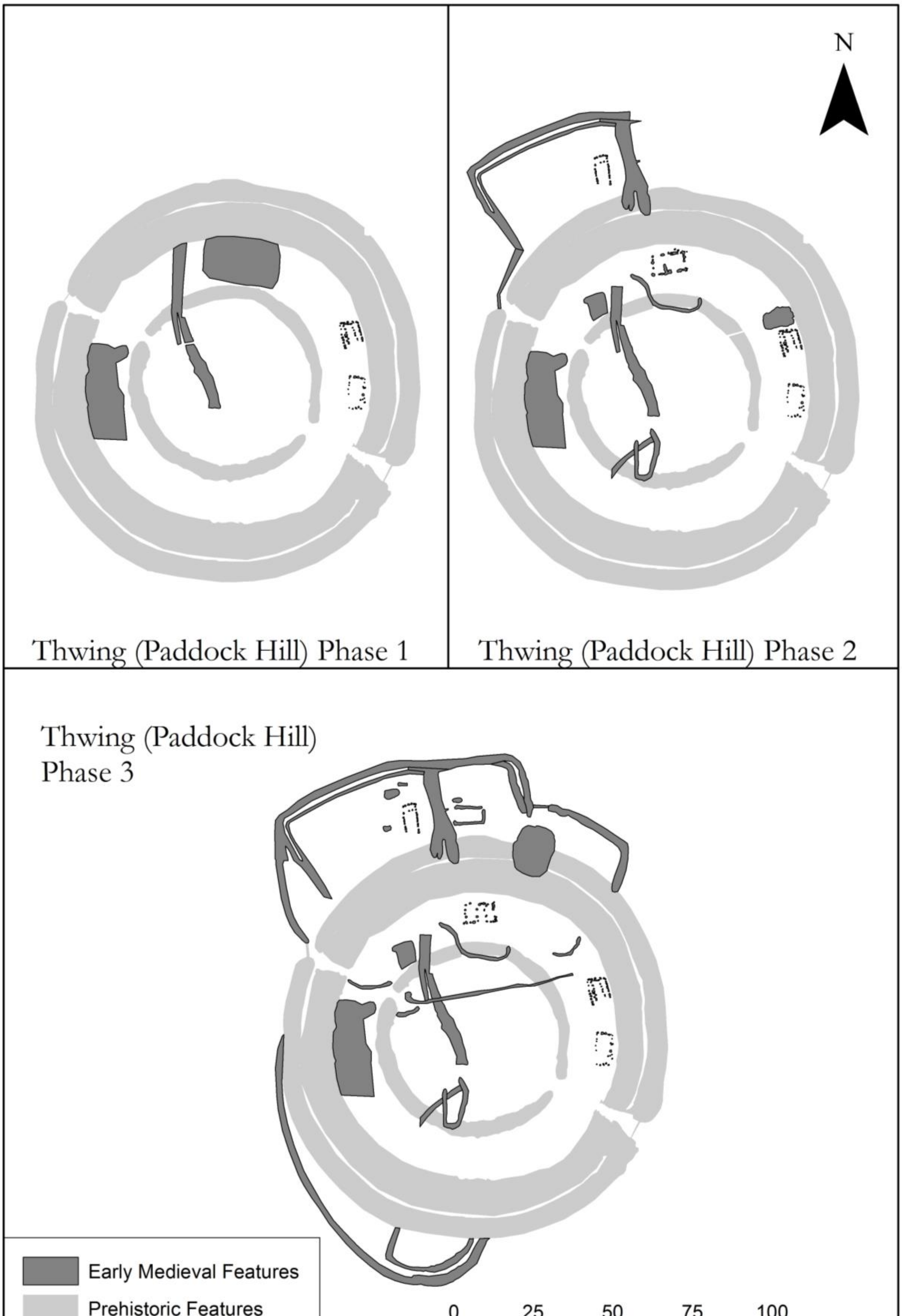
FIGURE 6.3.6.1.b All identified grubenhäuser at West Heslerton



### 6.3.6.2 THWING/PADDOCK HILL (TA 030 707)

The Anglo-Saxon settlement at Paddock Hill, near the small village of Thwing, dates from the late 7th through the mid-10th centuries, and consists of a reoccupied Bronze Age ring earthwork. T.G. Manby led excavations between 1973 and 1987 that revealed a long and complex history of settlement. The entirety of the prehistoric earthwork was used and remodelled during the Early Medieval period, and was expanded through the construction of enclosures to the north and south of the earthwork. The interior of the structure was altered through the construction of palisades, boundaries, structures (including a grubenhäuser and post-built halls), and a cemetery (Manby, unpublished, p. 2.1 General Layout). The excavator identified three phases of Early Medieval settlement that were analysed using VGA (Manby, unpublished, Figures 6.3.7). Although the site has yet to be published, based on the interim reports and unpublished draft report, it is probable that the Early Medieval settlement at Thwing represents a high-status settlement of Deira (southern Northumbria).

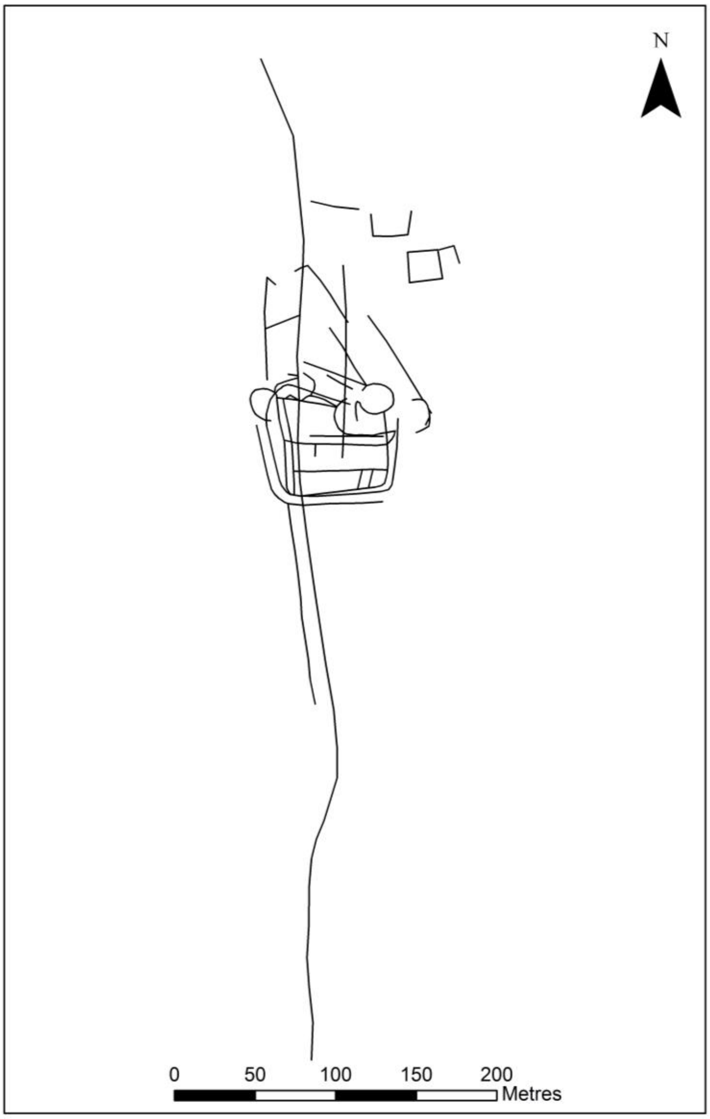
FIGURE 6.3.6.2. Thwing (Paddock Hill)



### 6.3.6.3 COTTAM (SE 994 646)

The Early Medieval settlement at Burrow House Farm, Cottam was first identified by metal detectorists in the 1980s and later examined in a series of archaeological investigations led by Julian Richards (Haldenby and Richards, 2009; Richards, 1999a, 1999b; Richards, 2000). Located between Malton and Driffield, Cottam B has been mapped through extensive metal detecting and geophysical surveys, fieldwalking, cropmarks from aerial reconnaissance, and exploratory trenching. Cottam B was comprised of a series of sub-rectangular enclosures along a north-south trackway linking the site to the Roman period ladder-settlement of Cottam A (Richards, 2001, p. Discussion, Figure 6.3.8). The enclosure type is different from the other ones Stoertz (1997, 69) identified as post-Roman. Two fragments of two timber-built structures were excavated. The enclosures at Cottam B were analysed using VGA.

FIGURE 6.3.6.3 Cottam



#### 6.3.6.4 BUTTERWICK-TYPE SETTLEMENTS

The Butterwick-types are curvilinear-enclosure settlements based on cropmarks that are largely undated and unexplored. Thus it is difficult to determine the settlement history and phasing within these settlements. They generally have been dated from the 7th century onwards due to increased enclosure occurring throughout the Anglo-Saxon kingdoms at this time (Hamerow, 2012; Reynolds, 2003). Though more recently a date range of the 8th to 10th centuries has been identified for a curvilinear settlement at Burdale (Richards and Roskams, 2012, 2013; Wrathmell, 2012). This relative dating is a potential limitation in terms of their use here as it becomes difficult to compare these largely undated sites to the NSR settlements, which generally date from the 5th through 7th centuries. That said Butterwick-type sites might date earlier as the curvilinear enclosure at Sherburn has been dated to the early 7th century (Landscape Research Centre Online) and the Butterwick-type enclosures at West Heslerton could potentially be as early as the founding of the settlement in the 5th century (Powlesland, 1998). In sum it was felt worthwhile to test these settlements in comparison to earlier sites in the YSR as well other Early Medieval settlements. As such, VGA was processed over all the recorded features, in a similar manner to the settlements at Sprouston and Milfield in the NSR. While this analysis does not accurately reflect the spatial morphology of the settlements, it was felt that by doing this, these types of settlements could be compared with the Iron Age/Roman ladder settlements, as well as the crop mark settlements examined from the Milfield region (Milfield and Sprouston). The Butterwick-type settlements examined by VGA include Butterwick, Huggate, Boynton-Caythorpe, Lutton, Binnington, Burdale, and a Butterwick-type settlement at Wharram Percy. The settlement at Burdale has been investigated recently, revealing a multi-period settlement with features from the Roman and Early Medieval periods (Richards and Roskams, 2012, 2013). Figures 6.3.9.a-6.3.9 show the forms of the Butterwick-type settlements analysed by VGA.

FIGURE 6.3.9.a Huggate and Boynton-Caythorpe

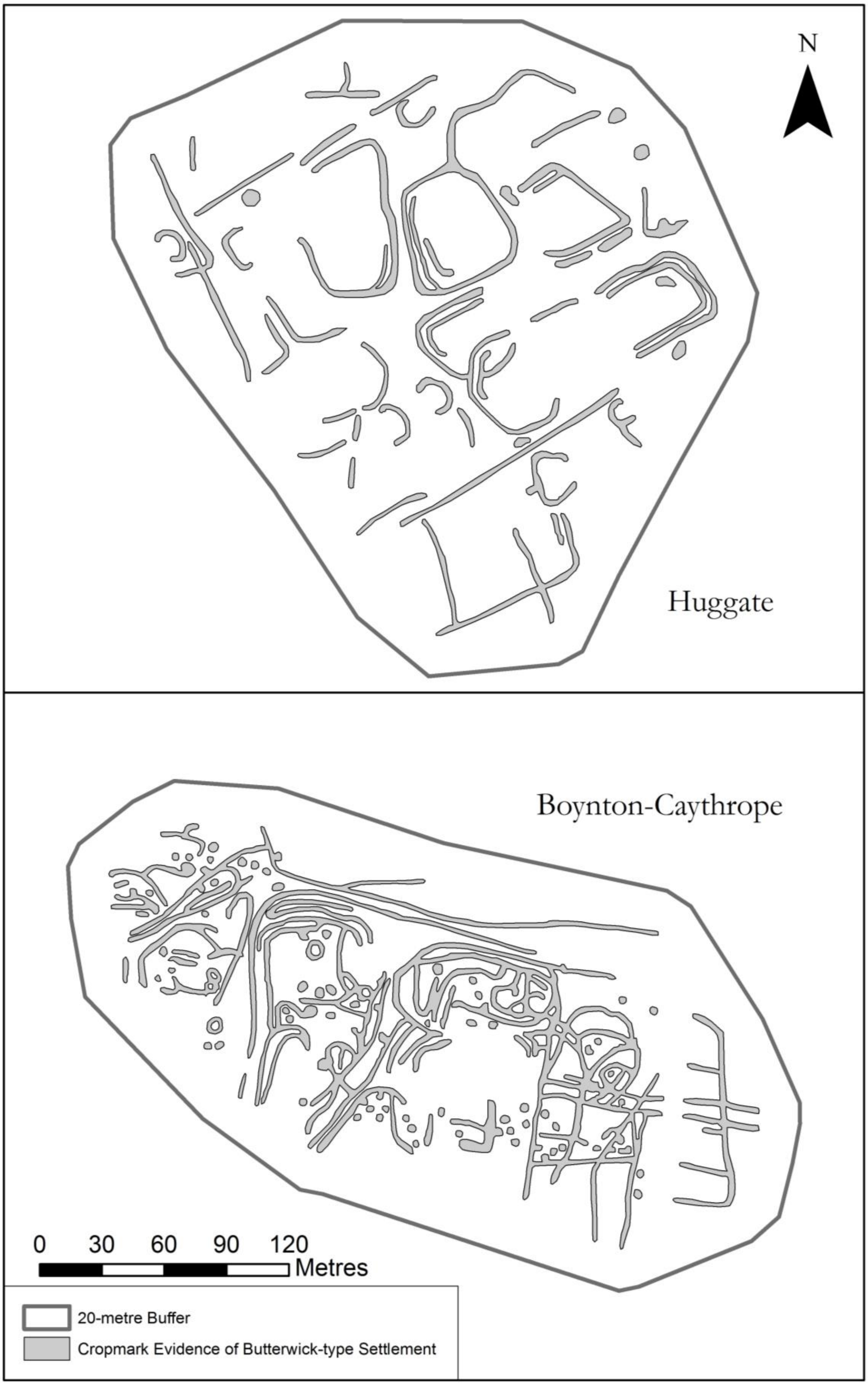


FIGURE 6.3.9.b Lutton and Wharram Percy

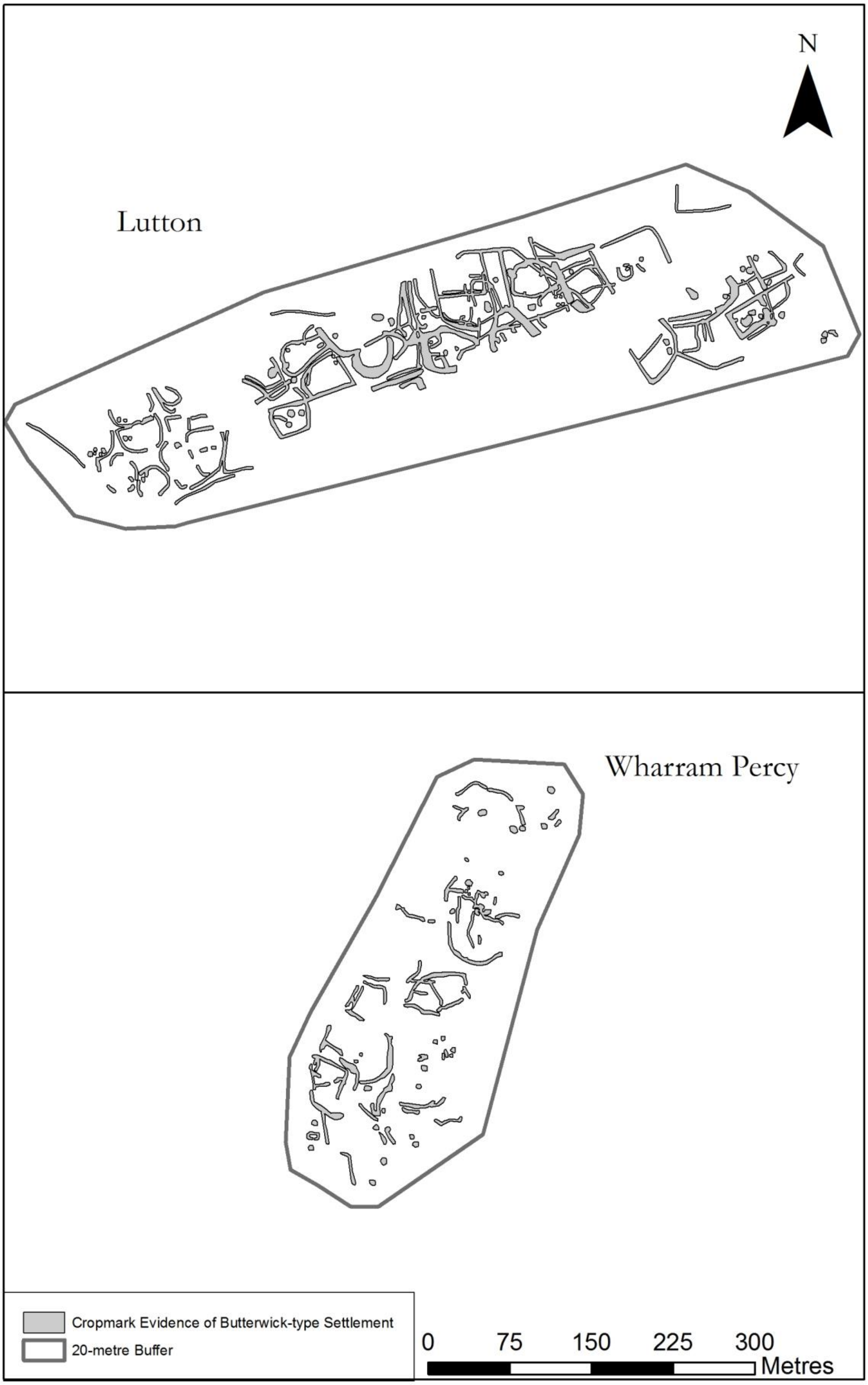


FIGURE 6.3.9.c Binnington and Burdale

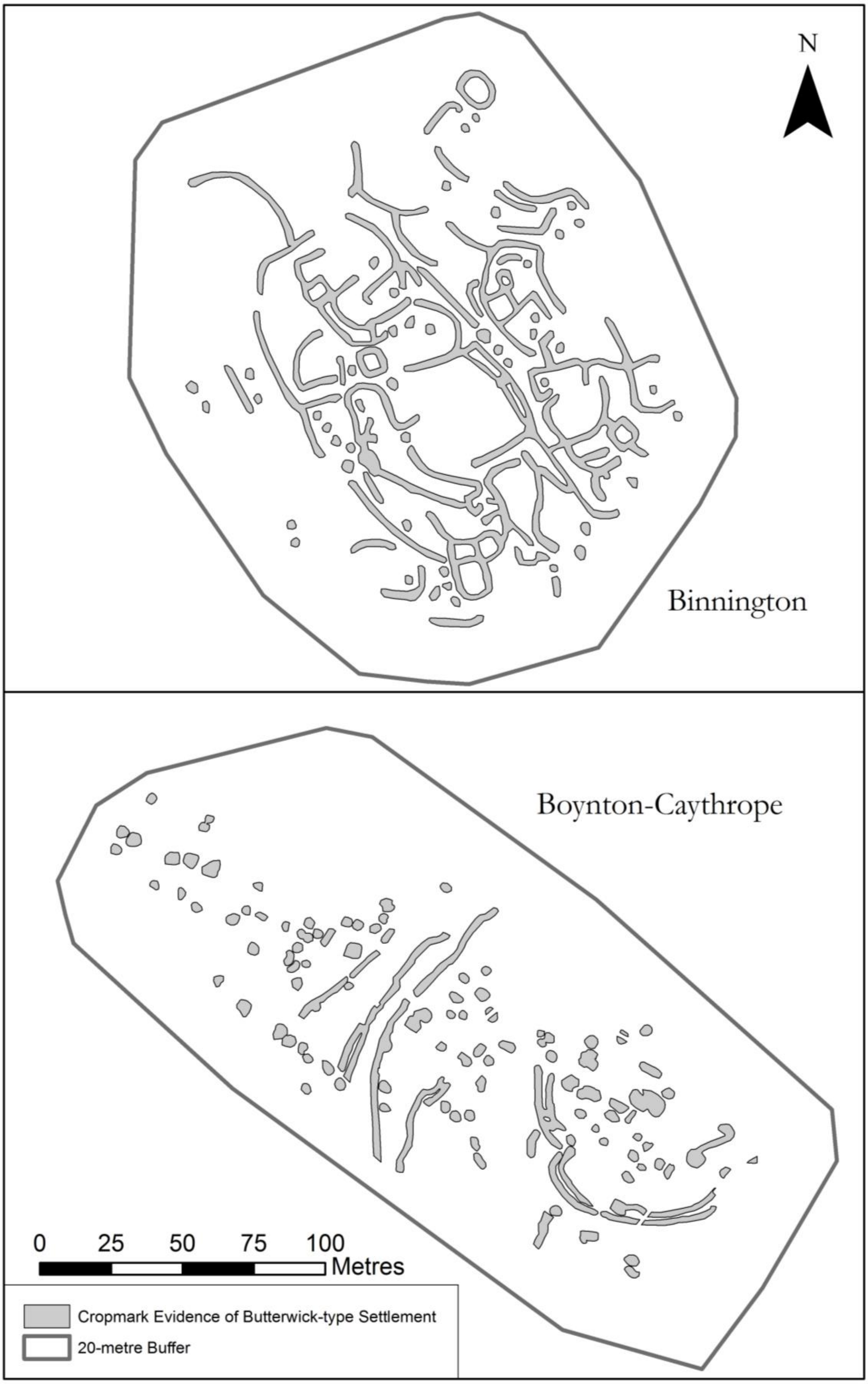


FIGURE 6.3.9.d Butterwick

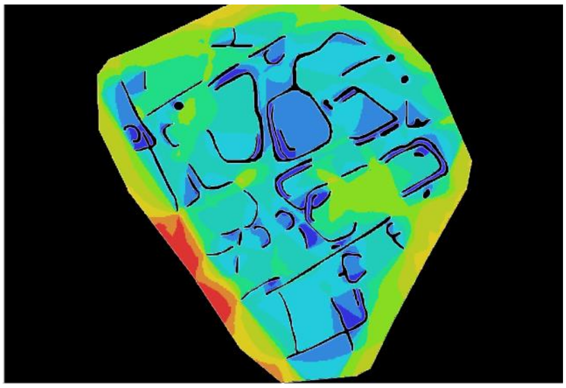

## 6.3.7 VISIBILITY GRAPH ANALYSIS OF EARLY MEDIEVAL SETTLEMENTS FROM THE YSR

The results of VGA conducted on the Early Medieval settlements from the YSR are shown in Table 6.3.7 and Figures 6.3.7.a and 6.3.7.b. As in the Iron Age and Roman Iron Age settlements, the median and average scores of the measurements were similar, implying a standard pattern of demarcation and use of space in the Early Medieval period. There is more variability in the VGA measurements of the YSR Early Medieval data than in the other analysed periods, however this is probably related to the larger number of settlements based purely on cropmark evidence as well as on the broader chronological range of settlements. That said, the median and average results show that the Early Medieval VGA measurements appear to share more similarities to the Iron Age and Roman built environment in the YSR than to the Early Medieval VGA measurements in the NSR. The Early Medieval settlements analysed here were selected due to their complete plans. The later dates of Cottam and Thwing, along with the potentially later dates of the Butterwick settlements, may be seen as a limitation in the strength of the analysis presented here. In addition West Heslerton was the only site examined that dates to the earliest part of the Early Medieval period. This is taken into consideration later in this chapter

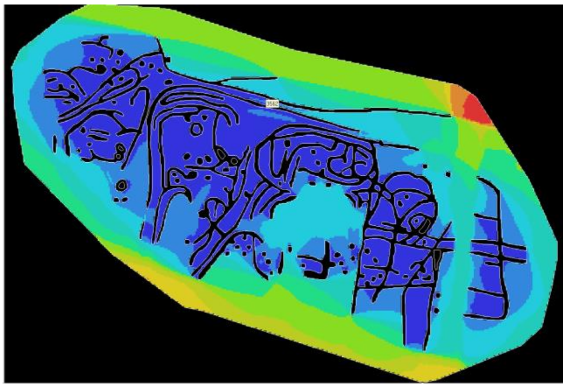
TABLE 6.3.7 Results of VGA of Early Medieval settlements in the YSR

| | Visual Entropy | Visual Integration [Tek] | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Huggate | 1.70497 | 0.898543 | 2.75747 | 2.40908 |
| Boynton-Caythorpe | 2.03008 | 0.891148 | 3.02939 | 2.2808 |
| Lutton | 1.63641 | 0.927778 | 2.32754 | 2.17019 |
| Wharram Percy | 1.3238 | 0.929177 | 2.1337 | 2.31816 |
| Binnington | 2.04928 | 0.872683 | 2.91734 | 2.21293 |
| Burdale | 1.22925 | 0.934729 | 2.01152 | 2.31103 |
| Butterwick | 2.31127 | 0.859582 | 3.50865 | 2.38069 |
| West Heslerton Housing Zone | 0.90722 | 0.979985 | 1.63197 | 2.28771 |
| West Heslerton grubenhäuser | 0.935755 | 1.01435 | 1.46987 | 2.10286 |
| West Heslerton | 1.3857 | 0.901412 | 2.24353 | 2.34345 |
| Thwing Phase 1 | 1.64709 | 0.905672 | 2.19441 | 2.0804 |
| Thwing Phase 2 | 1.99782 | 0.860039 | 2.9314 | 2.37072 |
| Thwing Phase 3 | 2.04944 | 0.842341 | 3.1567 | 2.46537 |
| Cottam | 1.06073 | 0.981248 | 1.58621 | 2.0965 |
| ***Median*** | 1.64175 | 0.903542 | 2.285535 | 2.29937 |
| ***Mean*** | 1.590629643 | 0.914191929 | 2.421407143 | 2.273563571 |

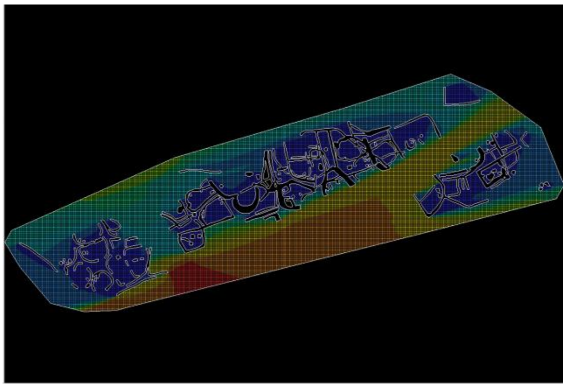
FIGURE 6.3.7.a Connectivity measurements of Early Medieval settlements analysed from YSR (not to scale)



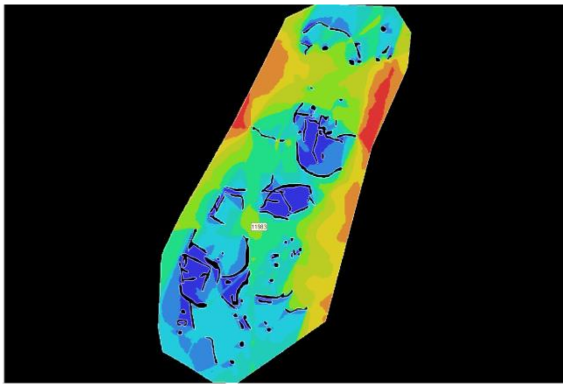
HUGGATE



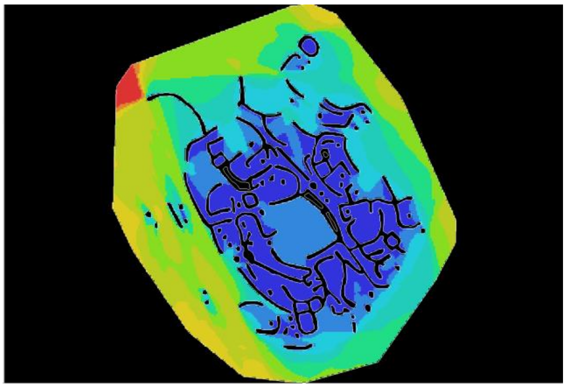
BONYNTON-CAYTHROPE



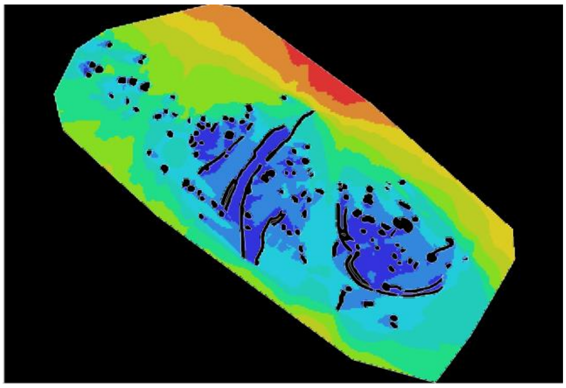
LUTTON



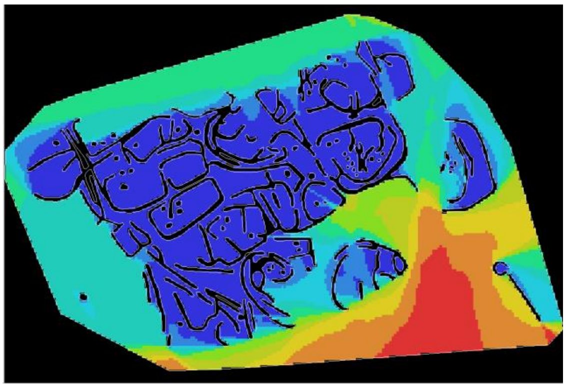
WHARRAM PERCY



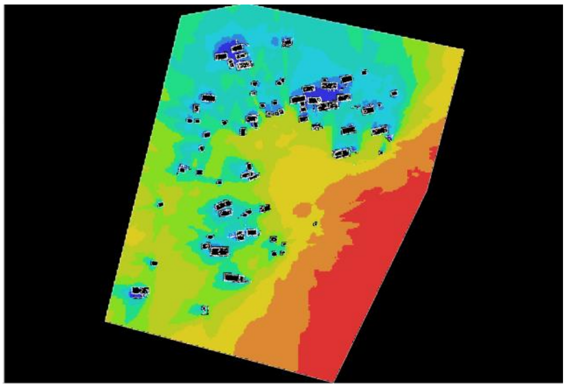
BINNINGTON



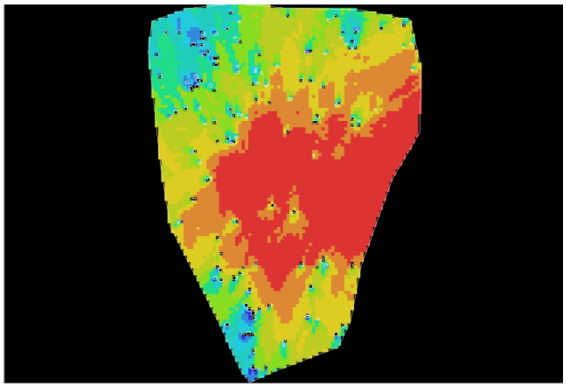
BURDALE



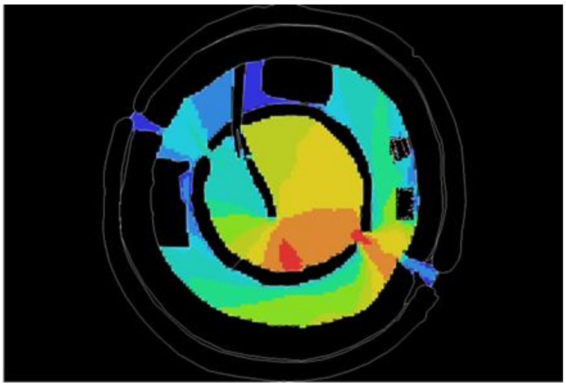
BUTTERWICK



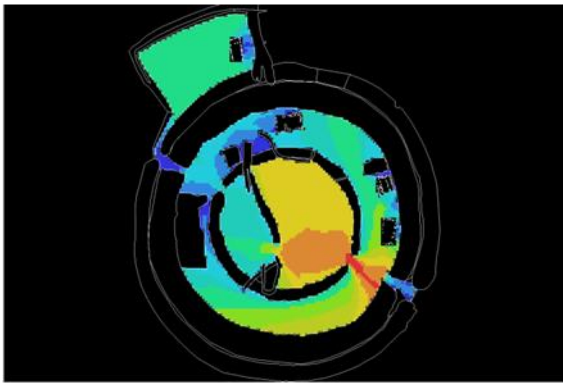
WEST HESLERTON HOUSING ZONE



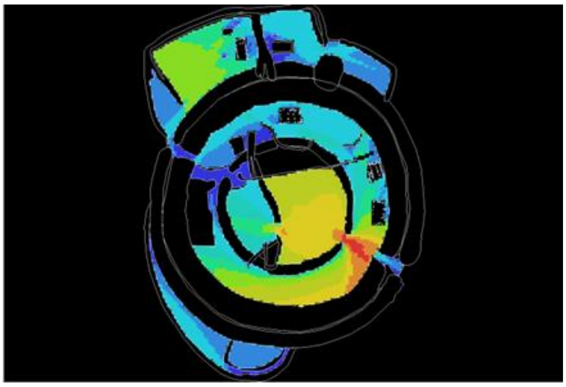
WEST HESLERTON GRUBENHAUS



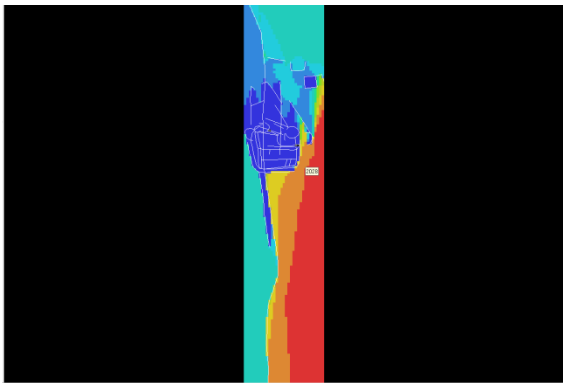
THWING PHASE 1



THWING PHASE 2

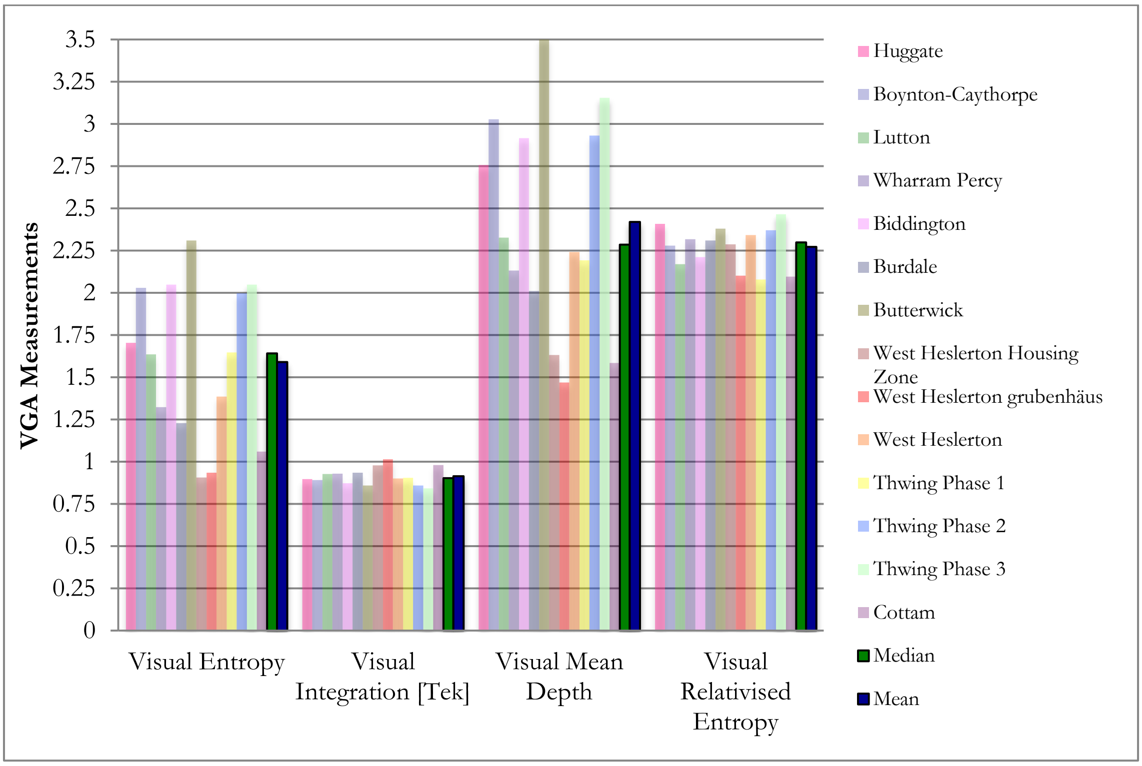


THWING PHASE 3



COTTAM

FIGURE 6.3.7.b Visibility graph analysis results on Early Medieval settlements in the YSR



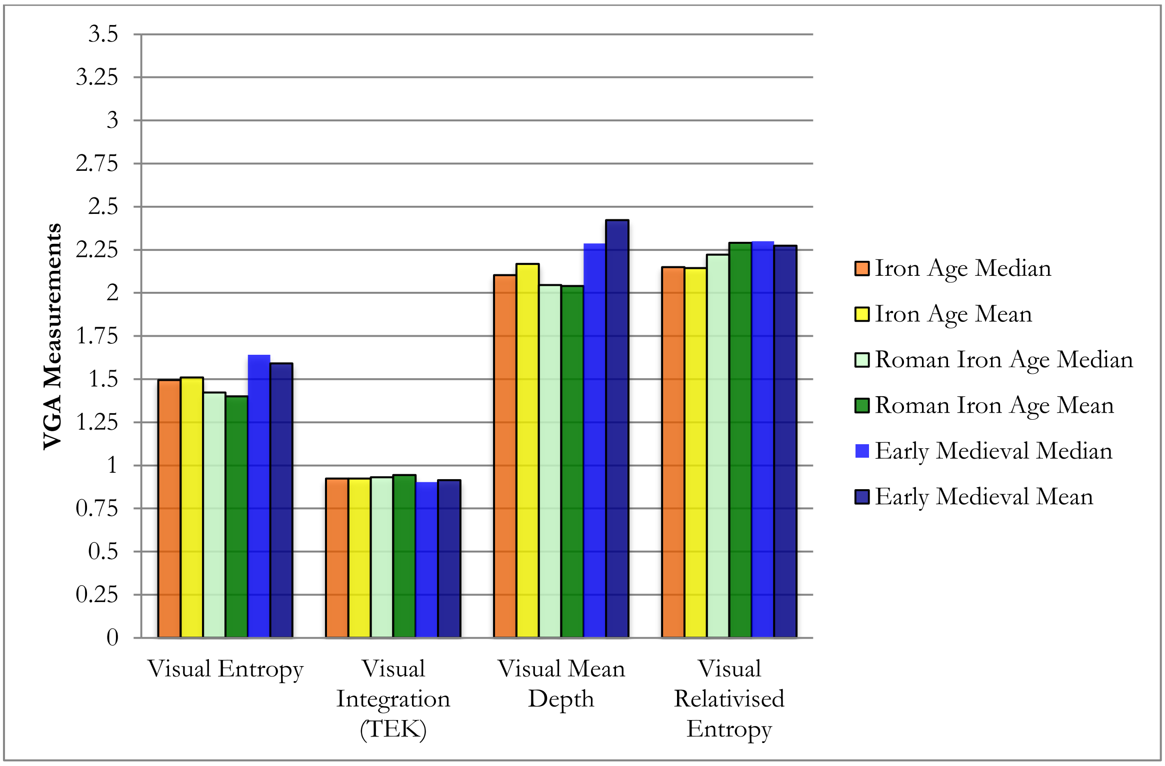

## 6.3.8 SUMMARY OF VISIBILITY GRAPH ANALYSIS IN YSR

The VGA results of the YSR built environment demonstrate that the average measurements in the three examined periods are broadly similar to one another. The mean and median measurements of the YSR settlements are compared in Table 6.3.8 and Figure 6.3.8, with the complete results located in Appendix D. The differences between the three periods are not meaningful, especially when compared to the differences between the periods in the NSR (Figure 6.2.7). The limited differences imply a consistency or continuity of the visual arrangement of space between the three periods in the YSR.

TABLE 6.3.8 VGA measurement comparisons from the YSR

| | Visual Entropy | Visual Integration (TEK) | Visual Mean Depth | Visual Relativised Entropy |
|---|---|---|---|---|
| Iron Age Median | 1.49366 | 0.923463 | 2.10365 | 2.14943 |
| Iron Age Mean | 1.509336 | 0.9228696 | 2.168118 | 2.142838 |
| Roman Iron Age Median | 1.4218 | 0.93143 | 2.04482 | 2.22242 |
| Roman Iron Age Mean | 1.400017 | 0.942815111 | 2.040416667 | 2.289481111 |
| Early Medieval Median | 1.64175 | 0.903542 | 2.285535 | 2.29937 |
| Early Medieval Mean | 1.590629643 | 0.914191929 | 2.421407143 | 2.273563571 |

FIGURE 6.3.8 Comparison of the VGA results from the YSR settlements




## 6.9 STATISTICAL ANALYSIS OF THE VISIBILITY GRAPH ANALYSIS RESULTS

The results of the VGA conducted on the settlements and structures of the NSR and YSR have indicated there were similarities between how space was visually organised in the Iron

Age and Roman periods across Northumbria, while the Early Medieval settlements differed from not only the previous time periods, but also from each other. The Early Medieval settlements in the NSR, in particular, appear to be quite different from all of the other analysed periods. That said, the differences between the Early Medieval built environment to the preceding periods in the NSR seem to be less than the differences to the other analysed periods in the YSR. Statistical tests are therefore used to determine if these observed patterns were significant or the result of chance.

A frequency distribution of the sites examined by VGA shows that the data is skewed and not normally distributed; therefore non-parametric tests are needed to examine the results, as the assumptions of a parametric test are not met. A Kruskal-Wallis test was performed to determine if the differences between the settlements' VGA results were significant. The Kruskal-Wallis test is the non-parametric version of a one-way independent ANOVA test (described in Chapters 4 and 5) and performs its calculation by ranking the medians of the pooled variates of all the examined groups. Similar to an ANOVA test, the Kruskal-Wallis test can only determine if a significant effect exists and not where the difference is from (Field, 2009, p. 549). The Mann-Whitney non-parametric test (basically the non-parametric *t*-test) comparison of medians can be used as a post hoc test to determine where the differences lie if there are significant results from the Kruskal-Wallis test, although care needs to be taken to minimize Type I errors. A Type I error occurs when we *fail to reject the null hypothesis* when it is actually true (VanPool and Leonard, 2011, p. 105). Unfortunately, repeated *t*-tests increase the likelihood of a Type I error. Field recommends a *Bonferroni correction* to address Type I errors and to use a select set of comparisons (Field, 2009, p. 550). A Bonferroni correction divides the 95% confidence interval (.05) by the number of tests to address potential Type I errors with the resulting significance level. Since one is dividing the confidence interval by the number of tests, the critical value decreases dramatically based on the number of Mann-Whitney tests and hence Field's recommendation to use small, selected groups during the post hoc analysis. A detailed description of the Kruskal-Wallis and Mann-Whitney tests, their equations, and complete results are found in Appendix B.

### 6.9.1 KRUSKAL-WALLIS TEST RESULTS

The Kruskal-Wallis test reveals there are significant differences between the Visual Integration (TEK) ($H(1) = 14.513$, $p < .05$), Visual Relativised Entropy ($H(3) = 19.844$, $p < .05$), and Visual Mean Depth ($H(4) = 12.476$, $p < .05$) global measurements of all of the settlements compared to one another. As these measurements also meet the Monte Carlo significance of .01, these significant differences are considered reliable. The Visual Entropy measurements, however, are not found to be significant, as their rank was $p > .05$, and as such we *fail to reject the null hypothesis* that these measurements are equivalent.

A Mann-Whitney test was run as a post hoc test on the Kruskal-Wallis analysis to determine where the significant differences originate. A series of groups of Mann-Whitney tests were examined using the Bonferroni correction to lessen the chances of a Type I error. Five Mann-Whitney tests were run:

- Comparing the NSR Iron Age settlements to the NSR Roman Iron Age settlements.
- Comparing the YSR Iron Age settlements to the YSR Roman settlements.
- Comparing the NSR Roman Iron Age settlements to the NSR Early Medieval settlements.
- Comparing the YSR Roman settlements to the YSR Early Medieval settlements.
- Comparing the NSR Early Medieval settlements to the YSR Early Medieval settlements.

These comparisons were chosen in order to assess whether there were significant differences in the use of space over time within a study region, and to compare the Early Medieval settlements across the two regions. These focused groups changed the critical significance value from 0.05 to 0.01 using the Bonferroni correction. Only the Early Medieval settlements differed significantly from one another at the corrected significance level (as shown in Table 6.9.1.b). These significant differences were in the same categories as the Kruskal-Wallis test, and all had a strong effect: Visual Integration ($U$=23, $r$= 0.59), Visual Relativised Entropy ($U$= 19, $r$=0.64), and Visual Mean Depth ($U$=27, $r$= 0.54). As in the overall statistical test, the Visual Entropy scores were larger than the critical value of 0.01, so we *fail to reject the null hypothesis* that these measurements are equivalent.

Based on the results of the Kruskal-Wallis and Mann-Whitney statistical tests, there are significant differences in three of the four global measurements produced using VGA. Therefore, it can be concluded that there are significant differences in how space was visually laid out and/or used in the Early Medieval period between the two study regions. However, these tests are based on all of the settlements processed using VGA. The following sections detail the statistical analysis of the excavated settlements and settlements mapped off cropmark evidence separately to determine if the recording method makes a difference in how VGA examines the data.

### 6.9.2 KRUSKAL-WALLIS TEST ON THE EXCAVATED SETTLEMENTS

When examining only the excavated settlements investigated using VGA, the Kruskal-Wallis test revealed there are significant differences between the Visual Integration (TEK) ($H(1)$ = 15.234, $p < .05$), Visual Relativised Entropy ($H(3)$ = 20.718, $p < .05$), and Visual Mean Depth ($H(4)$ = 13.508, $p < .05$) global measurements. These significant differences are genuine as they also meet the Monte Carlo significance level of .01. The Visual Entropy measurements once again were not significant ($H(2)$ = 8.506, p > 0.05) as such we *fail to reject the null hypothesis* that these measurements are equivalent.

The results of the Kruskal-Wallis test on the excavated settlements were similar to the overall statistical test examining differences between settlements and their global measurements. The Mann-Whitney post hoc test revealed a slight difference to the overall examination. Five Mann-Whitney tests were run in a similar manner to the Mann-Whitney tests of all the settlements, yielding a Bonferroni correction significance level of 0.01. Again, only the Early Medieval settlements significantly differed from one another using these test but in this case only one of the global measurement categories, Visual Relativised Entropy, was lower than the corrected significance level ($U$= 2.000, $r$= .76) compared to the three global measurements when examining all the settlements. This indicates that analyses of only excavated settlements affects the overall results of the statistical test.

### 6.9.3 MANN-WHITNEY TEST ON THE SETTLEMENTS BASED OFF CROPMARK EVIDENCE

The settlement plans derived from cropmarks used in this analysis were from the Early Medieval time period and examples were found in both study regions. Therefore, it was more appropriate to run a Mann-Whitney test as it examines two categories versus the Kruskal-Wallis, which is designed to examine more than two categories. The results of this test indicate that there are no significant differences in the global measurements between the settlements based on cropmark evidence. This is notable as it contrasts to the results of the tests on all the settlements and on the excavated settlements, which indicated there are significant differences between the NSR and YSR Early Medieval use of space. It appears that the cropmark evidence either indicates no significant difference in spatial layout between the regions or is not a useful form of evidence for this type of analysis due to the particular characteristics of cropmark-mapped settlements of limited time control, feature identification, etc. A third option, however, is that the Mann-Whitney significance test of the cropmark sites may be skewed due to the low number of settlements examined ($N$=10, 2 from Northumberland, 8 from Yorkshire). This is probably the most likely option, as it is apparent that when added to the excavated settlements, there are significant differences in the patterns between the time periods and regions and a more balanced understanding of the differences is achieved.

### 6.9.4 KRUSKAL-WALLIS TEST RESULTS OF BUILDINGS

A selection of buildings was examined using VGA from the Early Medieval settlements of Thirlings and Yeavering in the NSR and from Dalton Parlours and Beadlam in the YSR. These buildings were chosen due as they have internal differentiation that could be examined by VGA. Statistical tests were run to determine the relationship between the buildings and their settlements (i.e. a building at Thirlings and the overall settlement of Thirlings), between the settlements from a same period/region (i.e. comparing Thirlings and its buildings to Yeavering and its buildings), and between the time periods/regions (i.e. comparing Thirlings and its buildings to Dalton Parlours and its buildings). A Kruskal-Wallis test followed by Mann-Whitney post hoc tests were used as the data was non-parametric.

The examination of the excavated settlements using the Kruskal-Wallis test reveal there are significant differences between the NSR Early Medieval and YSR Roman buildings in all four global measurement categories (Visual Integration (TEK) ($H(1)$ = 11.954, $p < .05$), Visual Entropy ($H(2)$=11.608, $p < .05$), Visual Relativised Entropy ($H(3)$ = 7.302, $p < .05$), and Visual Mean Depth ($H(4)$ = 11.766, $p < .05$)). These results differ from the VGA results of the settlements in that the differences in the Visual Entropy measurements are also significant.

The Mann-Whitney post hoc tests run on the data focused on examining the differences between the settlements and their structures, the differences between different settlement's buildings, and the differences between the time periods/study regions buildings yielding a Bonferroni corrected critical value of 0.17. The only significant difference that occurs is between the Early Medieval buildings and the Roman Buildings based on the Visual Integration (TEK), Visual Entropy, and Visual Mean Depth measurements. These results align with the results of the ANOVA test in Chapter 5 that demonstrated the visual arrangement of space within buildings is similar to their settlements as a whole. Finally, the differences between the Early Medieval and Roman buildings also was expected, however the significance of the Visual Entropy scores was surprising, as Visual Entropy results were not significant in the other statistical examinations.

### 6.9.5 SUMMARY OF STATISTICAL TESTS OF THE VISIBILITY GRAPH ANALYSIS RESULTS

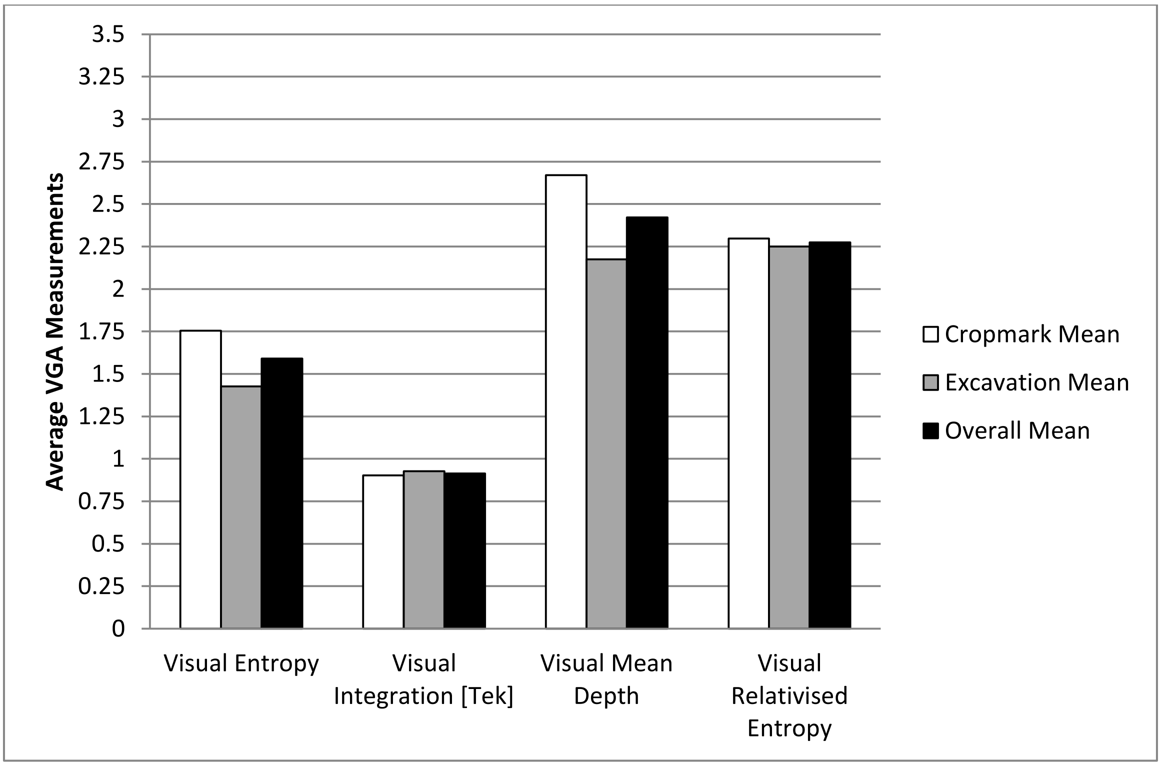
The statistical test of the VGA results was chosen to assess the patterns of visual use of space between the Iron Age, Roman, Roman Iron Age, and Early Medieval periods from the two study regions and to determine whether this indicated that the Early Medieval settlements differed not only from one another, but also from the preceding time periods in each study region based on the average measurements of the VGA results. The Kruskal-Wallis tests determined that these observations were statistically significant. The use of space in the Early Medieval period settlements from each region differed significantly from one another, but not to the preceding periods in each region. In addition, the Kruskal-Wallis and Mann-Whitney post hoc tests demonstrated that while the excavation and cropmark plans differed in how they were analysed using VGA, together they produced a more nuanced view of the use of space in the past. Finally, the statistical tests confirmed that the interior of structures use of space was not significantly different from the use of space in the overall settlement at two Early Medieval and two Roman sites. This pattern was discussed in Chapter 3 and this suggests that the structuring of a societies household is a reflection of the community and/or societal structure as well as that VGA works across scales of analysis.

## 6.10 SUMMARY OF VISIBILITY GRAPH ANALYSIS RESULTS

This chapter has described the results of VGA conducted on 52 phases of occupation at 31 settlements and 18 buildings in the two study regions to investigate the influence of the spatial arrangement of the built environment during the Roman period on the later organisation of Early Medieval structures and communities. The results have identified trends in the analysed periods in the two study regions that there are more meaningful differences in the visual arrangement of space between the two regions as opposed to between the temporal periods within the NSR or YSR. This is not to say that the different periods spatial arrangements within a study region are similar to one another, but that the differences between the average and median scores of the three temporal periods were not statistically significant.

The YSR Early Medieval settlements were less visually connected and more complex than the NSR Early Medieval settlements based on the VGA results. This possibly could be due to the larger number of cropmark-derived settlement plans analysed in the YSR. However, Figure 6.10 demonstrates that the differences between the average global measurements of Early Medieval settlements taken from excavation or cropmark plans are not significant. This signifies that the differences between study regions are not due to different recording techniques and more probably relate to the roles of space and place at the local level. The YSR Early Medieval settlements, in contrast to the NSR Early Medieval built environment, were, in terms of visual complexity and connectivity, similar to the YSR Iron Age and Roman settlements.

FIGURE 6.10 Comparisons of the global measurement mean of the analysed YSR Early Medieval settlements based on their recording methodology




The Early Medieval built environment in the YSR was remarkably similar to the Iron Age and Roman sites in the study region. This is in contrast to the Early Medieval in the NSR, which, although not statistically significant, was more variable in the visual arrangement of the settlements when compared with the preceding periods. The sites examined by VGA ranged in date from c. 100 BC-AD 800. In general, the sites from each study region were from similar time periods, although in the YSR the Early Medieval settlements were broadly later in date than those selected in the NSR. That said, two settlements in the NSR, Milfield and Sprouston, were probably occupied into the 8$^{th}$ century. In contrast, the YSR Early Medieval category only had one site dated to the 5$^{th}$ century, and many of the analysed Early Medieval settlements were either dated to at least the 8th century, or their dating evidence was unknown (the Butterwick settlements). This is an acknowledged limitation in this study and a potential issue for this investigation; however the statistical analysis of the YSR settlements demonstrates broad continuities in the organisation of visual space not only in the Early Medieval period but with the Iron Age and Roman period settlements as well. This suggests a long-term, but local continuity in the spatial arrangement of the built environment in the YSR, and validates the inclusion of late-dated Early Medieval settlements in this analysis.

The gradual changes over time in the spatial arrangements of the built environment in each region have broad implications for understanding Britain between the 1st century BC and the 9th century AD. The implications and meaning of these and the Landscape Analysis results are discussed in Chapter 7.

# CHAPTER 7
# DISCUSSION

The preceding chapters described the results of the VGA and landscape analysis of space and place from c. 100 BC through AD 800 in north-east England. These chapters have demonstrated distinctive patterns in how the built environment was spatially positioned and organised in the two study regions. The results of these investigations indicate notable variations in the spatial location of built forms across the landscape; these reflect and reinforce the trends witnessed in the internal structure of the examined settlements and households. Statistically significant differences were noted in the global measurements of integration, relativised entropy, and mean depth between the Early Medieval built environments in the two study regions. The Early Medieval period in the NSR, outside the main sphere of Roman influence, demonstrates a different use of the built environment compared to the preceding periods from the same region, especially when compared with the Early Medieval settlements in the YSR. This pattern aligns with the hypothesis that the inhabitants of Iron Age and Roman Britain influenced the later development of Early Medieval settlement configurations.

The results also suggest that regionality is more important to the development and use of space and the built environment in how people consciously or subconsciously shaped and used their built environment between c. 100 BC and AD 800. Lucy makes a similar argument for variation at the regional level over higher level identities due to her studies into ethnicity and burial evidence indicating local patterns of deposition (Lucy, 2000, p. 16). Since it is understood that the built environment is a reflection of a society, it can be argued that there is more transitional continuity in this period than previously thought at the local level. This is not to discount other patterns of change, but to argue for incorporating detailed analyses of the complexities of the past as a product of cultural memory and transmission.

Following a summary of the results, this chapter interprets these findings using theoretical approaches related to human interaction, practice, and change and considers how these factors created regional societies that are visible in the archaeological remains of space and the built environment. Creolization is introduced as a theoretical framework to interpret these results. These interpretations are then placed in a wider context, explaining how these ideas align and challenge conventional views of the transition from Iron Age to Roman and Roman to Early

Medieval Britain and examining the strengths and weaknesses of this methodological and theoretical approach. The chapter closes with suggestions for future research employing these approaches to the archaeological record.

## 7.1 SUMMARY OF THE RESULTS

Based on the results of the landscape and visibility graph analyses, there were significant differences in how the Early Medieval built environment was organised. The results show that the variation between the regions was larger than within each region between temporal periods. The following section briefly summarises the results based on time period and location.

### 7.1.2 EARLY MEDIEVAL BUILT ENVIRONMENT

Although the only statistically significant differences in the VGA measurements are between the Early Medieval settlements of the two regions, the average results show that the NSR Early Medieval settlements' spatial layouts are more different from the preceding periods in the NSR as well as when compared to the YSR Early Medieval sites' differences to its preceding periods. Table 7.1.2 shows the average global measurement variations between the examined periods and regions and the significant differences. The patterns of change between the time periods follow similar trends across the four measurement results, and indicate that the differences within each study region are larger in the NSR than in the YSR.

TABLE 7.1.2 Mean Global Measurements of the Analysed Settlements from the Examined Periods and Regions using VGA

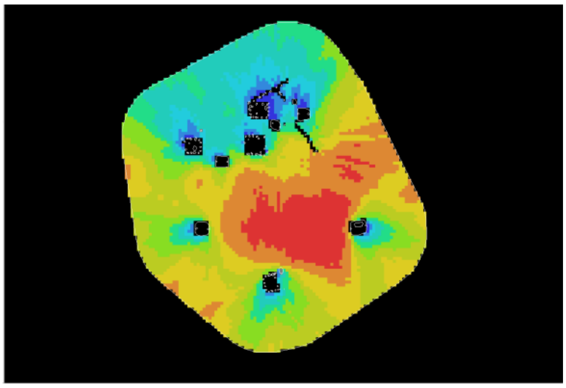
| | NSR Iron Age | NSR Roman Iron Age | **NSR Early Medieval** | YSR Iron Age | YSR Roman | YSR Early Medieval |
|---|---|---|---|---|---|---|
| Visual Entropy | 1.60 | 1.44 | **1.20** | 1.51 | 1.40 | 1.63 |
| Visual Integration (Tek) | 0.90 | 0.96 | **1.00** | 0.92 | 0.94 | 0.91 |
| Visual Mean Depth | 2.45 | 2.03 | **1.71** | 2.17 | 2.04 | 2.49 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Visual Relativised Entropy | 2.32 | 2.12 | **2.07** | 2.14 | 2.29 | 2.29 |

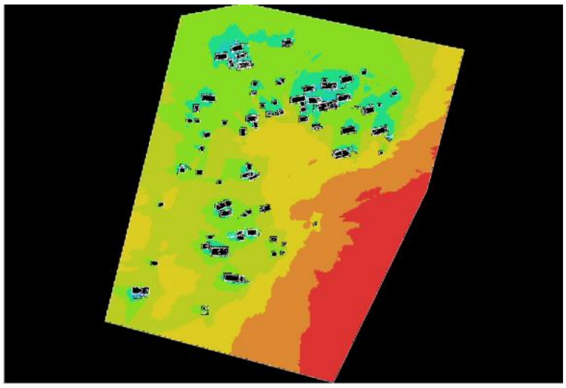
Though the numerical results of VGA performed in *UCL Depthmap* are easier to quantitatively compare, the other product of VGA, colour-shaded graphs visually showing the most and least visually connected portions of a plan, indicate that the NSR Early Medieval settlements are different from the YSR Early Medieval settlement in the visual use and structuring of space. An intriguing aspect of these results is that, in general, there were more visually connected spaces located in the central portions of the NSR Early Medieval settlements in comparison to the YSR Early Medieval sites, where the most visually connected spaces were along the outskirts of the settlements. This suggests a difference in the emphasis on visual organisation in the two study regions. This trend was not universally true as occasionally the graphical imagery results were skewed due to the large size of the settlements[3]. Figure 7.1.2.a demonstrates these differences using representative examples from the Northumberland and Yorkshire study regions. Although this pattern is not universal, it demonstrates there were important distinctions in the visual organisation of space in the Early Medieval period, even though they tend to follow similar overall patterns of household construction. These patterns are intriguing, particularly because the general style, shape, and scale of the buildings in Early Medieval Northumbria (and across southern Britain) are remarkably similar (Hamerow, 2002, 2011, 2012; Ware, 2009; O'Brien and Miket, 1991; Powlesland, 1997). Though these trends are not replicated in every example or measurement (see Appendix D), in general the central areas of Early Medieval settlements in the NSR contained some of the most visually connected portions of these settlements.

[3] The larger settlements' colour-shaded graph results did not necessarily always reflect the statistical global measurement results of the analysed settlements. This is most likely due to the scale and adapting the program for much larger spaces than originally intended, which interferes with the graphical capabilities of *UCL Depthmap*. For more information see Turner's *Depthmap Handbook* (Turner, 2004).

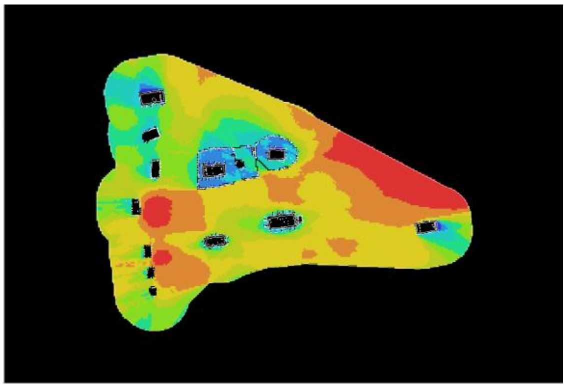
FIGURE 7.1.2.a Representative Comparisons of Visual Integration (Tek) Colour-Shaded Graphs of Excavation and Cropmark-derived plans from the Northumberland and Yorkshire Study Regions. The red colours represent the most visually integrated areas and the dark blue the least.



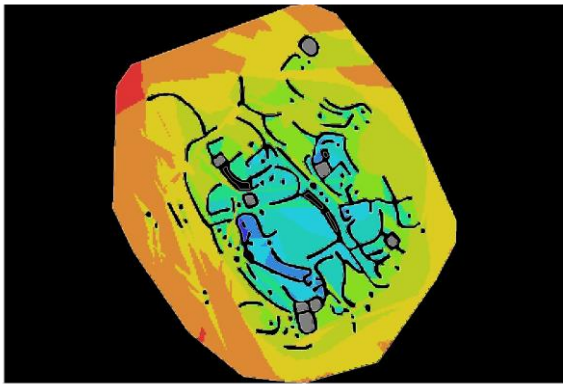
Lanton Quarry, NSR



West Heslerton Housing Zone, YSR



Thirlings, NSR



Binnington, YSR

Together, the VGA measurements show that the Early Medieval use of space in the NSR is more visually integrated and less complex than the YSR Early Medieval built environment. This would have undoubtedly affected movement and practice by individuals in these settlements. Tuan argues that the organisation of the built environment is based on sight (Tuan, 1977, p. 16), and Rapoport contends that the built environment reflects aspects of a society (Rapoport, 1982). Therefore the more visually open areas of the NSR Early Medieval built environment suggests a more accessible and unstructured society north of Hadrian's Wall. As we can only hypothesise how these settlements would have looked and how individuals would have visually reacted to them, it is suggested that based on the VGA results, individuals moving through one of the NSR Early Medieval settlements would have been able to see farther and move more freely than through the YSR Early Medieval built environment. Built forms are inherently culturally situated and carry underlying meanings understood by members of a society. The built environment establishes individuals' connections to the world and support "[…] the conditions in which the unconsidered practice of everyday life (the habitus) may proceed" (Ware, 2009, pp. 154–155). Therefore the differences in the internal arrangement of built forms in a settlement reflect the differences in the social structure of the two different 'heartlands of Northumbria' examined by this thesis to the north and south of Hadrian's Wall (Rollason, 2003, p. 46-50).

The statistical tests of the landscape analysis results demonstrate that the NSR Early Medieval built form locations across the landscape are different not only from the preceding NSR Iron Age and Roman Iron Age periods, but also from the YSR Iron Age, Roman, and Early Medieval periods. The landscape analysis results provide important context for the VGA analysis, as it demonstrates that there were shifts in the settlement placement in the NSR during the Early Medieval period. These modifications to the settlement patterning in the landscape align with shifts in the internal organisation of space in the Early Medieval settlements.

The YSR Early Medieval built forms are located in similar geographic locales to the Iron Age and Roman sites based on the examined environmental factors (Chapter 4). The VGA and landscape analyses demonstrate that differences in the spatial organisation of the YSR built environment across the three analysed time periods are not significant and are smaller than the variation observed in the NSR. When the landscape analysis results are combined with the VGA results, it is apparent that the organisation and layout of the Early Medieval built environment in the NSR was different from the preceding periods in the region as well as to the other analysed periods in the YSR.

### 7.1.3 THE IRON AGE AND ROMAN PERIODS

This thesis focuses on Early Medieval Northumbria by contrasting its built environment with the use of space and place in the preceding prehistoric and Roman periods in order to more fully understand long-term patterns of spatial organisation. Potential patterns were examined using both analyses to determine similarities or differences between the Iron Age and Roman periods, Iron Age and Early Medieval periods, and the Roman and Early Medieval periods.

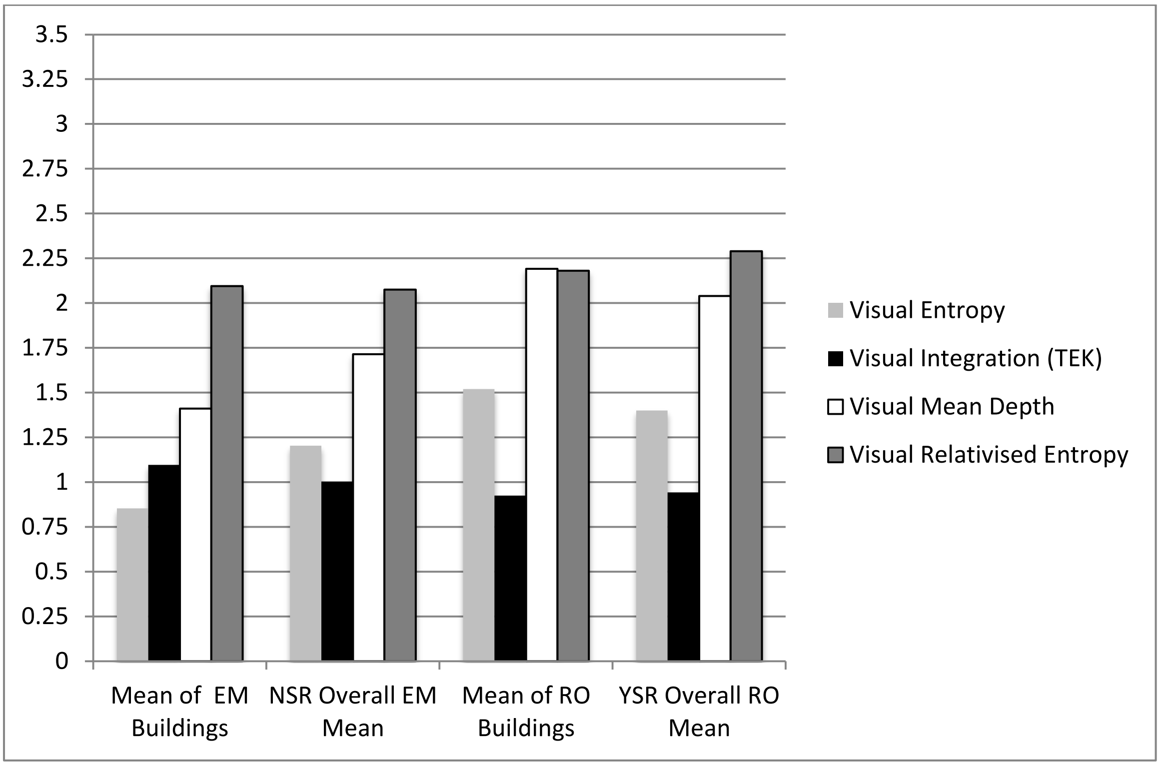
There are differences between the average global measurements of the Iron Age and Roman periods but these are not statistically significant. Of particular note is that besides the visual relativised entropy average scores, the differences between the periods are similar between the study regions, implying there were similar patterns of change occurring during the analysed periods of study (Figure 7.1.2.a). The variances between the Iron Age and Roman period settlements are larger between the two study regions than between the time periods. This is reinforced, once again, by the landscape analysis, which demonstrates that while there are differences *between* the study areas in Iron Age and Roman settlement location; *within* each area they correlate to similar geographical locales (even if their actual locations were in significantly different spatial locations as shown by the ANOVA results in Chapter 4). Taken together, the landscape and VGA results indicate that the spatial organisation and settlement patterning gradually shifted between the Iron Age and Roman periods in both study areas. These variations are smaller than the Roman to Early Medieval changes, and interestingly appear to vary in similar ways in both study regions even though the NSR was outside the main sphere of Roman influence. This perhaps indicates that the cultural interaction between these areas was larger and/or more influential than previously thought. The results of the analyses of the Iron Age and Roman built environment again emphasises that the differences between the two study regions were more noteworthy than between time periods, suggesting that although the built environment did change over time, these changes were gradual and locally specific. That said, patterns in the Early Medieval period appear to be more closely tied to region than the Iron Age and Roman patterns, which potentially relates to the stronger influence of Roman period individuals in the YSR, differences in the cultural norms of the Germanic settlers in the two regions, and/or less interaction across the two regions in the Early Medieval period reinforcing regional identities.

### 7.1.4 ANALYSIS OF STRUCTURES

The primary focus of the VGA has been on the spatial organisation of settlements as opposed to the interior of households because Early Medieval structures tend to have limited internal differentiation (Hamerow, 2012, p. 37). This is not to say that they were not separated by temporary or portable partitions, but that the archaeological remains cannot easily define the internal visual organisation of space. Structural evidence from Yeavering and Thirlings in the NSR, however, had internal posts and/or separate rooms that would have altered visibility and the use of interior space. These structures have been analysed using VGA along with the interior of Roman buildings from the YSR to provide additional evidence to investigate space and place in the examined temporal periods and study regions.

The structural analysis noted differences between the averages of the VGA results of Early Medieval NSR structures and Roman YSR structures. This was not unexpected, as the VGA results of the settlements indicate differences between the time periods and regions. More importantly, however, are the similarities observed in the global measurements of the interiors of structures compared to the overall measurement scores of the settlements from each time period, indicating that the similar organisation of space defined and practised at the household level was replicated at the settlement level (Figure 7.1.4). This pattern was first identified during the testing of VGA in Chapter 5 and was demonstrated again with the comparison of NSR and YSR buildings in Chapter 6. The VGA results of the Early Medieval structures at Yeavering and Thirlings (NSR) and the Roman structures at Dalton Parlours, Shiptonthorpe, and Beadlam (YSR) show that the differences between the organisation of space at the settlement and structural levels within a particular community are not statistically significant. Although this is admittedly a small sample size and therefore interpretations of these results should be made carefully, it does highlight the similarities in how households and community space are arranged and points out a future aspect of research using VGA. These results suggest that the organisation of space and the built environment is at least partially due to cultural values and ideas, and studies at the household, settlement, or landscape levels provide insights into how past societies structured their everyday practises and lives. This has important implications for the application of VGA studies of households and communities beyond 1$^{st}$ century BC to 9$^{th}$ century AD Britain, and is discussed in detail later in this chapter.

FIGURE 7.1.4 Comparisons between the average global measurements of Early Medieval NSR and Roman YSR structures with the average measurements of the NSR and YSR settlements




## 7.2 SIGNIFICANCE OF SPACE, PLACE, AND PRACTICE

Due to the built environment being a culturally formed unit that both influences and is influenced by the individuals of a society, changes to the built environment indicate a change in the habitus of a group. The household, and by extension community, embody the values, ideals, and dispositions that through daily individual and communal practice comprise the cultural reality of a society (Bourdieu, 1973, 1977). Rapoport contends that the built environment reflects the thoughts and practices of a society as a form of nonverbal communication decoded and understood by members of a society (Rapoport, 1982, pp. 287-289). Combining ideas of the habitus with Rapoport's *cognitive congruence model* and the VGA results can yield interpretations about past societies and how interaction between social groups changed both the built environment and patterns of movement and interaction of individuals living in 1$^{st}$ century BC to 9$^{th}$ century AD Britain. In the case of this research, VGA has focused on the changes of the visual arrangement of space and how this would have affected movement and interaction across temporal and regional boundaries. Archaeological settlements, by their nature, do not retain all of the forms of non-verbal communication within the built environment such as walls, gates, colours, and/or structural materials that individuals subconsciously use to situate themselves within both the settlement and society

(Rapoport, 1982, p. 149). What we do have, in the case of north-eastern England c. 100 BC-AD 800, are the structural remains or indications of where buildings were located. Visibility graph analysis, as used in this thesis, has examined built environment layouts and reconstructed the culturally situated nonverbal communication of vision and movement based on a fraction of the original built environment cues that would have been understood by past individuals. That said, this thesis has determined that there are both cultural trends and shifts between regions and time periods in how space and place were organised and how this would have affected the habitus of past societies.

Combining Rapoport and Bourdieu's ideas with Hillier and Hanson's space syntax and Turner's VGA can help to interpret the results of this thesis as demonstrative of a shift in how settlements were both organised and understood in the Early Medieval period. This is not surprising and has been argued as one of the key differences between Roman and Early Medieval Britain due to dramatic changes in material culture, dress, and burial practices in the historical and archaeological records (Esmonde Cleary, 2001, pp. 90–91; Hamerow, 2012, p. 1). What is interesting is that the VGA results differ more regionally than temporally, with the YSR in particular having limited change across chronological boundaries between the Iron Age, Roman, and Early Medieval visual arrangements of space. This suggests that the structuring of space in settlements, and its subsequent effect on movement and interaction based on these visual arrangements, were more similar between different temporal periods in each study region than between study regions. Whilst these results do contrast with traditional thought on the dramatic differences between the Iron Age, Roman, and Early Medieval periods, it is important to note that this is not arguing for an exact continuity of settlement forms between the periods (this is obviously not true due to changes in enclosure patterns, structural forms and materials, and the size and scale of the built environment). Rather, it demonstrates that the shifts in the visual arrangement of the built environment indicate gradual change at a local level and that these changes are potentially connected to cultural interactions altering social groups' habitus and unconsciously learned attitudes to spatial arrangements at the household, community, and landscape levels.

Visually more open and less complex spaces of the NSR Early Medieval built environment would have affected individuals' perception and practice in profound, culturally specific ways that are difficult to define and interpret even in ethnographic contexts, much less archaeological. In general, the more defined or constricted a settlement or household is equates to more visual cues available that can inform socially accepted practice. "The purpose of structuring space and time is to organise and structure communication (interaction, avoidance, dominance, and so on), and this is done partly through organising meaning" (Rapoport, 1982, pp. 182–183). Thus, differences in spatial arrangements of built forms are ethnically distinct and can be investigated and interpreted (Hillier and Hanson, 1984, pp. 1–2). Finally, the more visually complex built environments typically have more areas for public or private practice, which in turn structures individual actions, agency, and identity in more regulated ways than open, unbounded space.

Patterns or trends in settlement forms of Early Medieval Britain are difficult to discern due to the small number of settlements that have been excavated, the limited number of datable finds at Early Medieval sites to establish chronologies, the relative invisibility of the structural evidence to be found by remote sensing techniques in much of Britain, and the scale of investigations preferring partial excavations that generally do not expose enough of settlements to determine their spatial plans (Hamerow, 2012, pp. 5–8). In spite of these limitations, trends in settlement forms have been identified for Early Medieval Britain with 5$^{th}$ to late 6$^{th}$ century settlements being fairly dispersed, open, and lacking focal points and clear boundaries (Hamerow, 2012, pp. 70-71). Settlements began to become more complex in the 7$^{th}$ to 9$^{th}$ centuries, incorporating enclosures, boundaries, and alignments to the overall settlement forms that align with increasing consolidation of power and control by elites of the landscape (Hamerow, 2012, pp. 72-83). In contrast, Roman period settlements are characterised as being more compact, with clear boundaries, and typically some focal point such as the praetorium or main building in a villa complex (i.e. Housesteads, Beadlam). Iron Age settlements tend to be more open than the Roman built environment but less so than the Early Medieval period, and often are bounded by ramparts or enclosures (i.e. Yeavering Bell or Dalton Parlours).

The meaning of more or less open spaces within the built environment to members of a society is a form of nonverbal communication that reflects overall social organisation. Rapoport argues that the built environment is encoded with cultural meaning that is understood based on material, verbal, and nonverbal cues that individuals use to interpret their surroundings and the appropriate actions and activities to practice in these settings (Fisher, 2009, p. 443; Rapoport, 1982, p. 81). The nonverbal communication of built space generally needs a redundancy of cues so that individuals understand their roles and proper activities (Rapoport, 1982, p. 81). For example, Tahar and Brown's work using VGA to examine the interior of structures of the M'zab region in Algeria from the 11$^{th}$ to 14$^{th}$ centuries

AD found that housing compounds were split between male and female portions of the building positioned around central courtyards. The female quarters were very private and the least visually integrated and most complex whilst the courtyard and male areas were considered the most public and at the same time the most visually integrated and least complex (Tahar and Brown, 2003, p. 56.1-56.2). There are many cross-cultural comparisons demonstrating that the symbolic organisation of space in households and communities is a reflection of a societies' shared ideas of appropriate practices and actions that can take place between individuals (Steadman, 1996, pp. 64–65). Thus the differing trends in settlement forms in 1st millennium AD Northumbria of bounded or unbounded space and more or less open and dispersed settlements reflects the cultural ideas of interaction and practice during the Iron Age, Roman, and Early Medieval periods. This thesis has shown that while there are distinctions between temporal and cultural boundaries, there are continuities regionally in how space is structured and this is a product of cultural transmission and environmental constraints.

### 7.2.1 MATERIAL IDENTITY AND CULTURAL TRANSMISSION

The results demonstrate there were similarities in how the built environment was structured at a local, regional level over the *longue durée* and this contrasts with many of the accepted viewpoints put forward to explain how Britain changed from the late-Iron Age through Early Medieval periods. Scholars have noted the observational differences in the shape and form of structures and settlements between these periods as indicative of shifts in societal roles and rules. The following section explores these discussions and how this compares and contrasts with the landscape and VGA results. It closes by introducing creolization as a theoretical idea that might usefully be employed to explore how the built environment may have been structured and consciously and unconsciously by disparate cultural groups inhabiting the study regions under discussion here.

Research of the Roman forts along Hadrian's Wall shows that both continuity and change occurred between the Roman and Early Medieval periods (Collins, 2012, pp. 33–35). These studies have given rise to a number of explanatory scenarios: after the withdrawal of Roman power, the garrison leaders of the forts became locally powerful chiefs of war bands (Wilmott et al., 1997); the forts were not the seat of a chiefdom but rather the consciously occupied and defended boundary by warbands under the command of a regional ruler (Dark, 1992); and/or a combination of these models. Collins adapted the warband model into an *occupational community* model where individuals that share a similar profession (in this case being soldiers) construct and maintain their own society based around their occupation and this transforms in the post-Roman period into small, localised communities of warbands (Collins, 2011, pp. 27–31). Regardless of the model, the structural space of the forts along the Roman frontier from the 4th through 6th centuries AD witnessed both continuity and change. For example, the repurposing of *principia* at Newcastle and South Shields into markets or chapels (Bidwell and Speak, 1994; Snape and Bidwell, 2002), the construction of a hall-like structure at Birdoswald (Wilmott et al., 1997), and the defensive refurbishment of the stone/timber walls of the forts in the 5th century (Collins, 2011, p. 30) all indicate that there was continual use of the Roman built environment but different functional uses of the structures within Roman settlements in the 5th century.

Possibly related to the continuity noted above is the stability of the agrarian landscape during the 4th and 5th centuries in the north (Collins, 2012, pp. 135-137). The patterns of clearances and woodland regeneration in the north, based on pollen coring, indicate that the more extensive changes to the landscape occurred in the 6th and 7th centuries, indicating a general continuity in landscape exploitation at the local level in the immediate post-Roman period. Changes to the agrarian economy in the late 6th and 7th centuries may relate to changes in the natural environment as well as to the structure of Early Medieval society. The growth of boundaries and enclosures from the 7th century onwards has been argued as resulting from the increased political stabilisation and control of the landscape as well as the development of new crop and husbandry techniques providing for more stable settlements (Hamerow 2002, 2012, pp. 161-163; Reynolds, 2003). This increased interest in enclosure can be seen in the Butterwick-type settlements in the YSR and at Sprouston and Milfield in the NSR. Although the increased enclosure of settlements represents a dramatic change in the structuring of settlements from the 7th century onwards, the VGA results suggest that the visual organisation of these settlements shares long held continuities at the local level.

Although the above models explain the continuous use of some Roman settlements and the later changes that affected settlement in the Early Medieval period, they do not adequately address the results of VGA and landscape analysis which imply that although there are broad and dramatic changes to society occurring from c. 100 BC-AD 800, there are locally identified ideas on space and place that persevere over the *longue durée*. Group and individual identities continually evolve and shift due to transformative processes that occur over time and, in particular, when different cultural groups come into contact with one another. These changes affect the material remains of a society that archaeologists encounter (Groover, 2000, p. 102).

Creolization is introduced here as a theoretical approach that may explain the results of the two analyses better than other models due to its strengths in interpreting how aspects of the built environment endure and hybridise when multiple social groups interact. Creolization can be defined thus:

> Creolization, finally, directs our attention toward cultural phenomena that result from displacement and the ensuing social encounter and mutual influence between/among two or several groups, creating an on-going dynamic interchange of symbols and practices, eventually leading to new forms with varying degrees of stability (Eriksen, 2007, p. 172).

Archaeologists, mainly working on historic-period sites in North America, have adapted creolization to interpret multi-ethnic households and communities of the past (Deetz, 1996; Ferguson, 1992; Wilkie, 2000a, 2000b). Deetz's work on creolized forms of vernacular architecture demonstrates the strength of creolization in interpreting hybrid built forms. The front porch, one of the most ubiquitous aspects of American vernacular architecture has its roots in West African structural traditions combined with European construction techniques (Deetz, 1996, p. 217). The idea of a covered outdoor area along the front of a structure is outside of English architectural traditions, but is quite appropriate for the hot and humid summers of the American south and were adopted from the incoming African slaves to become a standard fixture of the built environment across the United States (Figure 7.2.1) (Deetz, 1996, p. 228). Deetz argued that porches are a material example of creolization, and that they demonstrate the end products of culture contact and transmission.

FIGURE 7.2.1 Comparison of author's childhood home in Pennsylvania displaying a porch across the front of the house and the author's current residence in County Durham, England without a porch. These photos show the effect of creolization on similar building styles due to the presence/absence of a porch.


Deetz's front porch example demonstrates that aspects of the built environment are both adopted and adapted in conscious and subconscious ways by cultural groups (Deetz, 1996, p.

228). The front porch is an excellent example of creolization, as the power dynamics of African enslaved and Euroamerican master would make it seem unlikely that the white plantation owner class would adopt traditions from their chattel property. Yet the porch as an architectural form was adopted and adapted and spread quickly throughout what became the United States (especially in the warmer, southern climates). This was in spite of the attitudes and prejudices of the time, demonstrating that creolization is a product of cultural interactions and transmissions affecting all parties involved and not just the dominant cultural group. Similarly, dynamics in the two study regions between Roman conquerors and native Britons, or between Romano-British inhabitants and Germanic migrants would be just as complex with differing power roles, relationships, and structures that can be interpreted using creolization. Britain between c. 100 BC and AD 800 was obviously quite different from Colonial America, but shares similarities in how the built environment changed dramatically while at the same time retaining aspects of previous ideas on space and place as well as sharing an analogous situation of differing constituent groups interacting in a colonial situation containing at least three groups of people (in this case native Britons, Romano-British, and Germanic migrants, themselves probably from different areas and being members of numerous groups). The VGA results indicate a continuity of how space was visually organised in the NSR and YSR across temporal boundaries. Interpreting these results using creolization suggests that interactions between the various social groups inhabiting the two study regions was responsible for the exchange of ideas on spatial organisation that allowed this long continuity to occur.

Scholars have noted that Early Medieval building traditions may be the result of hybrid Germanic and Romano-British construction techniques and forms, with examples in Early Medieval Britain appearing similar to continental as well as earlier Romano-British features (Hamerow, 2012, pp. 18–22; James et al., 1985, pp. 205–206). The pre-existing ideas of structural forms and settlement types used by the Germanic settlers coming to north-eastern England contrasted with the built environment of Romano-British traditions in both form and scale, but shared similarities in construction techniques and materials (timber post-in-ground constructions). The most ubiquitous type of building throughout north-western continental Europe was the timber longhouse, which "(…) generally took the form of an east-west oriented building with living quarters containing a hearth and a variable number of compartments at the west end, a central entrance 'hall' with two opposing doorways, and a byre at the east end" (Hamerow, 2002, p. 15). The longhouse, however, has not been found in archaeological excavations in England. The main difference of the continental longhouse to the buildings in Early Medieval Britain was the scale of the structures due to the lack of a byre as well as no internal posts or internal differentiation of space. This lack of a byre has been explained due to the relatively milder English climate not requiring cattle to be kept indoors during winter (Rahtz, 1976, p. 61); the relative unimportance of cattle to the economy of Early Medieval Britain (Zimmermann, 1999); or the Romanized populace resisting this continental building style. Hamerow discounts these reasons and instead argues that the shape and form of structures in Britain reflected both shifts in structural styles occurring across continental Europe in the 5$^{th}$ century AD and also may represent a hybridised shape of Romano-British and Anglo-Saxon structural techniques and forms (Hamerow, 2002, p. 15).

Continental settlements also differed from Early Medieval communities in Britain, as they were more densely packed with structures and often arranged in organised rows or patterns, had distinctive functional areas, and were demarcated by enclosures or other boundaries (Hamerow, 2002, p. 53). Early Medieval settlements in Britain during the 5$^{th}$-6$^{th}$ centuries AD, on the other hand, were generally not bounded, were fairly dispersed, and often lacked functional zones (although there were outliers to this such as at West Heslerton) (Hamerow, 2002, 93). Although Early Medieval settlements became increasingly stratified with the shift towards bounded space from the 7$^{th}$ century onwards, the VGA results indicated that at a local level, these more bounded and enclosed settlements still displayed continuities to the previous periods' use of space within each study region. The households and settlements of Early Medieval Britain have links to the built environment of the continent, but differ in unique ways such as scale (the household), shape (lack of a byre) and organisation (unbounded, dispersed settlements). These differences, like the differences identified between the Early Medieval settlements analysed using VGA may relate to the importance of regional identities and perhaps to the creolization processes that occurred in transitional Britain changing ideas of the incoming settlers on how to organise space and place.

The VGA results have shown a similar hybrid use of space across temporal periods. It has been argued that Early Medieval structures across Britain are remarkably similar in shape, scale and style (Hamerow, 2012, pp. 22–26; Marshall and Marshall, 1991, p. 42; Powlesland, 2000, p. 26). "What little evidence survives for the layout of the Anglo-Saxon house suggests that, in contrast to the longhouse, it consisted essentially of one room, often with a small subdivision at the end"(Hamerow, 2002, p. 47). However, the results of the VGA have shown that the arrangement and organisation of settlements differed regionally (at least in Northumbria). It is argued here that these differences can be profitably understood as a product of creolization; as the incoming migrants (themselves coming from different regions and having disparate building traditions), interacted with the local populace (that was also a creolized society due to its own post-colonial relationship to different social and political events in relation to Roman Britain) ideas on the built environment were exchanged, adapted, and used. These results suggest a model of spatial organisation that is more locally based rather than temporally related as the arrangement of the built environment reflected a creolized culture that incorporated Germanic built forms and British/Romano-British use of space in each region. The distinctiveness of the patterns of settlement across the landscape as well as in the layout of the communities are indicative of broad societal trends that may have formed through a creolization process.

Creolization is not a linear process with equal sharing of traits and ideas, and the different results between the study regions can be seen as a product of contrasting ideas on spaces and places. However, they can also be the result of varying degrees of interaction, adoption, and resistance. Creolization occurs at different scales due to a variety of complex factors relating to interaction, power, resistance, adoption, and transmission. For example, dress, ceramics, and even built form styles (such as the front porch in Colonial America or the standard one-room style of the Anglo-Saxon structure) can quickly be adopted. These adopted changes can be seen archaeologically across broad regions as some cultural ideas spread rapidly as individuals acclimate and accept these new patterns and practices. More subtle ideas on spatial organisation, however, appear to be tied to regional patterns of organisation and practice.

# 7.3 INTERPRETATION

## 7.3.1 REGIONAL DIFFERENCES VERSUS TEMPORAL DIFFERENCES

The VGA results in both study regions demonstrate that locality rather than temporality is more important for understanding the changes that occurred in Northumbria between the Iron Age and Early Medieval period. Gradual changes over time occurred in the YSR between the analysed Iron Age, Roman, and Early Medieval settlements and more dramatic changes occurred in the NSR. It has been shown that at the regional level, the spatial changes are smaller between temporal periods than across regional boundaries. The Early Medieval built environment north of Hadrian's Wall was a product of interaction between incoming migrants and the descendants of the Votadini, themselves altered from their prehistoric past by time and interaction with their Roman neighbours to the south (Haselgrove et al., 2009; Hunter, 2010, 2007; Loveluck, 2002, p. 131). Although the Early Medieval period in the NSR was quite different from the preceding periods in the NSR, these differences are not statistically significant and are perhaps indicative of the limited amounts of interaction and cultural adoption between the native British inhabitants and incoming Germanic migrants as compared to the YSR. The Early Medieval built environment south of the wall was a product of a very different society where the native Parisi arguably became a more Romano-British hybrid culture that when they came into contact with the incoming migrants of the 5$^{th}$ century, affected the settlement patterns in a very different way (Halkon, 2013, p. 231; Millett et al., 2006, p. 220). Therefore the results suggest that the Romano-British society in the YSR, when it interacted with incoming migrants, potentially creolized into a new group that incorporated aspects of the built environment of the two regions at a greater scale than in the north, explaining why the results are more similar in the YSR. Therefore the built environment of regions can be seen as a result of interaction at the more local level.

Connected to these regional differences is the relationship between social hierarchy and spatial organisation. Research has shown that less open settlement plans and more condensed arrangements of structural forms reflect societies with more hierarchy and centralised control (Allison, 1999; Blanton, 1994; Giddens, 1984; Hillier, 2007; Hillier and Hanson, 1984; Lawrence and Low, 1990; Rapoport, 1982, 1994; Wilk and Rathje, 1982). For example, Foster's study of Iron Age *brochs* in Orkney using Hillier and Hanson's access analysis (albeit interpreted using Giddens' structuration theory) noted a shift in the hierarchical nature of the built environment from the Early to Middle Iron Age (Foster, 1989, p. 47). The access analysis of the Middle Iron Age brochs on Orkney indicated limited permeability and access to the interiors of the broch settlements, which contrasted with the more open plans of the Early Iron Age communities. Foster argues that the more condensed and less open plans of the nucleated settlements surrounding the brochs indicates a shift in the ranked social hierarchy between the Early and Middle Iron Age periods in Orkney, concentrating status with the inhabitants of the broch itself in the 'centre' of the nucleated villages (Foster, 1989, p. 49). Following this, the more or less open settlement plans of the two study regions can be considered as representative of the social hierarchy of the Early Medieval period in the two areas.

The contrasting of the more open plans of the NSR Early Medieval settlements to the more condensed and less visually integrated YSR Early Medieval sites suggests that society may have been less hierarchical in the more northern study region compared to the YSR. The VGA results corroborate these observations, with the NSR settlements more visually integrated and less visually complex than the YSR settlements. Whilst including the densely packed Butterwick-type enclosure settlements undoubtedly influenced these results, both West Heslerton and Thwing also are more complex than any of the NSR Early Medieval settlements. The noted contrasts between the two study regions compares favourably with the pre-Christian burial evidence of Bernicia and Deira, which suggests there were far fewer elites in the NSR compared to the YSR. O'Brien's doctoral thesis reviewed the burial evidence of Bernicia and Deira, and emphasised the broad differences in the burial practices and material culture recovered from internments from the two regions (O'Brien, 1996, p. 161). The Deiran burial evidence typically contained more grave goods and artefacts of a higher social status than the Bernician evidence. She related these differences to the traditions of the Iron Age and Roman periods in each region as affecting the later burial practices locally in the Early Medieval period. The burial practises in the YSR, which included both inhumations and cremations, and the relative wealth of grave goods as compared to the NSR indicate varying identities between the two regions (Semple, 2013, p. 27). As Lucy has argued that the East Yorkshire Early Medieval burial evidence is unique to the region due to the higher percentage of weapon burials and crouched burials compared to other regions of Britain (Lucy, 2002, p. 86). The regional differences of burial evidence between the NSR and YSR, or between the Early Medieval kingdoms of Bernicia and Deira, confirms the importance of regionality in understanding the differences in the two regions of Northumbria. Taken together, the arrangement of the built environment and the burial evidence of the two study regions during the Early Medieval period indicate differing degrees of social hierarchy and elite control of both the organisation of communities and social practice between the NSR and YSR.

These results support the hypothesis that Roman Britain affected the later spatial organisation of the Early Medieval period while at the same time arguing that regionality was very important to understanding how settlements were organised in the later period. In the case of Northumbria, one of the primary factors for the regional differences is that the NSR Roman Iron Age, although similar in visual organisation in some ways to the Roman sites in the YSR, was still meaningfully different at the household, settlement, and landscape levels so that when incoming migrants intermixed in the NSR during the Early Medieval period and formed a creolized society, they formed a regional identity distinct from the regions south of Hadrian's Wall (in the YSR) that was at least partially due to the limited presence of Roman Britain.

### 7.3.2 MIGRATION AND THE BUILT ENVIRONMENT

Bede's description of the origins of the English people describes a massive invasion of Germanic peoples that conquered and displaced the native population. He specifically describes the continental origins of the Anglo-Saxon kingdoms, implying the differences in his time between the kingdoms could be traced to the historical and cultural differences during the migration period.

> They came from three very powerful Germanic tribes, the Saxons, Angles, and Jutes. The people of Kent and the inhabitants of the Isle of Wight are of Jutish origin, and also those opposite the Isle of Wight, that part of the kingdom of Wessex which is still today called the nation of the Jutes. From the Saxon country, that is the district now known as Old Saxony, came the East Saxons, the South Saxons, and the West Saxons. Besides this, from the country of the Angles, that is, the land between the kingdoms of the Jutes and the Saxons, which is called *Angelus*, came the East Angles, the Middle Angles, the Mercians, and all the Northumbrian race (that is those people who dwell north of the River Humber) as well as the other Anglian tribes. *Angulus* is said to have remained deserted from that day to this (*EH,* 1:15).

As discussed in Chapters 2 and 3, the debate on the origins and creation of Early Medieval Britain have focused on the migration of Germanic peoples as one of the key factors to explaining the shift in material culture in the 5th century (Brugmann, 2011, p. 30; Hamerow, 1997, 1994; Härke, 2011; Hines, 1997; Woolf, 2007). These debates have concentrated on the traditional view of a large group coming over and displacing or replacing the native populace (as argued by Gildas and Bede), an 'elite model' where a relatively small group of warrior elites migrated and controlled the native populace, an 'apartheid model' where the incoming immigrants kept themselves separate from the native populace before acculturating and assimilating in the $7^{th}/8^{th}$ centuries, or combinations of the above ideas.

Many scholars have discussed the differences between Bernicia and Deira as relating to their different experiences during the migration period, with the argument being made that the YSR witnessed a larger number of immigrants that took over the region through conquest, while the NSR witnessed a smaller, elite takeover (Cramp, 1999; Hawkes and Mills, 1999; Higham, 1993; Petts and Turner, 2011a; Rollason, 2003). These arguments are based on place name, artefactual, and the relatively large amount of burial evidence (i.e. West Heslerton) along with the historical descriptions of the period. The results of this thesis at first glance appear to contradict these findings, as the Early Medieval period in the YSR shares many similarities to the preceding Iron Age and Roman periods in both spatial locations and visual organisation of household and community space. The Early Medieval period in the NSR, in contrast, was more different than the preceding periods concentrating settlements along the drainage basins and being more accessibly arranged and visually connected than the preceding periods. These results imply that if there were large migrations into the YSR in the 5th century, some sort of contact and cultural transmission between groups would have taken place for the similarities in spatial positioning and organisation of space observed by the VGA and landscape analyses. Thus conquest and assimilation seem unlikely due to the meaningful similarities witnessed in the spatial arrangements of built form sites in the YSR throughout the 1st millennium AD. Likewise, if there was an elite takeover in the north, it could be expected that these results would align more closely to the preceding periods instead of differing as a smaller group would hypothetically be integrating and creolizing more with the native population. Although it is quite possible that the results could be a product of the archaeological visibility of sites, if we interpret the results as they are, it is probable that the creolization process in the NSR was of a very different character than in the YSR.

In addition to the movement of people and ideas from outside of Britain, the early polities of North East Britain were also subject to internal political interest and take over. After the consolidation of Bernicia and Deira, the kings of Northumbria worked to expand their kingdom in the North through conquest (*EH*, 2). This consolidation of power may also have impacted upon the built environment. The movement and integration of Anglo-Saxon elites in these northern territories might have had influence on the changing nature of settlement shape and form at a supra-local level. The more organised and planned structural organisation of elite Early Medieval settlements across England by the 7th and 8th centuries has been linked to the emerging power of royal families or aristocratic groups; villa regia or 'palace' sites in different nascent kingdoms are argued to share remarkably similar plan forms and hall complexes (Hamerow, 2002, pp. 96-99, 2012; Reynolds, 2003). Chris Scull has disputed Hope

Taylor's early dating of the first phases at Yeavering, arguing these are entirely plausible as a first phase of Anglian settlement in the 6th century (Scull, 1991). In addition, by comparison to the evolved 'estate centre' complexes of Chalton and Cowdery's Down in Hampshire, the later Post-Roman phases IIIAB, IIIC, IV, and V at Yeavering (Hope-Taylor, 1977) share similarities in the organisation of structures and enclosures to other elite settlements in southern England dated to the 7$^{th}$ century (Reynolds, 2003, p. 104-107). The results of this thesis do not deny these identified elite links between established major estate complexes, but they do suggest that the organisation of the built environment in the north continued to be influenced by local long-term traditions and identity.

The observed and statistical patterns reinforce ideas of regionality over temporality, implying that there was a transmission of cultural ideas on the visual arrangement of space at either a conscious or subconscious level and if that is the case, then it is probable that these settlements were a product of a creolization process. Although creolization is not measureable per se, it is seems probable that the NSR in the Early Medieval period developed differently than in the YSR. It is conceivable that the populations in the NSR although subject to elite takeover, retained long-held traditions of inhabitation in terms of space and housing, despite a significant spatial shift in terms of settlement location. By contrast creolizing processes seem more evident in the YSR where there are more demonstrable continuities in settlement location and use of space.

Gradual changes to the settlement patterns suggest variations in the way communities creolized and developed in each region. The results of this analysis, therefore, provide strength to the argument that Bernicia and Deira were settled differently while at the same time arguing that the preceding, Roman period played a strong role in how the migration proceeded and how the spaces and places were structured.

## 7.4 CONTRIBUTIONS AND LIMITATIONS OF THE RESEARCH

This research has produced both general and specific methodological and theoretical contributions to research on Britain in the 1$^{st}$ century BC through to the 9$^{th}$ century AD as well as to the archaeological studies of space and the built environment. The following section critically examines these contributions.

### 7.4.1 METHODOLOGICAL CONTRIBUTIONS AND LIMITATIONS

An aim of this thesis was to examine the socially constructed use of space and place in a quantitative manner to investigate the negotiated reproduction of social rules and relationships in Early Medieval Britain, and how these were related to the influence of cultural interaction between the various groups inhabiting 1st century BC through 9th century AD north-east England. It has done so by developing a new use of VGA, expanding its original design for investigating the internal space of structures into analysis of the spatial arrangement of settlements in order to statistically compare the findings. Combining the results of VGA with more traditional GIS spatial analysis has demonstrated that the specific examination of space and the built environment yields important results that can be queried and interpreted to understand change or lack thereof over time. For the first time, this thesis has demonstrated the specific examination of spatial arrangements can be both observationally and quantitatively analysed, providing a larger dataset to compare, contrast, and interpret the past built environment. It has shown the benefits of examining space and place at multiple scales using a combination of innovative methodological techniques. These innovations contribute much to the study of Iron Age through Early Medieval Britain and these techniques can be expanded to look at other transitional landscapes and built environments across temporal and regional boundaries. By focusing on space as constructed evidence of past social practice, this thesis has argued that a re-examination of legacy data (the records of previously excavated and recorded archaeological settlements) can provide new interpretations on transitional Britain using VGA and GIS.

Another important contribution of this methodological approach has been to formalise the study of space and place in Early Medieval Britain as an essential component for understanding the complexities of interaction and transmission between the establishment of Roman Britain, the later dissolution of Roman control, and the transformation into Anglo-Saxon England. By specifically focusing on space using excavation and cropmark plans, this thesis argues that the large amount of recorded data available in the published and grey literature can contribute much to the current academic and research debates on the period. This argument aligns with current on-going projects such as *The Landscape and Identities: The case of the English Landscape 1500 BC-AD 1086* project which has been compiling large amounts of spatial and recorded data from across England to examine long-term continuities and changes to landscape patterns (ten Harkel et al., 2012). Computational archaeology can relatively quickly analyse past excavations and incorporate them into current research designs and studies.

There are limitations to using GIS and VGA to examine these issues that are associated with the constraints of the methodologies and the data sets used for the analysis. Firstly, the GIS landscape approach relied upon data recorded at the HERs. Although this data is extremely useful for understanding positioning across the landscape, there are inherent biases in this dataset. Therefore the patterns observed in the data may be due to biases resulting from archaeological practise as well past use of the landscape (see section 4.14.1).

Though this is an acknowledged limitation of the dataset, the statistical examination of the landscape results examined the correlations between the environmental factors (topographic relief, proximity to water, and geology) rather than focusing on density of settlement, in order to mitigate the potential limitations of the dataset. Secondly, it has been shown that the use of VGA requires good, detailed, and relatively complete settlement plans. Thus there is an inherent bias in the site selection process, excluding many important settlement types such as the monastic settlement at Lindisfarne or Monkwearmouth, the Iron Age cropmark enclosures on the coastal plain, and the Roman Iron Age scooped settlements that do not have detailed plans noting the arrangement of structural forms. Future excavations and/or advancements in digital mapping techniques may aid our understanding of these arrangements, and will allow these settlements to be analysed using VGA. An associated limitation as a result of the demands of VGA, is the need to include only settlement sites with extensive known plans. This meant the selected YSR settlements tended to date to the later end of the period under discussion. Related to this is the higher proportion of cropmark-based settlement plans analysed using VGA as compared to the selected sites from the NSR. These differences potentially limit the success of any cross-regional comparison. The statistical analysis of the VGA results, however, has shown that the YSR Early Medieval settlements not only do not differ significantly from one another, but also do not differ from the preceding Iron Age or Roman periods. This indicates continuity in how the built environment was structured in the YSR over the *longue durée*. Future research exploring additional Early Medieval settlements will add context to this analysis and will mitigate the limitations as described above.

*UCL Depthmap* was designed for two-dimensional plans and cannot take into account the ground surface and how it affects the visual organisation of space within settlements. In general, most of the settlements had adequate visibility across the site; however there were a few examples where the topography would have affected the visibility within the settlements included in this analysis. This was mitigated by thinking of the VGA results as a proxy for understanding the organisation of the built environment rather than recreating the literal past visibility of individuals inhabiting these sites. Secondly, the steps to using VGA correctly require time-consuming digitisation of archaeological settlement plans, and using these digitised plans in *UCL Depthmap* requires a large amount of time and processing power. These limitations should lessen over time, as it is now common practice to digitise site plans and the integration of VGA on other platforms, such as GRASS GIS (Geographic Resources Analysis Support System GIS, an open source software package) and ArcGIS, will speed up the amount of time spent performing the analysis, thereby making the technique more accessible and applicable for other users. Finally, this thesis has relied upon previously published site reports and monographs. Chronologically, few 5th century AD settlements have been included, and many of these sites were poorly dated due to limited datable evidence and/or discernibility in the archaeological record. This weakness has been mitigated by the fact that if there were patterns in visual organisation from the Roman period to the Early Medieval settlements, even if they were from the 7th or 8th centuries, it could be assumed these were long-term and long-held patterns in the arrangements of space. Advancements in dating Early Medieval archaeological deposits due to new techniques and typologies will aid this methodological consideration of Early Medieval Britain, allowing a tighter chronological consideration of changes to spatial and visual arrangement of the built environment in this period.

### 7.4.1 THEORETICAL CONTRIBUTIONS AND LIMITATIONS

Recently there has been an interest in researching the meaning of the Early Medieval built environment, particularly as relates to the great halls at sites such as Yeavering (Walker, 2011; Ware, 2009). This work expands on spatial research by investigating cultural continuities and similarities between historically defined temporal periods to understand how the transmission of ideas affected the built environment. Although examining space as a social construct is not a new idea in archaeological research, this research, by developing a new methodology, has been able to statistically compare how space was arranged across time periods and regions and therefore examined space in an innovative way. By doing so, it agrees with Ware (2009) in that the specific examination of space and place is vital for archaeological research into the Early Medieval periods. The results indicate that traditional views on the differences between the Iron Age, Roman, and Early Medieval periods material culture need to be understood in a more nuanced way, and new models and methodologies as proposed here are needed to examine long-held traditions or continuities.

In addition, this research advocates for thinking of Early Medieval Northumbria as the product of colonialism, as suggested by Bowles (2007) in his work on the late antique Bristol Channel region. Creolization has been proposed as a framework that potentially can address the continuities in spatial design between c. 100 BC-AD 800. Like Webster's (2001) argument for using creolization to discuss the broad societal changes that occurred in Britain after the Roman conquest, this thesis demonstrates the utility of this theoretical approach to examining the 1st century BC to 9th century AD transitions. The explicit investigation of space and place paired with creolization enables this thesis to make specific interpretations on the influence of preceding periods and social groups on the Early Medieval period as well as to address issues of migration, interaction, acculturation, and assimilation.

The specific focus on space and place of Early Medieval Britain, as well as using post-colonial theory to interpret it can be critiqued on a number of grounds. The adaptation of creolization to Early Medieval Britain may be seen as problematic, as the theory was developed to investigate the post-colonial Caribbean and in the opinion of Palmié, for instance, should not uncritically be transferred out of the specific temporal and regional locale it was developed to interpret (Palmié, 2006, p. 435). It has been suggested as a framework that addresses how ideas of spatial organisation may have continuously been replicated and used across a long period due to the transferring and sharing these of these notions between multiple social groups from the late Iron Age through Early Medieval periods. Although it is felt this post-colonial framework is a valuable addition to examining Early Medieval Britain, more work is needed to fully understand whether or not creolization is the most appropriate theoretical approach to understanding how the continuities in the built environment from c. 100 BC-AD 800.

Another potential limitation of this research is that the ecclesiastical sites of the 7th to 8th century have not been addressed. Although excellent examples of these types of sites are found in Northumbria at, for example, Lindisfarne, Jarrow, Monkwearmouth, Hartlepool, and Whitby, they were not included as they were either outside of the study regions (such as Jarrow/Monkwearmouth and Hartlepool) or have not been excavated to a large enough degree to use VGA (Lindisfarne) (Cramp, 2005; Cramp et al., 2006; Daniels, 1988). An expansion of the study regions will allow the methodological and theoretical approaches advocated here to include the early Christian built environment. Related to this is the examination of symbolic space as discussed by Ware in her examination of the great halls of Yeavering. VGA does not take into account symbolism and ideology; important cultural aspects that also should be considered to fully understand and interpret this period in future research projects.

## 7.5 SUMMARY

The results of the two methodologies show that a more gradual change occurred between Iron Age, Roman, and Early Medieval Britain due to creolization than traditionally believed, indicating that there had to be some form of interaction for these patterns to exist regardless of how many peoples from what is today Denmark, Germany, and the Netherlands actually migrated to north-east England. It has argued that the results are indicative of contact, although to a different degree in each region. The Early Medieval built environment in the NSR was different from all the other regions, and this may be the result of a more limited migration into the region. These limited numbers would have interacted with the native populace to a lesser degree. At the same time, it is acknowledged that this region's population was probably much smaller, and this would have also affected the rate of creolization and cultural transmission of ideas on the built environment. Likewise, the strong continuities across the Iron Age to Early Medieval period in the YSR indicates a creolized society that changed gradually over time, suggesting large scale migration into the region that interacted with the local populace. It is important to note that creolization does not rule out conquest or warfare, and is not necessarily indicative of peaceful negotiations. It is probable there was warfare and strife occurring across these two periods. What it does say that at a local level individuals from different cultural groups were interacting, sharing ideas (consciously or subconsciously) and forming the future Anglo-Saxon kingdoms of Bernicia and Deira, and later on Northumbria.

# CHAPTER 8
# CONCLUSION

This research has analysed how Roman Britain affected the spatial organisation of Early Medieval built environments in north-east England. It has demonstrated that space and the built environment are cultural constructs that can be critically compared across regional, temporal, and cultural boundaries. An innovative adaptation of VGA was designed and implemented in order to quantifiably analyse the visual arrangement of structural forms in archaeological settlements. The patterns and trends resulting from this process were combined effectively with traditional GIS spatial analysis techniques to address the research question. These results were statistically tested to measure the significance of the differences or similarities observed in the results and these findings were interpreted using creolization to determine that:

- In 1st millennium AD north-east England, regionality was more important to understanding spatial patterns and trends then temporal or cultural groups. Whilst there were meaningful changes or shifts in the spatial organisation of the built environment between the Iron Age, Roman Iron Age/Roman, and Early Medieval periods, these variations were smaller within each study region. These differences suggest continuities in spatial awareness, design, and adaptation of the built environment at a local level in post-Roman Northumbria.

- The Early Medieval built environment in the NSR was significantly different from the Early Medieval built environment in the YSR. In addition, there were meaningful variations in the NSR between the Early Medieval periods and preceding periods based on the VGA and landscape analysis, although these contrasting results were smaller than the comparable differences to the YSR time periods. In contrast, the Early Medieval YSR built environment locations correlated strongly to the preceding YSR periods, and the VGA results were similar to the YSR Iron Age and Roman sites. These strong correlations may be the result of cultural transmission due to sustained contact, changing settlement patterns due to changing subsistence methods and environmental factors, or a combination of these reasons.

- The results provide measurable data and statistical strength to the argument that the organisation of a household is a reflection of the organisation of a settlement and by extension of the society (Canuto and Yaeger, 2000, p. 5; Peterson and Drennan, 2005, p. 5). The statistical examination of the VGA results of the structures compared to the results of the overall settlement indicated the visual arrangements of the built environment were similar at the household and settlement levels. This research related the VGA results to the spatial location of the sites across the landscape, suggesting a relationship between the multiple scales of society from the household through the region.

- Finally, the results have shown that the large numbers of previously recorded archaeological data from published books and journals, site records, and unpublished grey literature can provide new insights into the past using innovative methodologies and theoretical frameworks. It demonstrates that past excavations and records have much to offer to our understanding of the past, and need to be better integrated into research agendas.

## 8.1 VISIBILITY, SPACE, AND PLACE

This thesis has demonstrated that the specific investigation of visibility and its relationship to the organisation of structural space has a great potential in archaeological studies of the built environment. The importance of vision has been critically examined by archaeologists examining past landscapes by using phenomenology and the reconstruction of experience or computers to reconstruct past visual fields between archaeology and the environment (Chapman, 2006; Conolly and Lake, 2006; Jones, 2006; Tilley, 1994, 2004; Wheatley, 1995). Although the approaches to visibility differ depending on theoretical approach, the importance of vision to past individuals' identities, movement, and practice is undeniable. The use of VGA to analyse past households and settlements builds on this scholarship by focusing on the visual sensory experience and understanding of the built environment by quantifiably examining the visual arrangement of structural features. Although it has been used as a proxy to understand organisation rather than recreating the visual fields in the past, this does not detract from its importance as a model for understanding spatial awareness and use in the past. Although this thesis has focused on the late-Iron Age through Early Medieval world, the methodological and theoretical frameworks developed in this research have a wide applicability for research outside the regional/temporal focus of this study. An expansion of the method to other regions as well as incorporating topographical surfaces to the method will enhance the outcomes of VGA, and are discussed section 8.4.

## 8.2 AVENUES OF FUTURE RESEARCH

Now that it has been shown that we can examine the spatial organisation of settlements and households using VGA, there is scope to expand and develop the themes discussed throughout this thesis and address the flagged limitations of this research discussed in Chapter 7. It has been argued that a detailed consideration of recorded built form sites can yield interesting and innovative interpretations on the Early Medieval period, and can assist in providing a fuller explanation of the complex interactions occurring between the 1st century BC through the 9th century AD. Future research is recommended on the two primary strands of this thesis: the further development of VGA in coordination with other computational archaeological techniques and focusing on post-colonial approaches to the built environment of Iron Age, Roman, and Early Medieval Britain.

This research can be expanded to include additional regions of Northumbria (such as Cumbria, Tyne and Wear, and Scotland) in order to compare and contrast the results of this thesis with other regions and at the same time expanding the dataset to improve the statistical analysis of the results. In addition, Early Medieval settlements from other regions including southern England, Wales, and continental Europe can be examined using VGA and creolization to understand the profound changes occurring across northern Europe during this time. Settlements such as Mucking and West Stow in Britain or Wijster and Flögeln-Eekhölten on the continent will benefit from examination using VGA to investigate the regionality of spatial arrangements across the Saxon world. Comparing the results of this thesis to the VGA of continental settlements, in particular, is an important avenue of future research. There are notable benefits to comparing Early Medieval settlements from Britain to continental examples (Hamerow, 2002; Hope-Taylor, 1977). Expanding this approach to other regions may increase the range of the results and will allow a broader incorporation of these ideas into medieval studies.

Another avenue of research to pursue is adapting VGA to work with three dimensional elevation models so that topographic surface profiles that also affect visibility could be placed into their proper context. This thesis has used VGA as a proxy, relying purely on the spatial organisation of the built forms within settlements to dictate the visual interpretations. Adapting these software packages' programming to run on three-dimensional surfaces in ArcGIS, for instance, would lead to a more nuanced and valuable methodological tool. Recently available archived LiDAR survey data has the potential to assist the three-dimensional VGA analysis of settlements as it can provide additional data sources to the mapping of settlements based on cropmark evidence s LiDAR can create a highly accurate and detailed topographic surface model. Additionally, there is scope to reconstruct the structures themselves in a three-dimensional environment in order to test visibility in other ways, incorporating new techniques in agent analysis and movement. Affordable multi-spectral images derived from drone flights can be used to target built form sites quickly and easily throughout the year to add evidence to the settlement plans based on cropmark evidence. The incorporation of these new techniques and technologies to the landscape and VGA methodologies will provide more contextual evidence for these types of analyses.

This research has demonstrated that the internal demarcation of space within settlements and households is an important factor of excavation that needs to be recorded and understood. The trend over the last 25 years has been to focus on "keyhole" excavations that investigate specific research questions on features identified through geophysical surveys and/or cropmark evidence. These excavations do not expose the overall settlement plans and therefore limit the utility of using VGA to reconstruct and examine visibility within these sites. Although development-led archaeology has exposed settlement plans as part of the regulatory process (for example Lanton Quarry in Northumberland), research-led excavations have often ignored wholesale excavation due to time constraints and ethical dilemmas. The results of this thesis demonstrate that for some excavations, such as important built form sites like Yeavering, exposure of the site plans (even if not excavated) can lead to invaluable interpretive clues using the methods employed in this thesis. An integration of cropmark evidence and geophysical results to excavation plans could also address these issues of investigating the organisation of space and place in the archaeological built environment. Finally, the various methods developed here are ideal for the re-examination of legacy data and incorporating past scholarship into current interpretive frameworks.

Combining the theoretical and methodological advances advocated in this work with recent advances in isotopic and DNA evidence derived from burial evidence will help to address many of the key questions about transitional Britain (Härke, 2011; Montgomery et al., 2005). Although a strong argument has been put forth for considering the built environment as a cultural construct, a synthesis of these and other forms of scientific and typological evidence will provide the most complete interpretive picture of this complex period. There is room to expand both the methodological and theoretical ideas of this work to include more regions, more sites, using new techniques, and incorporating the work of other aspects of Early Medieval archaeology. Only then can we get a clearer picture of the complexities of 1$^{st}$ century BC to the 9$^{th}$ century AD in Britain and how it adapted from its prehistoric past into a province of Rome and then transformed into a grouping of independent kingdoms leading into the genesis of the countries of England, Wales, and Scotland.

## 8.5 CONCLUDING REMARKS

The transitional periods of late-Iron Age/Roman and late Roman/Early Medieval Britain can be better understood through a detailed consideration of the arrangement of space and the built environment from a multi-scalar perspective of the period. The combination of in-depth GIS spatial analysis, the innovative use of VGA to investigate the built environment, and the statistical examination of the results has shown that there are continuities in the organisation and use of space over the *longue durée* at the local level in north-eastern England from c. 100 BC-AD 800. The results have shown that the arrangement and use of space changed gradually across cultural and temporal boundaries. These outcomes have been explored using theoretical views adapted from household and community archaeologies, space syntax and VGA theory. In close, the specific focus on space and place has been shown as important avenues of research for understanding how north-eastern England gradually transitioned from the prehistoric Iron Age into Early Medieval Northumbria.

# APPENDIX A: GIS GLOSSARY

## BUFFER

A Buffer command demarcates an area containing everything within a specified distance from a point, polyline, or polygon (Connolly and Lake, 2006, p. 290).

## DIGITAL ELEVATION MODEL (DEM)

A raster-surface model of topographic relief, a digital elevation model, or DEM, is arguably the most common type of raster data used to examine the 3-dimensional environment in GIS. These are interpolated from contour maps, satellite or LiDAR surveys, or terrestrial surveying. A DEM can be used in a variety of spatial analysis techniques including slope analysis, aspect analysis, cost-surface analysis, and viewshed analysis (Connolly and Lake, 2006, pp. 102–103). Digital elevation models were used in this thesis for the landscape analysis as well as for data visualisation.

## DIGITISE

Transforming conventional cartographic features into digital forms (Connolly and Lake, 2006, p. 291).

## GEOREFERENCE

Placing spatial data, such as scanned maps or geophysical data, into their correct geographic location using control points to transform the image to fit the appropriate locational coordinates (Connolly and Lake, 2006, p. 293).

## POINT

A point is a zero-dimensional vector object without length or width that represent either a single object at a specific XY coordinate or an abstract centroid of an area, such as a point representing a town on a large-scale map.

## POLYGON

Polygons are two-dimensional vector objects that are formed by lines that enclose an area of space defined by XY coordinates (Burrough and McDonnell, 1998, p. 24; Conolly and Lake, 2006, p. 25; Wheatley and Gillings, 2002, p. 34).

## POLYLINE

Lines and polylines are one-dimensional (having a length but no width) vector data and are represented as a linkage between at least two XY coordinate points.

## RASTER DATA

Raster data employs a grid system of cells or pixels to represent spatial data. Each cell contains a value associated with the status of the object it is representing (Burrough and McDonnell, 1998, p. 27; Conolly and Lake, 2006, p. 27). As such, the size and number of cells in a raster image relate to the resolution and precision of the image. Elevation is often displayed within GIS as raster data, as the system of using a grid represents the continuing nature of a ground surface with each cell having a single elevation number assigned to it. In addition, aerial photography and geophysical data are all brought into GIS as raster data, and have to be manipulated as this type of data.

Raster data has many advantages as well as some disadvantages. Firstly, raster data is processed and displayed much faster than vector data due to the nature of the dataset. Secondly, raster datasets, due to their simplistic nature, can be easily joined and manipulated with other raster imagery. This makes raster data a powerful tool when examining and mathematically manipulating spatial data, such as how elevation, slope, aspect, and hydrology interact with one another in a landscape (Conolly and Lake, 2006, p. 30). Connolly and Lake (2006, p. 31) note three distinct disadvantages of raster data: its fixed resolution, the difficulty it has in displaying discrete objects (where vector data excels), and its limited ability to work with data containing multiple attributes (again, as in vector data). When raster datasets are gathered in different scales, it is difficult to align them with one another in GIS. Due to representing data as cells/pixels, objects with distinct boundaries (like buildings, trenches, etc.) are displayed in a raster dataset as chunky and "fuzzy". Finally, raster data typically can only have one aspect of information associated with it. This can be mathematically combined with other forms of raster data, but cannot have an unlimited number of attributes attributed with it, as in the case with vector data.

Both vector and raster data sets are essential for the GIS practitioner working on archaeological landscapes, as vector data is used to represent site and building locations, while raster data is used to display elevation and density maps. Shapefiles and raster datasets are discussed throughout the remainder of this thesis, and an understanding of their functionality is essential to understand the spatial analysis applications used to ascertain how the environment as well as the cultural interactions that occurred during this period affected the settlement patterns of the transitional period.

## TYPES OF GIS DATA

One of the key reasons GIS is such a useful programme for archaeological research is that nearly all archaeological data can be linked to a spatial location on Earth. This data can be represented as distinct entities (vector data) or as continuous fields or surfaces (raster data) (Burrough and McDonnell, 1998, p. 20). Both of these data structures are digital, generalised representations of geographical features, with the characteristics of vector or raster data aligning with what the GIS practitioner wishes to display or analyse. Understanding the differences between the types of digital geographic data is necessary to understanding the types of analysis possible using archaeological and environmental data.

## VECTOR DATA

Vector data "refers to one or more coordinates used to define an object in Cartesian space" (Conolly and Lake, 2006, p. 25). Vector data represents real-world objects as *points*, *lines*, or *polygons*. The three types of vector data have specific topological relationships with one another that are important for spatial analysis. Their discrete nature allows GIS to locate the points, lines, and polygons at their correct geographic coordinate. In addition, vector data has a discrete nature that allows GIS to assign individual identifier numbers to each point, line, and/or polygon. This unique identifier can then be linked with a set of attributes that give the vector object meaning both within the GIS and in the real world (Connolly and Lake, 2006, p. 25). This can then be selected and extracted as new data based on either the spatial location or due to the data in the attribute table.

For many people, when they think of archaeological GIS data, they think of vector data. Site boundaries, grave locations, and artefact distributions all fall within the vector data category as polygons, lines, and points. One of the key advantages of vector data for archaeological research is the spatial precision that can be achieved using vector data types. Real-world items can be drawn in GIS to match their spatial location and complexity. Along with this precision is the ability of vector data to be linked to an attribute table that can contain an unlimited amount of quantitative information that can be queried and be used to answer research questions (Connolly and Lake, 2006, p. 29).

While vector data has many advantages, it also has some disadvantages. Firstly, vector data requires more computer storage and processing power than raster data. Each point, line, and vertex/node of a vector object requires computer storage. These demands on storage affect the processing speed and power of the hardware. In addition, vector data can misrepresent real world data because of its characteristics of what Connolly and Lake term 'boundedness' (Connolly and Lake, 2006, p. 29). Polygons and lines naturally demarcate space.

# APPENDIX B
# STATISTICS

Appendix B provides in-depth explanations of the statistical tests used to investigate the results of the landscape analysis and VGA. Two tests were chosen to examine the Landscape Analysis results: a Pearson's Product-Moment Correlation and an ANOVA test. Kruskal-Wallis, Mann-Whitney, and ANOVA tests were performed on the VGA results. Included in this appendix are the equations and results of all the tests used in this thesis.

## B.1 PEARSON'S PRODUCT CORRELATION

A correlation test examines the strength of a relationship between two dependent variables, and was used to examine how the spatial positioning of sites based on the three examined environmental parameters compared to one another (VanPool and Leonard, 2011, p. 221). A frequency distribution of the landscape analysis results established that the data was not skewed and meets the assumptions of the Pearson's Product-Moment Correlation Coefficient (often shortened to the Pearson's Coefficient) statistical test. This test solves for the covariance $(\mathrm{cov}_{xy})$ of two variables divided by the multiplication of their standard deviations $(S_x S_y)$. Equation B.1 breaks this down into the sum of each entry minus the mean of the variable times another variable minus its mean. This is divided by the degree of freedom (*N*-1) multiplied by the standard deviations of each variable.

**Equation B.1**

$$r = \frac{\mathrm{cov}_{xy}}{S_x S_y} = \frac{\sum(x_i - \bar{x})(y_i \overline{=y}\ )}{(N-1)S_x S_y}$$

The IBM SPSS matrix output shows the correlation coefficients and their significance (critical significance for a one-tailed test p < .05, two-tailed p < .01). A variable is perfectly correlated to itself with a coefficient of 1.00 or -1.00 (Field, 2009, p. 126), and the results of a correlation test fall between -1 through 1. A score of zero indicates no correlation between the variables. A positive score indicates a positive correlation (i.e. the effect of one variable influences a positive rise in the other) while a negative score does the opposite. A general interpretation of the correlation coefficient is summarised after Salkind (2008, p. 85) in Table B.1

Table B.1 Correlation coefficient

| Size of the Correlation | Coefficient General Interpretation |
|---|---|
| .8 to 1.0 | Very strong relationship |
| .6 to .8 | Strong relationship |
| .4 to .6 | Moderate relationship |
| .2 to .4 | Weak relationship |
| .0 to .2 | Weak to no relationship |

Finally, the significance scores determine the probability that a correlation coefficient occurred by chance (Field, 2009, p. 126). In this case the significance score is based off of a modified *t*-test of the correlation coefficient $t = r\sqrt{\frac{n-2}{1-r^2}}$ where *r* is the correlation coefficient and *n-2* is the degrees of freedom of the test. A 95% confidence coefficient of $p < .05$ was used for these tests.

Correlation tests were run on the relationship between the landscape analysis results within each time period grouping (i.e. the relationship of the NSR Iron Age sites based on their elevation, proximity to water, and underlying land classification) and then these results were compared to one another. Six correlation matrices, one for each analysed time period from the two study regions, were produced that show the patterns of the relationships between the three environmental parameters as compared to spatial location.

## B.1.1 MILFIELD BASIN AREA LANDSCAPE CORRELATIONS

The correlation matrices produced for the Iron Age, Roman Iron Age, and Early Medieval built form sites from the Milfield Basin study area indicate there are similar patterns of significant relationships between the Iron Age and Roman Iron Age (Tables B.1.1.a and B.1.1.b). The results of these tests show there are very strong positive correlations between the spatial location of the sites based on elevation and underlying geology (Iron Age $r = .866$, Roman Iron Age $r = .878$), moderate relationships between the sites' elevation and proximity to water (Iron Age $r = .425$, Roman Iron Age $r = .335$), and weak correlations between sites' underlying geology and proximity to water (Iron Age $r = .247$, Roman Iron Age $r = .215$). There was less than a .001 probability that these correlation coefficients occurred by chance in these time periods, and therefore is considered significant.

Table B.1.1.a: Correlations of Milfield Basin Iron Age site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .425** | .866** |
| | Sig. (2-tailed) | | .000 | .000 |
| | N | 202 | 202 | 202 |
| Proximity to Water | Pearson Correlation | .425** | 1 | .247** |
| | Sig. (2-tailed) | .000 | | .000 |
| | N | 202 | 202 | 202 |
| Land Classification | Pearson Correlation | .866** | .247** | 1 |
| | Sig. (2-tailed) | .000 | .000 | |
| | N | 202 | 202 | 202 |

**. Correlation is significant at the 0.01 level (2-tailed).

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

Table B.1.1.b: Correlations of Milfield Basin Roman Iron Age site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .335** | .878** |
| | Sig. (2-tailed) | | .000 | .000 |
| | N | 177 | 177 | 177 |
| Proximity to Water | Pearson Correlation | .335** | 1 | .215** |
| | Sig. (2-tailed) | .000 | | .004 |
| | N | 177 | 177 | 177 |
| Land Classification | Pearson Correlation | .878** | .215** | 1 |
| | Sig. (2-tailed) | .000 | .004 | |
| | N | 177 | 177 | 177 |

**. Correlation is significant at the 0.01 level (2-tailed).

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

In contrast to the Iron Age and Roman Iron Age, the Early Medieval sites in the Milfield Basin study area displayed weak positive correlations between elevation and underlying geology ($r$ = .258) and elevation and proximity to water ($r$ = .272). There was, in effect, no relationship between the proximity to water and underlying geology ($r$ = .021) (Table B.1.1.c). None of these correlation coefficients were considered significant ($p < .05$), although this was probably due to the smaller sample size of the Early Medieval sites negatively affecting the *t*-test results than reflecting the actual probability. Regardless, the correlation matrix of the Early Medieval period demonstrates there are much weaker relationships between the spatial location of the Early Medieval sites and the preceding time periods, indicating that the settlements' relationships in this period differed significantly from the preceding periods. Whilst correlation tests do not indicate the cause of these differences, the lack of a relationship between the spatial locations and environmental parameters indicates a distinct settlement pattern compared to the Iron Age and Roman Iron Age.

Table B.1.1.c Correlations of Milfield Basin Early Medieval site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .272 | .258 |
| | Sig. (2-tailed) | | .139 | .162 |
| | N | 31 | 31 | 31 |
| Proximity to Water | Pearson Correlation | .272 | 1 | .021 |
| | Sig. (2-tailed) | .139 | | .909 |
| | N | 31 | 31 | 31 |
| Land Classification | Pearson Correlation | .258 | .021 | 1 |
| | Sig. (2-tailed) | .162 | .909 | |
| | N | 31 | 31 | 31 |

**. Correlation is significant at the 0.01 level (2-tailed).

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

## B.1.2 EAST YORKSHIRE STUDY AREA LANDSCAPE CORRELATIONS

Unlike the Milfield Basin correlation results, the relationships in the three examined periods in East Yorkshire are similar to one another, but this relationship is considered weak or insignificant (Tables B.1.2.a, B.1.2.b, and B.1.2.c). That said, not all of the relationships are considered significant at either the .05 or .001 probabilities. None of the Early Medieval built form locations (like the Milfield Basin Early Medieval sites) are significant, and again this is probably due to the small sample size.

The East Yorkshire correlation tests indicate weak relationships between spatial location, elevation, proximity to water, and underlying geology. Even though these relationships are weak, there are distinct patterns between the three time periods in how their sites' locations relate to environmental factors. These results match the observations discussed in Chapter 4, where the Early Medieval sites in the East Yorkshire study area appear to be located in similar environmental and spatial locales as in the earlier periods. The statistical examination confirms these similar relationships, but cannot comment on the reasons for these correlations.

Table B.1.2.a: Correlations of East Yorkshire Iron Age site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .110 | .217** |
| | Sig. (2-tailed) | | .192 | .009 |
| | N | 143 | 143 | 143 |
| Proximity to Water | Pearson Correlation | .110 | 1 | -.053 |
| | Sig. (2-tailed) | .192 | | .533 |
| | N | 143 | 143 | 143 |
| Land Classification | Pearson Correlation | .217** | -.053 | 1 |
| | Sig. (2-tailed) | .009 | .533 | |
| | N | 143 | 143 | 143 |

**. Correlation is significant at the 0.01 level (2-tailed).

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

Table B.1.2.b Correlations of East Yorkshire Roman period site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .290** | -.179* |
| | Sig. (2-tailed) | | .000 | .023 |
| | N | 162 | 162 | 162 |
| Proximity to Water | Pearson Correlation | .290** | 1 | .001 |
| | Sig. (2-tailed) | .000 | | .995 |
| | N | 162 | 162 | 162 |
| Land Classification | Pearson Correlation | -.179* | .001 | 1 |
| | Sig. (2-tailed) | .023 | .995 | |
| | N | 162 | 162 | 162 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

Table B.1.2.c Correlations of East Yorkshire Early Medieval site locations

| | | Elevation | Proximity to Water | Land Classification |
|---|---|---|---|---|
| Elevation | Pearson Correlation | 1 | .160 | -.253 |
| | Sig. (2-tailed) | | .391 | .170 |
| | N | 31 | 31 | 31 |
| Proximity to Water | Pearson Correlation | .160 | 1 | -.264 |
| | Sig. (2-tailed) | .391 | | .152 |
| | N | 31 | 31 | 31 |
| Land Classification | Pearson Correlation | -.253 | -.264 | 1 |
| | Sig. (2-tailed) | .170 | .152 | |
| | N | 31 | 31 | 31 |

*Green-shaded cell = strong to very strong relationship, yellow-shaded cell =moderate relationship, red-shaded cell = weak to no relationship*

### B.1.3 SUMMARY OF CORRELATION TESTS

The results of these statistical tests indicate there are relationships and differences in how the environment corresponds to the spatial location of the *recorded* built form sites in the two study regions. In particular, the correlation tests determined there were stronger relationships between the environmental factors and built form locations in the Milfield Basin than in East Yorkshire.

These correlations only indicate there is a relationship but do not define causality (Field, 2009, p. 127). This is due to bivariate correlations looking at only two variables, therefore other unknown factors may have influenced these correlations. In addition, the correlation coefficient cannot describe which variable causes the other to change (Field, 2009, p. 128). As such, another statistical test was used to examine the potential reasons for the noted relationships.

## B.2 ANOVA

ANOVA compares the means of normally distributed data of three or more means (VanPool and Leonard, 2011, p. 153). The ANOVA test examines the differences between the *variance within groups* and the *variance among groups*. The null hypothesis is that these should be equal to one another. In equation B.2.a, *a* is the number of groups and $\sum(\bar{Y} - \bar{\bar{Y}})$ is the sum of the square of means (VanPool and Leonard, 2011, p. 157).

**Equation B.2.a *variance within groups***

$$S_{\bar{Y}}^2 = \frac{\sum_{n=1}^{n=a}(\bar{Y} - \bar{\bar{Y}})^2}{a - 1}$$

Equation B.2.b is the formula for determining the variance among groups (also known as the population variance), which entails multiplying the variance among means by the total number of groups.

**Equation B.2.b, *variance among groups***

$$s^2 = n\left(s_{\bar{\bar{Y}}}^{2}\right)$$

The ANOVA test indicates there are significant differences between all of the built form locations examined during the landscape analysis. Tukey HSD post hoc tests breaks down the differences between the time periods and environmental factors (Tables B.2.a, B.2.b, and B.2.c). The rows shaded in grey are statistically significant differences between the means of two time periods based upon their spatial location and environmental factor. For the purposes of these graphs outputted by IBM SPSS, abbreviations for the Iron Age (IA), Roman Iron Age (RIA), Roman (RO) and Early Medieval (EM) periods were used.

Table B.2.a Tukey post hoc test of Elevation, Multiple Comparisons

| Dependent Variable | | | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Elevation | NSR IA | NSR RIA | -.61347* | .13831 | **.000** | -1.0086 | -.2183 |
| | | NSR EM | 1.30853* | .25913 | **.000** | .5682 | 2.0489 |
| | | YSR IA | .35567 | .14681 | .150 | -.0638 | .7751 |
| | | YSR RO | .95349* | .14168 | **.000** | .5487 | 1.3583 |
| | | YSR EM | .92143* | .25913 | **.005** | .1811 | 1.6618 |
| | NSR RIA | NSR IA | .61347* | .13831 | **.000** | .2183 | 1.0086 |
| | | NSR EM | 1.92200* | .26155 | **.000** | 1.1747 | 2.6693 |
| | | YSR IA | .96914* | .15105 | **.000** | .5376 | 1.4007 |
| | | YSR RO | 1.56696* | .14606 | **.000** | 1.1496 | 1.9843 |
| | | YSR EM | 1.53490* | .26155 | **.000** | .7876 | 2.2822 |
| | NSR EM | NSR IA | -1.30853* | .25913 | **.000** | -2.0489 | -.5682 |
| | | NSR RIA | -1.92200* | .26155 | **.000** | -2.6693 | -1.1747 |
| | | YSR IA | -.95285* | .26614 | **.005** | -1.7133 | -.1924 |
| | | YSR RO | -.35504 | .26335 | .758 | -1.1075 | .3974 |
| | | YSR EM | -.38710 | .34121 | .867 | -1.3620 | .5878 |
| | YSR IA | NSR IA | -.35567 | .14681 | .150 | -.7751 | .0638 |
| | | NSR RIA | -.96914* | .15105 | **.000** | -1.4007 | -.5376 |
| | | NSR EM | .95285* | .26614 | **.005** | .1924 | 1.7133 |
| | | YSR RO | .59782* | .15414 | **.002** | .1574 | 1.0382 |
| | | YSR EM | .56576 | .26614 | .275 | -.1947 | 1.3262 |
| | YSR RO | NSR IA | -.95349* | .14168 | **.000** | -1.3583 | -.5487 |
| | | NSR RIA | -1.56696* | .14606 | **.000** | -1.9843 | -1.1496 |
| | | NSR EM | .35504 | .26335 | .758 | -.3974 | 1.1075 |
| | | YSR IA | -.59782* | .15414 | **.002** | -1.0382 | -.1574 |
| | | YSR EM | -.03206 | .26335 | 1.000 | -.7845 | .7204 |
| | YSR EM | NSR IA | -.92143* | .25913 | **.005** | -1.6618 | -.1811 |
| | | NSR RIA | -1.53490* | .26155 | **.000** | -2.2822 | -.7876 |
| | | NSR EM | .38710 | .34121 | .867 | -.5878 | 1.3620 |
| | | YSR IA | -.56576 | .26614 | .275 | -1.3262 | .1947 |
| | | YSR RO | .03206 | .26335 | 1.000 | -.7204 | .7845 |

*. The mean difference is significant at the 0.05 level.

Table B.2.b Tukey post hoc test of Proximity to Water, Multiple Comparisons

| Dependent Variable | | | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Proximity to Water | NSR IA | NSR RIA | .09274 | .22272 | .998 | -.5436 | .7291 |
| | | NSR EM | 1.53433* | .41728 | **.003** | .3421 | 2.7266 |
| | | YSR IA | -.18279 | .23641 | .972 | -.8583 | .4927 |
| | | YSR RO | .38559 | .22815 | .539 | -.2663 | 1.0375 |
| | | YSR EM | 1.59885* | .41728 | **.002** | .4066 | 2.7911 |
| | NSR RIA | NSR IA | -.09274 | .22272 | .998 | -.7291 | .5436 |
| | | NSR EM | 1.44159* | .42118 | **.009** | .2382 | 2.6450 |
| | | YSR IA | -.27553 | .24324 | .868 | -.9705 | .4194 |
| | | YSR RO | .29284 | .23521 | .814 | -.3792 | .9649 |
| | | YSR EM | 1.50611* | .42118 | **.005** | .3027 | 2.7095 |
| | NSR EM | NSR IA | -1.53433* | .41728 | **.003** | -2.7266 | -.3421 |
| | | NSR RIA | -1.44159* | .42118 | **.009** | -2.6450 | -.2382 |
| | | YSR IA | -1.71712* | .42858 | **.001** | -2.9417 | -.4926 |
| | | YSR RO | -1.14875 | .42408 | .075 | -2.3604 | .0629 |
| | | YSR EM | .06452 | .54947 | 1.000 | -1.5054 | 1.6345 |
| | YSR IA | NSR IA | .18279 | .23641 | .972 | -.4927 | .8583 |
| | | NSR RIA | .27553 | .24324 | .868 | -.4194 | .9705 |
| | | NSR EM | 1.71712* | .42858 | **.001** | .4926 | 2.9417 |
| | | YSR RO | .56838 | .24822 | .199 | -.1408 | 1.2776 |
| | | YSR EM | 1.78164* | .42858 | **.001** | .5571 | 3.0062 |
| | YSR RO | NSR IA | -.38559 | .22815 | .539 | -1.0375 | .2663 |
| | | NSR RIA | -.29284 | .23521 | .814 | -.9649 | .3792 |
| | | NSR EM | 1.14875 | .42408 | .075 | -.0629 | 2.3604 |
| | | YSR IA | -.56838 | .24822 | .199 | -1.2776 | .1408 |
| | | YSR EM | 1.21326* | .42408 | **.049** | .0016 | 2.4249 |
| | YSR EM | NSR IA | -1.59885* | .41728 | **.002** | -2.7911 | -.4066 |
| | | NSR RIA | -1.50611* | .42118 | **.005** | -2.7095 | -.3027 |
| | | NSR EM | -.06452 | .54947 | 1.000 | -1.6345 | 1.5054 |
| | | YSR IA | -1.78164* | .42858 | **.001** | -3.0062 | -.5571 |
| | | YSR RO | -1.21326* | .42408 | **.049** | -2.4249 | -.0016 |

*. The mean difference is significant at the 0.05 level.

Table B.2.c Tukey post hoc test of Land Classification, Multiple Comparisons

| Dependent Variable | | | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Land Classification | NSR IA | NSR RIA | -.47886* | .10913 | .000 | -.7906 | -.1671 |
| | | NSR EM | .08320 | .20445 | .999 | -.5010 | .6674 |
| | | YSR IA | .66610* | .11583 | .000 | .3351 | .9971 |
| | | YSR RO | .29746 | .11179 | .084 | -.0219 | .6169 |
| | | YSR EM | .24449 | .20445 | .839 | -.3397 | .8286 |
| | NSR RIA | NSR IA | .47886* | .10913 | .000 | .1671 | .7906 |
| | | NSR EM | .56206 | .20636 | .072 | -.0276 | 1.1517 |
| | | YSR IA | 1.14496* | .11918 | .000 | .8044 | 1.4855 |
| | | YSR RO | .77631* | .11525 | .000 | .4470 | 1.1056 |
| | | YSR EM | .72335* | .20636 | .006 | .1337 | 1.3130 |
| | NSR EM | NSR IA | -.08320 | .20445 | .999 | -.6674 | .5010 |
| | | NSR RIA | -.56206 | .20636 | .072 | -1.1517 | .0276 |
| | | YSR IA | .58290 | .20999 | .063 | -.0171 | 1.1829 |
| | | YSR RO | .21426 | .20778 | .907 | -.3794 | .8079 |
| | | YSR EM | .16129 | .26922 | .991 | -.6079 | .9305 |
| | YSR IA | NSR IA | -.66610* | .11583 | .000 | -.9971 | -.3351 |
| | | NSR RIA | -1.14496* | .11918 | .000 | -1.4855 | -.8044 |
| | | NSR EM | -.58290 | .20999 | .063 | -1.1829 | .0171 |
| | | YSR RO | -.36864* | .12162 | .030 | -.7161 | -.0212 |
| | | YSR EM | -.42161 | .20999 | .339 | -1.0216 | .1784 |
| | YSR RO | NSR IA | -.29746 | .11179 | .084 | -.6169 | .0219 |
| | | NSR RIA | -.77631* | .11525 | .000 | -1.1056 | -.4470 |
| | | NSR EM | -.21426 | .20778 | .907 | -.8079 | .3794 |
| | | YSR IA | .36864* | .12162 | .030 | .0212 | .7161 |
| | | YSR EM | -.05297 | .20778 | 1.000 | -.6466 | .5407 |
| | YSR EM | NSR IA | -.24449 | .20445 | .839 | -.8286 | .3397 |
| | | NSR RIA | -.72335* | .20636 | .006 | -1.3130 | -.1337 |
| | | NSR EM | -.16129 | .26922 | .991 | -.9305 | .6079 |
| | | YSR IA | .42161 | .20999 | .339 | -.1784 | 1.0216 |
| | | YSR RO | .05297 | .20778 | 1.000 | -.5407 | .6466 |
| *. The mean difference is significant at the 0.05 level. | | | | | | | |

The post hoc tests of the ANOVA results show there were significant differences across the spectrum of environmental parameters, time periods, and study areas. Broadly speaking, the

Milfield Basin built form sites tended to display significant differences in their spatial locations from one other and to the East Yorkshire settlements. The East Yorkshire sites, on the other hand, tended to not have as many significant differences between the analysed time periods. Figures B.2.d and B.2.e show the percentages of significant differences based on spatial location. These charts show the differences in significance of a time period to all of the time periods (for example, how many significant differences were there between the Milfield Basin Iron Age sites and all of the other periods) and to the two other time periods in their study region. The tables demonstrate that there were more significant differences in the Milfield Basin study area, and within that region the Early Medieval settlements had a much different spatial pattern compared to the Iron Age and Roman Iron Age.

Figure B.2.d Significant Differences of Spatial Locations in the Milfield Basin study area

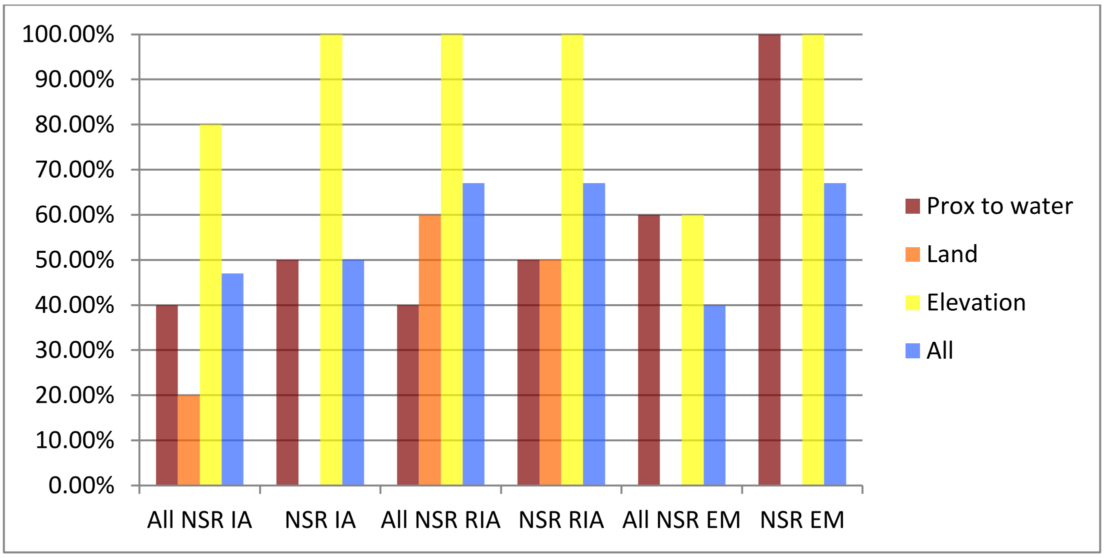
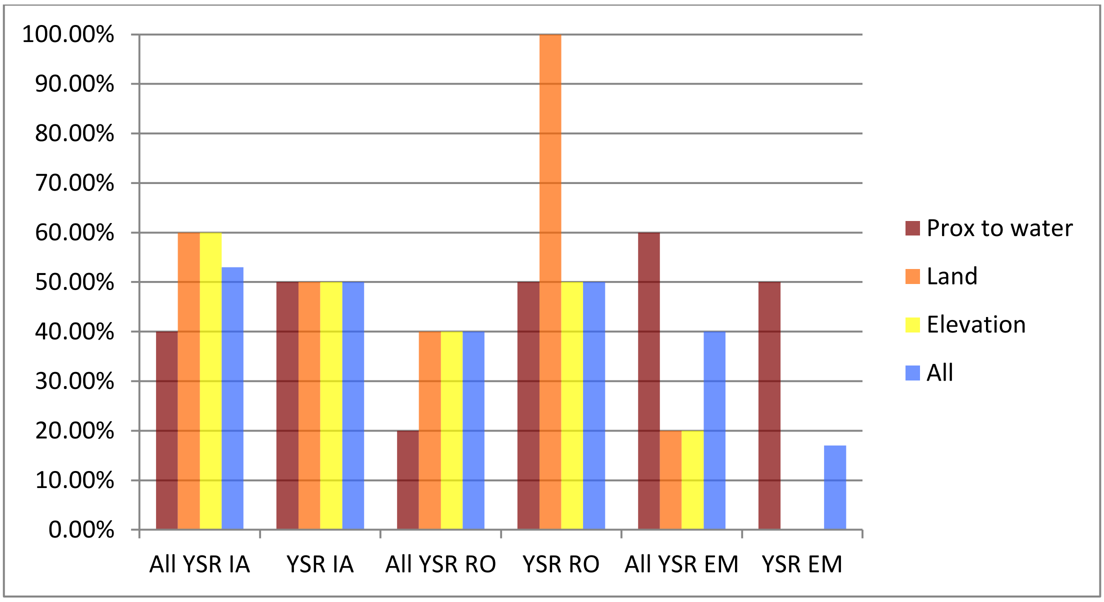



Figure B.2.e Significant Differences of Spatial Locations in the East Yorkshire study area



## B.3 KRUSKAL-WALLIS STATISTICAL TEST

A frequency distribution of the VGA results shows that the data is skewed and not normally distributed. Due to this distribution, non-parametric tests are used as the assumptions of a parametric test were not met. A Kruskal-Wallis test was performed to determine if the differences between the settlements' VGA results are significant. The Kruskal-Wallis test is the non-parametric version of a one-way independent ANOVA test and performs its calculation by ranking the medians of the pooled variates of all the examined groups and using this ranking to solve the below equation:

**Equation B.3**

$$H = \left[\frac{12}{N(N+1)} \sum^{a} \frac{(\sum R_i)^2}{n_i}\right] - 3(N+1)$$

In the case of this equation, *H* reflects the ranking of each group, *N* is the combined sample size of all the groups, and $\sum^{a} \frac{(\sum R_i)^2}{n_i}$ divides the squared sum of all the rankings for each group by their sample size and then adds these together (Field, 2009, p. 544; VanPool and Leonard, 2011, p. 268). The Kruskal-Wallis statistical test examines the null hypothesis of $H = R_1 = R_2 = R_3 = R_a$, where R = the sum of the rankings of each group. As used here, the Kruskal-Wallis test investigated whether or not the median global measurement results are the same (the null hypothesis) or differ from one another (the alternate hypothesis).

Similar to an ANOVA test, the Kruskal-Wallis test can only determine if a significant effect exists and not where the difference is from (Field, 2009, p. 549). The Mann-Whitney non-parametric test (basically the non-parametric *t*-test) comparison of medians is used as a post hoc test to determine where the differences lie if there are significant results from the Kruskal-Wallis test, although care needs to be taken to minimize Type I errors. A Type I error occurs when we *fail to reject the null hypothesis* when it is actually true (VanPool and Leonard, 2011, p. 105). Unfortunately, repeated *t*-tests increase the likelihood of a Type I error. Field recommends a *Bonferroni correction* to address Type I errors and to use a select set of comparisons (Field, 2009, p. 550). A Bonferroni correction divides the 95% confidence interval (.05) by the number of tests to address potential Type I errors with the resulting significance level. As you are dividing the confidence interval by the number of tests, the critical value decreases dramatically based on the number of Mann-Whitney tests and hence Field's recommendation to use small, selected groups during the post hoc analysis.

The effect size, an objective measurement of the strength of the differences between groups, was calculated for the Mann-Whitney tests using the formula $r = \frac{Z}{\sqrt{N}}$ where the *Z* score is provided by SPSS and *N* is the total number of Early Medieval settlements (Field, 2009, p. 555). The standard absolute effect size of *r* is a small effect of 0.1, a medium sized effect of 0.3, and a large sized effect of 0.5.

## B.3.1 KRUSKAL-WALLIS AND MANN-WHITNEY TESTS OF VGA RESULTS

The first Kruskal-Wallis test was run on all of the settlements examined by VGA. Two other Kruskal-Wallis tests examined the effect of settlement recording on the VGA results by investigating settlements recorded by excavation and by cropmark identification separately. Mann-Whitney post hoc tests using the Bonferroni correction investigated significant differences between sites and their global measurements. In addition, a similar batch of tests was used to examine the results of VGA on the interior of selected buildings from the settlements. Table B.3.1.a shows the results of the Kruskal-Wallis test on all of the settlements.

Table B.3.1.a Kruskal-Wallis Test Results on All Settlements

| | | | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|---|---|
| Chi-Square | | | 14.513 | 6.145 | 19.844 | 12.476 |
| Df | | | 5 | 5 | 5 | 5 |
| Asymp. Sig. | | | .013 | .292 | .001 | .029 |
| Monte Carlo Sig. | Sig. | | .006[c] | .294[c] | .000[c] | .018[c] |
| | 99% Confidence Interval | Lower Bound | .004 | .282 | 0.000 | .015 |
| | | Upper Bound | .008 | .306 | .000 | .022 |

a. Kruskal Wallis Test
b. Grouping Variable: Area Period
c. Based on 10000 sampled tables with starting seed 2000000.

A Mann-Whitney test was run as a post hoc test on the Kruskal-Wallis analysis to determine where the significant differences originate. A series of groups of Mann-Whitney tests were examined using the Bonferroni correction to lessen the chances of a Type I error. Five focused groups were chosen for the Mann-Whitney post hoc tests. These groups changed the critical significance value from 0.05 to 0.01 using the Bonferroni correction. Only the Early

Medieval settlements differed significantly from one another at the corrected significance level (as shown in Table B.3.1.b).

Table B.3.1.b Mann-Whitney Test of NSR and YSR Early Medieval settlements

| | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|
| Mann-Whitney U | 23.000 | 42.000 | 19.000 | 27.000 |
| Wilcoxon W | 128.000 | 108.000 | 85.000 | 93.000 |
| Z | -2.956 | -1.916 | -3.175 | -2.737 |
| Asymptotic Sig. (2-tailed) | .003 | .055 | .001 | .006 |
| Exact Sig. [2*(1-tailed Sig.)] | .002[b] | .058[b] | .001[b] | .005[b] |
| Exact Sig. (2-tailed) | .002 | .058 | .001 | .005 |
| Exact Sig. (1-tailed) | .001 | .029 | .000 | .003 |
| Point Probability | .000 | .004 | .000 | .000 |

a. Grouping Variable: Area/Period

b. Not corrected for ties.

| ***Effect size r=*** | ***0.59*** | *0.38* | ***0.64*** | ***0.54*** |
|---|---|---|---|---|

Based on the results of the Kruskal-Wallis and Mann-Whitney statistical tests, there are significant differences in three of the four global measurements. Therefore, it can be concluded that there are significant differences in how space was visually laid out and/or used in the Early Medieval period between the two study regions.

## B.3.2 KRUSKAL-WALLIS TEST ON THE EXCAVATED SETTLEMENTS

The Kruskal-Wallis test revealed there are significant differences between the Visual Integration (TEK) ($H(1) = 15.234$, $p < .05$), Visual Relativised Entropy ($H(3) = 20.718$, $p < .05$), and Visual Mean Depth ($H(4) = 13.508$, $p < .05$) global measurements when only the settlements were analysed. These significant differences are genuine as they also meet the Monte Carlo significance level of .01. The results of the Kruskal-Wallis test on all of the excavated settlements are shown in Table B.3.2.a.

Table B.3.2.a Kruskal-Wallis Test Results on Excavated Settlements

| | | | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|---|---|
| Chi-Square | | | 15.234 | 8.506 | 20.718 | 13.508 |
| Df | | | 5 | 5 | 5 | 5 |
| Asymptotic Sig. | | | .009 | .130 | .001 | .019 |
| Monte Carlo Sig. | Sig. | | .005[c] | .124[c] | .000[c] | .011[c] |
| | 99% Confidence Interval | Lower Bound | .003 | .116 | 0.000 | .008 |
| | | Upper Bound | .006 | .133 | .001 | .014 |

a. Kruskal Wallis Test
b. Grouping Variable: Area/Period
c. Based on 10000 sampled tables with starting seed 2000000.

The Mann-Whitney post hoc test yielded a slight difference to the overall examination, but in general was similar to the overall statistical test (Figure B.3.2.b). Five Mann-Whitney tests were run in a similar manner to the Mann-Whitney tests of all the settlements, yielding a Bonferroni correction significance level of 0.01. Once again, only the Early Medieval settlements significantly differed from one another. Only one of the global measurement categories, Visual Relativised Entropy, was lower than the corrected significance level ($U$= 2.000, $r$= .76).

Table B.3.2.b Mann-Whitney Test of the excavated settlements

| | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|
| Mann-Whitney U | 7.000 | 14.000 | 2.000 | 8.000 |
| Wilcoxon W | 28.000 | 59.000 | 47.000 | 53.000 |
| Z | -2.357 | -1.532 | -2.946 | -2.239 |
| Asymp. Sig. (2-tailed) | .018 | .126 | .003 | .025 |
| Exact Sig. [2*(1-tailed Sig.)] | .018[b] | .145[b] | .002[b] | .026[b] |
| Exact Sig. (2-tailed) | .018 | .145 | .002 | .026 |
| Exact Sig. (1-tailed) | .009 | .072 | .001 | .013 |
| Point Probability | .003 | .016 | .000 | .004 |

a. Grouping Variable: Area/Period
b. Not corrected for ties.

| ***Effect size r=*** | *.61* | *.40* | ***.76*** | *.58* |
|---|---|---|---|---|

## B.3.3 MANN-WHITNEY TEST ON THE CROPMARK EVIDENCE

The settlement plans derived from cropmarks used in this analysis are from the Early Medieval time period and examples are found in both study regions. Therefore, it was more appropriate to run a Mann-Whitney test as it examines two categories versus the Kruskal-

Wallis, which is designed to examine more than two categories. The results are shown in Table B.3.3.

Table B.3.3 Mann-Whitney Test of Settlements Based on Cropmark Evidence

| | | | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|---|---|
| Mann-Whitney U | | | 8.000 | 6.000 | 7.000 | 8.000 |
| Wilcoxon W | | | 44.000 | 42.000 | 43.000 | 44.000 |
| Z | | | 0.000 | -.522 | -.261 | 0.000 |
| Asymptotic Sig. (2-tailed) | | | 1.000 | .602 | .794 | 1.000 |
| Exact Sig. [2*(1-tailed Sig.)] | | | 1.000[b] | .711[b] | .889[b] | 1.000[b] |
| Monte Carlo Sig. (2-tailed) | Sig. | | 1.000[c] | .708[c] | .890[c] | 1.000[c] |
| | 99% Confidence Interval | Lower Bound | 1.000 | .697 | .882 | 1.000 |
| | | Upper Bound | 1.000 | .720 | .898 | 1.000 |
| Monte Carlo Sig. (1-tailed) | Sig. | | .552[c] | .351[c] | .442[c] | .552[c] |
| | 99% Confidence Interval | Lower Bound | .539 | .339 | .429 | .539 |
| | | Upper Bound | .564 | .363 | .455 | .564 |

a. Grouping Variable: Area/Period

b. Not corrected for ties.

***Effect size r=*** *0* *-0.17* *-0.08* *0*

## B.3.4 KRUSKAL-WALLIS TEST OF BUILDINGS

A selection of buildings were examined using VGA from the Early Medieval settlements of Thirlings and Yeavering in the Northumberland study region, from Dalton Parlours and Beadlam in the Yorkshire region, and from Housesteads Roman fort. The results are in Table B.3.4.

Table B.3.4 Kruskal Wallis Test of Early Medieval and Roman structures

| | | | Visual Integration (TEK) | Visual Entropy | Visual Relativised Entropy | Visual Mean Depth |
|---|---|---|---|---|---|---|
| Chi-Square | | | 11.954 | 11.608 | 7.302 | 11.766 |
| Df | | | 2 | 2 | 2 | 2 |
| Asymptotic Sig. | | | .003 | .003 | .026 | .003 |
| Monte Carlo Sig. | Sig. | | .000[c] | .000[c] | .011[c] | .000[c] |
| | 99% Confidence Interval | Lower Bound | 0.000 | 0.000 | .009 | 0.000 |
| | | Upper Bound | .000 | .000 | .014 | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: Area/Period

c. Based on 10000 sampled tables with starting seed 957002199.

The Mann-Whitney post hoc tests run on the data focused on examining the differences between the settlements and their structures, the differences between different settlement's buildings, and the differences between the time periods/study regions buildings yielding a Bonferroni corrected critical value of 0.17. The only significant difference that occurred was between the Early Medieval buildings and the Roman Buildings based on the Visual Integration (TEK), Visual Entropy, and Visual Mean Depth measurements.

These results align with the assumption in Chapter 5 of the ANOVA test results that the buildings should be similar to their settlements, and that the Early Medieval settlements from Northumberland and Roman settlements from Yorkshire would also share similarities

.

# APPENDIX C

# BUILT FORM SITES USED IN LANDSCAPE ANALYSIS

| MILFIELD BASIN IRON AGE BUILT FORM SITES | | | | | | | |
|---|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | SMR_ID | SITE_NAME | PTF_TYPE | PTF_PERIOD | EASTING | NORTHING |
| 1 | Point | 12858 | Ditched enclosure, Broomie Knowe | BIVALLATE HILLFORT | IA | 394290 | 639570 |
| 2 | Point | 855 | Moneylaws Castle Hill camp | Camp | IA | 387210 | 634740 |
| 3 | Point | 871 | Castle Hill camp | Camp | IA | 389870 | 633150 |
| 4 | Point | 1948 | Fordwood camp, Broomridge Dean | Camp | IA | 397160 | 636440 |
| 5 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | Camp | IA | 402090 | 627870 |
| 6 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | Camp | IA | 402150 | 627910 |
| 7 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | Camp | IA | 402070 | 627840 |
| 8 | Point | 4915 | Isabella's Mount | Camp | IA | 413370 | 627570 |
| 9 | Point | 4916 | Lucker camp | Camp | IA | 414630 | 629200 |
| 10 | Point | 5242 | Spindlestone Heughs defended settlement | Camp | IA | 415240 | 633920 |
| 11 | Point | 2027 | Sandy House camp | CIRCULAR ENCLOSURE | IA | 393150 | 632180 |
| 12 | Point | 3392 | Iron Age earthwork enclosure | CIRCULAR ENCLOSURE | IA | 406760 | 626300 |
| 13 | Point | 3401 | Enclosure on Birley Hill | CIRCULAR ENCLOSURE | IA | 407320 | 627460 |
| 14 | Point | 3402 | | CIRCULAR ENCLOSURE | IA | 406480 | 627150 |
| 15 | Point | 3731 | Buckton Moor North camp | CIRCULAR ENCLOSURE | IA | 406490 | 638350 |
| 16 | Point | 1847 | Letham Hill palisaded enclosure | CURVILINEAR ENCLOSURE | IA | 393750 | 638760 |
| 17 | Point | 3831 | Hetton Dean later prehistoric settlement cropmark | CURVILINEAR ENCLOSURE | IA | 404130 | 634660 |
| 18 | Point | 3912 | Iron Age curvilinear enclosure | CURVILINEAR ENCLOSURE | IA | 404800 | 631300 |
| 19 | Point | 12857 | Kinch Knowe | CURVILINEAR ENCLOSURE | IA | 391750 | 639250 |
| 20 | Point | 20041 | Curvilinear enclosure south of Adderstone Garage | CURVILINEAR ENCLOSURE | IA | 413370 | 629720 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | Point | 23026 | Curvilinear enclosure south of Adderstone Lodge | CURVILINEAR ENCLOSURE | IA | 413500 | 629750 |
| 25 | Point | 588 | Ring Chesters defended settlement | ENCLOSED SETTLEMENT | IA | 386700 | 628900 |
| 26 | Point | 700 | Pressen Hill possible iron age oval enclosure | DITCHED ENCLOSURE | IA | 382970 | 636050 |
| 27 | Point | 736 | Cropmarks of settlement | DITCH | IA | 389200 | 636300 |
| 28 | Point | 736 | Cropmarks of settlement | ENCLOSED HUT CIRCLE SETTLEMENT | IA | 389300 | 636300 |
| 29 | Point | 736 | Cropmarks of settlement | ENCLOSED HUT CIRCLE SETTLEMENT | IA | 389200 | 636300 |
| 30 | Point | 736 | Cropmarks of settlement | DITCH | IA | 389300 | 636300 |
| 31 | Point | 744 | Iron Age settlement and trackway | DITCH | IA | 389600 | 636680 |
| 32 | Point | 802 | Camp Hill, once thought to be the site of a Roman camp | EARTHWORK | IA | 382500 | 632530 |
| 33 | Point | 985 | Cornhill - linear cropmark | DITCH | IA | 386100 | 640400 |
| 34 | Point | 2374 | Roundabouts | EARTHWORK | IA | 397980 | 644160 |
| 35 | Point | 2378 | Camp Field Duddo Iron Age enclosure | EARTHWORK | IA | 395640 | 643240 |
| 36 | Point | 3309 | Camp | EARTHWORK | IA | 401260 | 629910 |
| 37 | Point | 3781 | Iron Age enclosure | EARTHWORK | IA | 400110 | 633450 |
| 38 | Point | 3781 | Iron Age enclosure | EARTHWORK | IA | 400120 | 633460 |
| 39 | Point | 3782 | Iron Age enclosure | EARTHWORK | IA | 401880 | 634510 |
| 40 | Point | 3782 | Iron Age enclosure | EARTHWORK | IA | 401890 | 634520 |
| 41 | Point | 3786 | Standing Stones Camp, Horton Moor | EARTHWORK | IA | 401390 | 631840 |
| 42 | Point | 3808 | Iron Age defended settlement in Fox Covert | ENCLOSED SETTLEMENT | IA | 402940 | 632940 |
| 43 | Point | 3813 | Spylaw 2 | EARTHWORK | IA | 404890 | 631940 |
| 44 | Point | 3820 | Broomy Knowe, hillfort | EARTHWORK | IA | 401700 | 630710 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 45 | Point | 5111 | Camps on Chesters Hill | EARTHWORK | IA | 410320 | 634680 |
| 46 | Point | 5245 | Iron Age earthwork | EARTHWORK | IA | 415840 | 633520 |
| 47 | Point | 12945 | Quarry Plantation irregular enclosure | ENCLOSED SETTLEMENT | IA | 404455 | 630747 |
| 48 | Point | 19688 | Linear ditch | DITCH | IA | 390060 | 634310 |
| 49 | Point | 19688 | Linear ditch | DITCH | IA | 390230 | 634280 |
| 50 | Point | 19724 | North Fenton Hill 2 enclosure | ENCLOSED SETTLEMENT | IA | 397310 | 634680 |
| 51 | Point | 21142 | Iron Age/Roman enclosed settlement, round house, stock enclosures and ditch | DITCH | IA | 388900 | 638200 |
| 52 | Point | 23840 | Iron Age fort 550m ESE of Melkington | ENCLOSED SETTLEMENT | IA | 388200 | 640890 |
| 53 | Point | 23929 | Marl Bog Iron Age/Roman enclosure | DITCHED ENCLOSURE | IA | 387690 | 637370 |
| 54 | Point | 581 | West Sinkside Iron Age homestead | ENCLOSED SETTLEMENT | IA | 388200 | 626280 |
| 55 | Point | 609 | Mid Hill enclosed settlement, Westnewton | ENCLOSED SETTLEMENT | IA | 388130 | 629570 |
| 56 | Point | 639 | Ell's Knowe defended settlement and earlier palisaded site | ENCLOSURE | IA | 387230 | 627790 |
| 57 | Point | 800 | Cropmarks of two enclosures | ENCLOSURE | IA | 383393 | 634427 |
| 58 | Point | 800 | Cropmarks of two enclosures | ENCLOSURE | IA | 383600 | 634370 |
| 59 | Point | 876 | Cropmarks of settlement | ENCLOSURE | IA | 388750 | 634220 |
| 60 | Point | 976 | Twizel Smithy Iron Age defended enclosure | ENCLOSED SETTLEMENT | IA | 388630 | 643590 |
| 61 | Point | 982 | Settlements north of Cornhill | ENCLOSED SETTLEMENT | IA | 385900 | 640200 |
| 62 | Point | 987 | St Cuthberts 2 - enclosure, cropmark | ENCLOSURE | IA | 387500 | 642700 |
| 63 | Point | 993 | Iron Age enclosure cropmark | ENCLOSURE | IA | 387000 | 640100 |
| 64 | Point | 1397 | Settlement at the south end of The Bell | ENCLOSURE | IA | 390200 | 628800 |
| 65 | Point | 1419 | Enclosed settlement | ENCLOSED SETTLEMENT | IA | 390710 | 629770 |
| 66 | Point | 1430 | Settlement 500yds (450m) south west of White Law | ENCLOSURE | IA | 394100 | 628600 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 67 | Point | 1446 | Enclosed settlement | ENCLOSED SETTLEMENT | IA | 392180 | 629470 |
| 68 | Point | 1825 | Flodden Hill Iron Age enclosure | ENCLOSURE | IA | 391350 | 635720 |
| 69 | Point | 1998 | Howtel Field Camp | ENCLOSURE | IA | 390250 | 634770 |
| 70 | Point | 2130 | Chesters Strip Plantation earthwork near Fenton House | ENCLOSURE | IA | 398500 | 634570 |
| 71 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSURE | IA | 402070 | 627840 |
| 72 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSURE | IA | 402150 | 627910 |
| 73 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSURE | IA | 402090 | 627870 |
| 74 | Point | 3399 | Iron Age multivallate hillfort | ENCLOSURE | IA | 407600 | 628320 |
| 75 | Point | 3400 | | ENCLOSURE | IA | 407460 | 628080 |
| 76 | Point | 3409 | Possible univallate hillfort | ENCLOSURE | IA | 407010 | 626990 |
| 77 | Point | 3677 | Defended enclosure | ENCLOSURE | IA | 403730 | 635080 |
| 78 | Point | 3683 | Kyloe Crag settlement | ENCLOSED SETTLEMENT | IA | 404810 | 639070 |
| 79 | Point | 3732 | Buckton Moor South camp | ENCLOSURE | IA | 407000 | 637580 |
| 80 | Point | 3742 | Iron Age enclosure | ENCLOSURE | IA | 409610 | 636270 |
| 81 | Point | 3802 | East Dod Law, hillfort | ENCLOSURE | IA | 400750 | 631630 |
| 82 | Point | 3802 | East Dod Law, hillfort | ENCLOSURE | IA | 400790 | 631630 |
| 83 | Point | 3802 | East Dod Law, hillfort | ENCLOSURE | IA | 400770 | 631650 |
| 84 | Point | 4029 | Iron Age enclosure | ENCLOSURE | IA | 401450 | 642070 |
| 85 | Point | 4099 | Fenhamhill cropmark enclosure | ENCLOSURE | IA | 406990 | 641270 |
| 86 | Point | 4925 | Hemphole Plantation, defended enclosure | ENCLOSED SETTLEMENT | IA | 413050 | 629870 |
| 87 | Point | 5119 | Iron Age/Roman enclosure | ENCLOSURE | IA | 412900 | 634190 |
| 88 | Point | 12924 | Bluntie Well rectilinear enclosure | ENCLOSED SETTLEMENT | IA | 399620 | 633080 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 89 | Point | 19659 | Sandy House 2 sub-circular enclosure | ENCLOSURE | IA | 393350 | 632220 |
| 90 | Point | 19660 | Sandy House 3 enclosure | ENCLOSED SETTLEMENT | IA | 393300 | 632080 |
| 91 | Point | 24161 | Possible Iron Age enclosure, Bamburgh | ENCLOSURE | IA | 417750 | 634640 |
| 92 | Point | 611 | Great Hetha defended settlement | HILLFORT | IA | 388550 | 627390 |
| 93 | Point | 634 | Little Hetha defended settlement | FORT | IA | 388610 | 628050 |
| 96 | Point | 747 | Cramondhill - settlement, cropmarks | FORT | IA | 387100 | 639700 |
| 97 | Point | 747 | Cramondhill - settlement, cropmarks | FORT | IA | 387200 | 639700 |
| 98 | Point | 804 | Mindrummill Farm, enclosure | HILLFORT | IA | 383700 | 634800 |
| 99 | Point | 805 | Hillfort | HILLFORT | IA | 383450 | 630900 |
| 100 | Point | 852 | Staw Hill defended settlement | HILLFORT | IA | 388440 | 630100 |
| 101 | Point | 868 | Pawston Hill camp | Fortified Settlement | IA | 385050 | 631850 |
| 102 | Point | 981 | Tillmouth Farm - enclosure, cropmark | HILLFORT | IA | 388800 | 644450 |
| 103 | Point | 981 | Tillmouth Farm - enclosure, cropmark | HILLFORT | IA | 389400 | 644500 |
| 104 | Point | 981 | Tillmouth Farm - enclosure, cropmark | HILLFORT | IA | 388800 | 644400 |
| 107 | Point | 1429 | St Gregory's Hill camp | FORT | IA | 391610 | 629790 |
| 110 | Point | 1544 | Humbleton Hill camp | HILLFORT | IA | 396660 | 628290 |
| 111 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | HILLFORT | IA | 398470 | 627300 |
| 112 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | HILLFORT | IA | 398580 | 627270 |
| 113 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | Hillslope Enclosure | IA | 398580 | 627270 |
| 114 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | Hillslope Enclosure | IA | 398470 | 627300 |
| 115 | Point | 1950 | Blackchester Hillfort | HILLFORT | IA | 396380 | 637930 |
| 116 | Point | 3781 | Iron Age enclosure | HILLFORT | IA | 400110 | 633450 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 117 | Point | 3781 | Iron Age enclosure | HILLFORT | IA | 400120 | 633460 |
| 118 | Point | 3819 | Horton Moor, unenclosed settlement | HUT CIRCLE | IA | 401500 | 631780 |
| 119 | Point | 3819 | Horton Moor, unenclosed settlement | HUT CIRCLE | IA | 401590 | 631870 |
| 120 | Point | 3819 | Horton Moor, unenclosed settlement | HUT CIRCLE | IA | 401400 | 631800 |
| 121 | Point | 3819 | Horton Moor, unenclosed settlement | HUT CIRCLE | IA | 401500 | 631900 |
| 122 | Point | 3819 | Horton Moor, unenclosed settlement | HUT CIRCLE | IA | 401600 | 631900 |
| 123 | Point | 4128 | Fenhamhill, possible hut site. | HUT CIRCLE | IA | 406400 | 641100 |
| 124 | Point | 5074 | Iron Age hillfort | HILLFORT | IA | 410500 | 637400 |
| 125 | Point | 13331 | Chattonpark settlement | HUT CIRCLE SETTLEMENT | IA | 407540 | 629340 |
| 126 | Point | 14104 | Kaimknowe fort | HILLFORT | IA | 390100 | 638500 |
| 128 | Point | 23866 | Iron Age fort | FORT | IA | 406607 | 630967 |
| 129 | Point | 731 | East Moneylaws Camp | OVAL ENCLOSURE | IA | 388070 | 635400 |
| 130 | Point | 736 | Cropmarks of settlement | MACULA | IA | 389200 | 636300 |
| 131 | Point | 736 | Cropmarks of settlement | MACULA | IA | 389300 | 636300 |
| 132 | Point | 747 | Cramondhill - settlement, cropmarks | PIT | IA | 387200 | 639700 |
| 133 | Point | 847 | Downham Camp | MULTIVALLATE HILLFORT | IA | 386810 | 634080 |
| 134 | Point | 995 | Hen Law palisaded enclosure | PALISADED ENCLOSURE | IA | 388608 | 642312 |
| 135 | Point | 1829 | Flodden Camp | MULTIVALLATE HILLFORT | IA | 392370 | 635100 |
| 136 | Point | 1853 | West Crookham later prehistoric circular cropmark enclosure | PALISADED ENCLOSURE | IA | 390430 | 639050 |
| 137 | Point | 1871 | Crookham Eastfield | PALISADED SETTLEMENT | IA | 391090 | 638850 |
| 138 | Point | 1873 | Ring ditch/Flodden North 2 | PALISADED ENCLOSURE | IA | 392040 | 635450 |
| 139 | Point | 1873 | Ring ditch/Flodden North 2 | PALISADED ENCLOSURE | IA | 392000 | 635400 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 140 | Point | 1953 | Fenton Hill Camp | MULTIVALLATE HILLFORT | IA | 397940 | 635410 |
| 141 | Point | 1958 | Roughting Linn camp | MULTIVALLATE HILLFORT | IA | 398280 | 636750 |
| 142 | Point | 1961 | Triple ditched circular enclosure south east of Ford | MULTIVALLATE HILLFORT | IA | 396300 | 635300 |
| 143 | Point | 2026 | Burrowses camp | MULTIVALLATE HILLFORT | IA | 393110 | 630650 |
| 144 | Point | 2047 | Canno mill, defended enclosure crop mark | MULTIVALLATE HILLFORT | IA | 390500 | 631300 |
| 145 | Point | 2047 | Canno mill, defended enclosure crop mark | MULTIVALLATE HILLFORT | IA | 390780 | 634690 |
| 146 | Point | 2105 | Circular and linear features | PALISADED ENCLOSURE | IA | 393410 | 630320 |
| 147 | Point | 2105 | Circular and linear features | PALISADED ENCLOSURE | IA | 393400 | 630300 |
| 148 | Point | 3318 | Double ditched enclosure south-west of Broomhouse | MULTIVALLATE HILLFORT | IA | 403999 | 627351 |
| 149 | Point | 3694 | Iron Age hillfort | MULTIVALLATE HILLFORT | IA | 401240 | 638770 |
| 150 | Point | 3743 | Kyloe camp | MULTIVALLATE HILLFORT | IA | 405160 | 638870 |
| 151 | Point | 3781 | Iron Age enclosure | PALISADED ENCLOSURE | IA | 400110 | 633450 |
| 152 | Point | 3781 | Iron Age enclosure | PALISADED ENCLOSURE | IA | 400120 | 633460 |
| 153 | Point | 3782 | Iron Age enclosure | MULTIVALLATE HILLFORT | IA | 401880 | 634510 |
| 154 | Point | 3782 | Iron Age enclosure | MULTIVALLATE HILLFORT | IA | 401890 | 634520 |
| 155 | Point | 3827 | Cropmarks of an oval ditched enclosure | OVAL ENCLOSURE | IA | 404140 | 630920 |
| 156 | Point | 3829 | Cropmarks of a double ditched circular enclosure | MULTIVALLATE HILLFORT | IA | 403800 | 633100 |
| 157 | Point | 3834 | Cropmarks of a promontory fort | MULTIVALLATE HILLFORT | IA | 403980 | 634970 |
| 158 | Point | 4044 | Kentstone Hill multivallate hillfort | PALISADED ENCLOSURE | IA | 404399 | 641453 |
| 159 | Point | 12863 | Pace Hill cropmark enclosures | PALISADED ENCLOSURE | IA | 391470 | 637460 |
| 160 | Point | 12867 | Circular enclosure, First Linthaugh 1 | PALISADED ENCLOSURE | IA | 393070 | 637200 |
| 161 | Point | 12882 | Branxton Moor, Curvilinear cropmarks | MULTIVALLATE HILLFORT | IA | 390200 | 635470 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 162 | Point | 12883 | Flodden North 1, cropmark complex | PALISADED ENCLOSURE | IA | 391830 | 635640 |
| 163 | Point | 12905 | Circular enclosure, Kypie Hill | MULTIVALLATE HILLFORT | IA | 390850 | 630340 |
| 164 | Point | 14797 | Palisaded settlement | PALISADED ENCLOSURE | IA | 392830 | 630380 |
| 165 | Point | 19655 | Yeavering 1 palisaded enclosure | PALISADED ENCLOSURE | IA | 392380 | 630380 |
| 166 | Point | 19679 | Pace Hill 2 cropmarks | MULTIVALLATE HILLFORT | IA | 391550 | 637370 |
| 167 | Point | 19698 | South Dod Law circular palisaded enclosure | PALISADED ENCLOSURE | IA | 401000 | 631100 |
| 168 | Point | 23895 | Fenham multivallate hillfort | MULTIVALLATE HILLFORT | IA | 409130 | 640130 |
| 169 | Point | 747 | Cramondhill - settlement, cropmarks | PIT | IA | 387100 | 639700 |
| 170 | Point | 921 | Remains of earthwork (possible site of 16th century castle) | PROMONTORY FORT | IA | 388440 | 645120 |
| 171 | Point | 986 | Mill Hill - earthwork, cropmark | PROMONTORY FORT | IA | 389100 | 643000 |
| 172 | Point | 986 | Mill Hill - earthwork, cropmark | PROMONTORY FORT | IA | 389100 | 643100 |
| 173 | Point | 1401 | Glead's Cleugh Iron Age promontory fort | PROMONTORY FORT | IA | 394900 | 629060 |
| 174 | Point | 569 | Sinkside Hill defended settlement | SETTLEMENT | IA | 388410 | 626280 |
| 175 | Point | 648 | Hut circle settlements and field systems at Hetha Burn Head | SETTLEMENT | IA | 386690 | 626400 |
| 176 | Point | 694 | Prehistoric/Roman ditched enclosure 500m south-east of Wark | SETTLEMENT | IA | 383330 | 638330 |
| 177 | Point | 747 | Cramondhill - settlement, cropmarks | ROUND HOUSE (DOMESTIC) | IA | 387100 | 639700 |
| 178 | Point | 747 | Cramondhill - settlement, cropmarks | ROUND HOUSE (DOMESTIC) | IA | 387200 | 639700 |
| 179 | Point | 757 | Branxtonmoor settlement enclosure | SETTLEMENT | IA | 389900 | 636100 |
| 180 | Point | 970 | Holy Chesters | RECTANGULAR ENCLOSURE | IA | 387480 | 642110 |
| 181 | Point | 977 | See NT 84 SE 41 | SETTLEMENT | IA | 385900 | 640200 |
| 182 | Point | 986 | Mill Hill - earthwork, cropmark | RECTILINEAR ENCLOSURE | IA | 389100 | 643100 |
| 183 | Point | 986 | Mill Hill - earthwork, cropmark | RECTILINEAR ENCLOSURE | IA | 389100 | 643000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 184 | Point | 1004 | Cartersford Bridge Iron Age or Roman period settlement | SETTLEMENT | IA | 389400 | 643400 |
| 185 | Point | 1004 | Cartersford Bridge Iron Age or Roman period settlement | SETTLEMENT | IA | 389400 | 643300 |
| 186 | Point | 1462 | Yeavering South-West, unenclosed settlement | SETTLEMENT | IA | 392700 | 628600 |
| 187 | Point | 1509 | Defended settlement on north slope of Harehope Hill, 570m south east of High Akeld Cottages | SETTLEMENT | IA | 395950 | 628920 |
| 188 | Point | 1555 | Iron Age defended settlement and cultivation terraces 600m north east of Brown's Law Cottage | SETTLEMENT | IA | 397650 | 627580 |
| 189 | Point | 2002 | Cropmark of native settlement | SETTLEMENT | IA | 392600 | 633980 |
| 190 | Point | 2049 | Flodden Edge camp | RECTILINEAR ENCLOSURE | IA | 391450 | 634950 |
| 191 | Point | 2111 | Early Neolithic settlement site, Milfield Airfield | SETTLEMENT | IA | 394300 | 632500 |
| 192 | Point | 2151 | Settlement north-west of Doddington | SETTLEMENT | IA | 398100 | 633300 |
| 193 | Point | 2214 | Whidden Hill native settlement (site of) | SETTLEMENT | IA | 390040 | 645050 |
| 194 | Point | 3341 | | SETTLEMENT | IA | 404900 | 629900 |
| 195 | Point | 3341 | | SETTLEMENT | IA | 405000 | 630000 |
| 196 | Point | 3396 | Chatton Law camp, and cup and ring marked rocks | SETTLEMENT | IA | 407210 | 629400 |
| 197 | Point | 3785 | | SETTLEMENT | IA | 402890 | 633280 |
| 198 | Point | 3794 | Middle Dod Law, hillfort | SETTLEMENT | IA | 400630 | 631700 |
| 199 | Point | 3812 | Buttony Wood Camp, Horton Moor | SETTLEMENT | IA | 401860 | 631190 |
| 200 | Point | 4978 | | SETTLEMENT | IA | 418300 | 628700 |
| 201 | Point | 5121 | Kippy Heugh defended settlement | SETTLEMENT | IA | 412610 | 634650 |
| 202 | Point | 12944 | Rectilinear enclosure | RECTILINEAR ENCLOSURE | IA | 404550 | 630960 |
| 203 | Point | 19674 | Hay Farm enclosure 2 | RECTILINEAR ENCLOSURE | IA | 394073 | 638378 |
| 204 | Point | 19675 | Cannon Burn 2 rectilinear enclosure | RECTILINEAR ENCLOSURE | IA | 395000 | 636380 |
| 205 | Point | 20039 | Irregular rectilinear enclosure cropmarks, north side of Chuckbridge Burn | RECTILINEAR ENCLOSURE | IA | 412930 | 629670 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 206 | Point | 21153 | An Iron Age/ Roman rectilinear ditched enclosure and prehistoric/ Roman ditches | RECTANGULAR ENCLOSURE | IA | 389740 | 638380 |
| 207 | Point | 23957 | Possible Iron Age settlement at Lanton Quarry | STRUCTURE | IA | 395600 | 630670 |
| 208 | Point | 5128 | Roundabouts Camp | SUB CIRCULAR ENCLOSURE | IA | 413150 | 631080 |
| 209 | Point | 20045 | Sub-circular enclosure south-west of Adderstone Mains | SUB CIRCULAR ENCLOSURE | IA | 412970 | 631190 |
| 210 | Point | 569 | Sinkside Hill defended settlement | UNIVALLATE HILLFORT | IA | 388410 | 626280 |
| 211 | Point | 1516 | Unenclosed scooped settlement on the east slope of Harehope Hill, 750m south east of High Ake | UNENCLOSED SETTLEMENT | IA | 396080 | 628750 |

| MILFIELD BASIN ROMAN IRON AGE BUILT FORM SITES | | | | | | | |
|---|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | SMR_ID | SITE_NAME | PTF_TYPE | PTF_PERIOD | EASTING | NORTHING |
| 1 | Point | 567 | Unenclosed settlement, part of a field system, Romano-British aggregate village and group of shielings, 470m south east of Whitehall | AGGREGATE VILLAGE | RO | 389200 | 625750 |
| 3 | Point | 3748 | | CIRCULAR ENCLOSURE | RO | 409100 | 635750 |
| 5 | Point | 570 | Trowupburn Roman period native enclosed settlement, 120m north of Trowupburn Farm | ENCLOSED SETTLEMENT | RO | 387610 | 626640 |
| 6 | Point | 576 | Roman period native enclosed settlement 480m north of Sutherland Bridge | ENCLOSED SETTLEMENT | RO | 388870 | 625440 |
| 7 | Point | 584 | Roman period native enclosed settlement 600m north east of Elsdonburn Shank | ENCLOSED SETTLEMENT | RO | 386730 | 629600 |
| 8 | Point | 603 | Roman period native settlement 250m west of Elsdonburn Shank | ENCLOSED SETTLEMENT | RO | 385970 | 629330 |
| 9 | Point | 606 | Enclosed settlement west of Mid Hill | ENCLOSED SETTLEMENT | RO | 387370 | 629650 |
| 10 | Point | 618 | Crowden Sike scooped homestead | ENCLOSED SETTLEMENT | RO | 387070 | 629190 |
| 11 | Point | 620 | Roman period native settlement on east slope of Mid Hill, 520m south of Staw Hill Camp | ENCLOSED SETTLEMENT | RO | 388540 | 629590 |
| 12 | Point | 636 | Hetha Burn defended settlement and associated trackways | ENCLOSED SETTLEMENT | RO | 387860 | 627600 |
| 13 | Point | 638 | Roman period homestead 100m south-west of Elsdonburn | ENCLOSED SETTLEMENT | RO | 387100 | 628170 |
| 14 | Point | 663 | Romano-British settlement 810m south east of Whitehall | ENCLOSED SETTLEMENT | RO | 389470 | 625540 |
| 15 | Point | 696 | Prehistoric/Roman enclosure | DITCHED ENCLOSURE | RO | 383490 | 637750 |
| 16 | Point | 696 | Prehistoric/Roman enclosure | D SHAPED ENCLOSURE | RO | 383490 | 637750 |
| 17 | Point | 696 | Prehistoric/Roman enclosure | D SHAPED ENCLOSURE | RO | 383500 | 637700 |
| 18 | Point | 696 | Prehistoric/Roman enclosure | DITCHED ENCLOSURE | RO | 383500 | 637700 |
| 21 | Point | 736 | Cropmarks of settlement | ENCLOSED HUT CIRCLE SETTLEMENT | RO | 389200 | 636300 |
| 22 | Point | 736 | Cropmarks of settlement | ENCLOSED HUT CIRCLE SETTLEMENT | RO | 389300 | 636300 |
| 23 | Point | 739 | Moneylaws Covert | DITCHED ENCLOSURE | RO | 388600 | 635300 |

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| 24 | Point | 812 | Cropmarks of probable Romano-British settlement | ENCLOSED SETTLEMENT | RO | 384080 | 632440 |
| 25 | Point | 812 | Cropmarks of probable Romano-British settlement | ENCLOSED SETTLEMENT | RO | 384000 | 632400 |
| 26 | Point | 813 | Mindrum Mill, cropmarks of possible Romano-British settlement | ENCLOSED SETTLEMENT | RO | 384600 | 634400 |
| 27 | Point | 819 | Romano-British enclosed settlement | ENCLOSED SETTLEMENT | RO | 384220 | 632500 |
| 28 | Point | 849 | Roman period native farmstead 320m north east of Longknowe | ENCLOSED SETTLEMENT | RO | 387160 | 631030 |
| 29 | Point | 974 | Rectilinear enclosure (?RB) (site of) | ENCLOSED SETTLEMENT | RO | 389740 | 644650 |
| 30 | Point | 974 | Rectilinear enclosure (?RB) (site of) | ENCLOSED SETTLEMENT | RO | 389630 | 644700 |
| 31 | Point | 974 | Rectilinear enclosure (?RB) (site of) | ENCLOSED SETTLEMENT | RO | 389790 | 644850 |
| 32 | Point | 974 | Rectilinear enclosure (?RB) (site of) | ENCLOSED SETTLEMENT | RO | 389640 | 644740 |
| 33 | Point | 979 | Stickle Heaton Iron Age or Roman defended enclosure | DOUBLE DITCHED ENCLOSURE | RO | 388500 | 641950 |
| 34 | Point | 1394 | Settlement on the east slope of The Bell | ENCLOSED SETTLEMENT | RO | 390300 | 629120 |
| 35 | Point | 1394 | Settlement on the east slope of The Bell | ENCLOSED SETTLEMENT | RO | 390370 | 629100 |
| 36 | Point | 1407 | Three Roman period native settlements and later droveway 750m south west of Torleehouse | ENCLOSED SETTLEMENT | RO | 390770 | 628510 |
| 37 | Point | 1410 | Roman period native settlement, associated field system and trackway 270m south of Torleehouse | ENCLOSED SETTLEMENT | RO | 391320 | 628660 |
| 38 | Point | 1442 | Settlement on NE slope of Yeavering Bell | ENCLOSED SETTLEMENT | RO | 393630 | 629580 |
| 39 | Point | 1455 | Enclosed settlement | ENCLOSED SETTLEMENT | RO | 393800 | 628950 |
| 40 | Point | 1458 | Romano-British settlement east of Yeavering Bell | ENCLOSED SETTLEMENT | RO | 393800 | 629360 |
| 41 | Point | 1519 | Roman period native homestead 400m south of Humbleton Hill hillfort | ENCLOSED SETTLEMENT | RO | 396530 | 627920 |
| 42 | Point | 1548 | Enclosure 400yds (370m) south of The Kettles | ENCLOSED SETTLEMENT | RO | 398370 | 626900 |
| 43 | Point | 1551 | Romano-British farmstead 630m south west of White Gables | ENCLOSED SETTLEMENT | RO | 397240 | 628110 |
| 44 | Point | 1553 | Roman period native settlement on Coldberry Hill | ENCLOSED SETTLEMENT | RO | 397130 | 627360 |
| 45 | Point | 1554 | Roman period native settlement on Coldberry Hill | ENCLOSED SETTLEMENT | RO | 397010 | 627270 |

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|---|---|---|---|---|---|---|---|
| 46 | Point | 3293 | Roman period homestead 250m north of Fowberry Moor | ENCLOSED SETTLEMENT | RO | 402200 | 627470 |
| 47 | Point | 3293 | Roman period homestead 250m north of Fowberry Moor | ENCLOSED SETTLEMENT | RO | 402180 | 627520 |
| 48 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSED SETTLEMENT | RO | 402070 | 627840 |
| 49 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSED SETTLEMENT | RO | 402150 | 627910 |
| 50 | Point | 3314 | Iron Age and Roman period enclosed settlement in North Plantation, Fowberry Moor | ENCLOSED SETTLEMENT | RO | 402090 | 627870 |
| 51 | Point | 3748 | | DOUBLE DITCHED ENCLOSURE | RO | 409100 | 635750 |
| 52 | Point | 3821 | Horton Moor, settlement | ENCLOSED SETTLEMENT | RO | 401740 | 632340 |
| 53 | Point | 3922 | Enclosed Roman settlement 450m north-east of Belford Mains | ENCLOSED SETTLEMENT | RO | 409910 | 632670 |
| 54 | Point | 3928 | Cropmarks of a possible enclosure | DITCHED ENCLOSURE | RO | 409700 | 631400 |
| 56 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | ENCLOSED SETTLEMENT | RO | 403180 | 640000 |
| 57 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | ENCLOSED SETTLEMENT | RO | 403170 | 640000 |
| 58 | Point | 13327 | Romano-British enclosed settlement on West Hill | ENCLOSED SETTLEMENT | RO | 391020 | 629550 |
| 59 | Point | 23935 | Kypie Hill curvilinear double enclosure cropmark | CURVILINEAR ENCLOSURE | RO | 390800 | 633800 |
| 60 | Point | 573 | Possible scooped enclosure | ENCLOSURE | RO | 388440 | 625970 |
| 61 | Point | 575 | Roman period native farmstead 550m south-west of Trowupburn Farm | FARMSTEAD | RO | 387340 | 625990 |
| 62 | Point | 592 | Settlement at Scaldhill Shank | FARMSTEAD | RO | 386660 | 627790 |
| 63 | Point | 608 | Roman period homestead on Staw Hill | FARMSTEAD | RO | 388420 | 629700 |
| 64 | Point | 624 | Settlement north-west of Ell's Knowe | FARMSTEAD | RO | 387020 | 627980 |
| 65 | Point | 625 | Settlement WSW of Ell's Knowe | FARMSTEAD | RO | 387020 | 627720 |
| 66 | Point | 632 | Settlements east of Laddies Knowe | FARMSTEAD | RO | 388280 | 628820 |
| 67 | Point | 664 | Romano-British farmstead 760m north of Whitehall | FARMSTEAD | RO | 389060 | 626790 |
| 68 | Point | 813 | Mindrum Mill, cropmarks of possible Romano-British settlement | ENCLOSED SETTLEMENT | RO | 384700 | 634470 |

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|---|---|---|---|---|---|---|---|---|
| 69 | Point | 850 | Farmstead, ENE of Stawhouse | FARMSTEAD | RO | 389380 | 630510 |
| 70 | Point | 981 | Tillmouth Farm - enclosure, cropmark | ENCLOSURE | RO | 388800 | 644400 |
| 71 | Point | 981 | Tillmouth Farm - enclosure, cropmark | ENCLOSURE | RO | 389400 | 644500 |
| 72 | Point | 981 | Tillmouth Farm - enclosure, cropmark | ENCLOSURE | RO | 388800 | 644450 |
| 73 | Point | 1033 | Prehistoric or Roman period enclosure 450m south-west of Tillmouth Farm | ENCLOSURE | RO | 388670 | 643950 |
| 74 | Point | 1392 | Settlement on the east slope of The Bell | ENCLOSURE | RO | 390460 | 629060 |
| 75 | Point | 1413 | Enclosure and field system | ENCLOSURE | RO | 391394 | 629356 |
| 76 | Point | 1437 | Romano-British settlements east of Yeavering Bell | ENCLOSURE | RO | 393890 | 629210 |
| 77 | Point | 1507 | Roman period native farmstead and associated scooped enclosures and trackways on east slope of Harehope Hill, 925m south east of High | FARMSTEAD | RO | 396040 | 628560 |
| 78 | Point | 1518 | Romano-British farmsteads 900m and 970m north east of triangulation point on Gains Law | FARMSTEAD | RO | 396380 | 628620 |
| 79 | Point | 1518 | Romano-British farmsteads 900m and 970m north east of triangulation point on Gains Law | FARMSTEAD | RO | 396460 | 628580 |
| 80 | Point | 1518 | Romano-British farmsteads 900m and 970m north east of triangulation point on Gains Law | FARMSTEAD | RO | 396370 | 628600 |
| 81 | Point | 3293 | Roman period homestead 250m north of Fowberry Moor | ENCLOSURE | RO | 402180 | 627520 |
| 82 | Point | 3293 | Roman period homestead 250m north of Fowberry Moor | ENCLOSURE | RO | 402200 | 627470 |
| 83 | Point | 3410 | Roman homestead | ENCLOSURE | RO | 406770 | 629820 |
| 84 | Point | 3923 | Roman enclosure and ditch | ENCLOSURE | RO | 407870 | 630650 |
| 85 | Point | 13326 | Possible Romano-British outer enclosure and settlement within West Hill hillfort | ENCLOSURE | RO | 390970 | 629510 |
| 86 | Point | 21732 | West Moneylaws possible prehistoric or Roman enclosure | ENCLOSURE | RO | 387300 | 635440 |
| 100 | Point | 1448 | Yeavering Bell Camp | Fortified Settlement | RO | 392800 | 629310 |
| 101 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | Fortified Settlement | RO | 398470 | 627300 |
| 102 | Point | 1546 | The Kettles (Maiden Castle or Greenside settlement) | Fortified Settlement | RO | 398580 | 627270 |
| 103 | Point | 2001 | Melmin (site east of Milfield village) | HISTORICAL SITE | RO | 394100 | 633900 |

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|---|---|---|---|---|---|---|---|
| 104 | Point | 1395 | Possible hut circle | HUT CIRCLE | RO | 390330 | 629020 |
| 105 | Point | 1543 | Hut circle 770m south east of White Gables | HUT CIRCLE | RO | 397080 | 628090 |
| 106 | Point | 3284 | Newtown Moor, possible unenclosed settlement | HUT CIRCLE | RO | 402650 | 626300 |
| 107 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | HUT CIRCLE | RO | 403180 | 640000 |
| 108 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | HUT CIRCLE | RO | 403170 | 640000 |
| 109 | Point | 696 | Prehistoric/Roman enclosure | PALISADED ENCLOSURE | RO | 383500 | 637700 |
| 110 | Point | 696 | Prehistoric/Roman enclosure | PALISADED ENCLOSURE | RO | 383490 | 637750 |
| 111 | Point | 696 | Prehistoric/Roman enclosure | PIT | RO | 383490 | 637750 |
| 112 | Point | 696 | Prehistoric/Roman enclosure | PIT | RO | 383500 | 637700 |
| 113 | Point | 741 | Cropmark of prehistoric/Roman enclosure and trackway | PIT | RO | 387700 | 636300 |
| 114 | Point | 996 | Crop mark of pit alignment | PIT ALIGNMENT | RO | 387570 | 642430 |
| 115 | Point | 3838 | Fox Covert, cropmark | PIT | RO | 402460 | 633190 |
| 116 | Point | 742 | Iron Age/Roman rectilinear enclosure | RECTANGULAR ENCLOSURE | RO | 386950 | 636260 |
| 117 | Point | 817 | Horse Rigg, probable Romano-British enclosed settlement | RECTANGULAR ENCLOSURE | RO | 382650 | 634070 |
| 118 | Point | 974 | Rectilinear enclosure (?RB) (site of) | RECTANGULAR ENCLOSURE | RO | 389740 | 644650 |
| 119 | Point | 974 | Rectilinear enclosure (?RB) (site of) | RECTANGULAR ENCLOSURE | RO | 389790 | 644850 |
| 120 | Point | 974 | Rectilinear enclosure (?RB) (site of) | RECTANGULAR ENCLOSURE | RO | 389640 | 644740 |
| 121 | Point | 974 | Rectilinear enclosure (?RB) (site of) | RECTANGULAR ENCLOSURE | RO | 389630 | 644700 |
| 122 | Point | 1000 | Cropmark of rectilinear enclosure | RECTANGULAR ENCLOSURE | RO | 386820 | 642700 |
| 123 | Point | 1000 | Cropmark of rectilinear enclosure | RECTANGULAR ENCLOSURE | RO | 386790 | 642640 |
| 124 | Point | 1006 | Enclosure | RECTANGULAR ENCLOSURE | RO | 386710 | 642530 |
| 125 | Point | 1036 | Rectilinear enclosure | RECTILINEAR ENCLOSURE | RO | 389700 | 644950 |

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|---|---|---|---|---|---|---|---|
| 126 | Point | 1835 | Camp 370m NNE of Flodden | RECTILINEAR ENCLOSURE | RO | 392240 | 635410 |
| 127 | Point | 3688 | Laverocklaw Roman camp | RECTILINEAR ENCLOSURE | RO | 402370 | 636350 |
| 128 | Point | 3835 | Possible Romano-British enclosed settlement | RECTANGULAR ENCLOSURE | RO | 400000 | 631280 |
| 129 | Point | 4033 | Cropmark of native Romano-British site | RECTILINEAR ENCLOSURE | RO | 400430 | 642260 |
| 130 | Point | 21150 | Crookham Westfield rectilinear enclosures | RECTILINEAR ENCLOSURE | RO | 389240 | 638320 |
| 131 | Point | 23861 | Iron Age or Roman enclosure | RECTILINEAR ENCLOSURE | RO | 419706 | 633506 |
| 132 | Point | 24040 | Prehistoric or Roman rectilinear enclosure | RECTILINEAR ENCLOSURE | RO | 383230 | 637950 |
| 133 | Point | 572 | Site of scooped enclosure | SCOOPED SETTLEMENT | RO | 388230 | 625980 |
| 134 | Point | 574 | Scooped enclosure | SCOOPED SETTLEMENT | RO | 388210 | 625900 |
| 135 | Point | 584 | Roman period native enclosed settlement 600m north east of Elsdonburn Shank | SCOOPED SETTLEMENT | RO | 386730 | 629600 |
| 136 | Point | 587 | Enclosed settlement and subsidiary enclosures 160m north of Ring Chesters defended settlement | SCOOPED SETTLEMENT | RO | 386620 | 629140 |
| 137 | Point | 589 | Roman period native enclosed settlement 700m south of Ring Chesters defended settlement | SCOOPED SETTLEMENT | RO | 386620 | 628110 |
| 138 | Point | 591 | Elsdonburn Roman period native settlements and medieval shieling | SCOOPED SETTLEMENT | RO | 386930 | 628190 |
| 139 | Point | 591 | Elsdonburn Roman period native settlements and medieval shieling | SCOOPED SETTLEMENT | RO | 386960 | 628150 |
| 140 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | SCOOPED SETTLEMENT | RO | 385140 | 628840 |
| 141 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | SCOOPED SETTLEMENT | RO | 385160 | 628890 |
| 142 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | SCOOPED SETTLEMENT | RO | 385200 | 628930 |
| 143 | Point | 601 | Roman period scooped settlement on Coldsmouth Hill | SCOOPED SETTLEMENT | RO | 385440 | 629160 |
| 144 | Point | 610 | Roman period native enclosed settlement 370m WNW of Great Hetha defended settlement | SCOOPED SETTLEMENT | RO | 388100 | 627520 |
| 145 | Point | 617 | Settlement south-west of Mid Hill | SETTLEMENT | RO | 387600 | 629400 |
| 146 | Point | 1417 | West Hill camp | SETTLEMENT | RO | 390970 | 629500 |
| 147 | Point | 1443 | Settlement west of Old Sheepfold | SETTLEMENT | RO | 393670 | 629210 |

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|---|---|---|---|---|---|---|---|
| 148 | Point | 1445 | Settlement on north slope of Yeavering Bell | SETTLEMENT | RO | 392520 | 629780 |
| 149 | Point | 1465 | Settlement | SETTLEMENT | RO | 392700 | 627300 |
| 150 | Point | 1527 | Iron Age multivallate hillfort at Monday Cleugh | SETTLEMENT | RO | 395610 | 628490 |
| 151 | Point | 2008 | Gefrin | SETTLEMENT | RO | 392600 | 630500 |
| 152 | Point | 2382 | Haydon Dean, rectilinear enclosure | SETTLEMENT | RO | 397220 | 644060 |
| 153 | Point | 3341 | | SETTLEMENT | RO | 404900 | 629900 |
| 154 | Point | 3795 | West Camp on Dod Law | SETTLEMENT | RO | 400410 | 631710 |
| 155 | Point | 3800 | The Ringses Camp 1120m E of Doddington Moor | SETTLEMENT | RO | 401350 | 632810 |
| 156 | Point | 4978 | | SETTLEMENT | RO | 418300 | 628700 |
| 157 | Point | 12738 | Scooped settlement south west of Great Hetha | SCOOPED SETTLEMENT | RO | 387950 | 627100 |
| 158 | Point | 12757 | North Whitehall scooped settlement | SCOOPED SETTLEMENT | RO | 388900 | 626770 |
| 159 | Point | 13346 | Scooped settlement on eastern slopes of West Hill | SCOOPED SETTLEMENT | RO | 391320 | 629660 |
| 160 | Point | 13367 | Scooped settlement on eastern slopes of West Hill | SCOOPED SETTLEMENT | RO | 391370 | 629670 |
| 161 | Point | 13368 | Scooped settlement on north-east slopes of West Hill | SCOOPED SETTLEMENT | RO | 391240 | 629700 |
| 162 | Point | 13369 | Scooped settlement on the south-east slopes of West Hill | SCOOPED SETTLEMENT | RO | 391320 | 629530 |
| 163 | Point | 13370 | Scooped settlement on south side of West Hill | SCOOPED SETTLEMENT | RO | 391040 | 629110 |
| 164 | Point | 984 | St Cuthbert's 1 - cropmark, enclosure | SETTLEMENT | RO | 386660 | 642200 |
| 165 | Point | 1000 | Cropmark of rectilinear enclosure | SETTLEMENT | RO | 386790 | 642640 |
| 166 | Point | 1000 | Cropmark of rectilinear enclosure | SETTLEMENT | RO | 386820 | 642700 |
| 167 | Point | 1004 | Cartersford Bridge Iron Age or Roman period settlement | SETTLEMENT | RO | 389400 | 643300 |
| 168 | Point | 1004 | Cartersford Bridge Iron Age or Roman period settlement | SETTLEMENT | RO | 389400 | 643400 |
| 169 | Point | 1464 | Roman period native settlement 340m east of Hethpool Bell | SETTLEMENT | RO | 390480 | 628460 |

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|---|---|---|---|---|---|---|---|
| 170 | Point | 1484 | Romano-British settlements WSW of Torleehouse | SETTLEMENT | RO | 390700 | 628700 |
| 171 | Point | 1501 | Prehistoric field system and unenclosed hut circle settlement on E slopes of Hart Heugh, 550m SW of Earlehillhead | SETTLEMENT | RO | 397250 | 625810 |
| 172 | Point | 1503 | Roman period native settlement 750m north-west of Carey Burn Bridge | SETTLEMENT | RO | 397060 | 625557 |
| 173 | Point | 3317 | Camp in Deershed Plantation | SETTLEMENT | RO | 402340 | 627350 |
| 174 | Point | 3341 | | SETTLEMENT | RO | 405000 | 630000 |
| 175 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | STOCK ENCLOSURE | RO | 385160 | 628890 |
| 176 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | STOCK ENCLOSURE | RO | 385200 | 628930 |
| 177 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | STOCK ENCLOSURE | RO | 385140 | 628840 |
| 178 | Point | 812 | Cropmarks of probable Romano-British settlement | SITE | RO | 384000 | 632400 |
| 179 | Point | 812 | Cropmarks of probable Romano-British settlement | SUB CIRCULAR ENCLOSURE | RO | 384080 | 632440 |
| 180 | Point | 812 | Cropmarks of probable Romano-British settlement | SUB CIRCULAR ENCLOSURE | RO | 384000 | 632400 |
| 181 | Point | 812 | Cropmarks of probable Romano-British settlement | SITE | RO | 384080 | 632440 |
| 182 | Point | 813 | Mindrum Mill, cropmarks of possible Romano-British settlement | SITE | RO | 384600 | 634400 |
| 183 | Point | 813 | Mindrum Mill, cropmarks of possible Romano-British settlement | SITE | RO | 384700 | 634470 |
| 184 | Point | 1835 | Camp 370m NNE of Flodden | SITE | RO | 392240 | 635410 |
| 185 | Point | 2164 | Cropmark of a Romano-British settlement | SITE | RO | 399170 | 630110 |
| 186 | Point | 3748 | | SITE | RO | 409100 | 635750 |
| 187 | Point | 3832 | East Horton possible Roman temporary camp | TEMPORARY CAMP | RO | 403400 | 630400 |
| 188 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | SITE | RO | 403170 | 640000 |
| 189 | Point | 4042 | Cropmark indicating sub-rectangular enclosure | SITE | RO | 403180 | 640000 |
| 190 | Point | 734 | East Learmouth, Roman camp | TEMPORARY CAMP | RO | 386900 | 637000 |
| 191 | Point | 834 | Mindrum temporary Roman camp | TEMPORARY CAMP | RO | 384100 | 633100 |

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|---|---|---|---|---|---|---|---|
| 192 | Point | 3832 | East Horton possible Roman temporary camp | TEMPORARY CAMP | RO | 403600 | 630300 |
| 193 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | VILLAGE | RO | 385160 | 628890 |
| 194 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | VILLAGE | RO | 385200 | 628930 |
| 195 | Point | 599 | Roman period aggregate village on Coldsmouth Hill, 650m south east of Ethelrede's Chapel | VILLAGE | RO | 385140 | 628840 |

| MILFIELD BASIN EARLY MEDIEVAL BUILT FORM SITES | | | | | | | |
|---|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | SMR_ID | SITE_NAME | PTF_TYPE | PTF_PERIOD | EASTING | NORTHING |
| 1 | Point | 14262 | Timber buildings at The Winery | BUILDING | EM | 412560 | 641910 |
| 2 | Point | 2201 | Woodbridge Farm rectangular building | BUILDING | EM | 395100 | 632850 |
| 3 | Point | 20321 | Dark Age features at Cheviot Quarry (Area 2) | BUILDING | EM | 395104 | 632751 |
| 4 | Point | 12264 | Possible early medieval building at Kimmerston Road End | BUILDING | EM | 393990 | 633670 |
| 9 | Point | 5257 | Church of St Aidan | BUILDING | EM | 417840 | 634970 |
| 16 | Point | 2122 | Pattern of ardmarks | DITCH | EM | 394290 | 633120 |
| 17 | Point | 2163 | Cropmark complex, possibly including a grubenhauser | GRUBENHAUS | EM | 395600 | 632300 |
| 18 | Point | 2163 | Cropmark complex, possibly including a grubenhauser | GRUBENHAUS | EM | 395750 | 632350 |
| 19 | Point | 2167 | House Plantation, crop mark complex | GRUBENHAUS | EM | 396200 | 630600 |
| 20 | Point | 12903 | Group of pit features | GRUBENHAUS | EM | 394000 | 632800 |
| 21 | Point | 19662 | Enclosure cropmark | GRUBENHAUS | EM | 393920 | 633770 |
| 22 | Point | 19663 | Grubenhaus east of Milfield village | GRUBENHAUS | EM | 394000 | 634000 |
| 23 | Point | 19690 | Pits or Grubenhaus cropmarks | GRUBENHAUS | EM | 390290 | 634330 |
| 24 | Point | 19694 | Grubenhaus or pits? and linear feature | GRUBENHAUS | EM | 393800 | 631450 |
| 25 | Point | 19720 | Grubenhauser or pits NW of Ewart Park henge | GRUBENHAUS | EM | 395610 | 631750 |
| 26 | Point | 2023 | Enclosure and Bronze Age cist | PALISADED ENCLOSURE | EM | 392720 | 630560 |
| 27 | Point | 2023 | Enclosure and Bronze Age cist | PALISADED ENCLOSURE | EM | 392750 | 630550 |
| 44 | Point | 5352 | <Null> | SETTLEMENT | EM | 412560 | 641830 |
| 45 | Point | 14266 | Prehistoric or early medieval post-holes at The Winery | POST HOLE | EM | 412570 | 641890 |
| 46 | Point | 14265 | Medieval post-holes at The Winery | POST HOLE | EM | 412560 | 641900 |

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|---|---|---|---|---|---|---|---|
| 47 | Point | 14269 | Prehistoric or Anglo-Saxon pit by Village Hall | PIT | EM | 412580 | 641940 |
| 48 | Point | 14259 | Anglo-Saxon pits and ditch at The Winery | DITCH | EM | 412500 | 641940 |
| 49 | Point | 14264 | Gully features at The Winery | DITCH | EM | 412560 | 641900 |
| 50 | Point | 14263 | Cobble surface at The Winery | PLATFORM | EM | 412560 | 641910 |
| 35 | Point | 1451 | Settlement, fields systems and terraces on the south-east slope of Yea | SETTLEMENT | EM | 392800 | 629000 |
| 36 | Point | 2040 | Site E of Milfield Village | SETTLEMENT | EM | 393500 | 633900 |
| 37 | Point | 5336 | Early medieval settlement | SETTLEMENT | EM | 412300 | 643200 |
| 39 | Point | 23955 | Early medieval settlement at Lanton Quarry | SETTLEMENT | EM | 395640 | 630600 |
| 40 | Point | 2013 | Bronze Age burials | STRUCTURE | EM | 392490 | 630470 |
| 41 | Point | 2037 | Old Yeavering Henge | STRUCTURE | EM | 392842 | 630425 |
| 42 | Point | 5337 | Early medieval farmstead at Green Shiel, Holy Island | SETTLEMENT | EM | 412180 | 643630 |

| EAST YORKSHIRE IRON AGE BUILT FORM SITES | | | | | | | |
|---|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | MONUID | PERIOD | MONTYPES | EASTING | NORTHING | NAME |
| 1 | Point | MHU12793 | Early Iron Age to Roman | OCCUPATION SITE, INHUMATION | 487150 | 441040.003 | IA, RB & EMED OCCUPATION |
| 2 | Point | MHU2533 | Lower Palaeolithic to Medieval | ROAD, RIDGE AND FURROW, RING DITCH, SITE | 482000 | 441700.004 | TRACKS, DITCHES, RING DITCH & R&F |
| 3 | Point | MHU20456 | Early Iron Age to Medieval | PIT, DITCH, FINDSPOT | 482125 | 443569.999 | IA/ROMAN PIT & OTHER FEATURES, CLARK'S COMMON FARM |
| 4 | Point | MHU4507 | Early Iron Age to Roman | RING DITCH, ENCLOSURE, SQUARE BARROW, ROUND BARROW, PIT | 483300 | 443700.001 | CROPMARK COMPLEX |
| 5 | Point | MHU8045 | Late Iron Age to Roman | RING DITCH | 484400 | 443800.003 | ?RING DITCH, N OF MANOR FARM |
| 6 | Point | MHU7654 | Early Iron Age to Roman | LINEAR SETTLEMENT, SQUARE BARROW | 490000 | 444400.001 | <Null> |
| 7 | Point | MHU21663 | Lower Palaeolithic to Roman | TRACKWAY, BOUNDARY, ENCLOSURE, HUT CIRCLE? | 488850 | 444489.995 | IRON AGE AND/OR ROMANO-BRITISH FARMSTEAD |
| 8 | Point | MHU20679 | Early Iron Age to Roman | DITCH | 482109.2 | 445807.228 | IRON AGE / ROMANO-BRITISH DITCH AND FINDS |
| 9 | Point | MHU18380 | Early Iron Age to Roman | DITCH, RECTANGULAR ENCLOSURE, ROAD, SQUARE BARROW | 486400 | 447400.002 | TRACKWAYS & DITCHES |
| 10 | Point | MHU3858 | Early Iron Age to Roman | SETTLEMENT, ENCLOSURE, LINEAR FEATURE, SITE | 489370 | 447839.996 | POSSIBLE ROMANO-BRITISH SETTLEMENT |
| 11 | Point | MHU1073 | Early Iron Age to Roman | RECTANGULAR ENCLOSURE, FIELD SYSTEM, ROAD, BARROW CEMETERY, RING DITCH, DITCH, DRAINAGE DITCH, PIT, IRON WORKING SITE | 480800 | 448200.003 | CROPMARK COMPLEX, SE OF POCKLINGTON |
| 12 | Point | MHU3847 | Early Iron Age to Roman | SETTLEMENT, HUT CIRCLE, DITCH, BARROW CEMETERY, SITE | 493200 | 448700 | SETTLEMENT SITE |
| 13 | Point | MHU15613 | Early Iron Age to Roman | SETTLEMENT?, SQUARE BARROW | 479900 | 450300.002 | ?SETTLEMENT SITE & SQUARE BARROWS |
| 14 | Point | MHU1069 | Lower Paleolithic to Roman | LINEAR EARTHWORK, RECTANGULAR ENCLOSURE, SQUARE BARROW, ROUND BARROW, ROAD, FINDSPOT | 480600 | 450599.996 | LINEAR DYKE, TRACKWAYS, SQUARE AND ROUND BARROWS |
| 15 | Point | MHU6733 | Lower Palaeolithic to Medieval | LINEAR EARTHWORK, ROAD, SITE | 489100 | 451100.003 | LINEAR DYKE & MEDIEVAL ROAD |
| 16 | Point | MHU7324 | Early Iron Age to Roman | SETTLEMENT, ROAD, ENCLOSURE, DITCH, BARROW CEMETERY | 494200 | 451100.003 | CROPMARK COMPLEX |
| 17 | Point | MHU6727 | Early Iron Age to Roman | LINEAR SETTLEMENT, SITE | 487800 | 451499.999 | LINEAR ENCLOSURE COMPLEXES |
| 18 | Point | MHU1083 | Iron Age | ENCLOSURE, TEMPLE | 487100 | 451600 | WARTER WOLD ENCLSURES |

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|---|---|---|---|---|---|---|---|---|
| 19 | Point | MHU284 | Early Iron Age to Roman | ROAD, DITCH, ENCLOSURE, SQUARE BARROW | 495300 | 453499.996 | DITCHES, ENCLOSURES AND BARROWS |
| 20 | Point | MHU7215 | Early Iron Age to Roman | DITCH, RECTANGULAR ENCLOSURE, SITE | 491400 | 454899.995 | LINEAR TRACKWAY & ENCLOSURES |
| 21 | Point | MHU8075 | Early Iron Age to Roman | LINEAR SETTLEMENT, LINEAR SETTLEMENT, DITCH, DICTH, ROAD, ROAD, RING DITCH, RING DITCH, SITE | 492700 | 456200.003 | WEST FIELDS LADDER SETTLEMENT |
| 22 | Point | MNY1530 | IA | <Null> | 484930 | 459200.005 | MORTIMER BARROW 33 |
| 23 | Point | MNY1536 | IA | <Null> | 484930 | 459200.005 | |
| 24 | Point | MHU9740 | Early Iron Age to Roman | ENCLOSURE, BOUNDARY DITCH, ROAD, PIT | 492300 | 459499.999 | SETTLEMENT SITE, SHORT BLEALANDS |
| 25 | Point | MHU3821 | Early Iron Age to Roman | RING DITCH, INHUMATION CEMETERY, SQUARE BARROW | 491900 | 459800.003 | BLEALANDS NOOK SETTLEMENT |
| 26 | Point | MNY6708 | IA | <Null> | 482920 | 460250.004 | |
| 27 | Point | MNY6709 | IA | <Null> | 482950 | 460290.003 | |
| 28 | Point | MHU21753 | IA | RECTANGULAR ENCLOSURE, FIELD BOUNDARY | 491999.9 | 460610.101 | RECTANGULAR ENCLOSURE AND DITCHES |
| 29 | Point | MNY7014 | IA | <Null> | 480090 | 461620.002 | |
| 30 | Point | MHU4344 | Early Iron Age to Medieval | CURVILINEAR ENCLOSURE, DITCH, ROAD | 495700 | 461699.999 | SETTLEMENT COMPLEX |
| 31 | Point | MNY7015 | IA | <Null> | 480560 | 461730.001 | |
| 32 | Point | MNY6238 | IA | <Null> | 480320 | 462409.996 | |
| 33 | Point | MNY6237 | IA | <Null> | 480300 | 462409.996 | |
| 34 | Point | MNY6243 | IA | <Null> | 480480 | 462469.999 | |
| 35 | Point | MNY6239 | IA | <Null> | 480350 | 462469.999 | |
| 36 | Point | MNY6244 | IA | <Null> | 480540 | 462509.997 | |
| 37 | Point | MNY6242 | IA | <Null> | 480460 | 462520.004 | |
| 38 | Point | MNY6240 | IA | <Null> | 480420 | 462530.002 | |
| 39 | Point | MNY6241 | IA | <Null> | 480430 | 462600.002 | |
| 40 | Point | MNY7000 | IA | <Null> | 483460 | 462819.999 | |
| 41 | Point | MNY7002 | IA | <Null> | 480150 | 463050.003 | |

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|---|---|---|---|---|---|---|---|
| 42 | Point | MNY6428 | IA | <Null> | 480220 | 463110.006 | |
| 43 | Point | MNY12477 | IA | <Null> | 483650 | 463419.997 | TOISLAND WOLD |
| 44 | Point | MNY12673 | IA | <Null> | 485950 | 464669.999 | WHARRAM PERCY |
| 45 | Point | MNY7013 | IA | <Null> | 484720 | 464700 | |
| 46 | Point | MNY6177 | IA | <Null> | 478730 | 466769.998 | |
| 47 | Point | MNY4072 | IA | <Null> | 483290 | 466769.998 | |
| 48 | Point | MNY4071 | IA | <Null> | 483290 | 466799.999 | |
| 49 | Point | MNY4076 | IA | <Null> | 483320 | 466809.996 | |
| 50 | Point | MNY4077 | IA | <Null> | 483340 | 466809.996 | |
| 51 | Point | MNY4070 | IA | <Null> | 483290 | 466820.004 | |
| 52 | Point | MNY4081 | IA | <Null> | 483380 | 466820.004 | |
| 53 | Point | MNY4078 | IA | <Null> | 483350 | 466830.001 | |
| 54 | Point | MNY4079 | IA | <Null> | 483360 | 466850.005 | |
| 55 | Point | MNY4082 | IA | <Null> | 483250 | 466869.999 | |
| 56 | Point | MNY4080 | IA | <Null> | 483370 | 466869.999 | |
| 57 | Point | MNY4061 | IA | <Null> | 481990 | 467000.002 | |
| 58 | Point | MNY4063 | IA | <Null> | 482010 | 467000.002 | |
| 59 | Point | MNY4067 | IA | <Null> | 482040 | 467000.002 | |
| 60 | Point | MNY4086 | IA | <Null> | 483220 | 467019.996 | |
| 61 | Point | MNY4065 | IA | <Null> | 482020 | 467030.003 | |
| 62 | Point | MNY4009 | IA | <Null> | 482670 | 467170.003 | |
| 63 | Point | MNY4099 | IA | <Null> | 482860 | 467620.005 | |
| 64 | Point | MNY4098 | IA | <Null> | 482870 | 467620.005 | |

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|---|---|---|---|---|---|---|---|
| 65 | Point | MNY4097 | IA | <Null> | 482850 | 467620.005 | |
| 66 | Point | MNY3985 | IA | <Null> | 483350 | 467859.996 | |
| 67 | Point | MNY4093 | IA | <Null> | 482600 | 467999.996 | |
| 68 | Point | MNY3961 | IA | <Null> | 483150 | 468330.001 | |
| 69 | Point | MNY3963 | IA | <Null> | 483170 | 468330.001 | |
| 70 | Point | MNY3962 | IA | <Null> | 483150 | 468349.996 | |
| 71 | Point | MNY3491 | IA | <Null> | 491660 | 468430.003 | |
| 72 | Point | MNY3986 | IA | <Null> | 483210 | 468490.006 | |
| 73 | Point | MNY4426 | IA | <Null> | 479400 | 468610.001 | |
| 74 | Point | MNY1622 | IA | <Null> | 484320 | 468799.997 | |
| 75 | Point | MNY3983 | IA | <Null> | 483110 | 468820.001 | |
| 76 | Point | MNY4326 | IA | <Null> | 488390 | 468860 | |
| 77 | Point | MNY4323 | IA | <Null> | 488330 | 468869.997 | |
| 78 | Point | MNY4324 | IA | <Null> | 488360 | 468869.997 | |
| 79 | Point | MNY4329 | IA | <Null> | 488280 | 468880.004 | |
| 80 | Point | MNY4325 | IA | <Null> | 488380 | 468880.004 | |
| 81 | Point | MNY4327 | IA | <Null> | 488340 | 468899.998 | |
| 82 | Point | MNY4328 | IA | <Null> | 488370 | 468930 | |
| 83 | Point | MNY3987 | IA | <Null> | 483050 | 468950.004 | |
| 84 | Point | MNY3981 | IA | <Null> | 483050 | 468969.998 | |
| 85 | Point | MNY3982 | IA | <Null> | 482910 | 468990.002 | |
| 86 | Point | MNY4394 | IA | <Null> | 487440 | 469020.004 | |
| 87 | Point | MNY4395 | IA | <Null> | 487440 | 469020.004 | |

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|---|---|---|---|---|---|---|---|
| 88 | Point | MNY4397 | IA | <Null> | 487450 | 469039.998 | |
| 89 | Point | MNY4396 | IA | <Null> | 487410 | 469050.005 | |
| 90 | Point | MNY3966 | IA | <Null> | 482000 | 469300.004 | THE BROUGHS |
| 91 | Point | MNY3497 | IA | <Null> | 493400 | 469370.004 | |
| 92 | Point | MNY3047 | IA | <Null> | 478920 | 470059.996 | |
| 93 | Point | MNY4054 | IA | <Null> | 481900 | 470080 | |
| 94 | Point | MNY4789 | IA | <Null> | 482700 | 470280.003 | Multiple ditch system |
| 95 | Point | MNY4790 | IA | <Null> | 482430 | 470290 | Ditched enclosure |
| 96 | Point | MNY4799 | IA | <Null> | 481110 | 470299.997 | Ditched enclosure 140m north-east of The Old Barn House |
| 97 | Point | MNY4788 | IA | <Null> | 482440 | 470299.997 | |
| 98 | Point | MNY4791 | IA | <Null> | 482350 | 470350.003 | Possible hut circle |
| 99 | Point | MNY4317 | IA | <Null> | 486630 | 470360 | |
| 100 | Point | MNY4891 | IA | <Null> | 480210 | 470369.997 | Possible square barrow on Sutton Low Field |
| 101 | Point | MNY4890 | IA | <Null> | 480240 | 470369.997 | Possible square barrow |
| 102 | Point | MNY4885 | IA | <Null> | 480210 | 470380.005 | Ditched enclosure 220m north-west of Howe Hill |
| 103 | Point | MNY4902 | IA | <Null> | 480230 | 470380.005 | Pit on Sutton Low Field |
| 104 | Point | MNY4318 | IA | <Null> | 486630 | 470380.005 | |
| 105 | Point | MNY4892 | IA | <Null> | 480200 | 470399.999 | Possible square barrow on Sutton Low Field |
| 106 | Point | MNY4897 | IA | <Null> | 480320 | 470420.003 | Possible square barrow on Sutton Low Field |
| 107 | Point | MNY4795 | IA | <Null> | 483010 | 470549.996 | Ditched enclosure |
| 108 | Point | MNY4775 | IA | <Null> | 481340 | 470590.004 | |
| 109 | Point | MNY2942 | IA | <Null> | 479380 | 470600.002 | |
| 110 | Point | MNY36005 | IA | <Null> | 480235.2 | 470614.367 | Square Barrow, Cheesecake Hill Farm, Norton |

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|---|---|---|---|---|---|---|---|
| 111 | Point | MNY2943 | IA | <Null> | 479390 | 470660.004 | |
| 112 | Point | MNY4948 | IA | <Null> | 483762.9 | 471160.251 | |
| 113 | Point | MNY4780 | IA | <Null> | 482930 | 471419.997 | Possible square barrow 420m west of Forkers Lane |
| 114 | Point | MNY4781 | IA | <Null> | 482920 | 471440.001 | Possible square barrow |
| 115 | Point | MNY4784 | IA | <Null> | 482960 | 471449.998 | Possible square barrow 150m south of The Holms |
| 116 | Point | MNY4782 | IA | <Null> | 482960 | 471480 | Possible square barrow 180m south of treatment plant |
| 117 | Point | MNY4783 | IA | <Null> | 482960 | 471480 | Possible square barrow 180m south of treatment plant |
| 118 | Point | MNY2947 | IA | <Null> | 479260 | 471589.998 | |
| 119 | Point | MNY4749 | IA | <Null> | 483900 | 471680.002 | Ring ditch |
| 120 | Point | MNY5136 | IA | <Null> | 486020 | 471780.004 | BLENKINS |
| 121 | Point | MNY3001 | IA | <Null> | 478520 | 472739.999 | PASTURE FIELDS |
| 122 | Point | MNY4279 | IA | <Null> | 494300 | 473099.996 | SEVERALS DIKE |
| 123 | Point | MNY4967 | IA | <Null> | 484160 | 474109.997 | |
| 124 | Point | MNY4967 | IA | <Null> | 484150 | 474109.997 | |
| 125 | Point | MNY4967 | IA | <Null> | 484150 | 474109.997 | |
| 126 | Point | MNY3917 | IA | <Null> | 493130 | 474120.004 | |
| 127 | Point | MNY24314 | IA | <Null> | 485604 | 474146.726 | ?Iron Age remains at Elllis Patents factory, High Street, Rillington |
| 128 | Point | MNY5205 | IA | <Null> | 489430 | 474190.004 | |
| 129 | Point | MNY5204 | IA | <Null> | 489420 | 474220.005 | |
| 130 | Point | MNY5206 | IA | <Null> | 489160 | 474330.004 | |
| 131 | Point | MNY4958 | IA | <Null> | 484740 | 474340.001 | Possible square barrow on West Field |
| 132 | Point | MNY4959 | IA | <Null> | 484720 | 474370.002 | |
| 133 | Point | MNY5328 | IA | <Null> | 485920 | 474375.001 | Square barrow and enclosing ditch at East Field, Rillington |

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| 134 | Point | MNY5253 | IA | <Null> | 485785 | 474459.997 | RILLINGTON:EAST FIELD |
| 135 | Point | MNY5214 | IA | <Null> | 489850 | 474949.996 | Staple Howe: a palisaded hilltop enclosure in Knapton Plantation |
| 136 | Point | MNY4628 | IA | <Null> | 485250 | 475070.002 | Possible square enclosure |
| 137 | Point | MNY11043 | IA | <Null> | 491980 | 475649.996 | DEVIL'S HILL |
| 138 | Point | MNY 4721 | IA | DITCHED ENCLOSURE, RING DITCH | 489840 | 476300.781 | <Null> |
| 139 | Point | MNY4711 | IA | DITCHED ENCLOSURE, SQUARE BARROW, PIT | 489780.1 | 476360.335 | Ditched enclosure 500m south-east of East Ochre, Pit 500 m se of East Ochre |
| 140 | Point | MNY4709 | IA | DITCHED ENCLOSURE, SQUARE BARROW | 489810 | 476370.293 | Ditched enclosure, ?square barrow 500m south-east of East Ochre |
| 141 | Point | MNY4713 | IA | DITCHED ENCLOSURE, SQUARE BARROW, PIT | 489799.7 | 476380.25 | Ditched enclosure 500m south-east of East Ochre, Pit 500 m se of East Ochre |
| 142 | Point | MNY4718 | IA | DITCHED ENCLOSURE | 489809.7 | 476390.208 | Ditched enclosure c.400m se of East Ochre |
| 143 | Point | MNY1099 | IA | SETTLEMENT, SITE (MNY1659) | 491699.6 | 476700.005 | WEST HESLERTON |

| EAST YORKSHIRE ROMAN BUILT FORM SITES | | | | | | |
|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | PERIOD | MONTYPES | EASTING | NORTHING | NAME |
| 1 | Point | Roman | ENCLOSURE, DITCH, ROAD, RING DITCH, FINDSPOT | 486499.9996 | 441000.0043 | ENCLOSURES, RING DITCHES, DITCHES & TRACKWAY, IA/RB SETTLEMENT |
| 2 | Point | Early Iron Age to Roman | OCCUPATION SITE, INHUMATION | 487149.999 | 441040.0029 | IA, RB & EMED OCCUPATION |
| 3 | Point | Roman | ENCLOSURE | 486499.9996 | 441199.9971 | POSSIBLE RB ENCLOSURES |
| 4 | Point | Roman | DITCH, ENCLOSURE, FIELD BOUNDARY, FINDSPOT, VILLA | 486400.0035 | 441299.9984 | CROPMARK COMPLEX, WEIGHTON COMMON |
| 5 | Point | Roman | ENCLOSURE, ROAD, BOUNDARY DITCH, SITE | 483199.9964 | 441500.0012 | CROPMARK COMPLEX, NE OF HARSWELL |
| 6 | Point | Roman | MOSAIC, FINDSPOT | 488880.0025 | 441850.001 | ROMAN MOSAIC, MARKET WEIGHTON |
| 7 | Point | Roman | DITCH, ENCLOSURE, KILN, SITE | 489200.0015 | 442200.0008 | SETTLEMENT COMPLEX |
| 8 | Point | Roman | SETTLEMENT, INHUMATION, SHIPTONTHORPE | 485200.0008 | 442300.0022 | RB SETTLEMENT SITE & BURIALS, SKELFREY PARK |
| 9 | Point | Roman | ROAD, POLYGONAL ENCLOSURE, FIELD SYSTEM, RING DITCH, SITE | 493800.0036 | 443200.0046 | POSSIBLE RB SETTLEMENT |
| 10 | Point | Late Iron Age to Roman | DITCH | 485600.0017 | 443299.996 | DITCHES, E OF SHIPTONTHORPE |
| 11 | Point | Late Iron Age to Roman | DITCH, ROAD, RING DITCH | 483799.9977 | 443499.9987 | DITCHES, ?TRACKWAY & RING DITCH |
| 12 | Point | Roman | RECTANGULAR ENCLOSURE, RING DITCH, PIT, ROAD, DITCH | 484500.0034 | 443499.9987 | MANOR FARM CROPMARK COMPLEX |
| 13 | Point | Early Iron Age to Medieval | PIT, DITCH, FINDSPOT | 482124.9971 | 443569.9987 | IA/ROMAN PIT & OTHER FEATURES, CLARK'S COMMON FARM |
| 14 | Point | Early Iron Age to Roman | RING DITCH, ENCLOSURE, SQUARE BARROW, ROUND BARROW, PIT | 483300.0007 | 443700.0015 | CROPMARK COMPLEX |
| 15 | Point | Late Iron Age to Roman | DITCH, LINEAR FEATURE | 483500.0012 | 444099.997 | DITCHES, NW OF NORTH FARM |
| 16 | Point | Roman | OCCUPATION SITE | 483500.0012 | 444299.9997 | RB OCCUPATION, GRAVEL PIT |
| 17 | Point | Early Iron Age to Roman | LINEAR SETTLEMENT, SQUARE BARROW | 490000.0033 | 444400.0011 | SETTLEMENT COMPLEX, POSSIBLE SQUARE BARROW |
| 18 | Point | Lower Palaeolithic to Roman | TRACKWAY, BOUNDARY, ENCLOSURE, HUT CIRCLE? | 488849.9987 | 444489.9953 | IRON AGE AND/OR ROMANO-BRITISH FARMSTEAD |
| 19 | Point | Roman | OCCUPATION SITE, ENCLOSURE, DITCH, ROAD, FINDSPOT | 487399.9975 | 444500.0025 | RB SETTLEMENT COMPLEX |
| 20 | Point | Roman | OCCUPATION SITE, DITCH | 482899.9998 | 444600.0038 | RB OCCUPATION SITE, TRENWICK |

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| 21 | Point | Roman | SETTLEMENT | 483999.9982 | 444700.0052 | POSSIBLE RB SETTLEMENT |
| 22 | Point | Roman | DITCH, CLAY PIT? | 482511.2864 | 445424.5678 | ROMANO-BRITISH FEATURES AND FINDS |
| 23 | Point | Lower Palaeolithic to Medieval | OCCUPATION SITE, FORT, GRUBENHAUS, BURIAL, ANIMAL BURIAL, SITE | 481699.9971 | 445480.0019 | ROMAN FORT & AS OCCUPATION SITE |
| 24 | Point | Roman | OCCUPATION SITE | 482200.0024 | 445599.9976 | RB BUILDING, BRIDGE FARM, 1996 |
| 25 | Point | Roman | OCCUPATION SITE | 482099.998 | 445699.999 | RB OCCUPATION, BRIDGE FARM |
| 26 | Point | Roman | DITCH, FINDSPOT | 482022.5192 | 445803.3194 | RB DITCH, GLEN GARTH |
| 27 | Point | Early Iron Age to Roman | DITCH | 482109.1913 | 445807.2283 | IRON AGE / ROMANO-BRITISH DITCH AND FINDS |
| 28 | Point | Roman | FINDSPOT, VILLA | 482499.9989 | 446049.9988 | IRON AGE/ROMANO-BRITISH SETTLEMENT, DUMBHILL ENDS |
| 29 | Point | Roman | DITCH, RECTANGULAR ENCLOSURE, ROAD, DITCH, FINDSPOT | 487100.001 | 446700.0027 | N-S LINEAR DITCH & ENCLOSURES, LONDESBORUGH FIELD |
| 30 | Point | Roman | SETTLEMENT | 481100.004 | 447300.001 | PROBABLE RB SETTLEMENT, SOUTH MOOR |
| 31 | Point | Roman | DITCH, FARMSTEAD, FINDSPOT | 480900.0036 | 447699.9965 | LINEAR DITCH |
| 32 | Point | Early Iron Age to Roman | SETTLEMENT, ENCLOSURE, LINEAR FEATURE, SITE | 489369.9982 | 447839.9964 | POSSIBLE ROMANO-BRITISH SETTLEMENT |
| 33 | Point | Roman | VILLA | 481800.0015 | 448000.0006 | SITE OF RB VILLA, COCOA BECK |
| 34 | Point | Early Iron Age to Roman | RECTANGULAR ENCLOSURE, FIELD SYSTEM, ROAD, BARROW CEMETERY, RING DITCH, DITCH, DRAINAGE DITCH, PIT, IRON WORKING SITE | 480799.9992 | 448200.0033 | CROPMARK COMPLEX, SE OF POCKLINGTON |
| 35 | Point | Roman | LYNCHET, SITE | 486299.9992 | 448300.0047 | LYNCHETS, DEEPDALE |
| 36 | Point | Roman | OCCUPATION SITE | 485200.0008 | 448399.9961 | RB OCCUPATION, NUNBURNHOLME PRIORY |
| 37 | Point | Early Iron Age to Roman | SETTLEMENT, HUT CIRCLE, DITCH, BARROW CEMETERY, SITE | 493200.0022 | 448700.0002 | SETTLEMENT SITE |
| 38 | Point | Early Iron Age to Roman | SETTLEMENT?, SQUARE BARROW | 479900.0014 | 450300.0022 | ?SETTLEMENT SITE & SQUARE BARROWS |
| 39 | Point | Lower Palaeolithic to Roman | LINEAR EARTHWORK, RECTANGULAR ENCLOSURE, SQUARE BARROW, ROUND BARROW, ROAD, FINDSPOT | 480599.9988 | 450599.9963 | LINEAR DYKE, TRACKWAYS, SQUARE AND ROUND BARROWS |
| 40 | Point | Early Iron Age to Roman | SETTLEMENT, ROAD, ENCLOSURE, DITCH, BARROW CEMETERY | 494199.9962 | 451100.0032 | CROPMARK COMPLEX |
| 41 | Point | Early Iron Age to Roman | LINEAR SETTLEMENT, SITE | 487799.9984 | 451499.9987 | LINEAR ENCLOSURE COMPLEXES |
| 42 | Point | Roman | ENCLOSURE, TEMPLE | 487100.001 | 451600.0001 | WARTER WOLD ENCLOSURES |

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|---|---|---|---|---|---|---|
| 43 | Point | Early Iron Age to Roman | SETTLEMENT, ROAD, ENCLOSURE, DITCH, BARROW CEMETERY | 494599.9971 | 451600.0001 | CROPMARK COMPLEX |
| 44 | Point | Roman | ENCLOSURE, ROAD, DITCH, RING DITCH, SITE | 480999.9997 | 451800.0029 | POSSIBLE RB FARMSTEAD |
| 45 | Point | Roman | DITCH, FIELD SYSTEM, FINDSPOT, VILLA | 481600.001 | 451800.0029 | IRREGULAR FIELD DITCHES, ROMAN VILLA? |
| 46 | Point | Roman | VILLA, TEMPLE | 483799.9977 | 452799.9966 | RB SETTLEMENT SITE, N OF BECK |
| 47 | Point | Roman | SETTLEMENT | 480999.9997 | 452999.9994 | ?RB SETTLEMENT SITE |
| 48 | Point | Early Iron Age to Roman | ROAD, DITCH, ENCLOSURE, SQUARE BARROW | 495300.0028 | 453499.9962 | DITCHES, ENCLOSURES AND BARROWS |
| 49 | Point | Roman | RECTANGULAR ENCLOSURE, SITE | 485200.0008 | 454679.9985 | PASTURE DALE ENCLOSURE |
| 50 | Point | Roman | RECTANGULAR ENCLOSURE, SITE | 493099.9979 | 454800.0041 | POSSIBLE RB SETTLEMENT |
| 51 | Point | Early Iron Age to Roman | DITCH, RECTANGULAR ENCLOSURE, SITE | 491399.9982 | 454899.9955 | LINEAR TRACKWAY & ENCLOSURES |
| 52 | Point | Early Iron Age to Roman | LINEAR SETTLEMENT, LINEAR SETTLEMENT, DITCH, DITCH, ROAD, ROAD, RING DITCH, RING DITCH, SITE | 492699.997 | 456200.0034 | WEST FIELDS LADDER SETTLEMENT |
| 53 | Point | Roman | SITE, SITE | 481400.0006 | 456900.003 | POSSIBLE RB SETTLEMENT |
| 54 | Point | Late Neolithic to Roman | ROUND BARROW, OCCUPATION SITE | 495899.9959 | 457920.001 | ROUND BARROW (MC64) |
| 55 | Point | Roman | ENCLOSURE, FIELD SYSTEM, ROAD, SITE | 495799.9998 | 458200.0009 | SETTLEMENT COMPLEX |
| 56 | Point | Roman | OCCUPATION SITE, FINDSPOT | 491100.0017 | 459299.996 | GREEN LANE FARM RB SETTLEMENT SITE |
| 57 | Point | Early Iron Age to Roman | ENCLOSURE, BOUNDARY DITCH, ROAD, PIT | 492299.9961 | 459499.9987 | SETTLEMENT SITE, SHORT BLEALANDS |
| 58 | Point | Early Iron Age to Roman | RING DITCH, INHUMATION CEMETERY, SQUARE BARROW | 491999.9996 | 459800.0029 | BLEALANDS NOOK SETTLEMENT |
| 59 | Point | Lower Palaeolithic to Roman | LINEAR EARTHWORK, ENCLOSURE | 490700.0008 | 459999.9956 | LINEAR EARTHWORK AND ENCLOSURE |
| 60 | Point | Early Iron Age to Roman | RECTANGULAR ENCLOSURE, FIELD BOUNDARY | 491999.8676 | 460610.101 | RECTANGULAR ENCLOSURE AND DITCHES |
| 61 | Point | Roman | OCCUPATION SITE, FIELD SYSTEM, ROAD | 493800.0036 | 460799.9966 | CROPMARK COMPLEX, HIGH BITINGS |
| 62 | Point | RO | <Null> | 484300.003 | 460999.9995 | THIXENDALE |
| 63 | Point | RO | <Null> | 484800 | 461319.9979 | |
| 64 | Point | RO | <Null> | 484800 | 461410.0022 | |
| 65 | Point | RO | <Null> | 484800 | 461410.0022 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 66 | Point | Lower Palaeolithic to Roman | ENCLOSURE, BOUNDARY, DITCH | 490409.9972 | 461760.0018 | LINEAR BOUNDARY |
| 67 | Point | RO | <Null> | 484449.9971 | 464350.0006 | |
| 68 | Point | RO | <Null> | 485800.0022 | 464499.9977 | Possible villa at Wharram Percy North Manor |
| 69 | Point | RO | <Null> | 478961.7299 | 465037.0739 | Iron Age/Romano-British site near All Saints Church, Burythorpe |
| 70 | Point | RO | <Null> | 485189.9996 | 465099.9959 | |
| 71 | Point | RO | <Null> | 485189.9996 | 465099.9959 | |
| 72 | Point | RO | <Null> | 485150.0028 | 465169.9959 | |
| 73 | Point | RO | <Null> | 481600.0011 | 465199.9973 | BIRDSALL |
| 74 | Point | RO | <Null> | 478930.0029 | 465549.9971 | |
| 75 | Point | RO | <Null> | 478499.9983 | 465600.0028 | Roman site SW of Kennythorpe |
| 76 | Point | RO | <Null> | 478219.996 | 465659.9956 | |
| 77 | Point | RO | <Null> | 484700.0039 | 465700.0042 | |
| 78 | Point | RO | <Null> | 478200.0017 | 465710.0013 | |
| 79 | Point | RO | <Null> | 484700.0039 | 465729.9956 | |
| 80 | Point | RO | <Null> | 478239.9985 | 465800.0056 | |
| 81 | Point | RO | <Null> | 486465.692 | 465898.8373 | Roman and medieval remains west of B1248, Wharram-le-Street |
| 82 | Point | RO | <Null> | 486780.0019 | 466150.0054 | WHARRAM LE STREET VILLA |
| 83 | Point | RO | <Null> | 486749.9981 | 466160.0025 | |
| 84 | Point | RO | <Null> | 487269.9977 | 466370.0024 | |
| 85 | Point | RO | <Null> | 482279.996 | 466580.0023 | |
| 86 | Point | RO | <Null> | 487300.0014 | 466599.9966 | |
| 87 | Point | RO | <Null> | 482349.9966 | 467140.002 | WHIN FIELDS/DALE BOTTOM |
| 88 | Point | RO | <Null> | 482190.0011 | 467219.9991 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 89 | Point | RO | <Null> | 482200.0024 | 467229.9962 | WHIN FIELDS |
| 90 | Point | RO | <Null> | 481090.0028 | 467450.0033 | MIDDLE FARM |
| 91 | Point | RO | <Null> | 481579.9985 | 467480.0047 | LANGTON VILLA:PHASE ONE |
| 92 | Point | RO | <Null> | 481579.9985 | 467480.0047 | LANGTON VILLA:PHASE TWO |
| 93 | Point | RO | <Null> | 481579.9985 | 467480.0047 | LANGTON VILLA:PHASE THREE |
| 94 | Point | RO | <Null> | 481600.0011 | 467600.0003 | Langton Roman villa |
| 95 | Point | RO | <Null> | 481559.996 | 467749.9974 | LANGTON VILLA:PHASE TWO? |
| 96 | Point | RO | <Null> | 483859.997 | 467910.0016 | |
| 97 | Point | RO | <Null> | 483269.997 | 467940.003 | |
| 98 | Point | RO | <Null> | 481649.9991 | 467980.0015 | LANGTON VILLA:PHASE TWO? |
| 99 | Point | RO | <Null> | 483180.0021 | 468080.0029 | |
| 100 | Point | RO | <Null> | 483339.9975 | 468360.0028 | |
| 101 | Point | RO | <Null> | 483040.001 | 468409.9985 | |
| 102 | Point | RO | <Null> | 481820.004 | 468600.0041 | |
| 103 | Point | RO | <Null> | 483050.0022 | 468969.9982 | |
| 104 | Point | RO | <Null> | 493080.0036 | 469200.0023 | WEST LUTTON |
| 105 | Point | RO | <Null> | 493349.9964 | 469450.0008 | Enclosures south of Luttons Primary School |
| 106 | Point | RO | <Null> | 494000.0041 | 469499.9965 | EAST LUTTON |
| 107 | Point | RO | <Null> | 482720.0019 | 469760.002 | |
| 108 | Point | RO | <Null> | 482730.0032 | 469809.9977 | |
| 109 | Point | RO | <Null> | 482000.002 | 470080.0004 | |
| 110 | Point | RO | <Null> | 481979.9994 | 470100.0047 | Ditched enclosure 340m south-east of Westfield Farm |
| 111 | Point | RO | <Null> | 495370.0034 | 470320.0017 | HELPERTHORPE |

| | | | | | | |
|---|---|---|---|---|---|---|
| 112 | Point | RO | <Null> | 482400.0029 | 470399.9988 | Settrington Villa site, Brough Hill |
| 113 | Point | RO | <Null> | 496099.9964 | 470579.9973 | |
| 114 | Point | RO | <Null> | 483009.9972 | 470719.9972 | SETTRINGTON:TOWN GREEN |
| 115 | Point | RO | <Null> | 483300.0007 | 470749.9986 | SETTRINGTON |
| 116 | Point | RO | <Null> | 482670.0039 | 470829.9957 | |
| 117 | Point | RO | <Null> | 479380.0019 | 470870.0043 | SUTTON COTTAGE |
| 118 | Point | RO | <Null> | 479399.9961 | 470880.0014 | CONISTON HOUSE |
| 119 | Point | RO | <Null> | 479570.0011 | 470880.0014 | NORTON |
| 120 | Point | RO | <Null> | 479559.9998 | 470899.9957 | NORTON |
| 121 | Point | RO | <Null> | 479339.9968 | 470929.9971 | YOUTH CLUB |
| 122 | Point | RO | <Null> | 479510.0017 | 470929.9971 | NORTON |
| 123 | Point | RO | <Null> | 479760.0002 | 470969.9957 | MODEL FARM ESTATE |
| 124 | Point | RO | <Null> | 479370.0006 | 471020.0014 | |
| 125 | Point | RO | <Null> | 479349.9981 | 471169.9984 | |
| 126 | Point | RO | <Null> | 479349.9981 | 471169.9984 | |
| 127 | Point | RO | <Null> | 479424.4757 | 471185.6939 | Roman remains at Ebenezer yard, Norton |
| 128 | Point | RO | <Null> | 479609.9978 | 471290.0041 | |
| 129 | Point | RO | <Null> | 479859.9963 | 471290.0041 | |
| 130 | Point | RO | <Null> | 479279.9975 | 471300.0012 | |
| 131 | Point | RO | <Null> | 479710.0022 | 471300.0012 | |
| 132 | Point | RO | <Null> | 479900.0014 | 471320.0055 | EASTFIELD ESTATE |
| 133 | Point | RO | <Null> | 483729.9972 | 471330.0026 | Probable Roman occupation floor |
| 134 | Point | RO | <Null> | 483729.9972 | 471330.0026 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 135 | Point | RO | <Null> | 483729.9972 | 471330.0026 | Roman floor |
| 136 | Point | RO | <Null> | 479266.6653 | 471368.5416 | Roman and Medieval features, 28 Church Street, Norton |
| 137 | Point | RO | <Null> | 479760.0002 | 471479.9997 | COMMERCIAL STREET |
| 138 | Point | RO | <Null> | 479554.5416 | 471489.1671 | Roman and medieval remains at 87 Commercial Street, Norton |
| 139 | Point | RO | <Null> | 479209.997 | 471521.9977 | SHEEPFOOT HILL |
| 140 | Point | RO | <Null> | 479248.9961 | 471590.9979 | |
| 141 | Point | RO | <Null> | 479200.0039 | 471599.9953 | The Roman Fort at Malton, North Yorkshire |
| 142 | Point | RO | <Null> | 479240.0007 | 471610.0025 | Derventio Vicus, Orchard Field, Malton |
| 143 | Point | RO | <Null> | 479225.003 | 471624.9982 | DERVENTIO VICUS |
| 144 | Point | RO | <Null> | 479120.0021 | 471720.001 | ORCHARD FIELD, MALTON, ROMAN FORT |
| 145 | Point | RO | <Null> | 479188.9968 | 471778.0044 | ORCHARD FIELD |
| 146 | Point | RO | <Null> | 479130.0034 | 471820.0024 | Orchard Field, Malton |
| 147 | Point | RO | <Null> | 479190.0027 | 471839.9966 | |
| 148 | Point | RO | <Null> | 479200.0039 | 471839.9966 | ORCHARD FIELD |
| 149 | Point | RO | <Null> | 479139.9964 | 471880.0052 | |
| 150 | Point | RO | <Null> | 479665.0007 | 472399.9963 | 'Entrance' to structures |
| 151 | Point | RO | <Null> | 484420.0016 | 472539.9963 | |
| 152 | Point | RO | <Null> | 483609.9985 | 472770.0004 | SCAGGLETHORPE |
| 153 | Point | RO | <Null> | 485909.9996 | 473379.9958 | THORPE BASSETT |
| 154 | Point | RO | <Null> | 487580.0037 | 474249.9968 | |
| 155 | Point | RO | <Null> | 485309.9982 | 474349.9982 | RILLINGTON |
| 156 | Point | RO | <Null> | 486149.9968 | 475460.0004 | SCAMPSTON |
| 157 | Point | RO | <Null> | 487729.9979 | 475649.996 | WEST KNAPTON |

| | | | | | | |
|---|---|---|---|---|---|---|
| 158 | Point | RO | <Null> | 487999.9989 | 475800.0031 | KNAPTON |
| 159 | Point | RO | <Null> | 488399.9998 | 476010.003 | Possible settlement east of Knapton |
| 160 | Point | <Null> | BUILDING | 488300.0037 | 476099.9972 | Remains of a possible Roman building Knapton |
| 161 | Point | RO | STREAM?, RECTILINEAR ENCLOSURE, PIT, RING DITCH, ROUND HOUSE (DOMESTIC)?, FIELD BOUNDARY, DITCH | 487376.9526 | 476579.7899 | Knapton Generating Station Field 1, Scampston |
| 162 | Point | RO | DITCHED ENCLOSURE, PIT ALIGNMENT | 491700.003 | 476700.0055 | WEST HESLERTON |

| EAST YORKSHIRE EARLY MEDIEVAL BUILT FORM SITES | | | | | | | |
|---|---|---|---|---|---|---|---|
| OBJECTID * | Shape * | PERIOD | MONTYPES | EASTING | NORTHING | RECORDTYPE | NAME |
| 1 | Point | Early Iron Age to Roman | OCCUPATION SITE, INHUMATION | 487155 | 441045 | MON | IA, RB & EMED OCCUPATION |
| 2 | Point | Early Medieval/Dark Age to Post Medieval | PIT, FINDSPOT, FINDSPOT | 478190 | 441250 | MON | MED/PM PITS, NR BEECH TREE VIEW |
| 3 | Point | Early Medieval/Dark Age to Post Medieval | RIDGE AND FURROW, DITCH, FINDSPOT | 478190 | 441250 | MON | RIDGE AND FURROW, NR BEECH TREE VIEW |
| 4 | Point | Early Medieval/Dark Age to Medieval | DESERTED SETTLEMENT | 494550 | 441550 | MON | GARDHAM DMV |
| 5 | Point | Early Medieval/Dark Age to Medieval | ANGLICAN CHURCH | 487765 | 441805 | BLD | CHURCH OF ALL SAINTS, CHURCH LANE (W SIDE) |
| 6 | Point | Early Medieval/Dark Age | MONASTERY, SITE | 480500 | 442500 | MON | SITE OF ST EVERILDA'S MONASTERY |
| 7 | Point | Early Medieval/Dark Age to Post Medieval | DESERTED SETTLEMENT, FARM, WINDMILL | 493450 | 442250 | MON | OLD ARRAS OR STEINTORP DMV |
| 8 | Point | Early Medieval/Dark Age to Medieval | DESERTED SETTLEMENT | 495550 | 442350 | MON | SITE OF NEWTON DMV, GARDHAM |
| 9 | Point | Early Medieval/Dark Age to Medieval | MANOR HOUSE | 488750 | 443150 | MON | SITE OF GOODMANHAM HALL |
| 10 | Point | Early Medieval/Dark Age | SHRINE, TEMPLE | 488985 | 443145 | MON | SITE OF ANGLO-SAXON PAGAN SHRINE |
| 11 | Point | Early Medieval/Dark Age to Medieval | OCCUPATION SITE, DITCH, FINDSPOT | 488965 | 443195 | MON | 11th CENTURY POT SHERD AND POSSIBLE DITCH, GOODMANHAM |
| 12 | Point | Early Iron Age to Medieval | PIT, DITCH, FINDSPOT | 482125 | 443570 | MON | IA/ROMAN PIT & OTHER FEATURES, CLARK'S COMMON FARM |
| 13 | Point | Lower Palaeolithic to Medieval | OCCUPATION SITE, FORT, GRUBENHAUS, BURIAL, ANIMAL BURIAL, SITE | 481705 | 445485 | MON | ROMAN FORT & AS OCCUPATION SITE |
| 14 | Point | Early Medieval/Dark Age | GRUBENHAUS, PIT, SITE | 481345 | 445605 | MON | ? GRUBENHAUSER SETTLEMENT SITE |
| 15 | Point | Early Medieval/Dark Age to Medieval | DESERTED SETTLEMENT | 491885 | 446445 | MON | ENTHORPE DMV |
| 16 | Point | Early Medieval/Dark Age to Medieval | DESERTED SETTLEMENT | 482050 | 451550 | MON | OUSETHORPE DMV |
| 17 | Point | Lower Palaeolithic to Medieval | LINEAR EARTHWORK, RIDGE AND FURROW, SITE | 488950 | 453750 | MON | LINEAR DOUBLE DYKE & FIELD SYSTEM |
| 18 | Point | Early Iron Age to Medieval | SHRUNKEN VILLAGE, BURIAL, KILN | 479650 | 455150 | MON | MEDIEVAL OCCUPATION, VICAR LANE, 1993 |
| 19 | Point | Early Medieval/Dark Age | SETTLEMENT | 488050 | 455950 | MON | `BUTTERWICK TYPE' SETTLEMENT SITE |
| 20 | Point | Early Medieval/Dark Age to Post Medieval | ANGLICAN CHURCH | 480855 | 458595 | BLD | CHURCH OF ALL SAINTS |

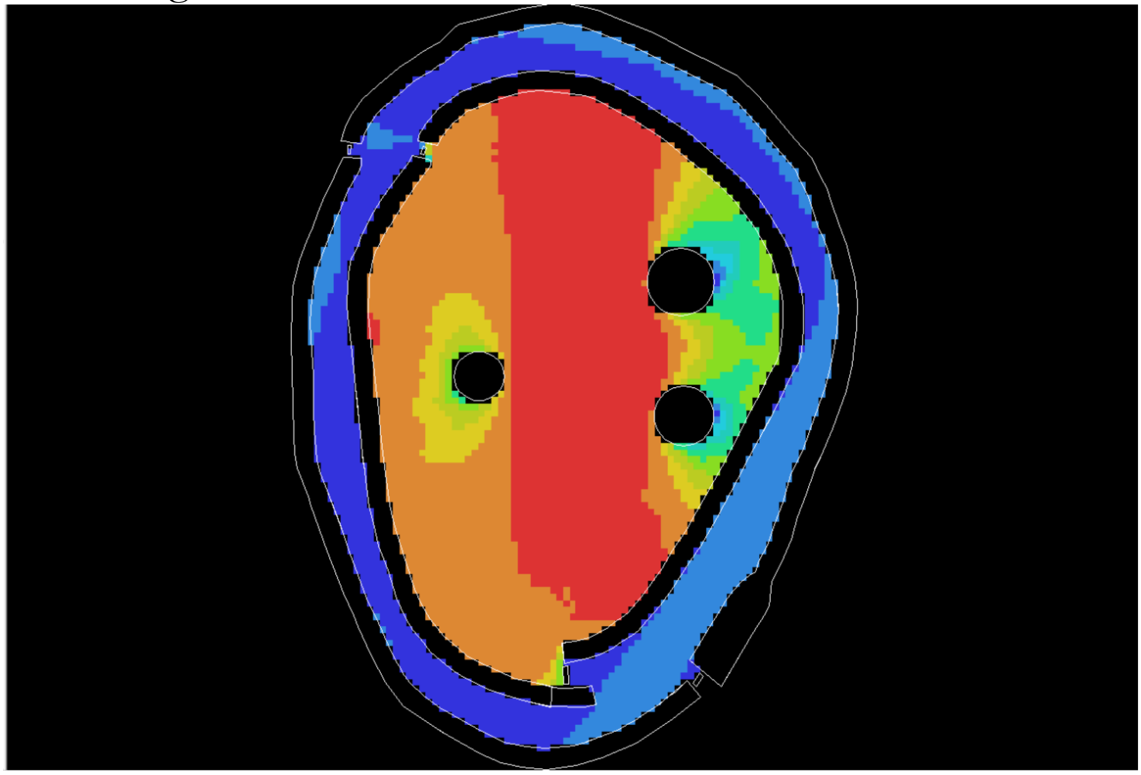
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | Point | Early Neolithic to Early Medieval/Dark Age | ROUND BARROW, INHUMATION CEMETERY, FURNACE | 489450 | 460650 | MON | BA & AS BURIALS, RB FURNACE?, ST MARY'S CHURCHYARD (MC33) |
| 22 | Point | EM | <Null> | <Null> | <Null> | MON | Wharram Percy deserted medieval village |
| 23 | Point | EM | <Null> | <Null> | <Null> | MON | Multi period settlement and funerary site, Kirby Grindalythe |
| 24 | Point | EM | <Null> | <Null> | <Null> | MON | NORTH GRIMSTON |
| 25 | Point | EM | <Null> | <Null> | <Null> | MON | Archaeological remains at Booth Row, Malton Lane, West Lutton |
| 26 | Point | EM | <Null> | <Null> | <Null> | MON | |
| 27 | Point | EM | <Null> | <Null> | <Null> | MON | Pit at Sutton Stables, Sutton Street, Norton |
| 28 | Point | EM | <Null> | <Null> | <Null> | MON | Old Malton village |
| 29 | Point | EM | SETTLEMENT | <Null> | <Null> | <Null> | <Null> |
| 30 | Point | EM | SITE, SETTLEMENT, GRUBENHAUS, GREAT HALL | <Null> | <Null> | <Null> | WEST HESLERTON |
| 31 | Point | EM | VILLAGE | <Null> | <Null> | <Null> | EAST HESLERTON |

# APPENDIX D

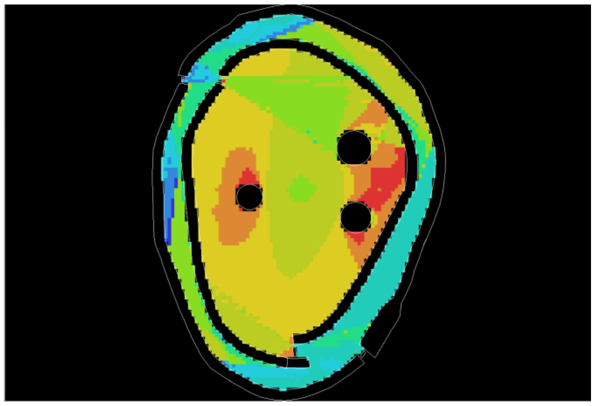
# VISIBILITY GRAPH MEASUREMENTS OF THE VISIBILITY GRAPH ANALYSIS

# NSR SETTLEMENTS

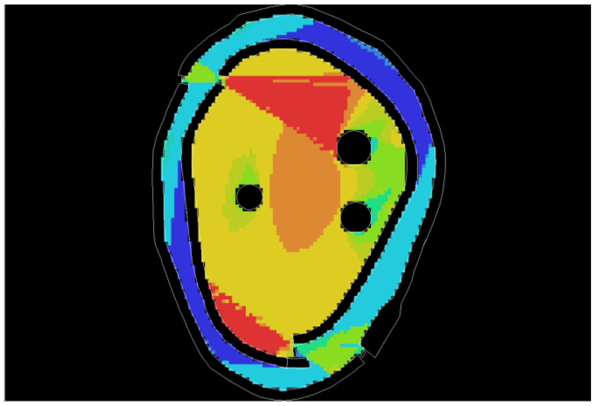
# Ring Chesters Hillfort Phase 2 VGA Measurements



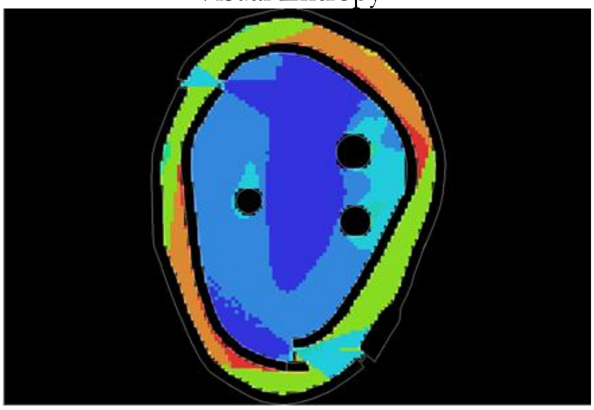
Connectivity



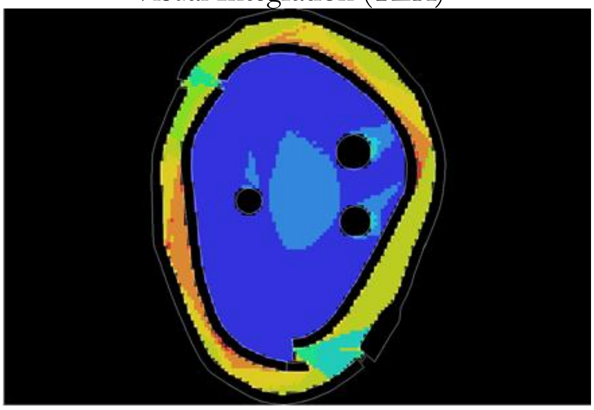
Visual Entropy



Visual Integration (TEK)

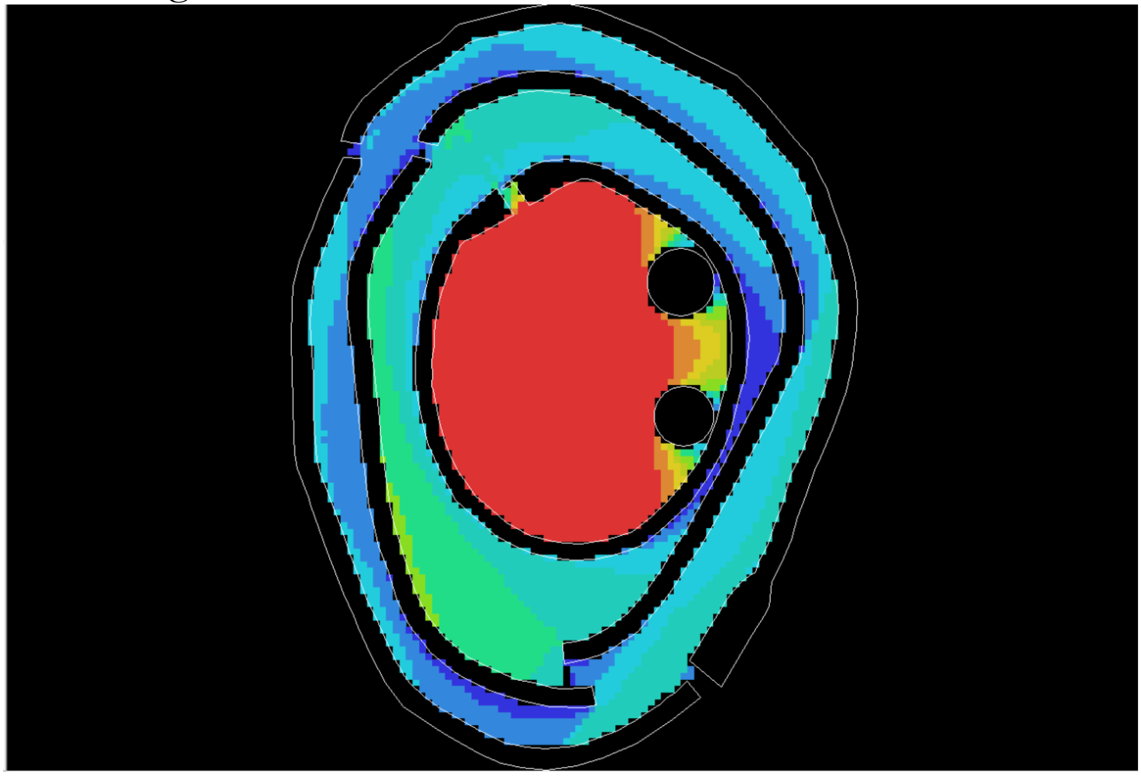


Visual Mean Depth

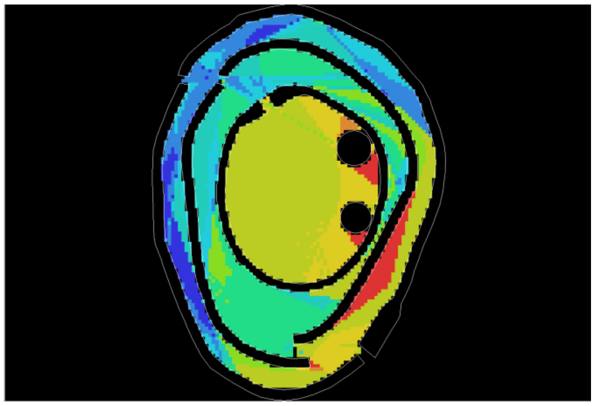


Visual Relativised Entropy

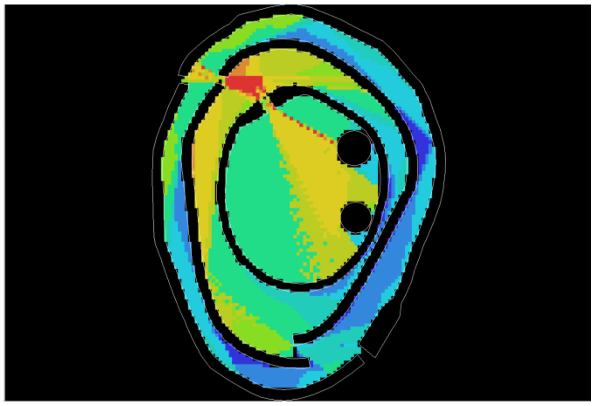
# Ring Chesters Hillfort Phase 3 VGA Measurements



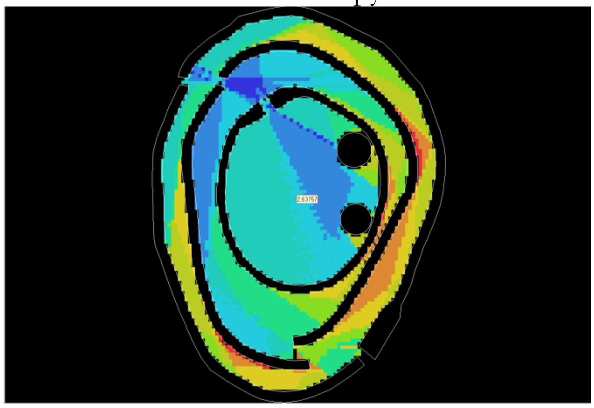
Connectivity



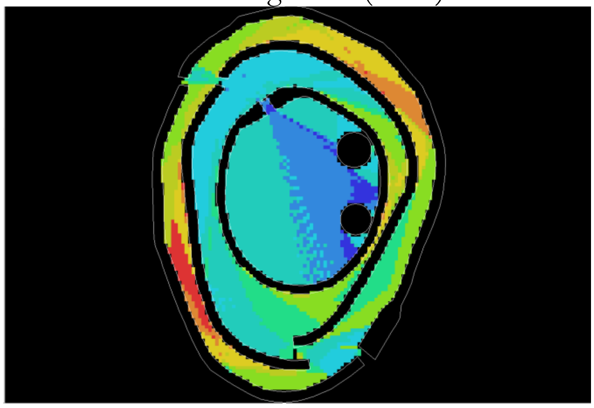
Visual Entropy



Visual Integration (TEK)

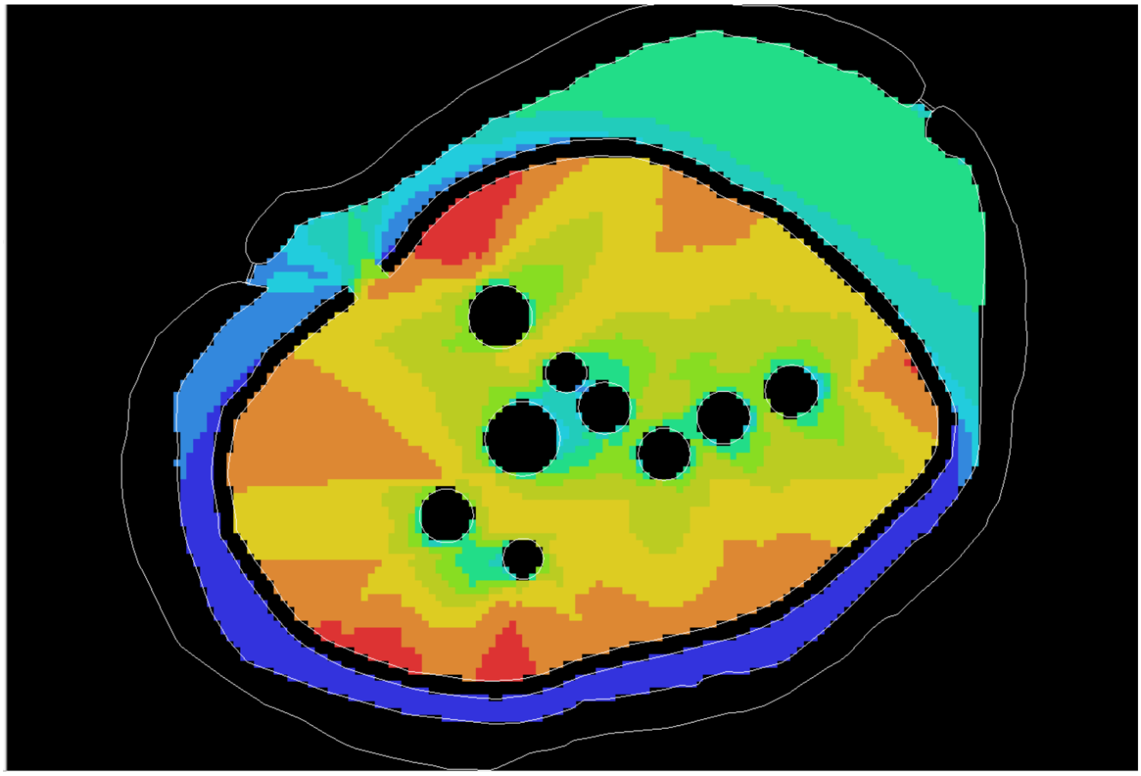


Visual Mean Depth

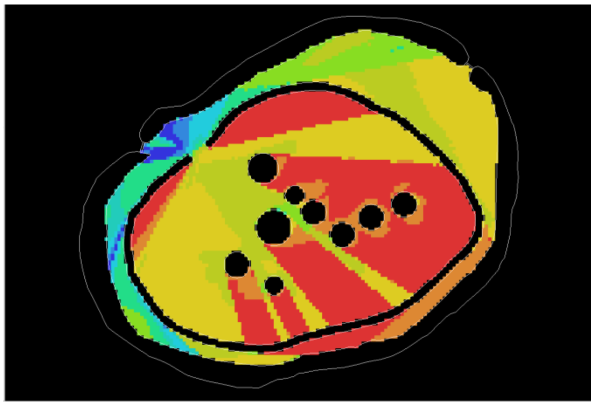


Visual Relativised Entropy

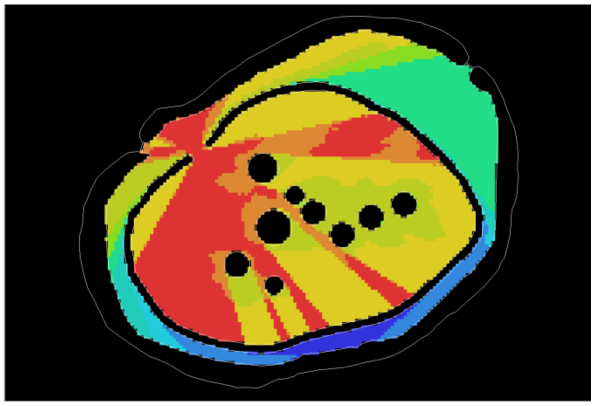
## Great Hetha Hillfort



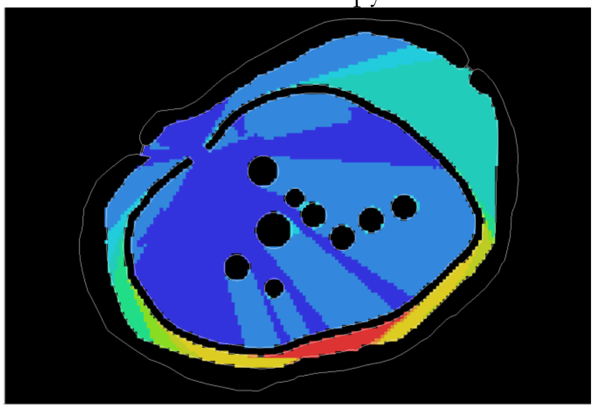
Connectivity



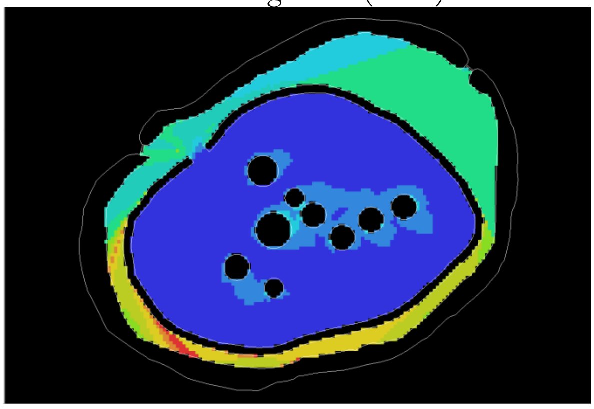
Visual Entropy



Visual Integration (TEK)

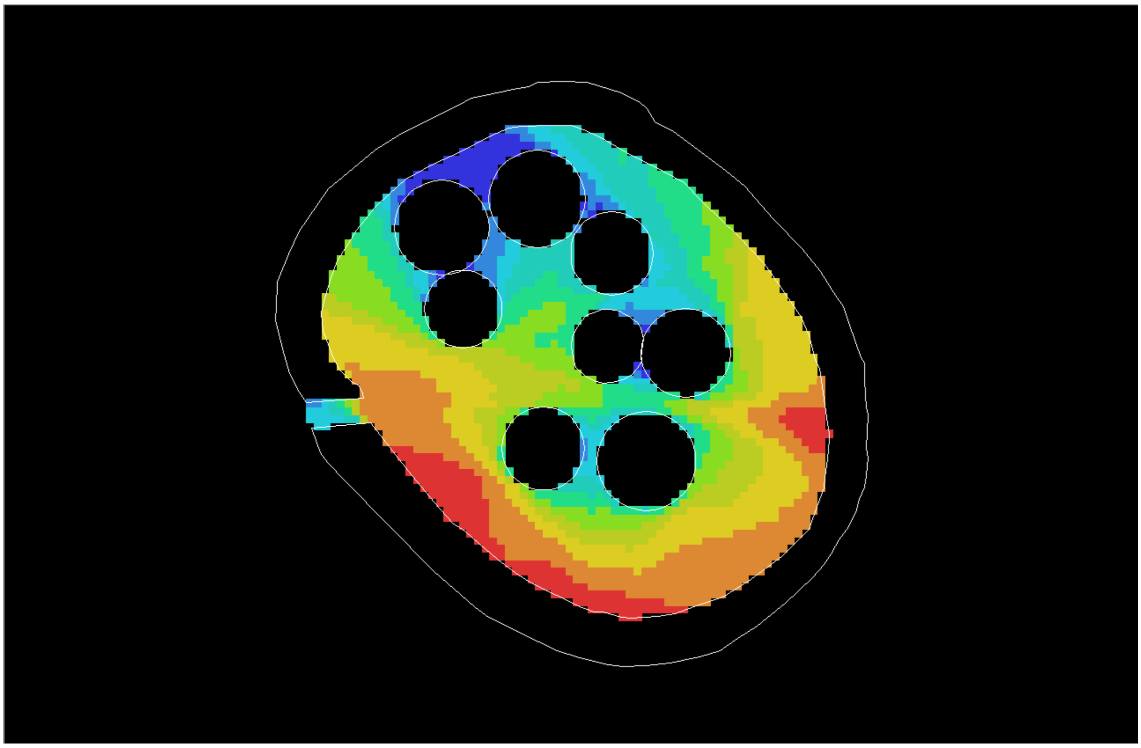


Visual Mean Depth

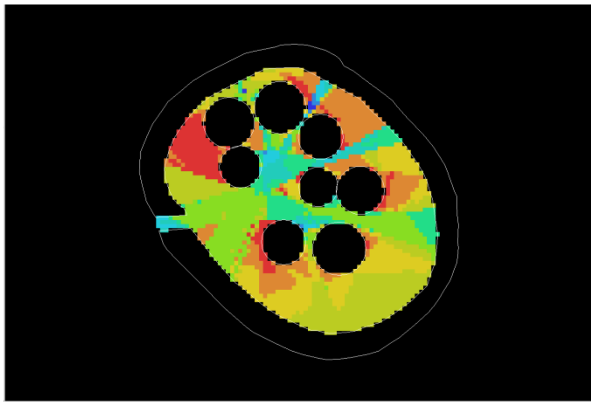


Visual Relativised Entropy

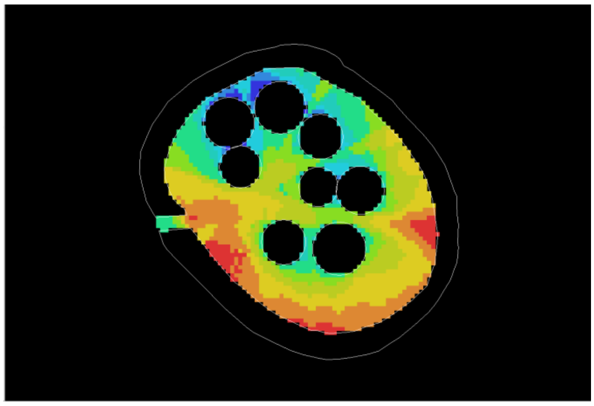
# Mid Hill Hillfort Phase 2



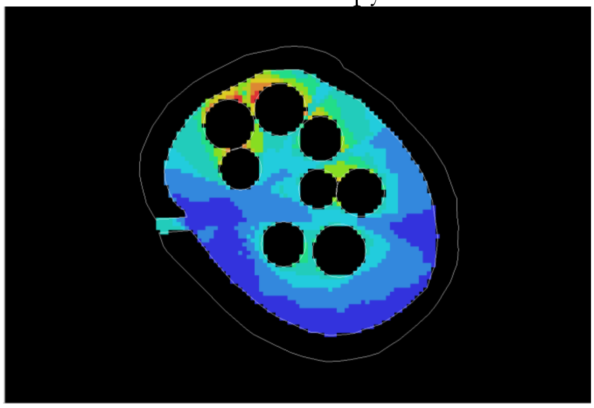
Connectivity



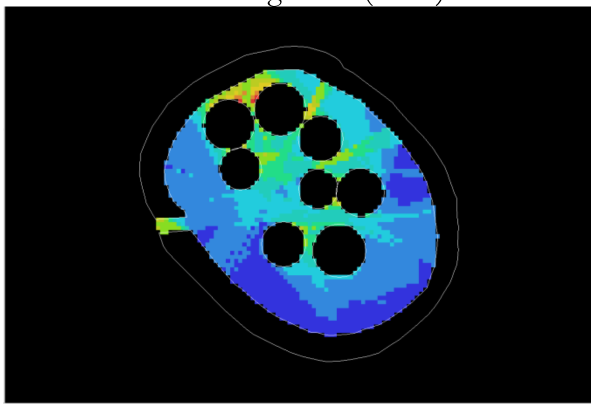
Visual Entropy



Visual Integration (TEK)

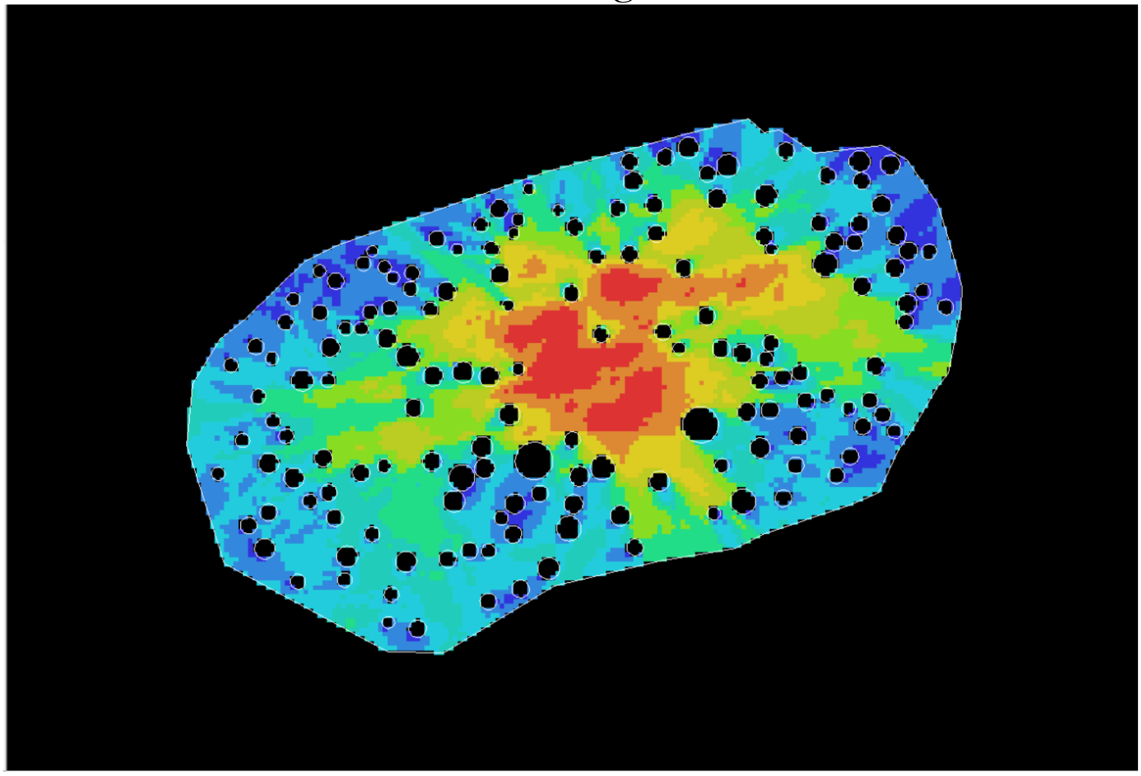


Visual Mean Depth

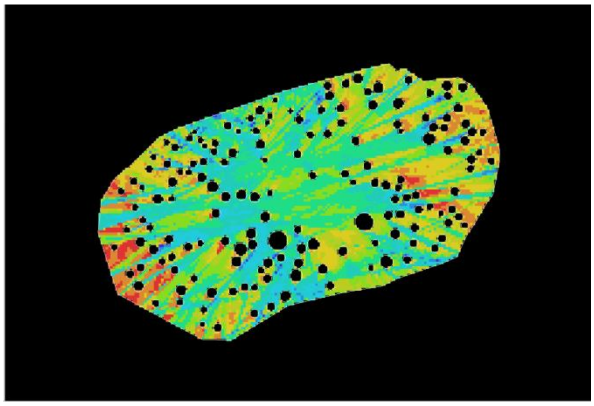


Visual Relativised Entropy

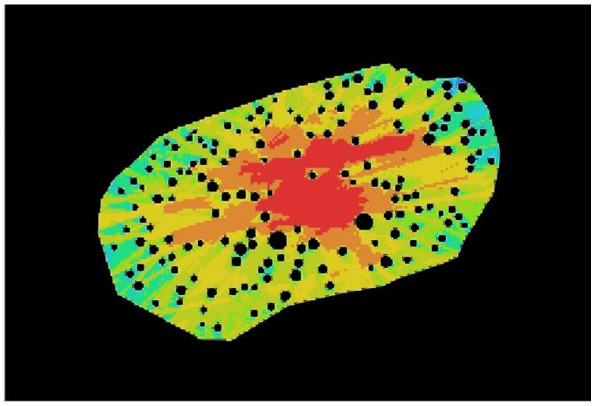
# Yeavering Bell



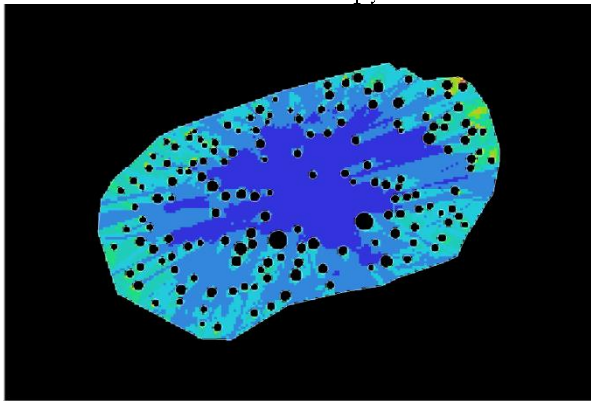
Connectivity



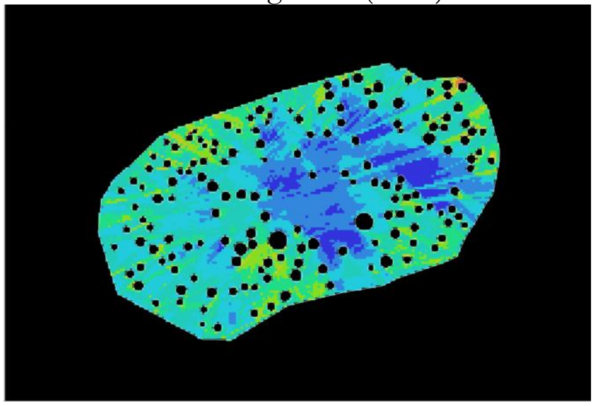
Visual Entropy



Visual Integration (TEK)

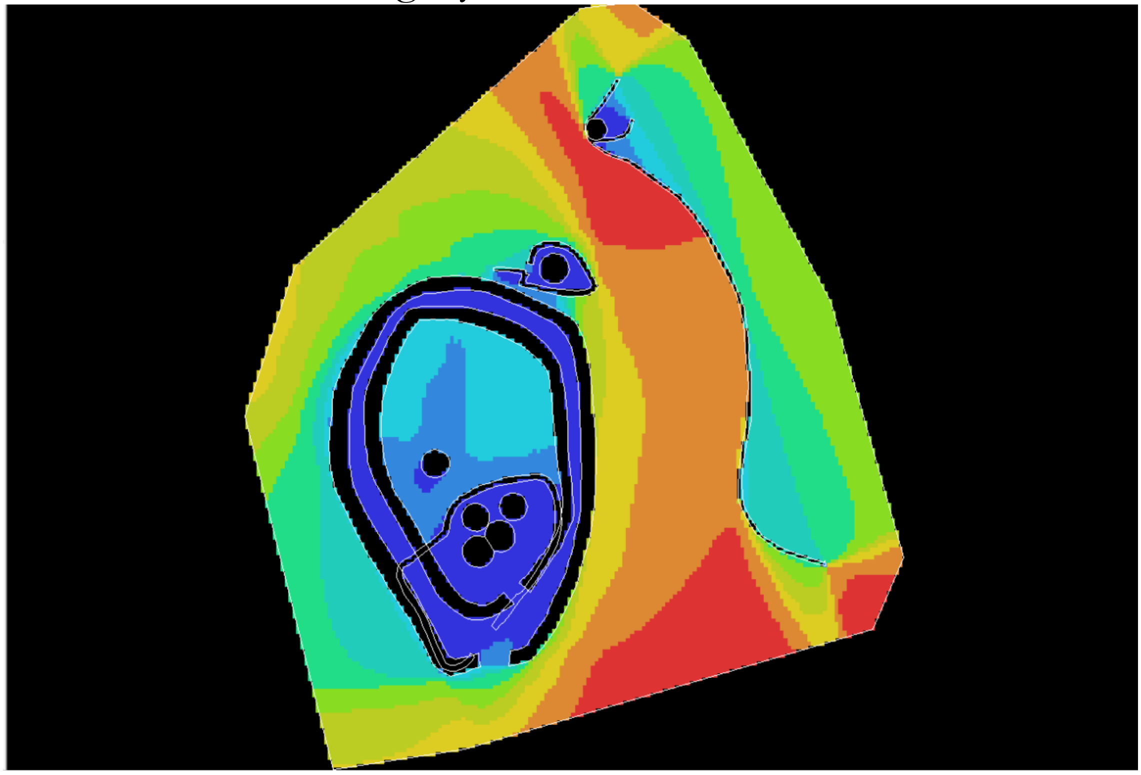


Visual Mean Depth

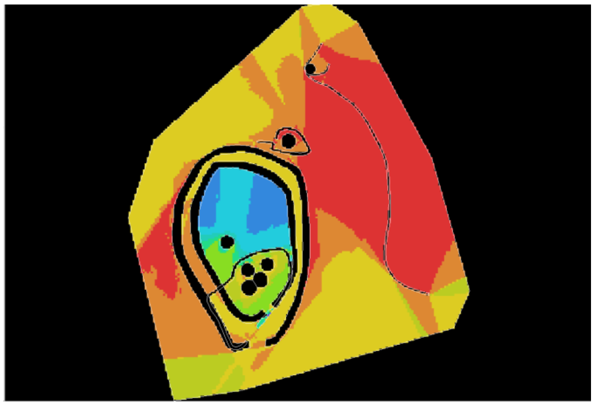


Visual Relativised Entropy

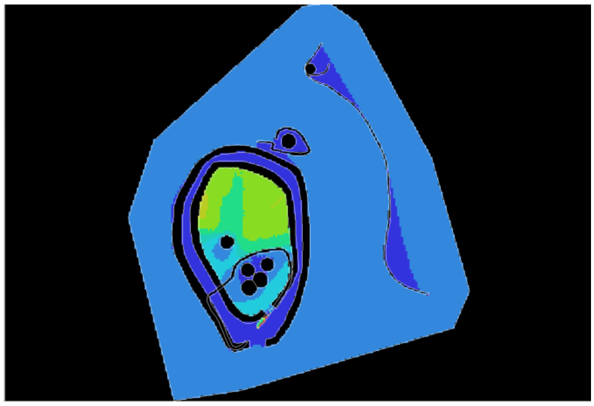
# St Gregory's Hill Hillfort Phase 3



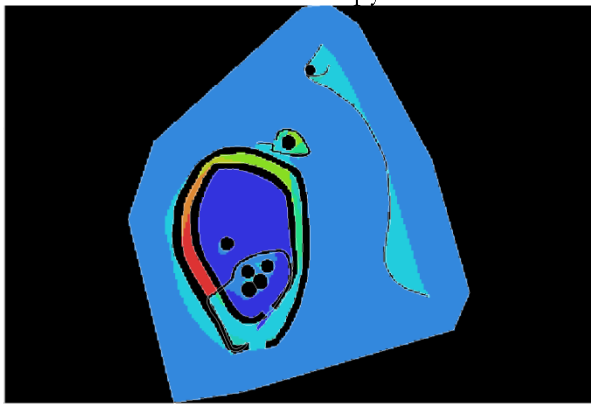
Connectivity



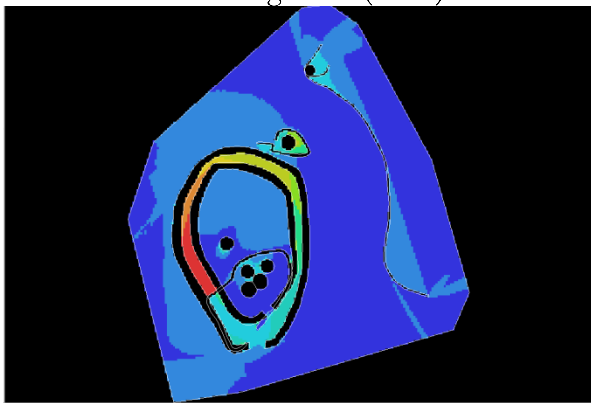
Visual Entropy



Visual Integration (TEK)

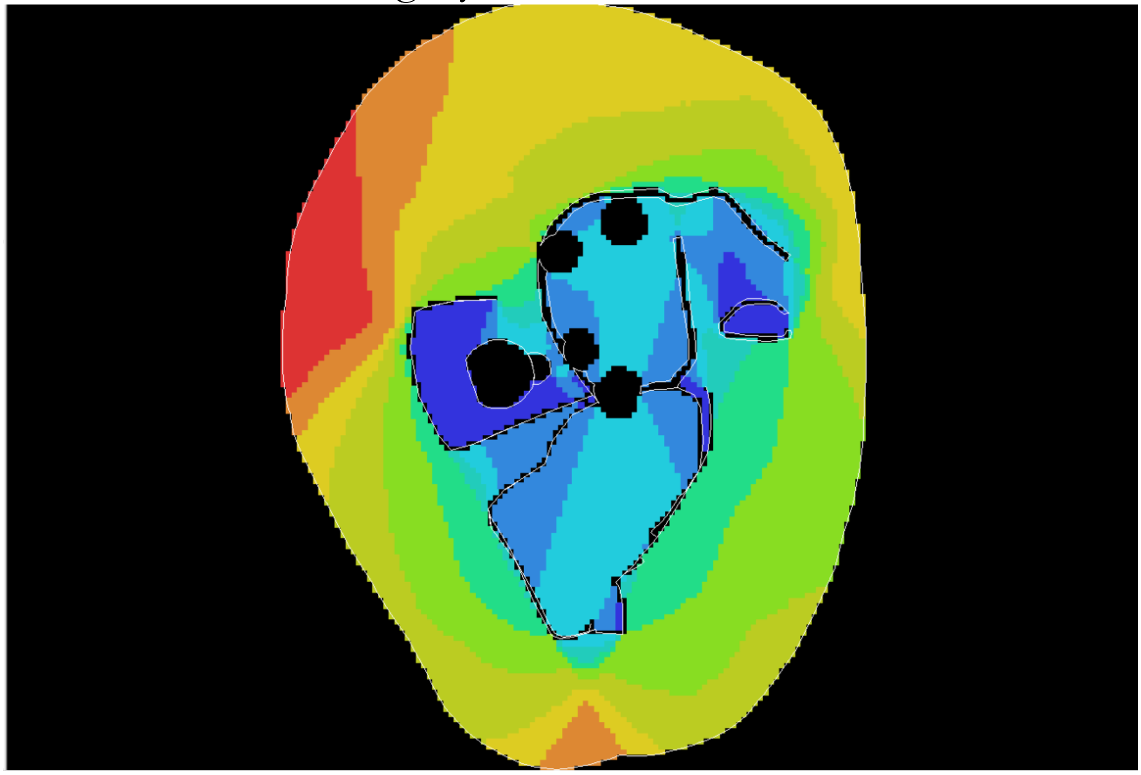


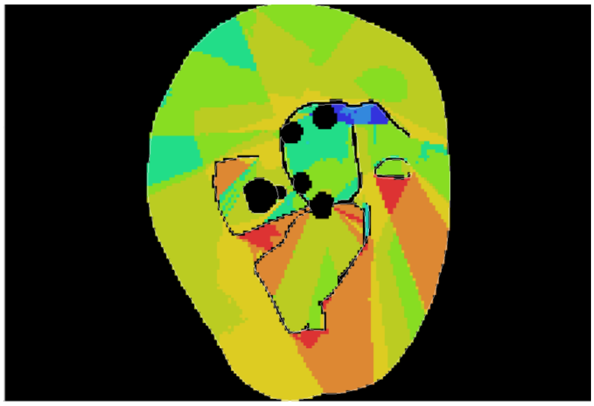
Visual Mean Depth

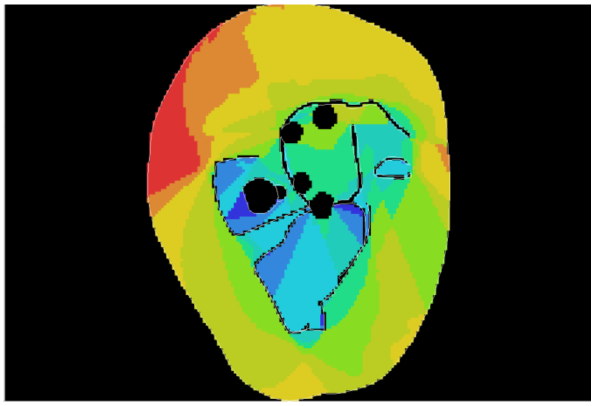


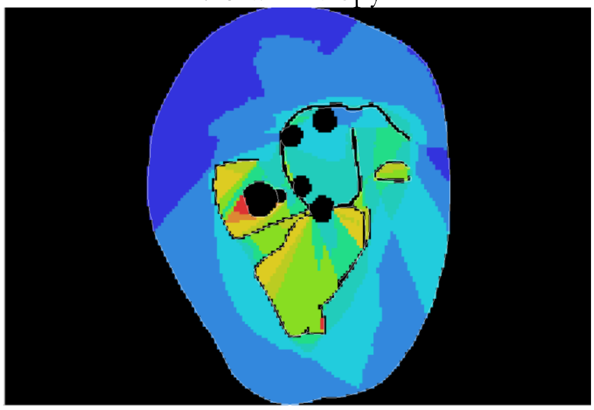
Visual Relativised Entropy

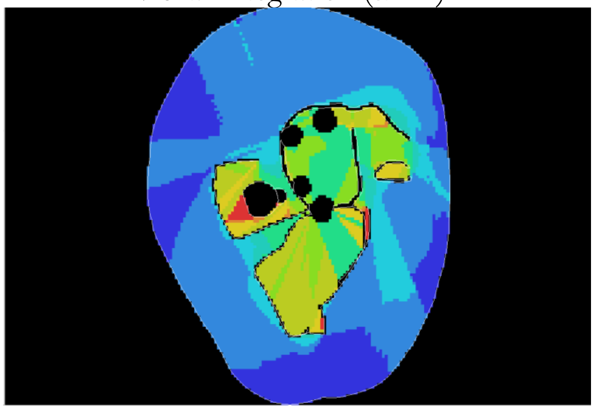
St Gregory's Hill Hillfort Phase 4


Connectivity

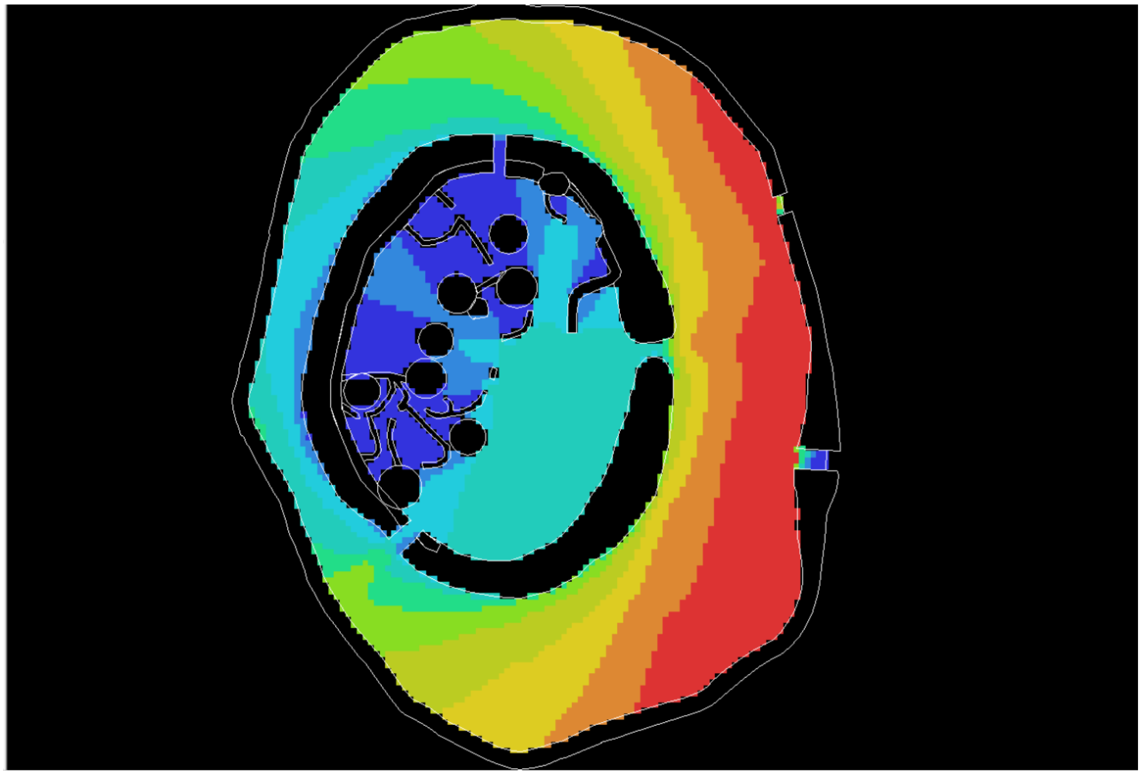

Visual Entropy


Visual Integration (TEK)

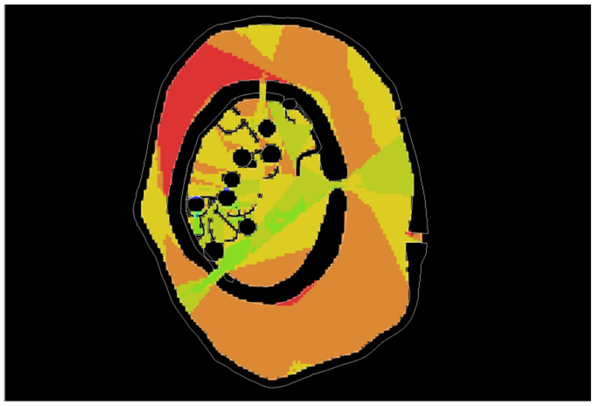

Visual Mean Depth


Visual Relativised Entropy

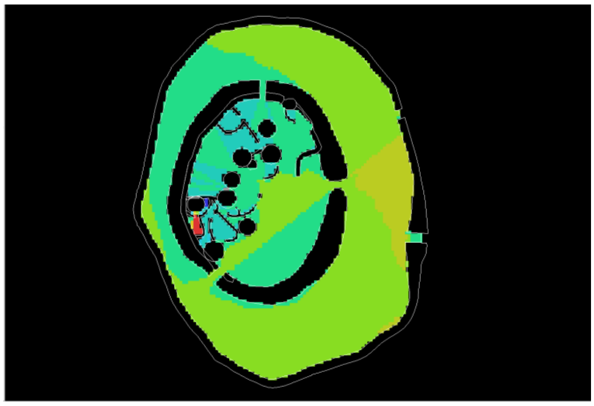
# West Hill Hillfort Phase 3



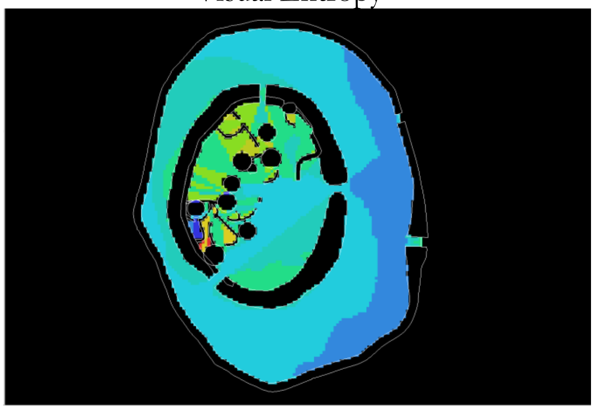
Connectivity



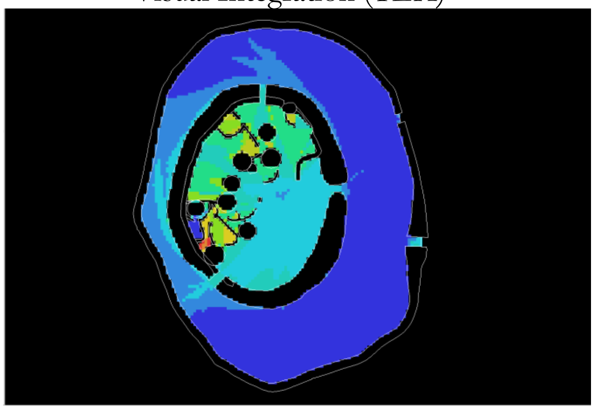
Visual Entropy



Visual Integration (TEK)

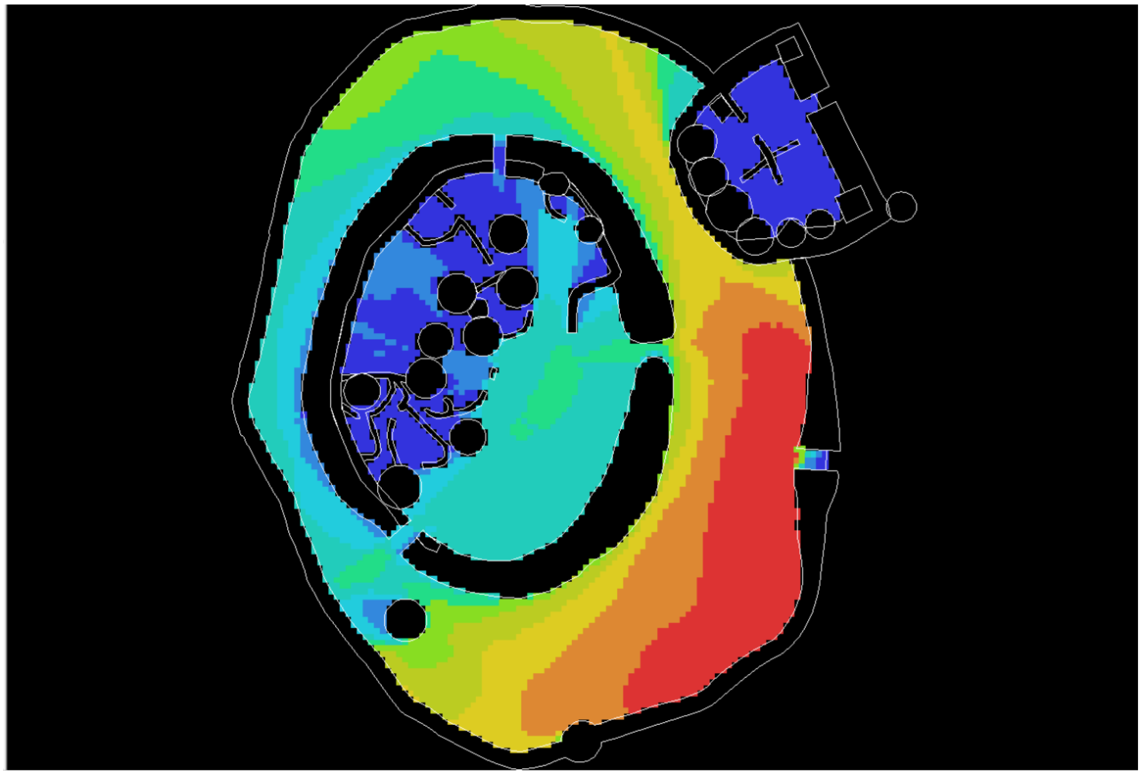


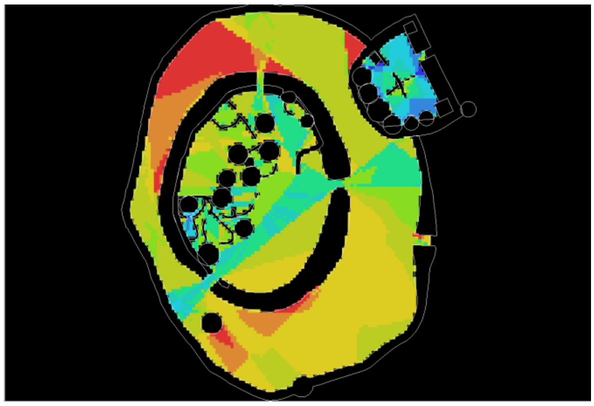
Visual Mean Depth

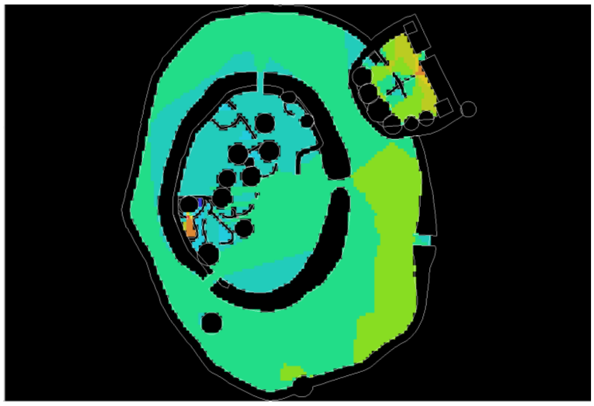


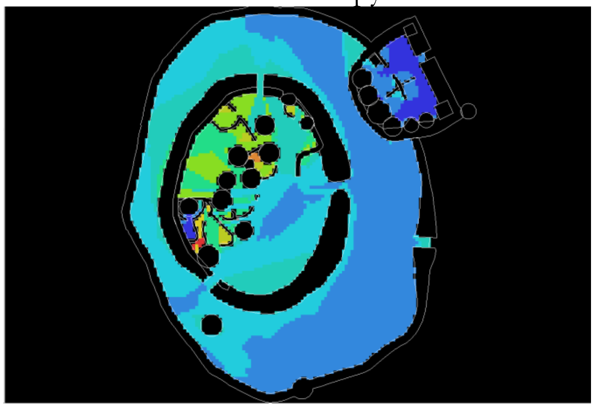
Visual Relativised Entropy

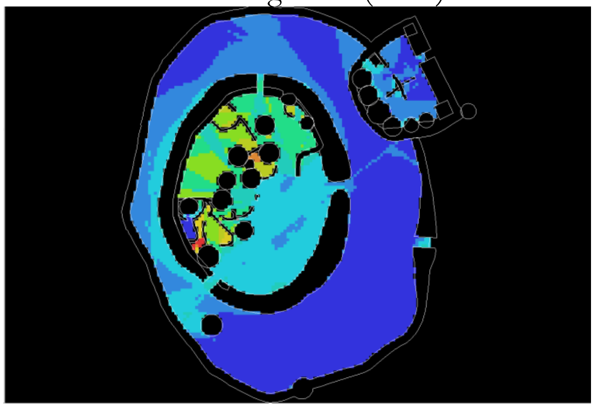
# West Hill Hillfort Phase 4


Connectivity

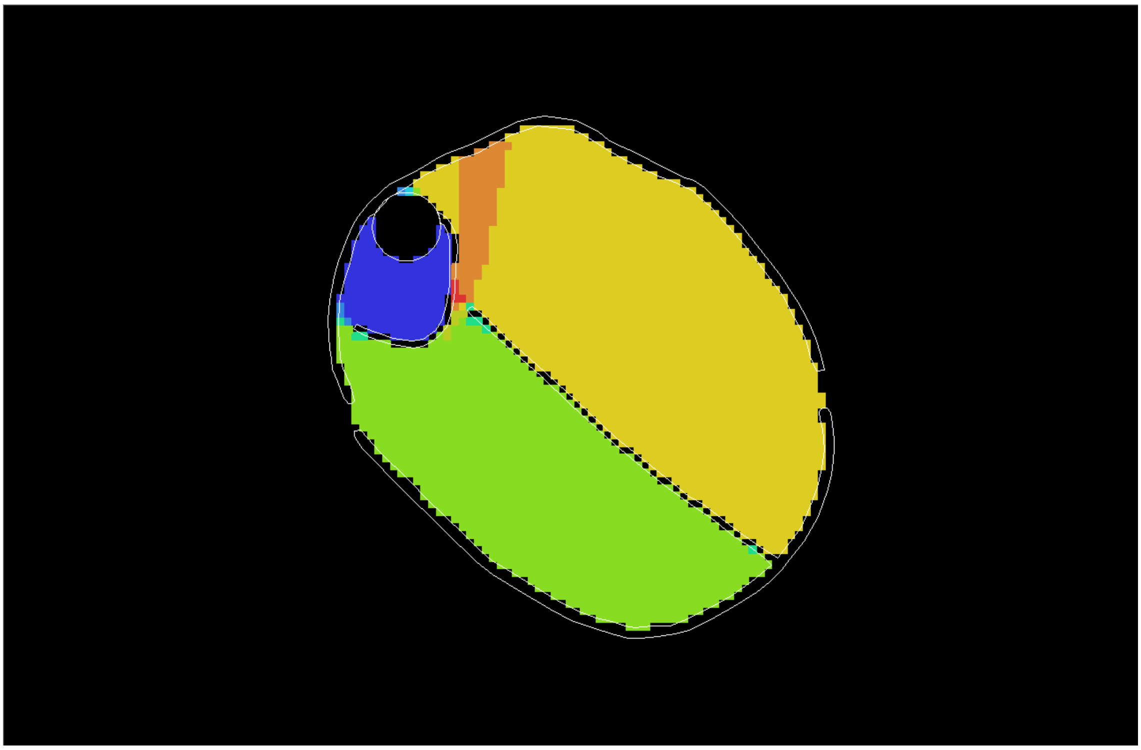

Visual Entropy


Visual Integration (TEK)

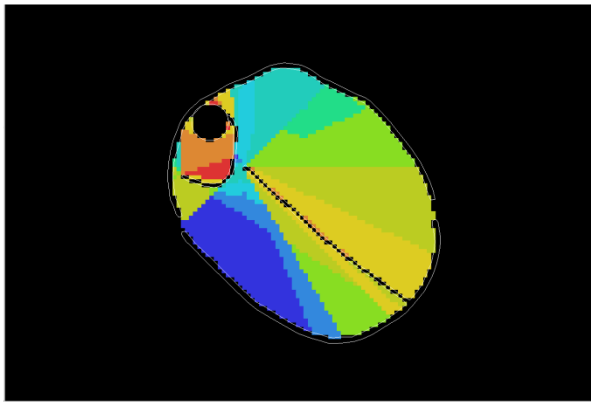

Visual Mean Depth


Visual Relativised Entropy

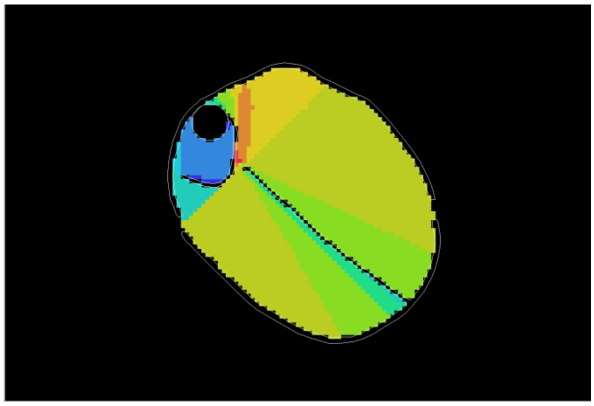
# Mid Hill Hillfort Phase 4



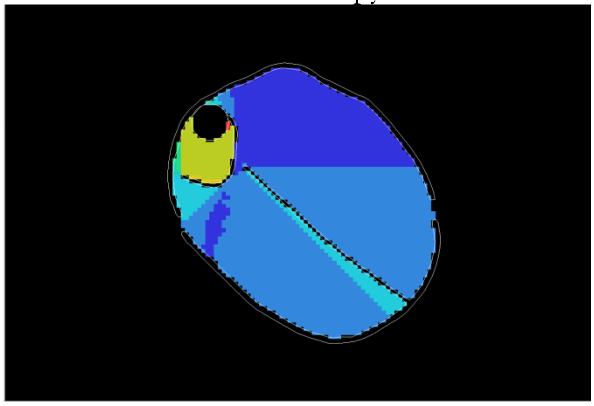
Connectivity



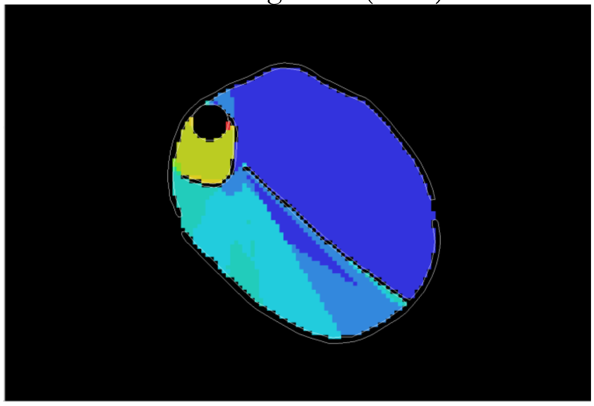
Visual Entropy



Visual Integration (TEK)

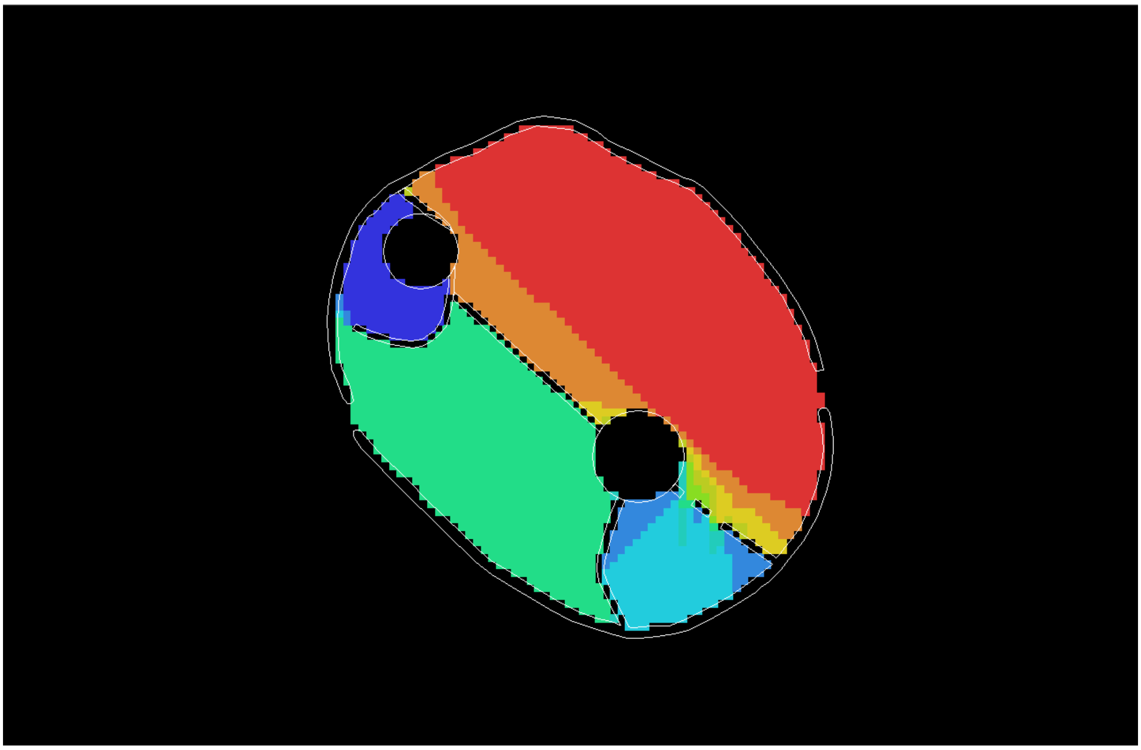


Visual Mean Depth

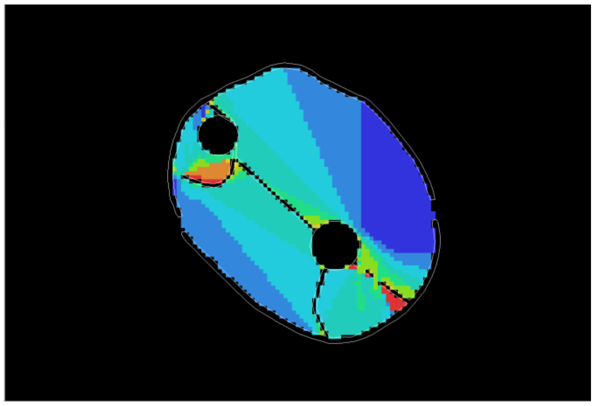


Visual Relativised Entropy

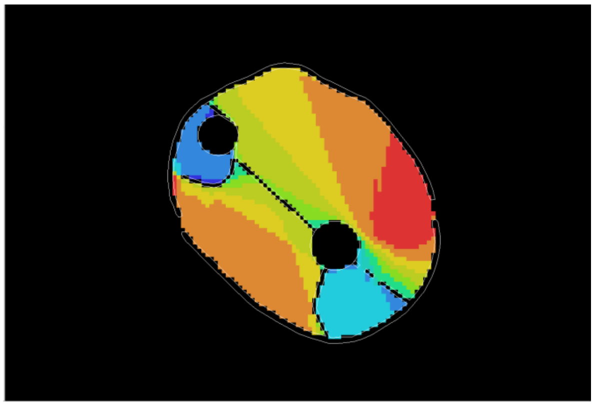
# Mid Hill Hillfort Phase 5



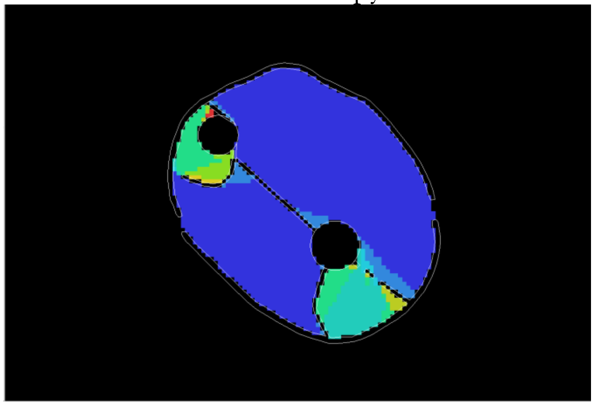
Connectivity



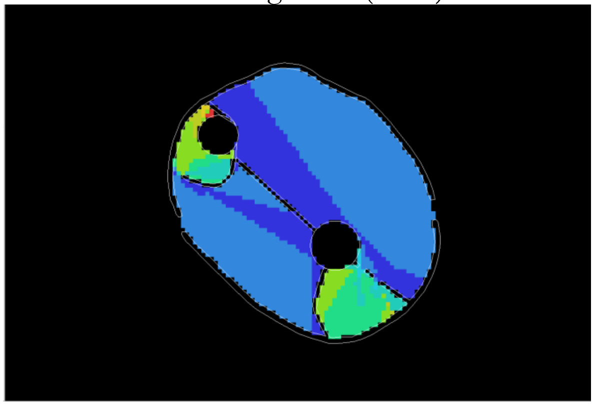
Visual Entropy



Visual Integration (TEK)

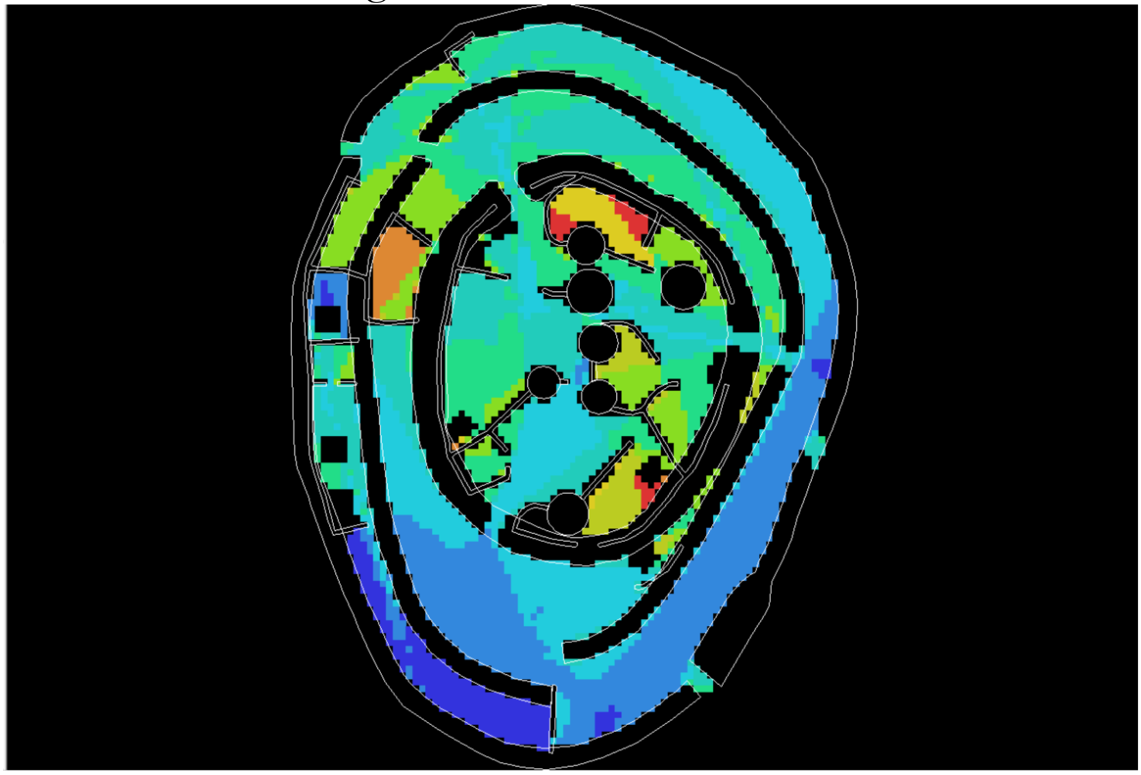


Visual Mean Depth

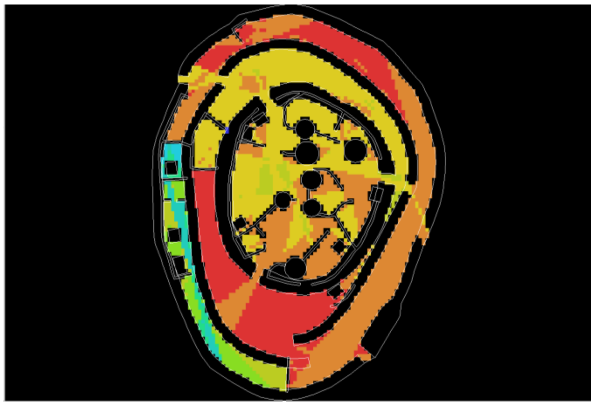


Visual Relativised Entropy

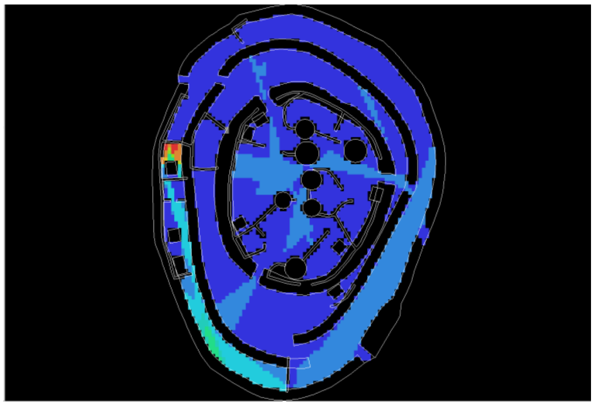
# Ring Chesters Hillfort Phase 4



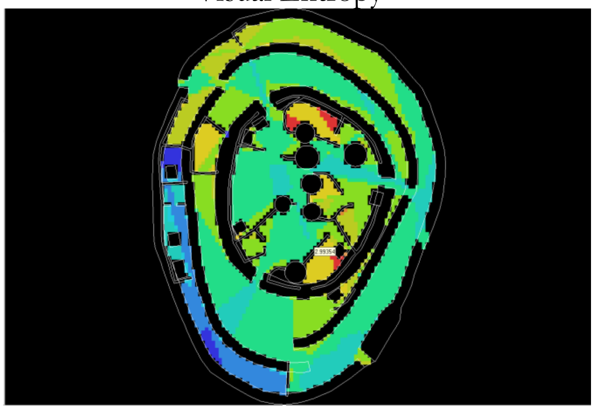
Connectivity



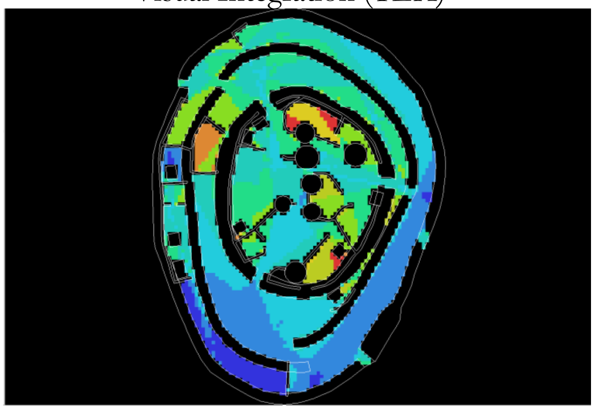
Visual Entropy



Visual Integration (TEK)

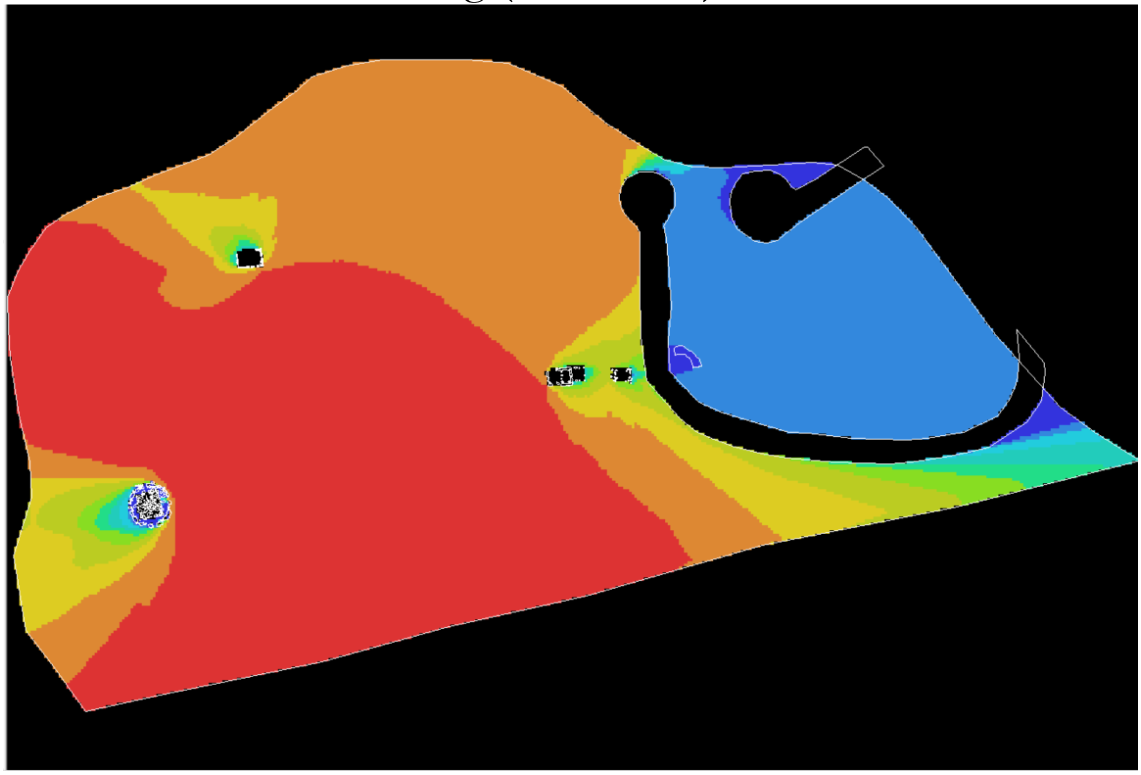


Visual Mean Depth

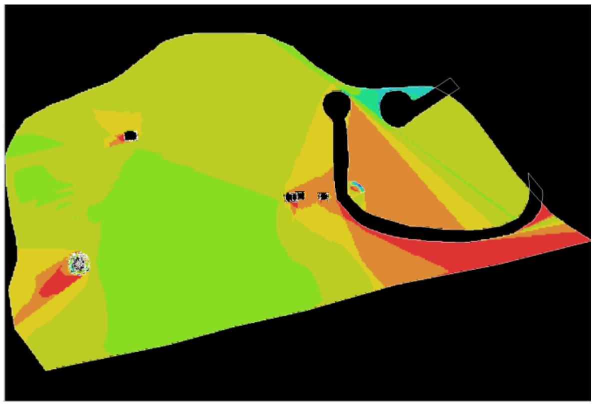


Visual Relativised Entropy

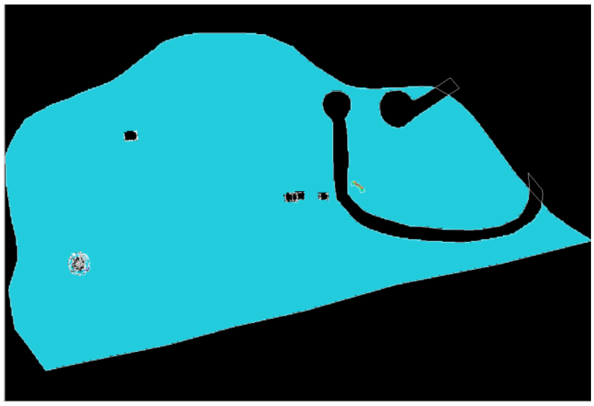
# Yeavering (Ad Gefrin) Phase I



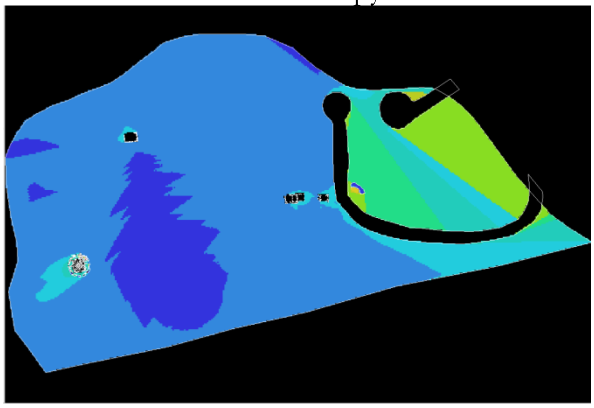
Connectivity



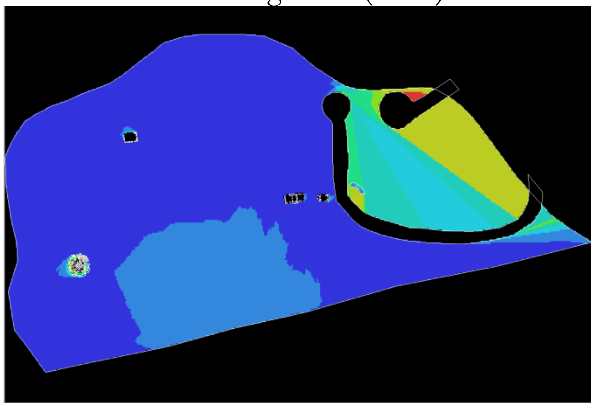
Visual Entropy



Visual Integration (TEK)

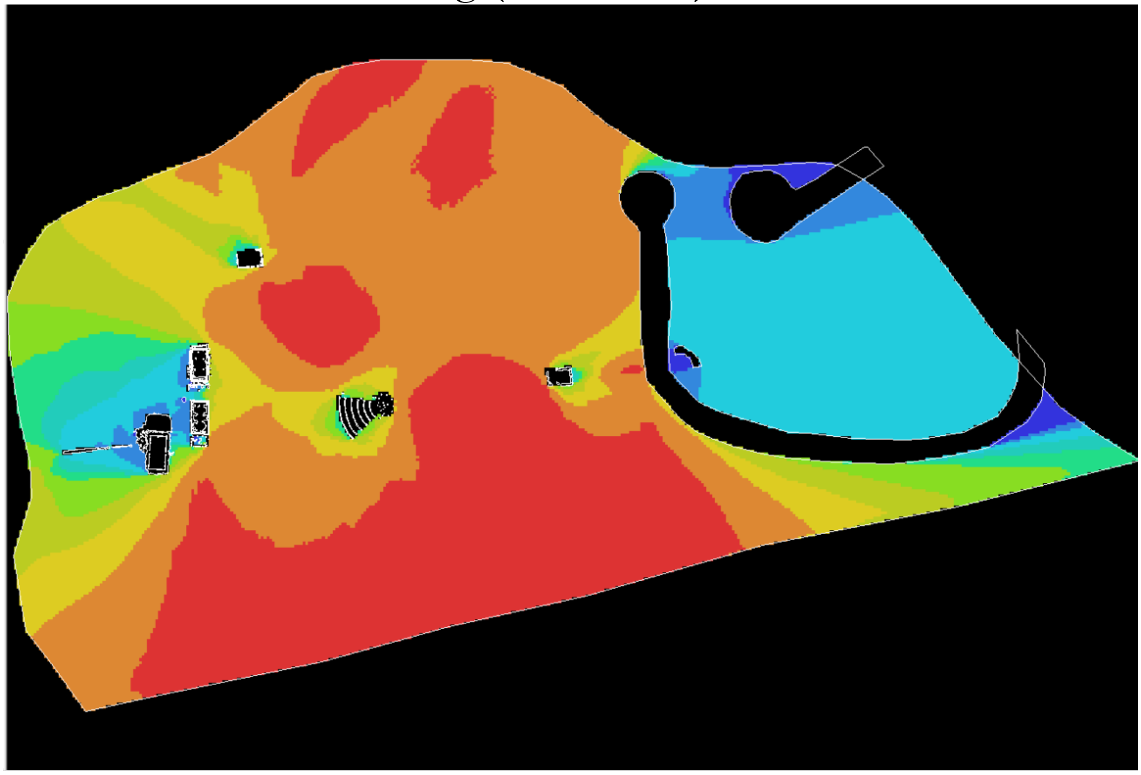


Visual Mean Depth

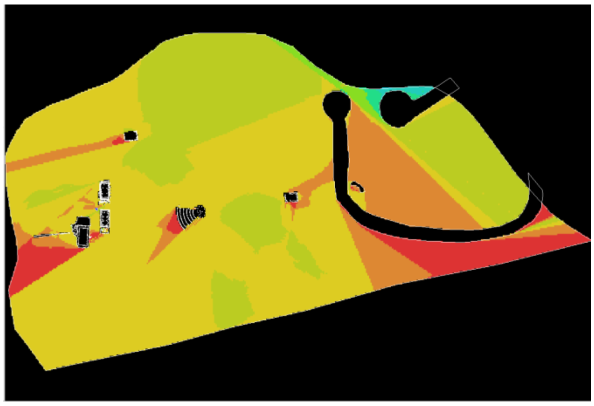


Visual Relativised Entropy

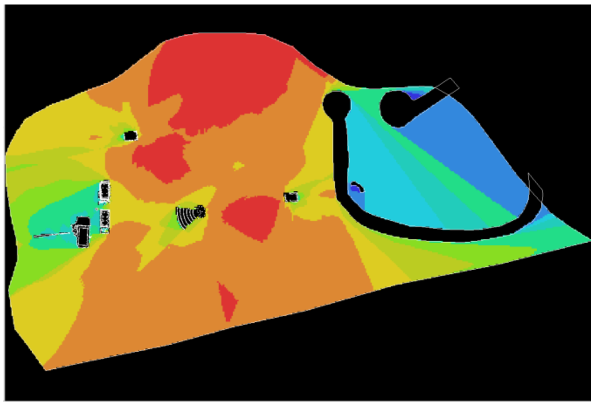
# Yeavering (Ad Gefrin) Phase II



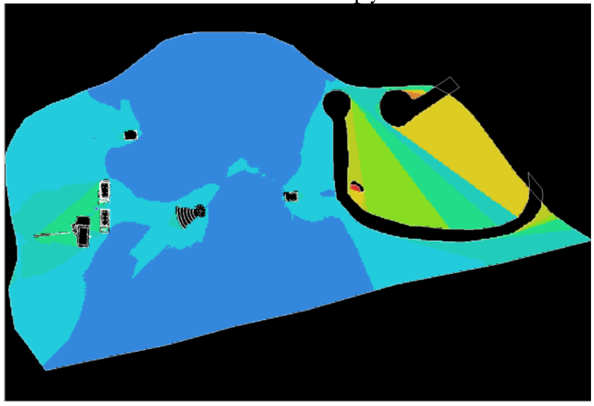
Connectivity



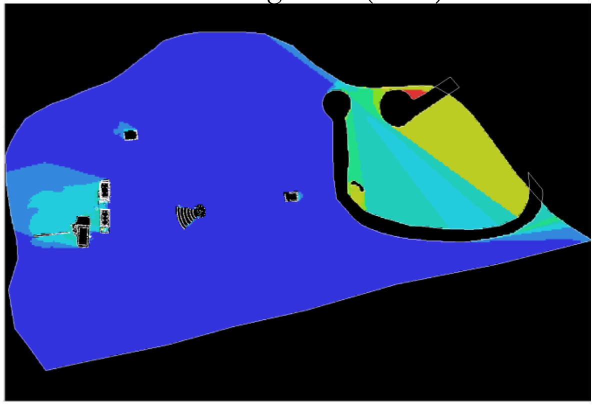
Visual Entropy



Visual Integration (TEK)

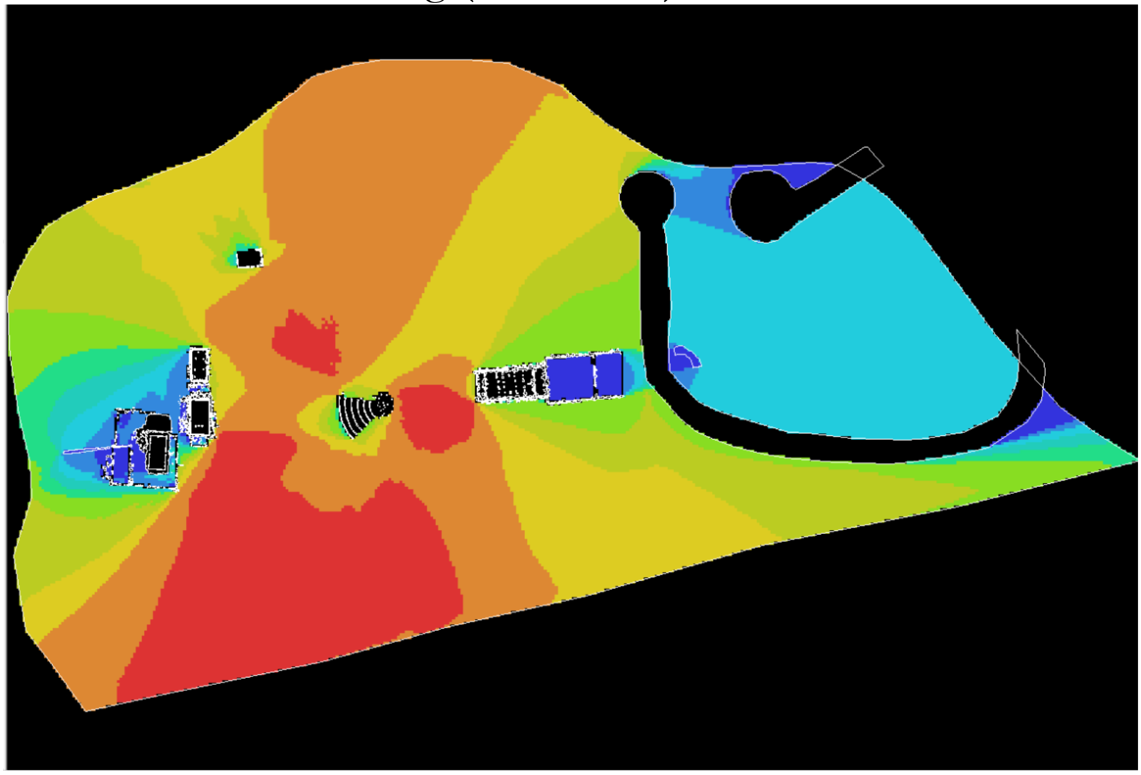


Visual Mean Depth

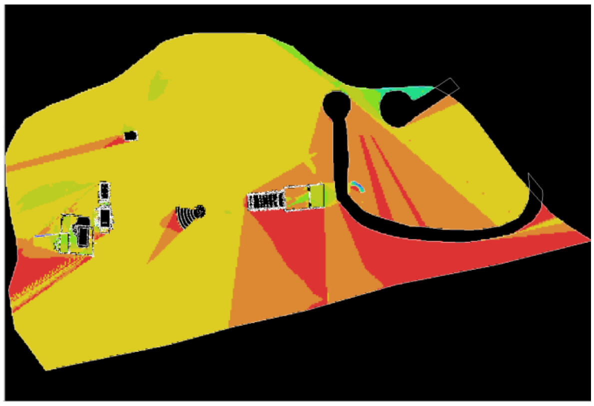


Visual Relativised Entropy

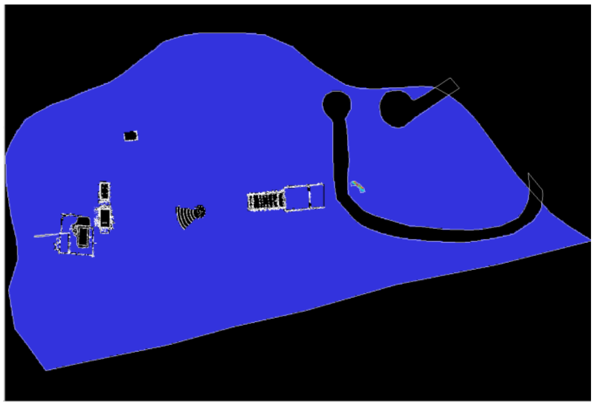
# Yeavering (Ad Gefrin) Phase IIIab



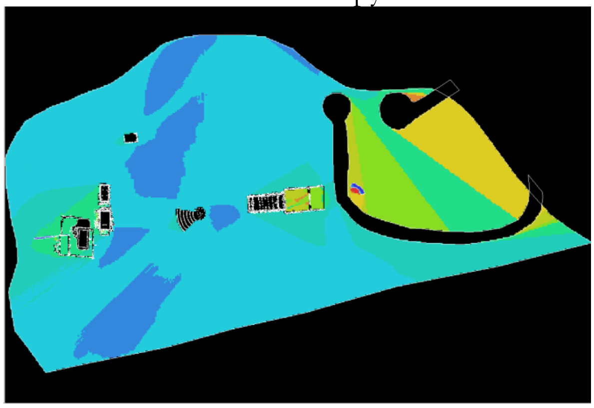
Connectivity



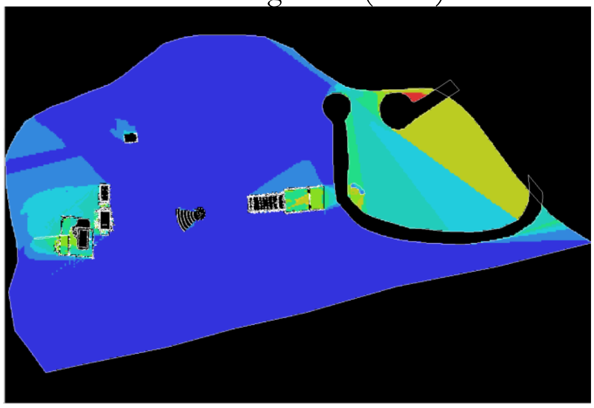
Visual Entropy



Visual Integration (TEK)

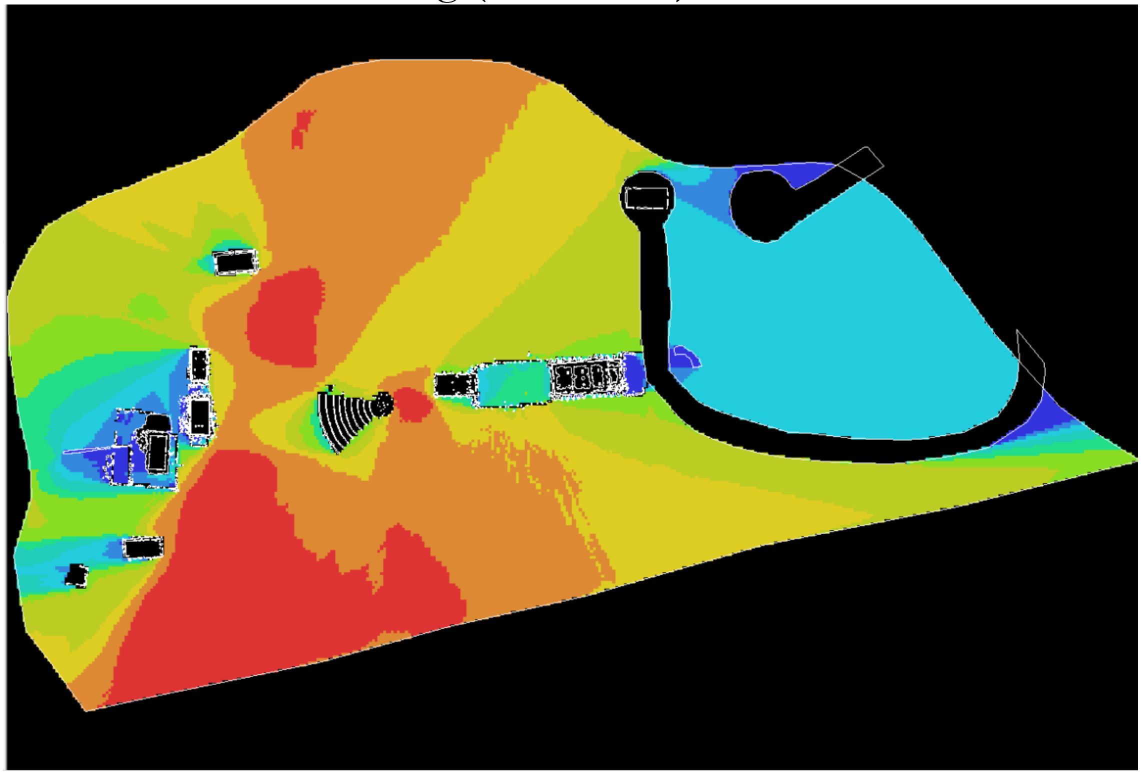


Visual Mean Depth

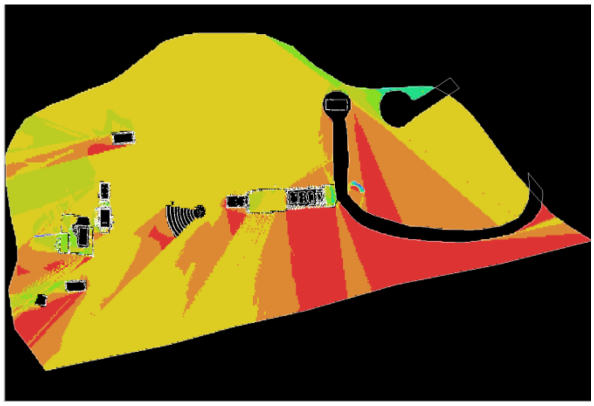


Visual Relativised Entropy

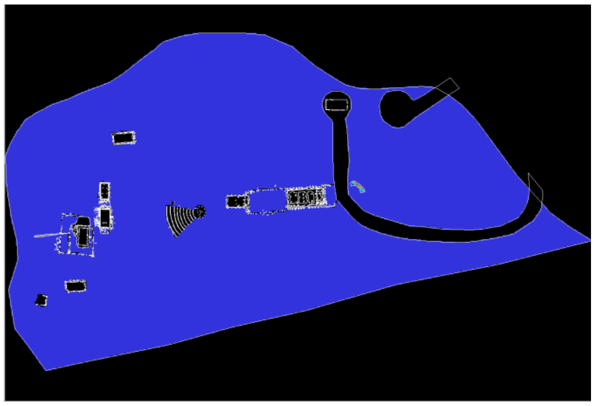
# Yeavering (Ad Gefrin) Phase IIIc



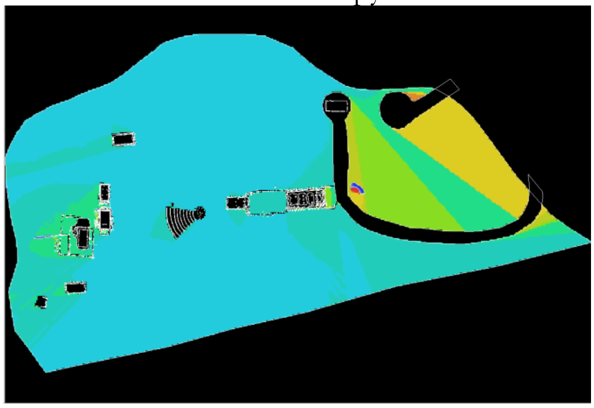
Connectivity



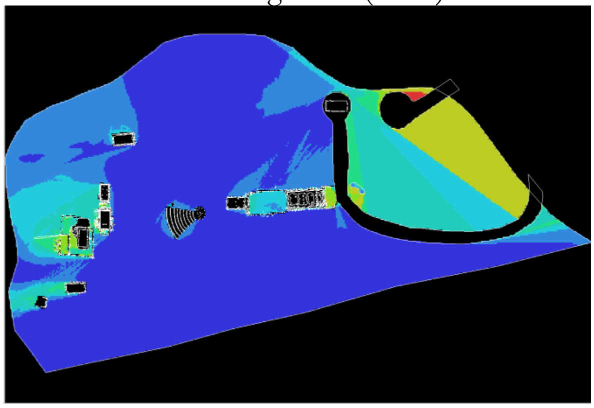
Visual Entropy



Visual Integration (TEK)

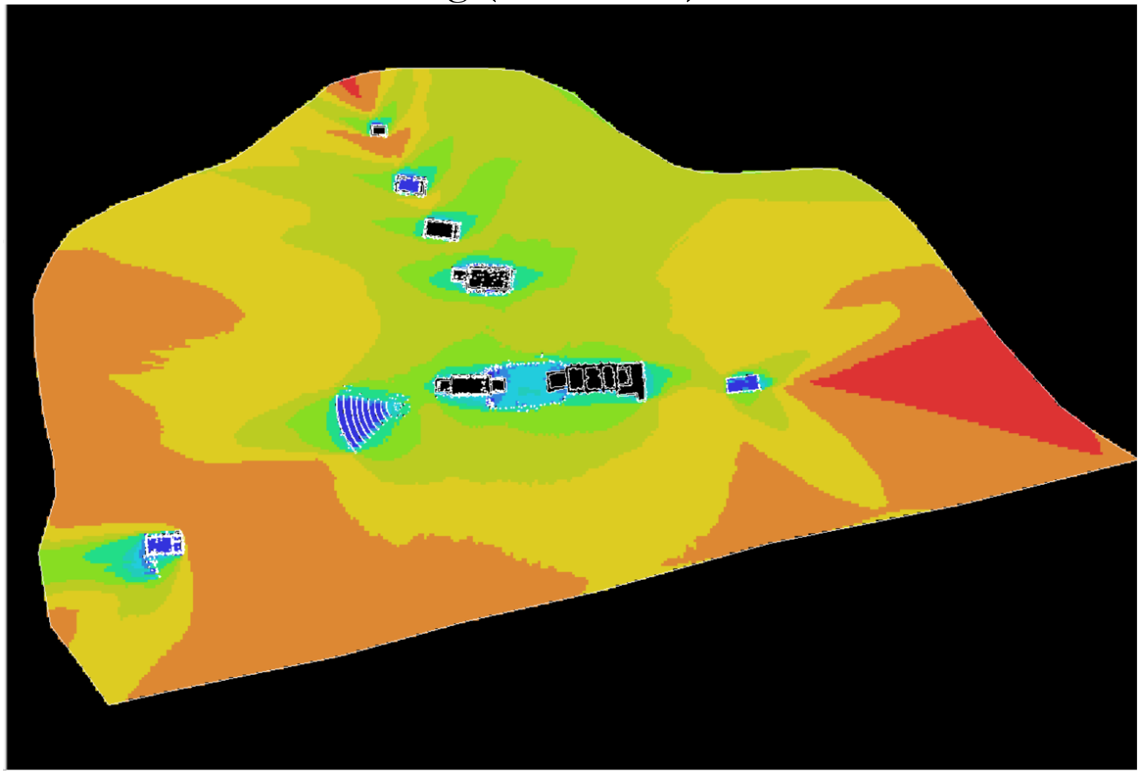


Visual Mean Depth

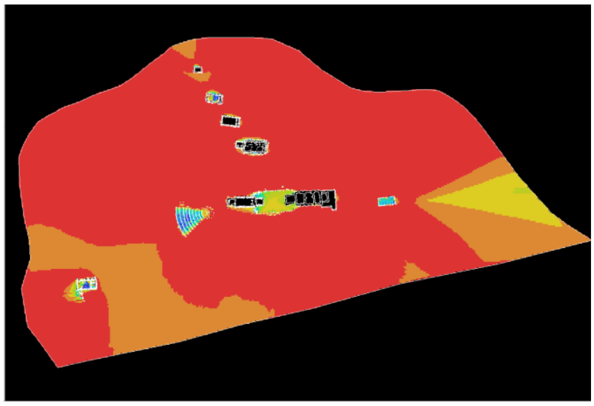


Visual Relativised Entropy

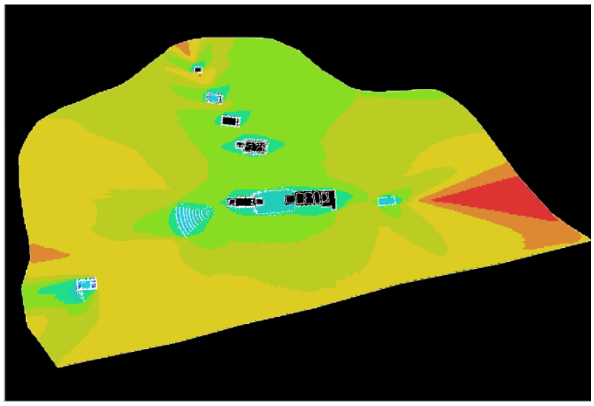
# Yeavering (Ad Gefrin) Phase IV



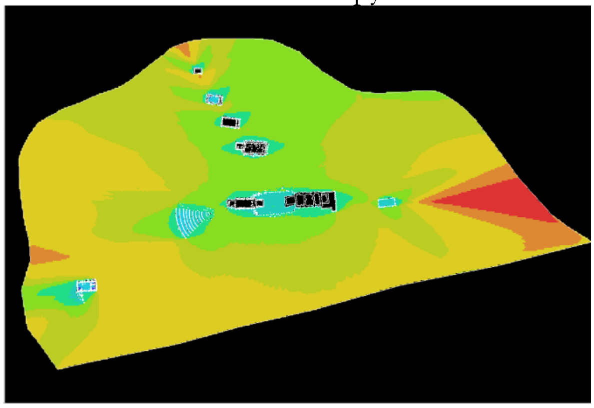
Connectivity



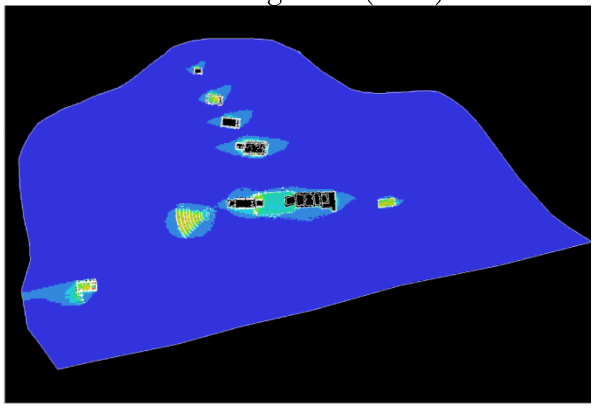
Visual Entropy



Visual Integration (TEK)

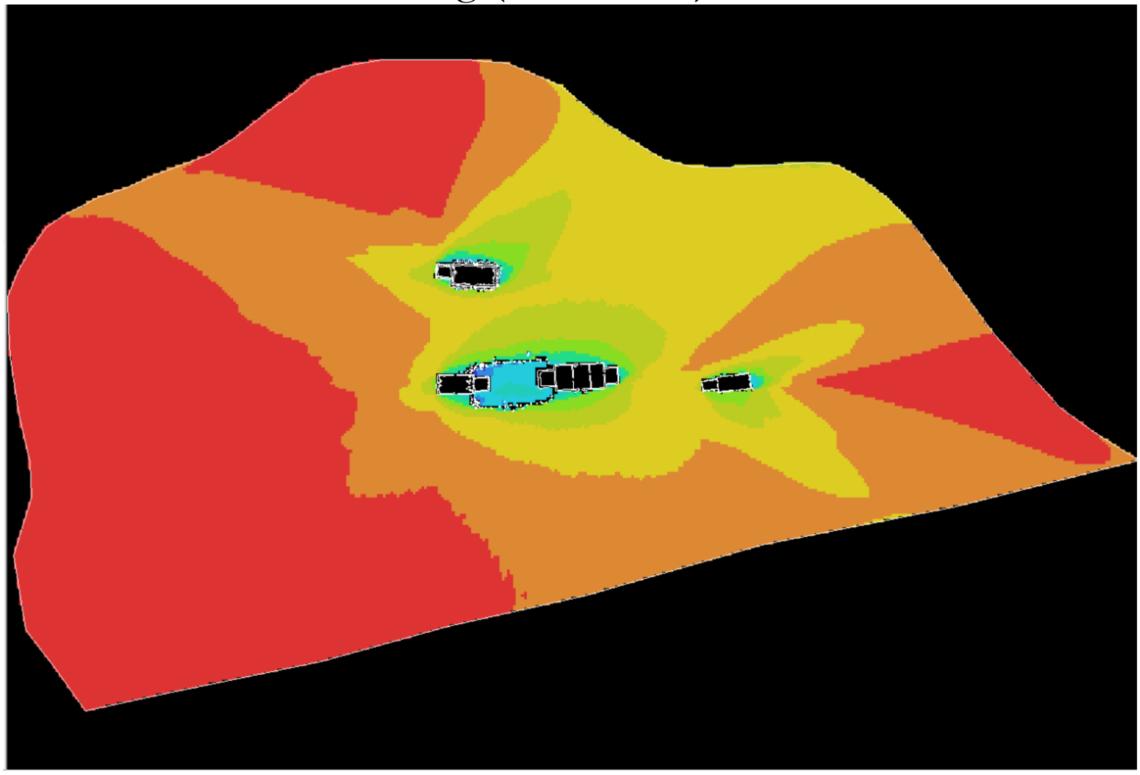


Visual Mean Depth

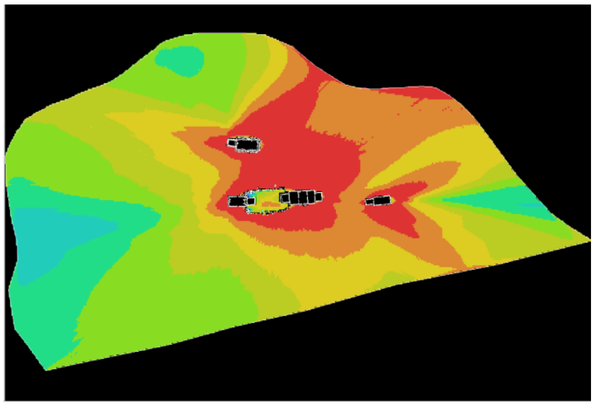


Visual Relativised Entropy

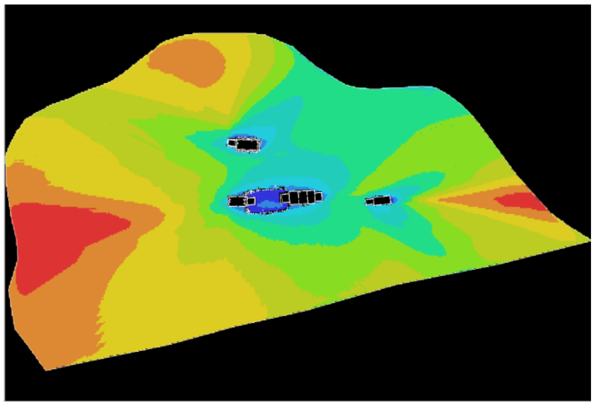
# Yeavering (Ad Gefrin) Phase V



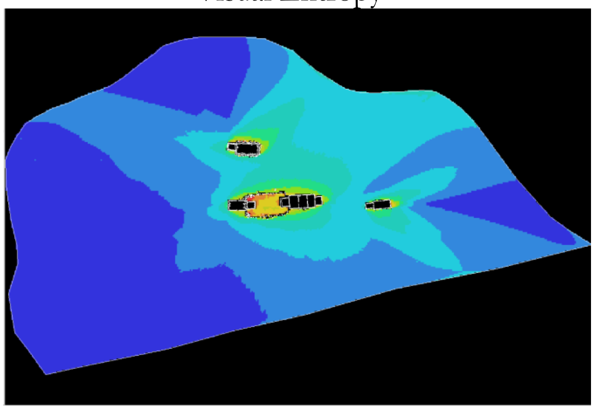
Connectivity



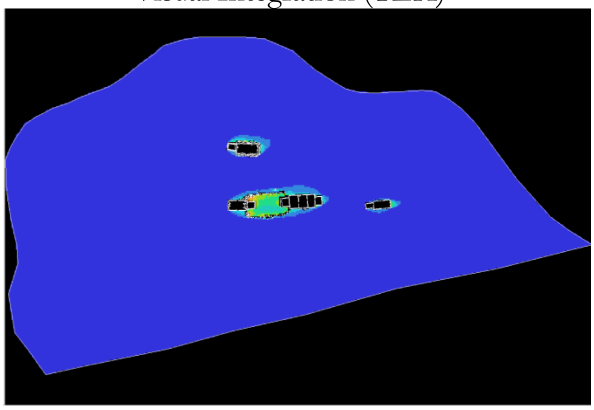
Visual Entropy



Visual Integration (TEK)

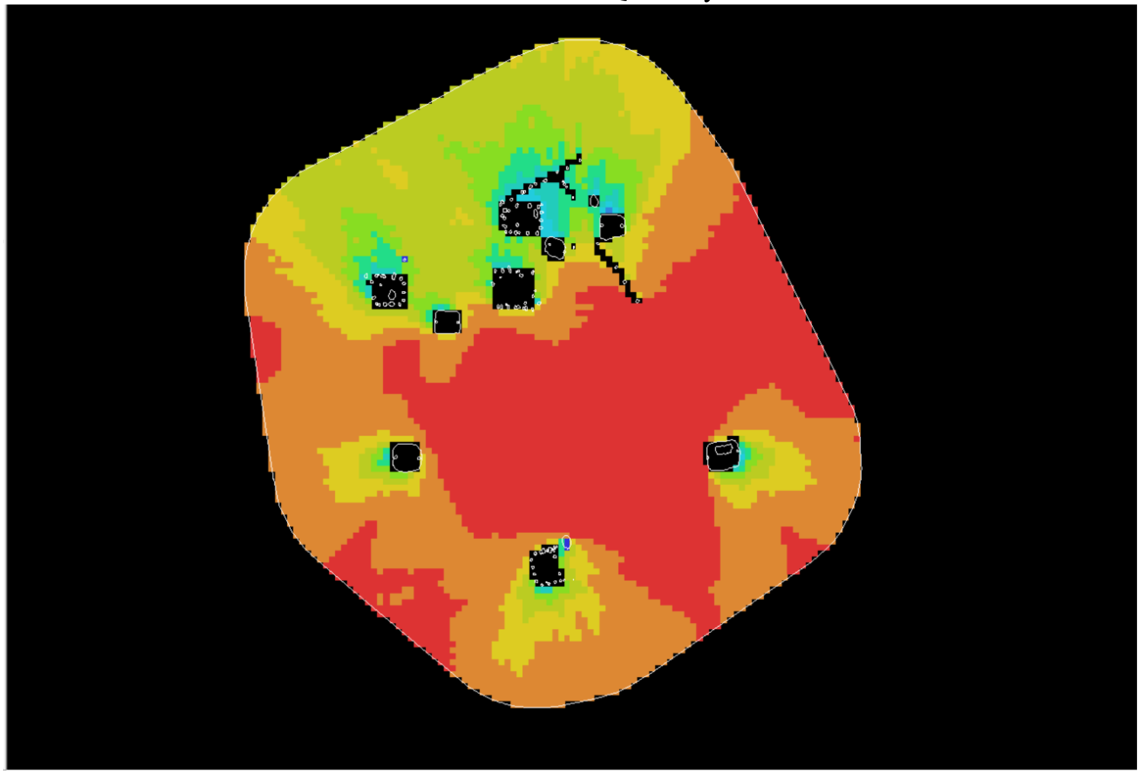


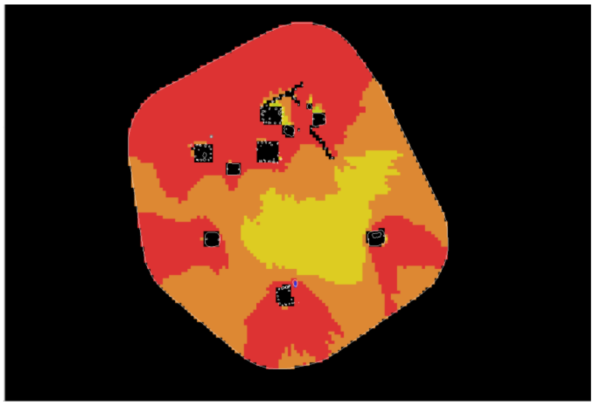
Visual Mean Depth

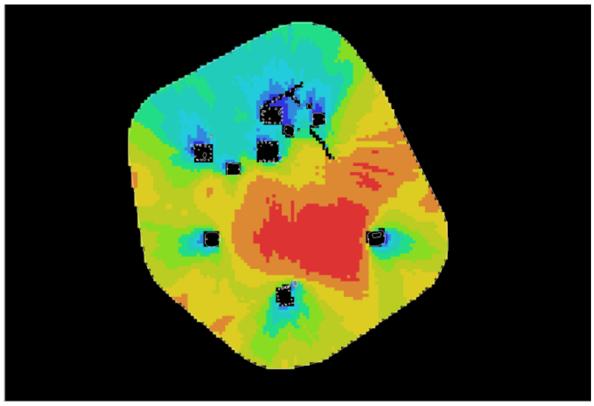


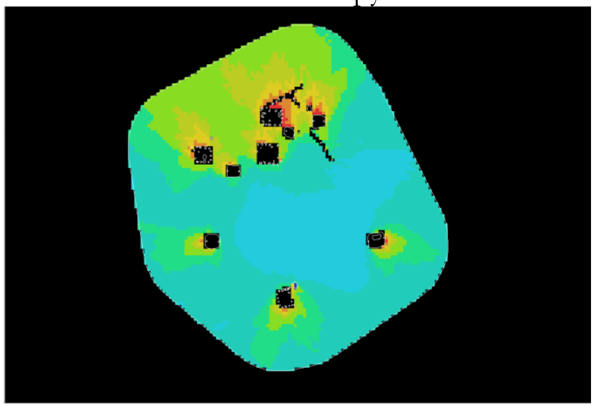
Visual Relativised Entropy

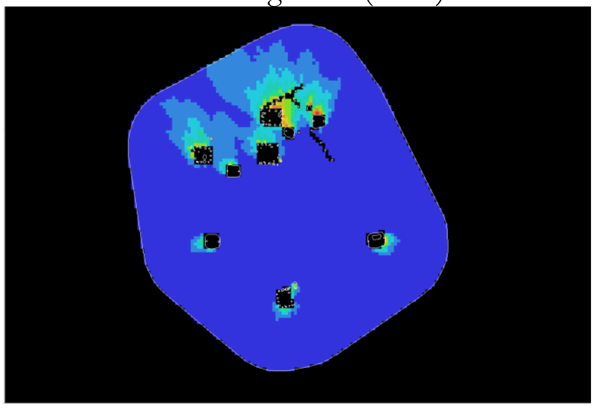
# Lanton Quarry


Connectivity

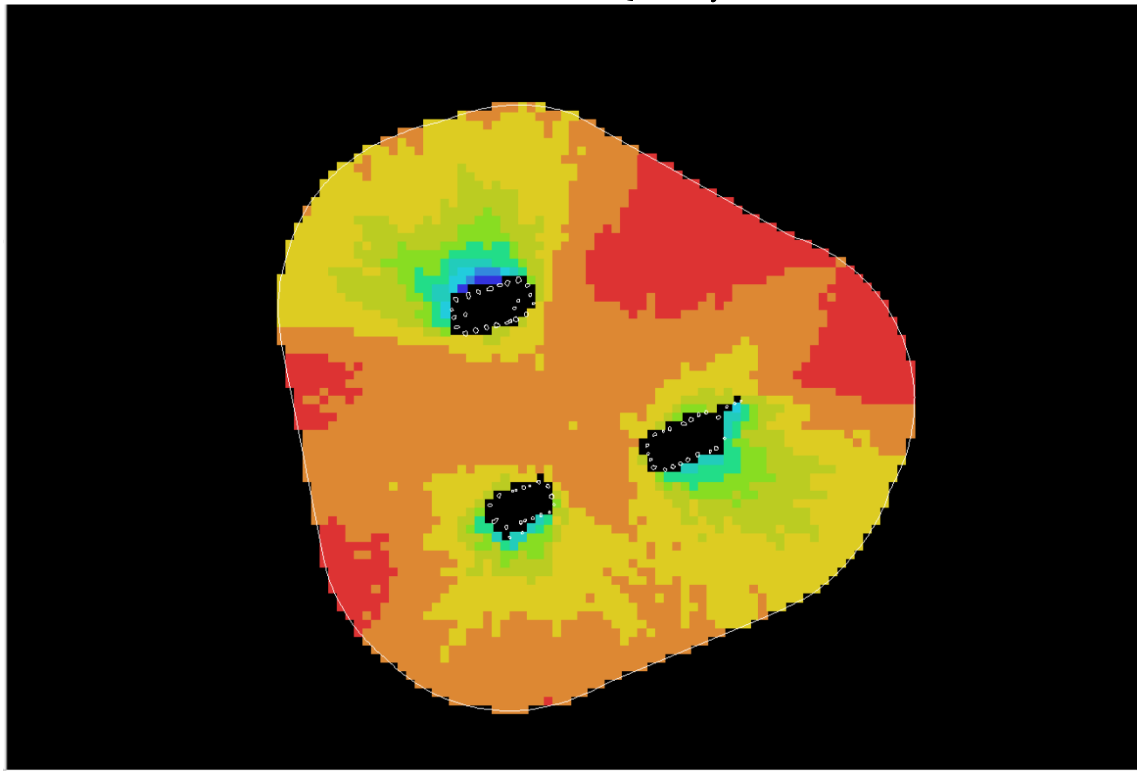

Visual Entropy


Visual Integration (TEK)

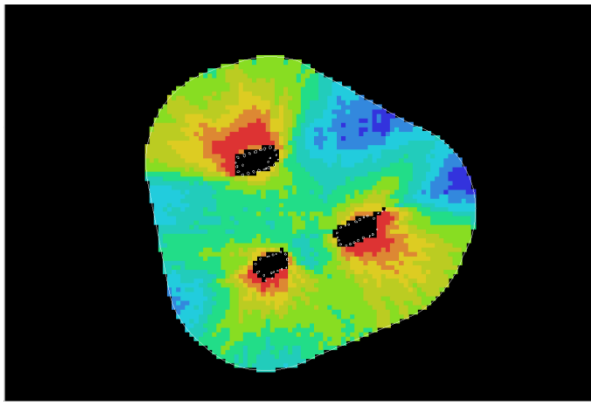

Visual Mean Depth


Visual Relativised Entropy

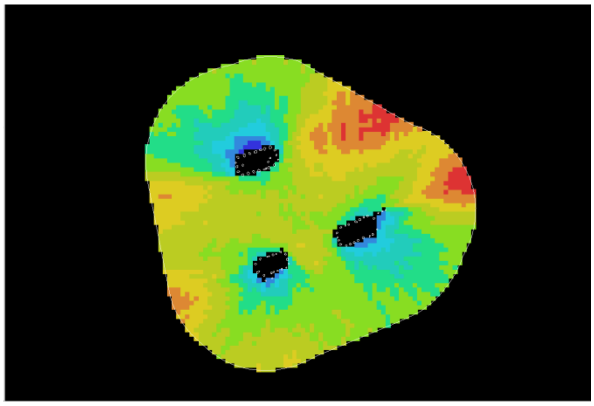
# Cheviot Quarry



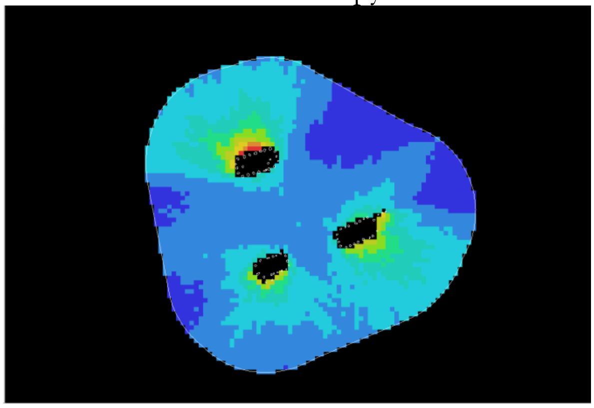
Connectivity



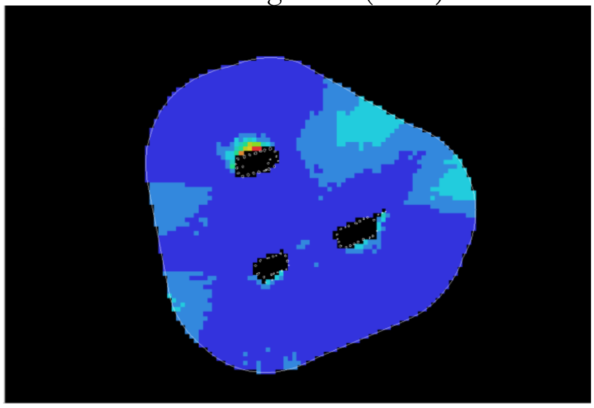
Visual Entropy



Visual Integration (TEK)

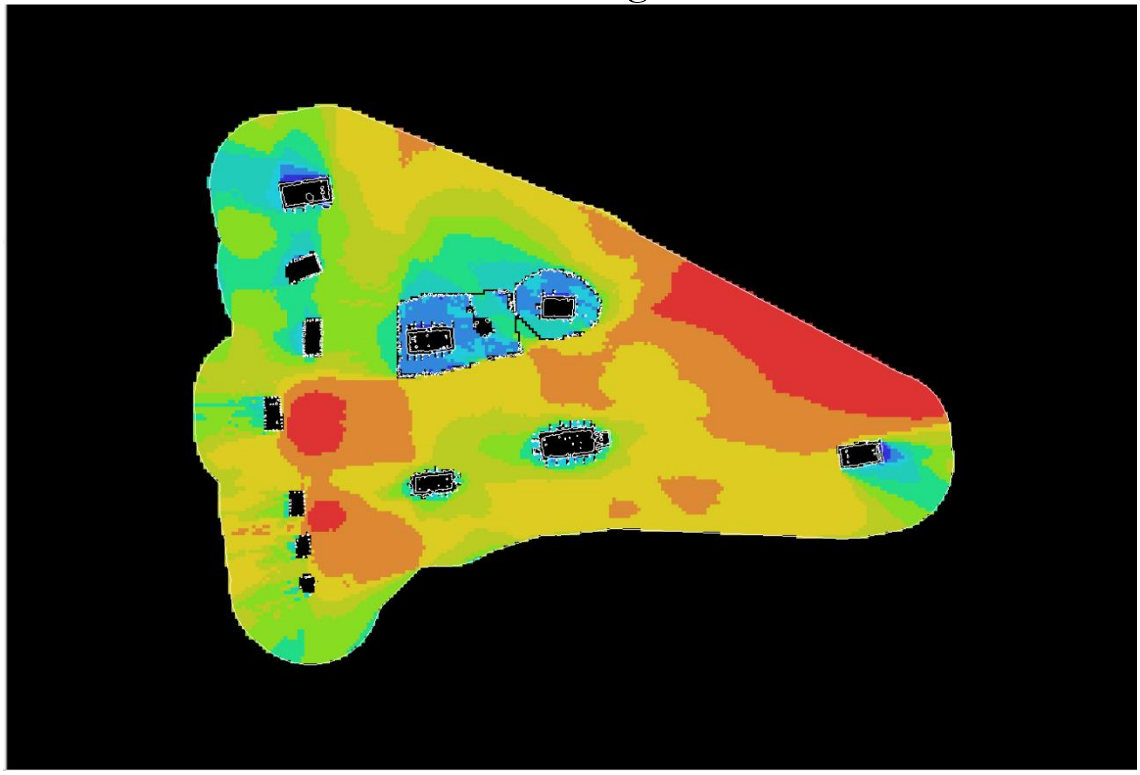


Visual Mean Depth

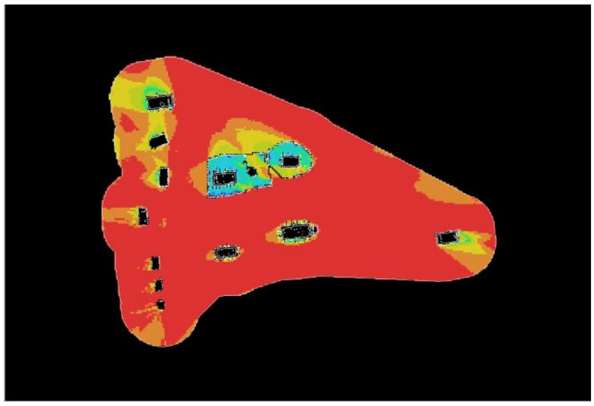


Visual Relativised Entropy

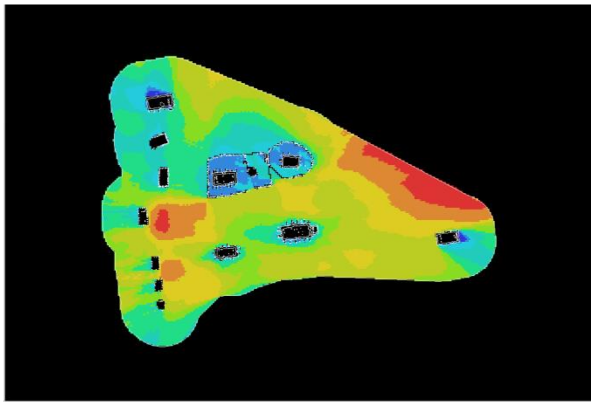
# Thirlings



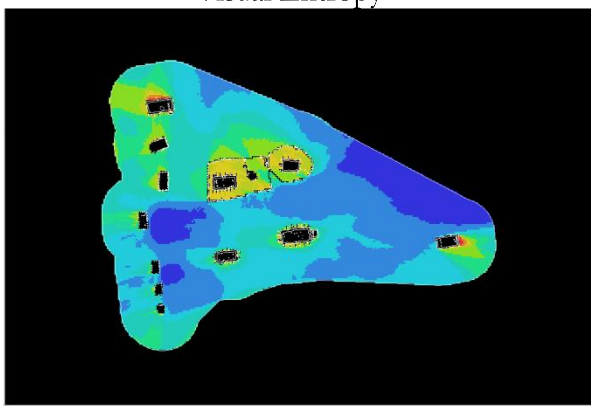
Connectivity



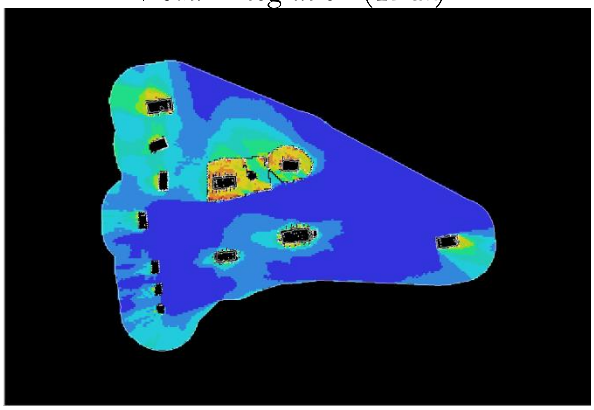
Visual Entropy



Visual Integration (TEK)

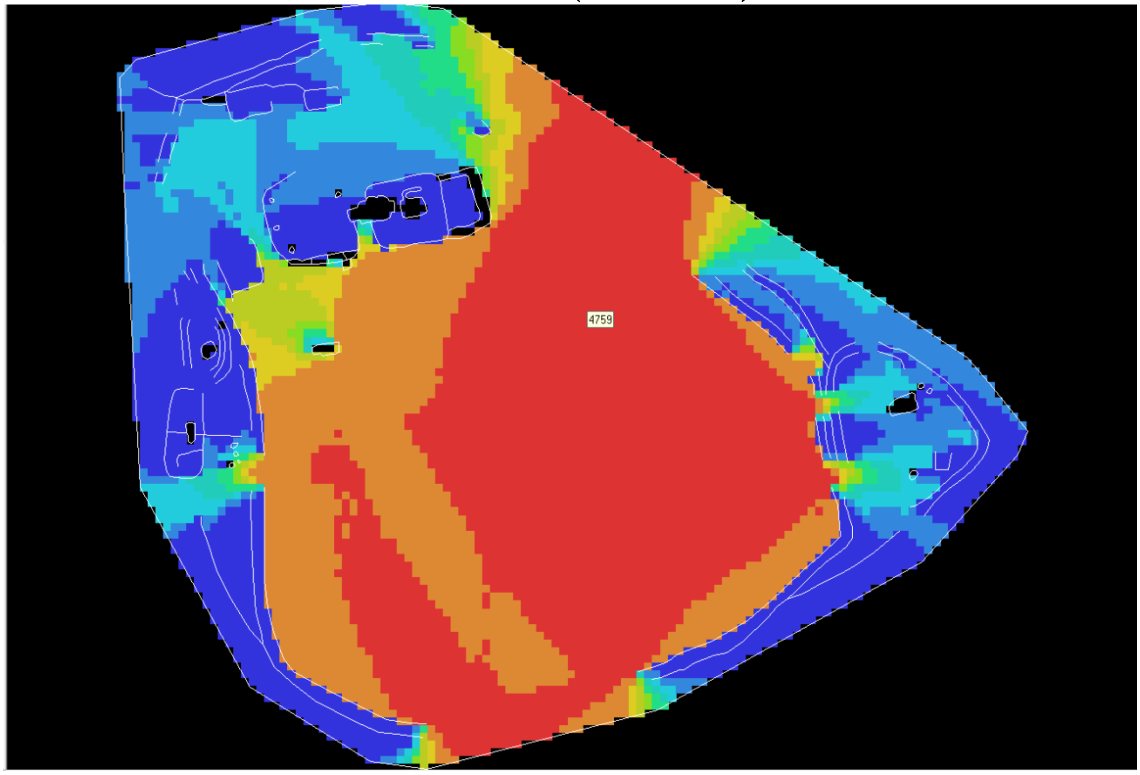


Visual Mean Depth

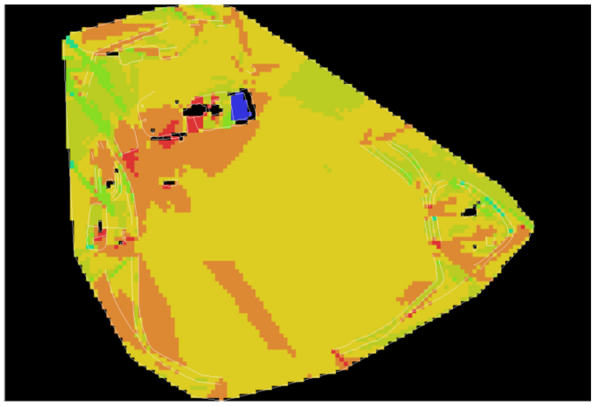


Visual Relativised Entropy

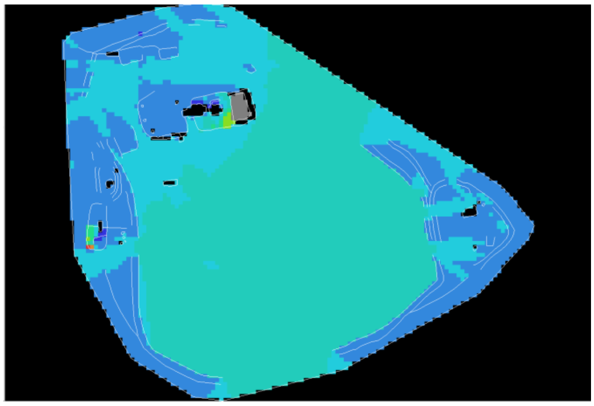
# Milfield (Maelmin)



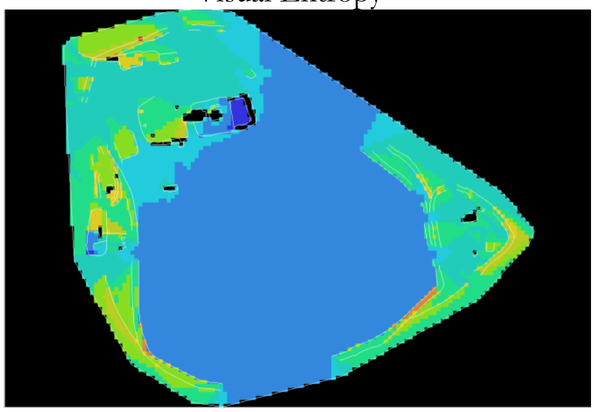

Connectivity



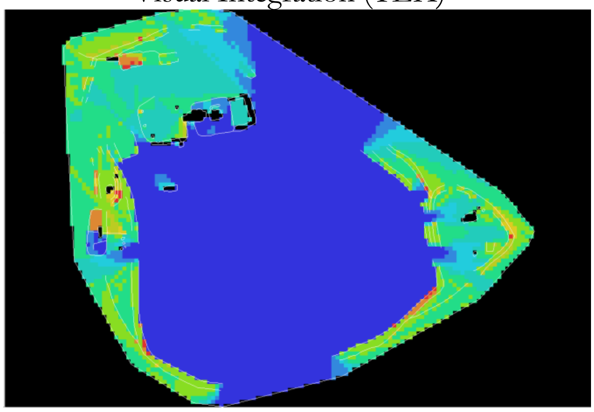
Visual Entropy



Visual Integration (TEK)

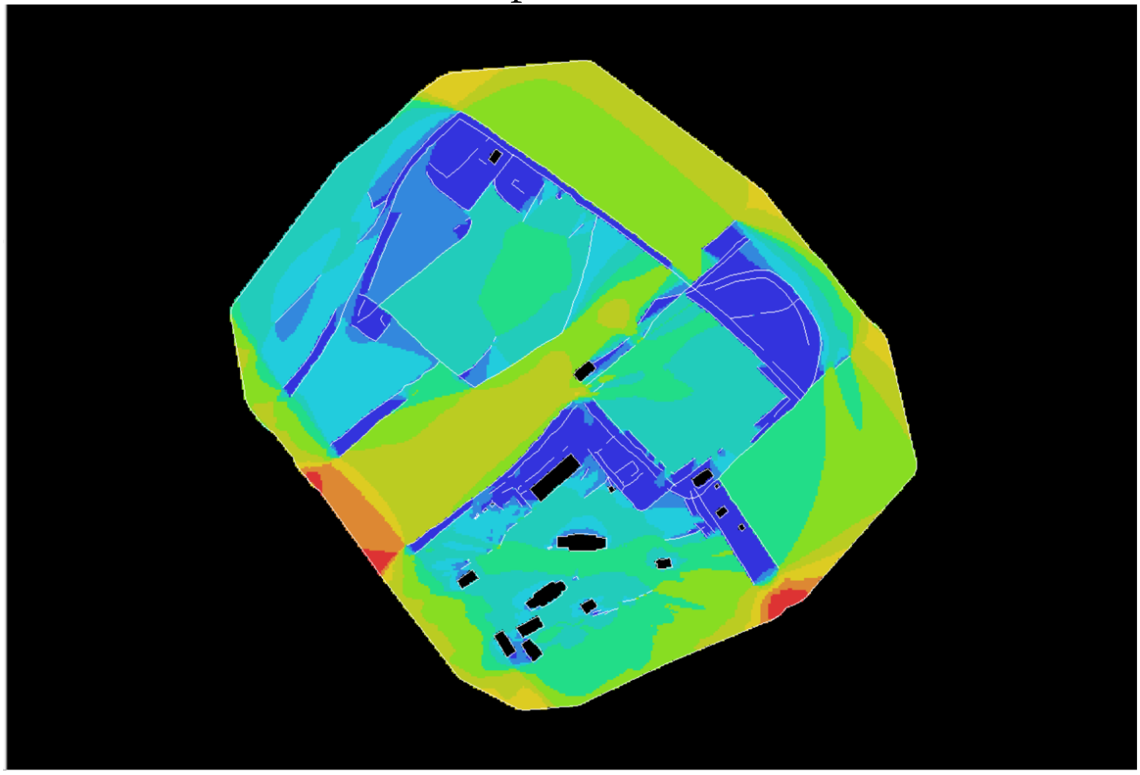


Visual Mean Depth

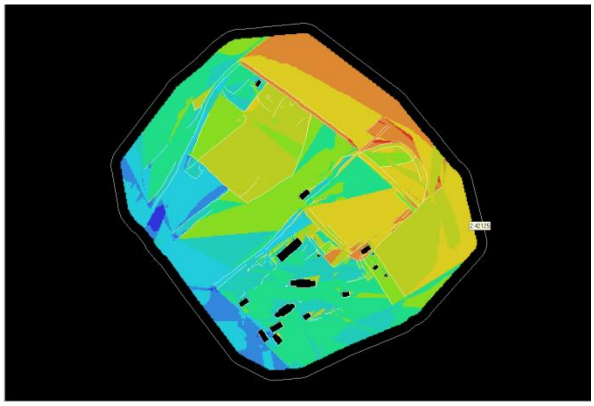


Visual Relativised Entropy

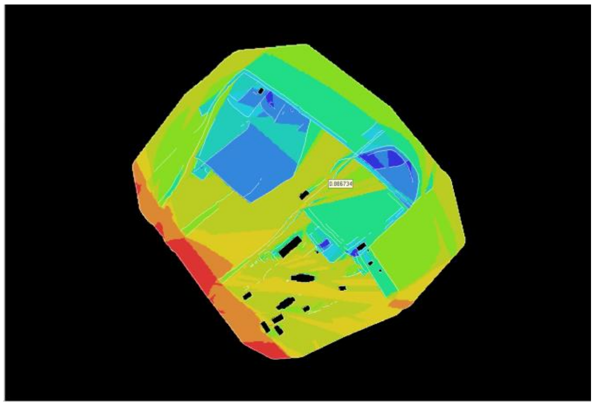
# Sprouston



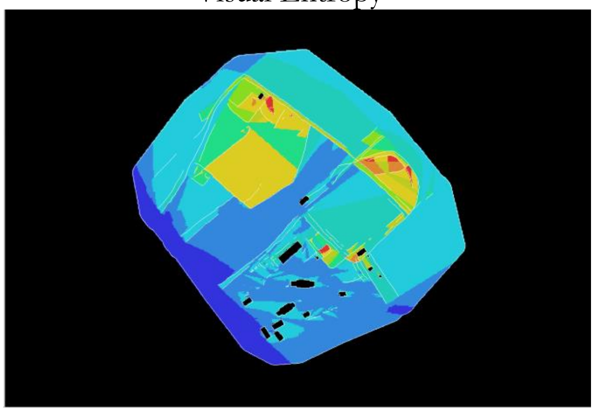
Connectivity



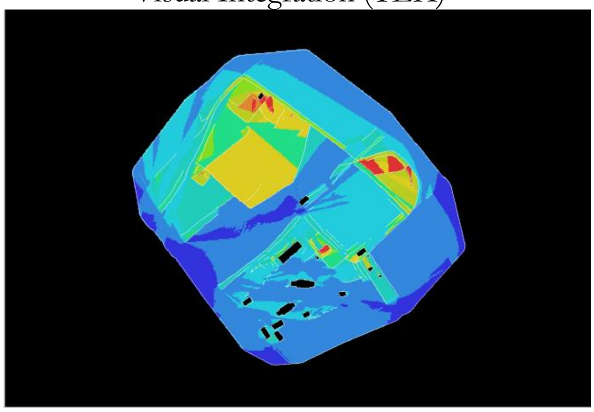
Visual Entropy



Visual Integration (TEK)



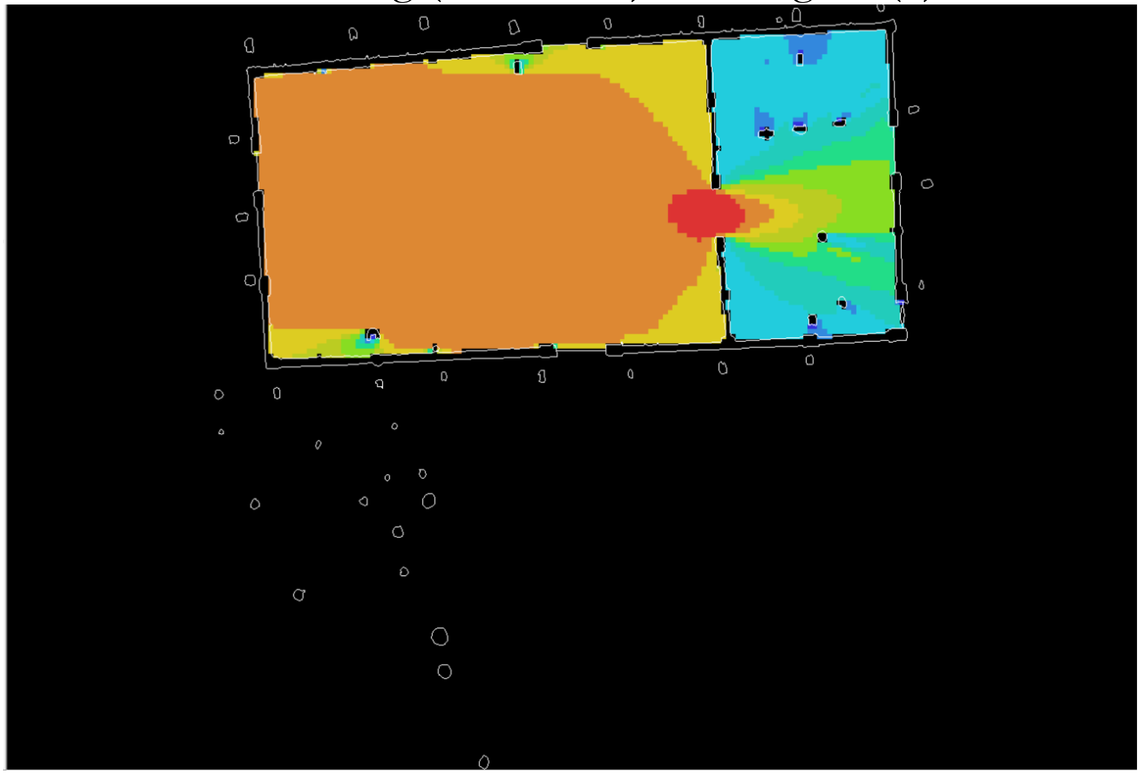
Visual Mean Depth



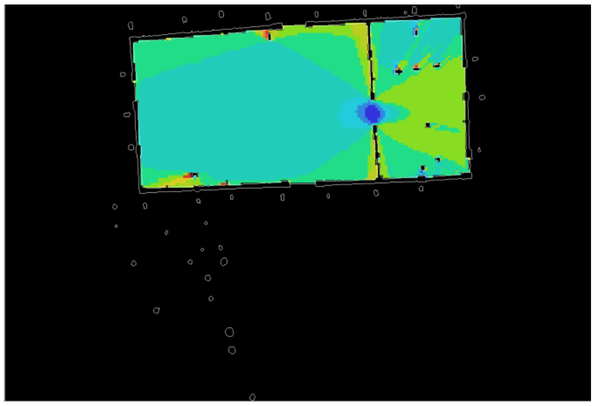
Visual Relativised Entropy

# NSR BUILDINGS

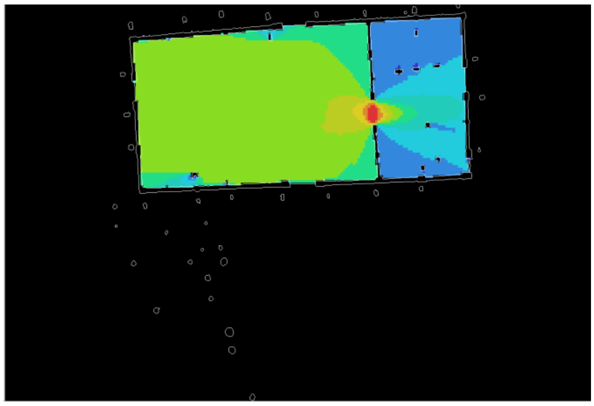
# Yeavering (Ad Gefrin) Building D4(b)



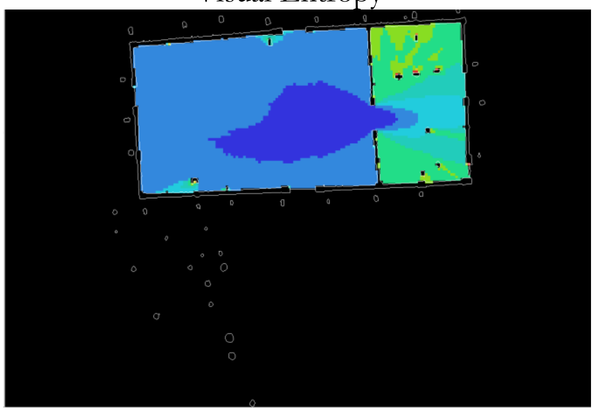
Connectivity



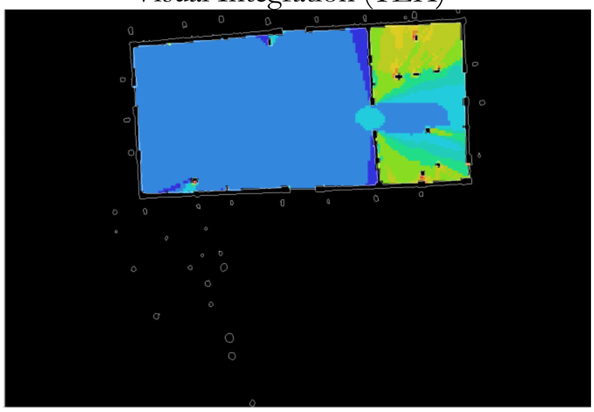
Visual Entropy



Visual Integration (TEK)

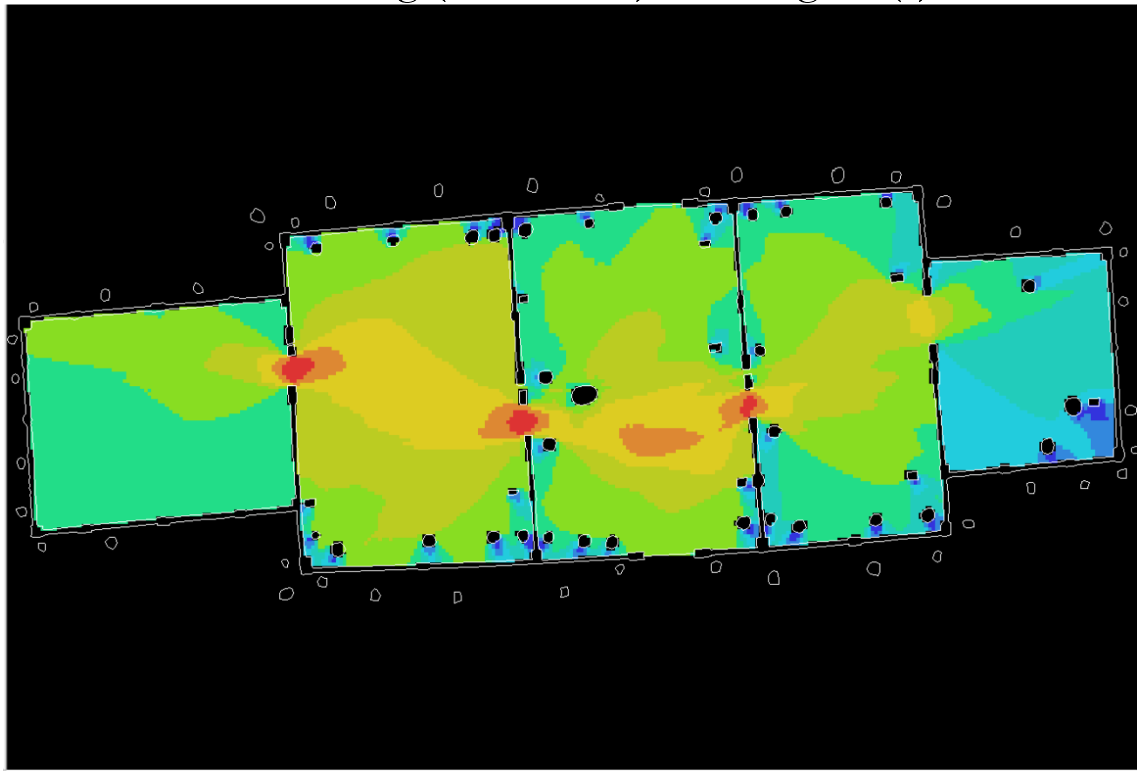


Visual Mean Depth

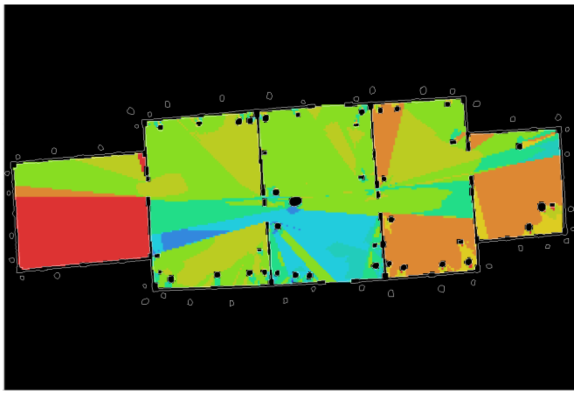


Visual Relativised Entropy

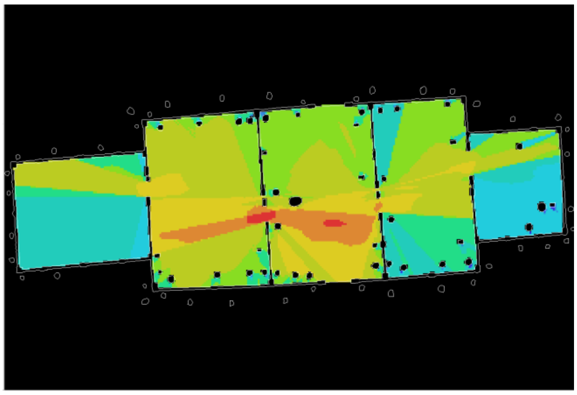
# Yeavering (Ad Gefrin) Building A3(a)



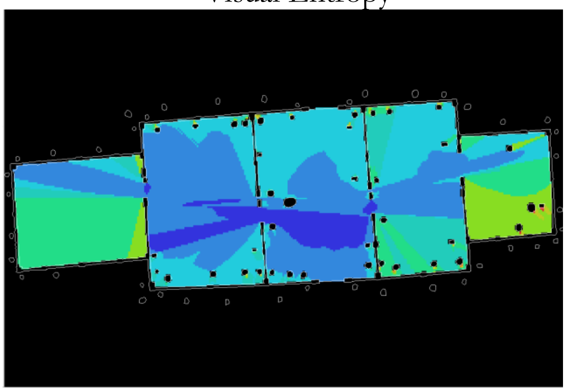
Connectivity



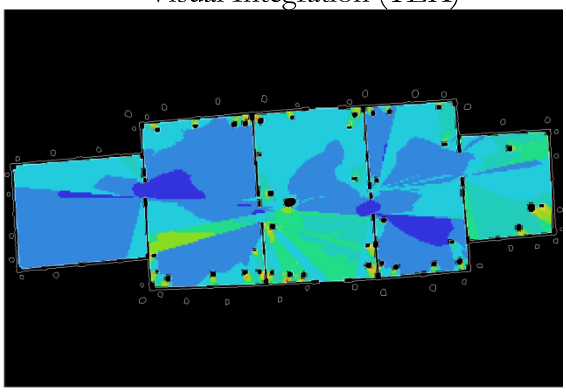
Visual Entropy



Visual Integration (TEK)

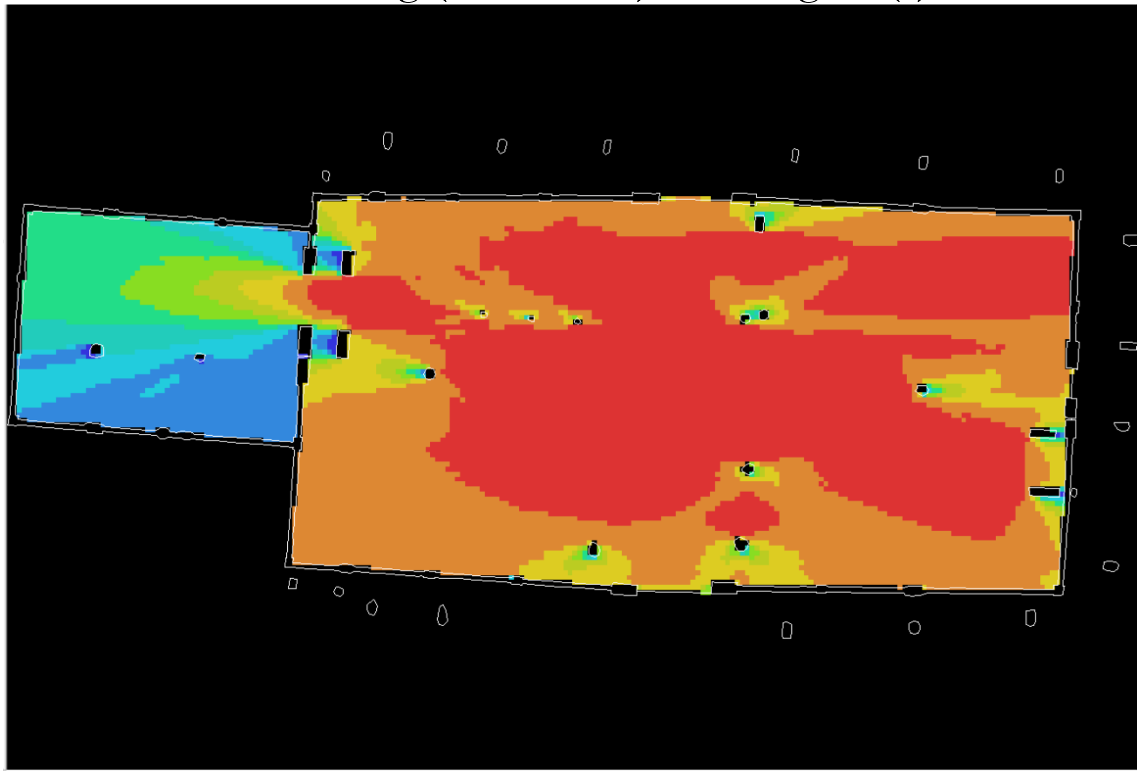


Visual Mean Depth

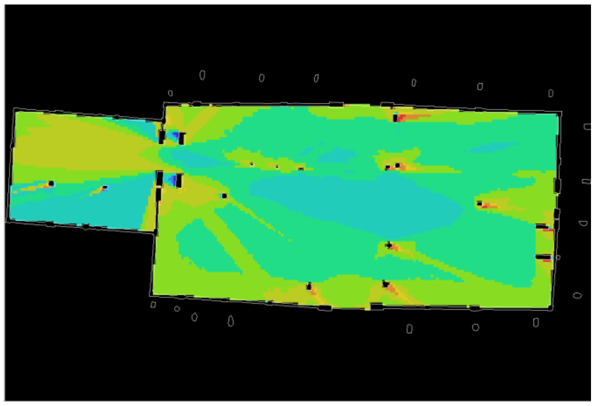


Visual Relativised Entropy

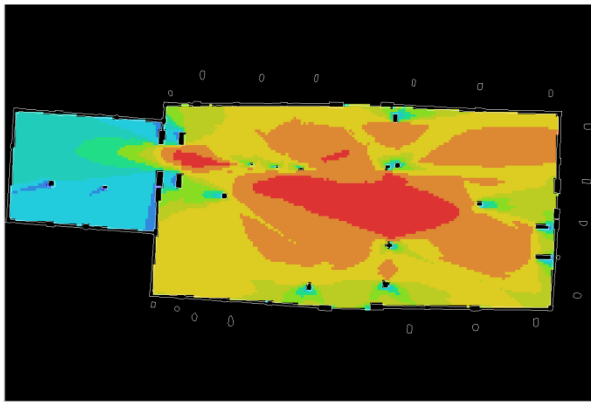
# Yeavering (Ad Gefrin) Building C4(a)



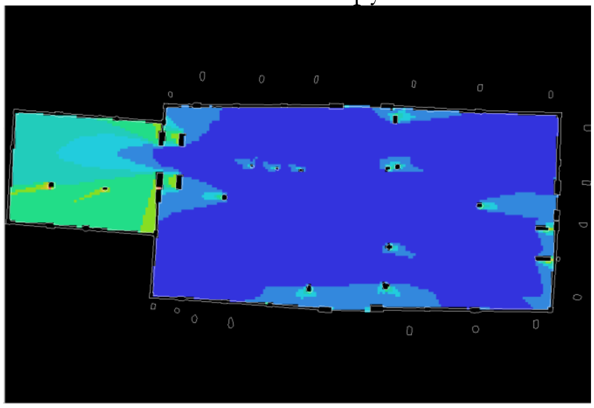
Connectivity



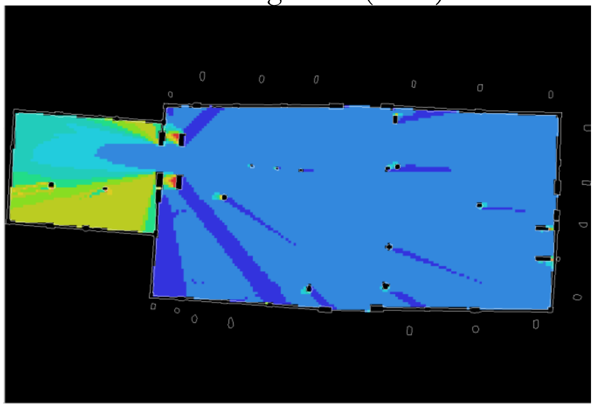
Visual Entropy



Visual Integration (TEK)

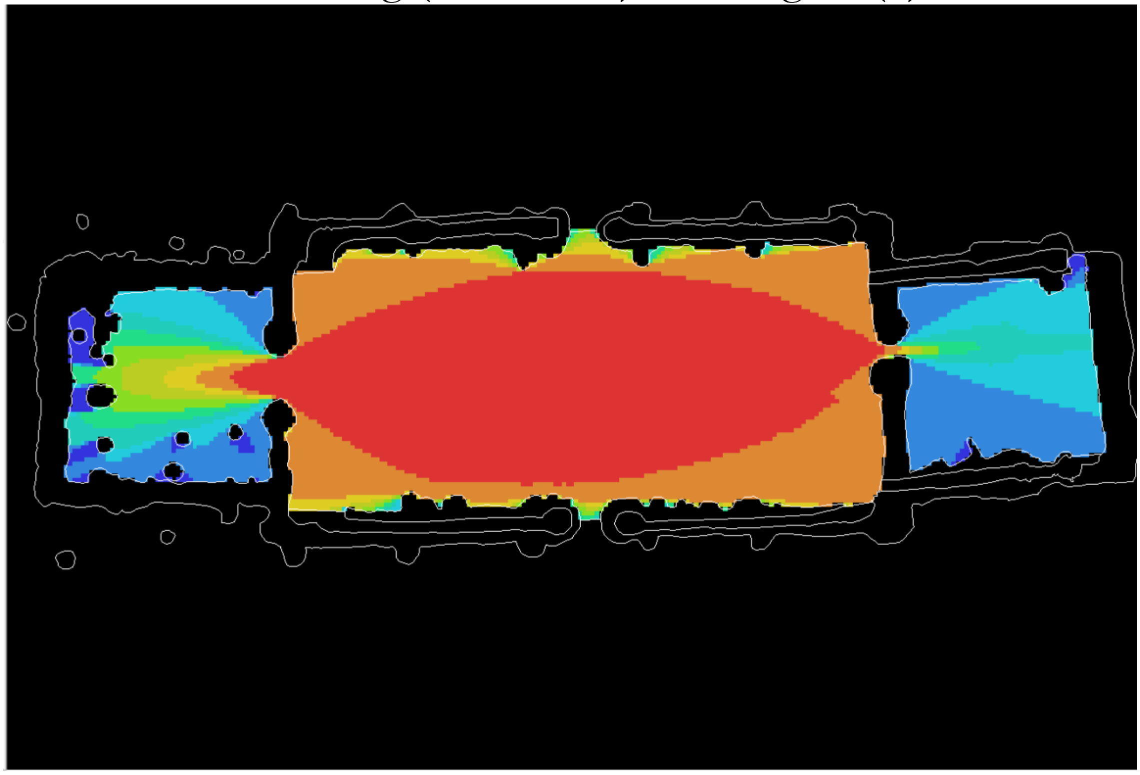


Visual Mean Depth

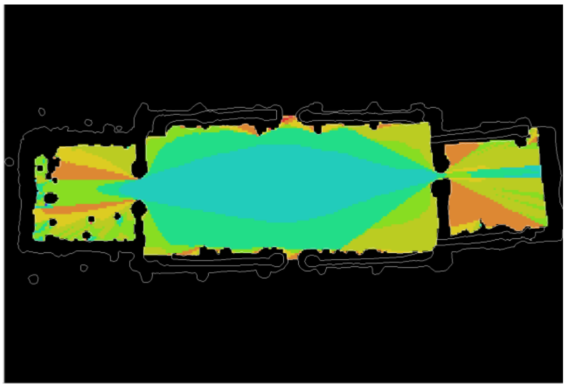


Visual Relativised Entropy

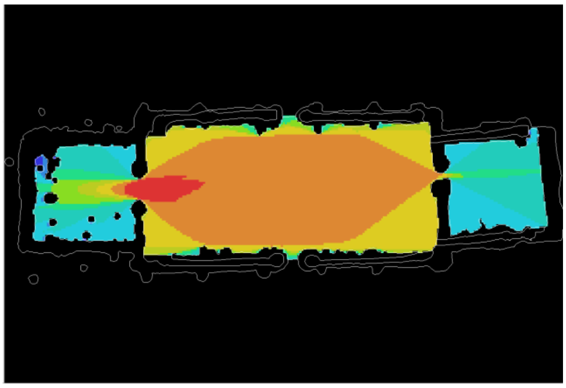
# Yeavering (Ad Gefrin) Building A1(b)



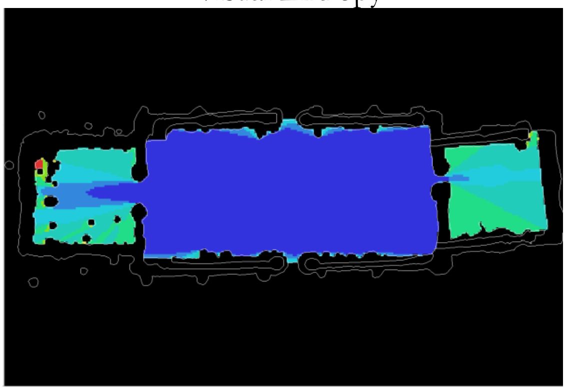
Connectivity



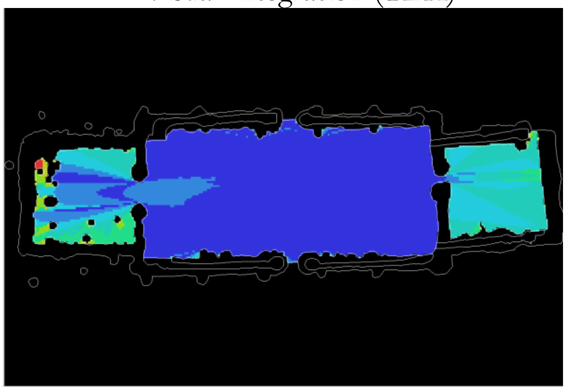
Visual Entropy



Visual Integration (TEK)



Visual Mean Depth



Visual Relativised Entropy

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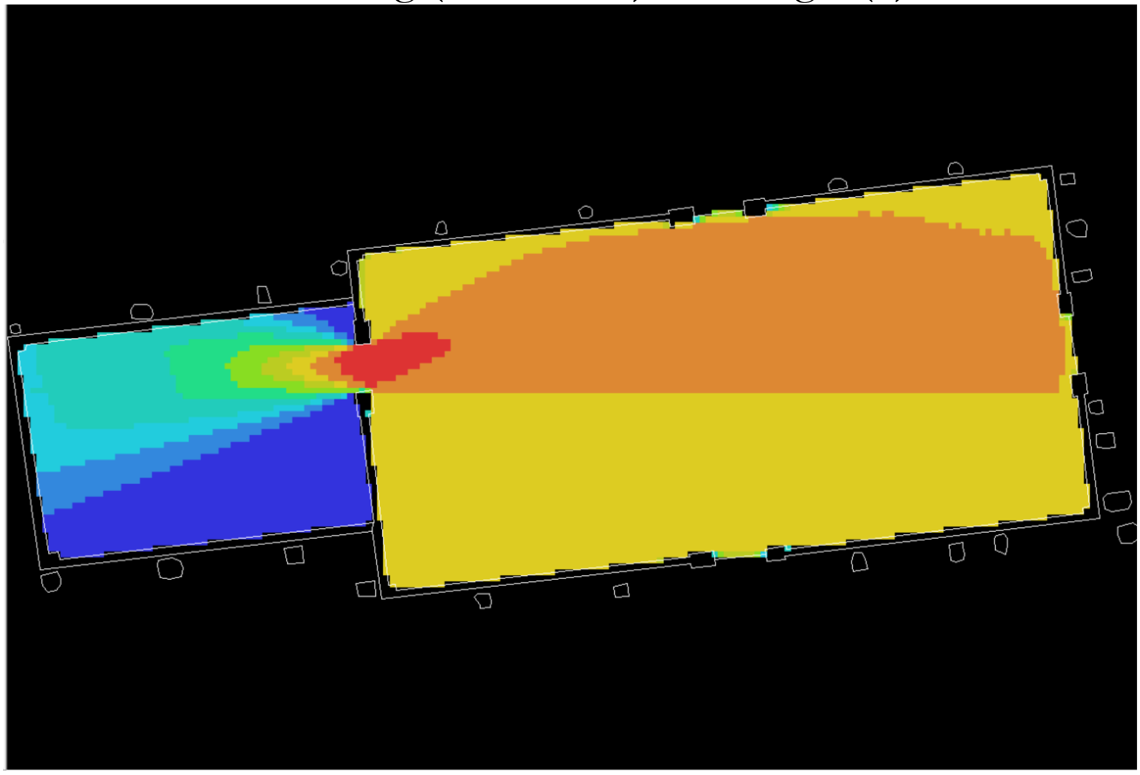
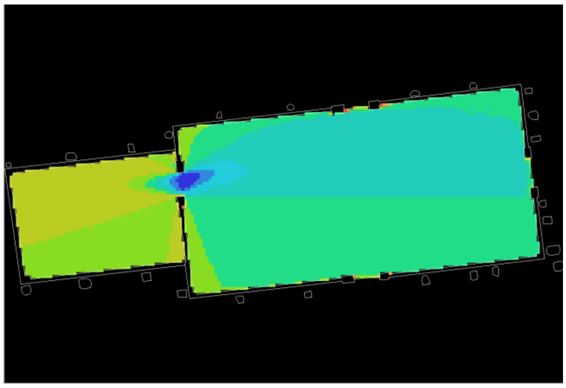
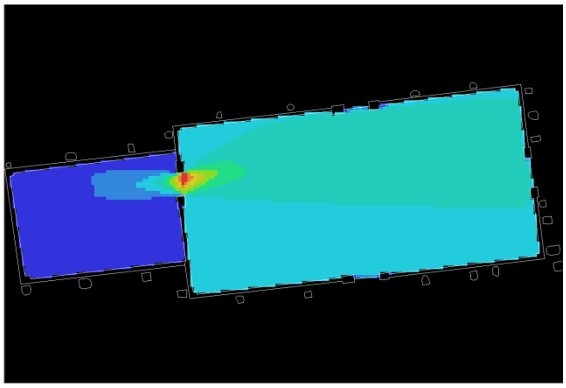


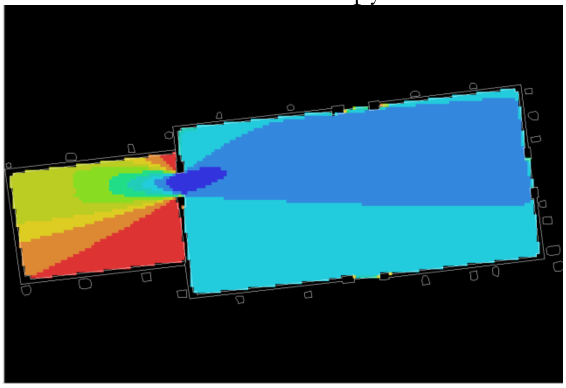
Connectivity



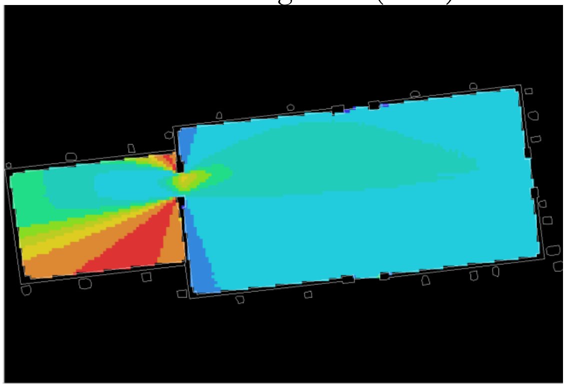
Visual Entropy



Visual Integration (TEK)

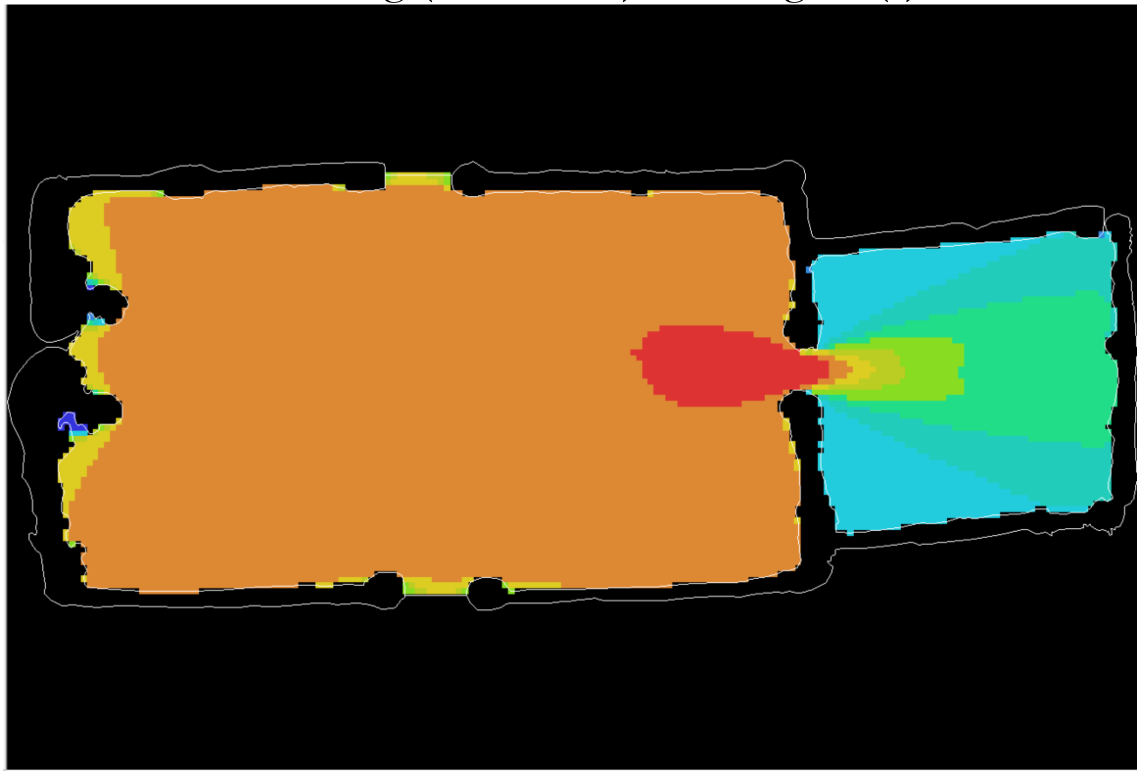


Visual Mean Depth

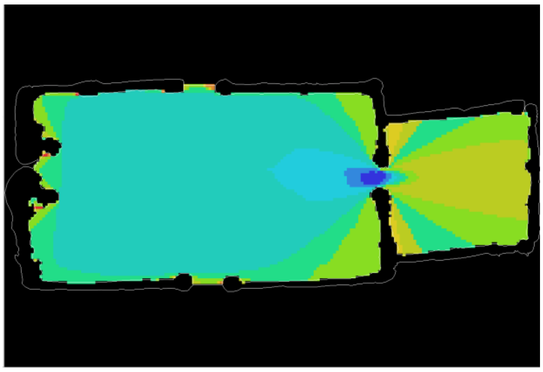


Visual Relativised Entropy

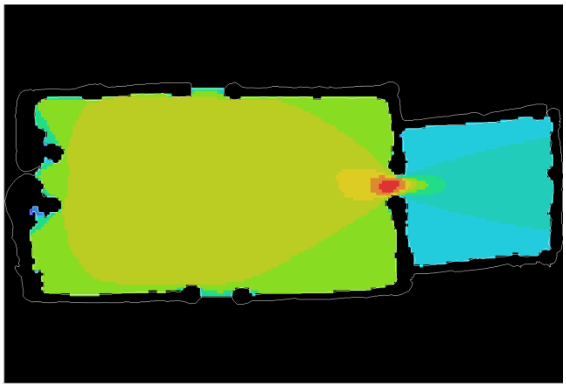
# Yeavering (Ad Gefrin) Building A1(c)



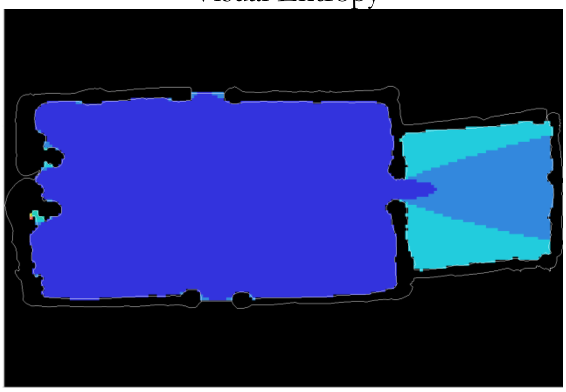
Connectivity



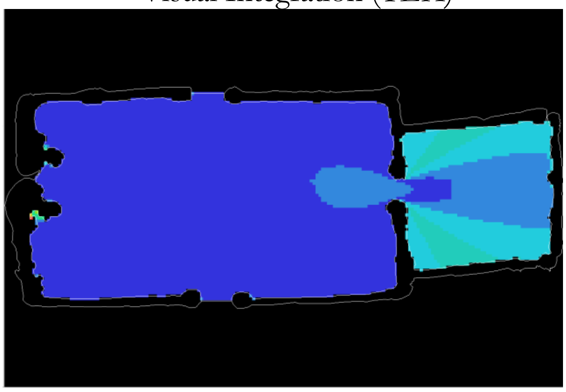
Visual Entropy



Visual Integration (TEK)

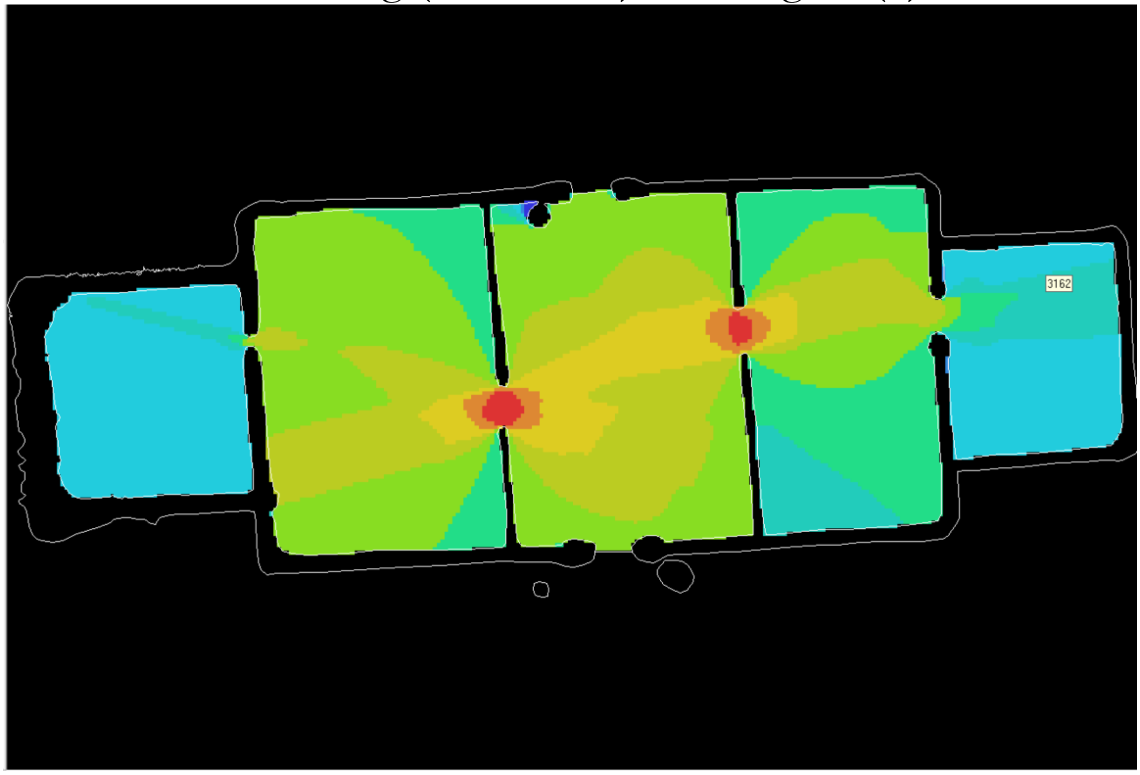


Visual Mean Depth

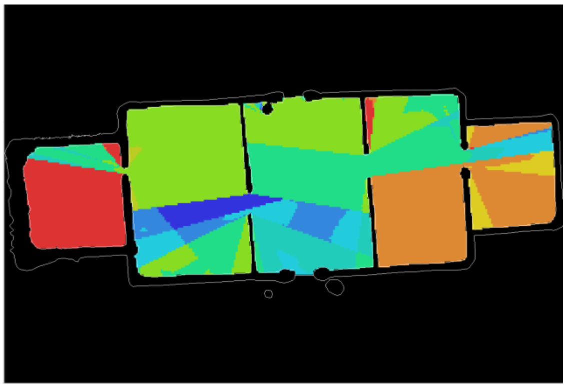


Visual Relativised Entropy

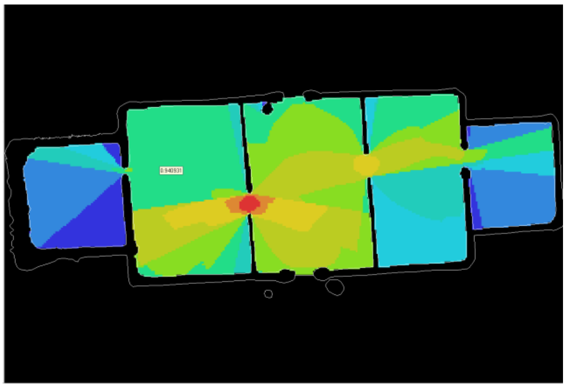
# Yeavering (Ad Gefrin) Building A3(b)



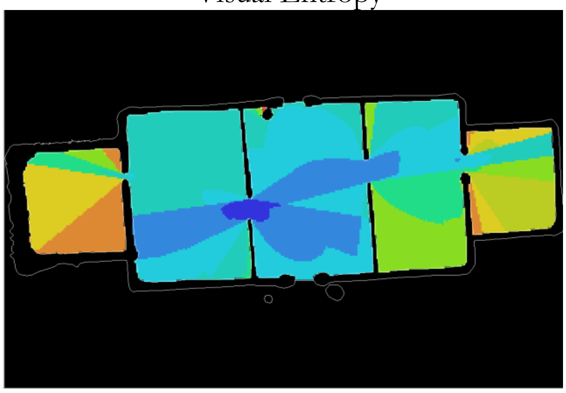

Connectivity



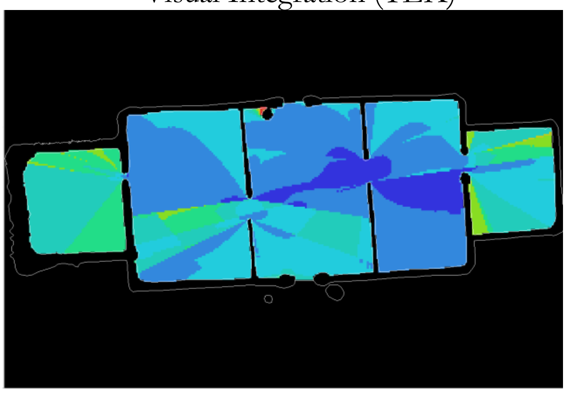
Visual Entropy



Visual Integration (TEK)

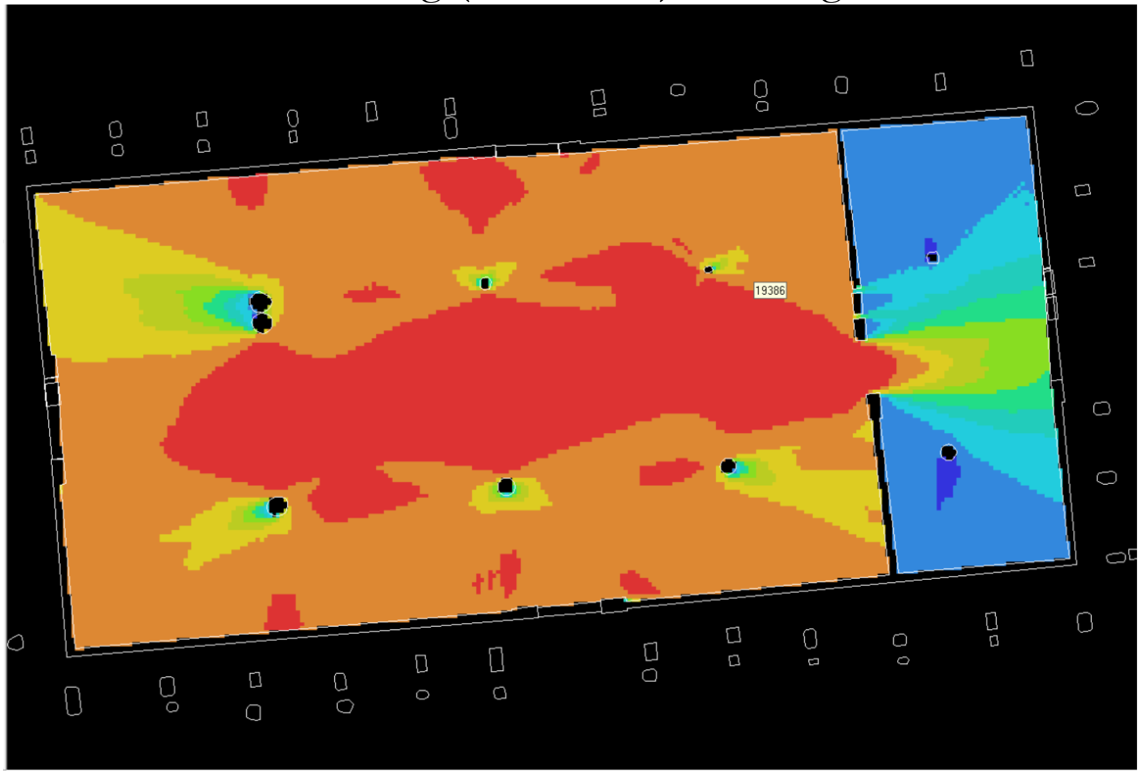


Visual Mean Depth

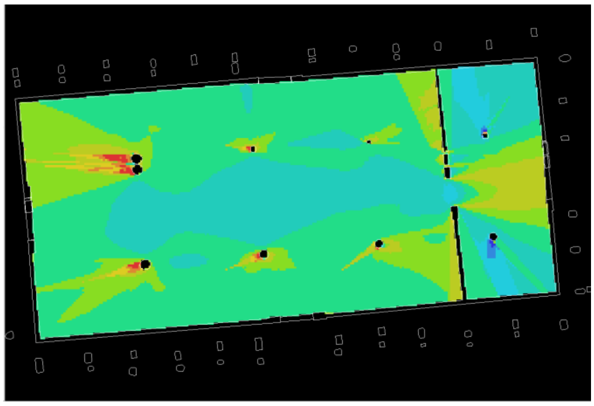


Visual Relativised Entropy

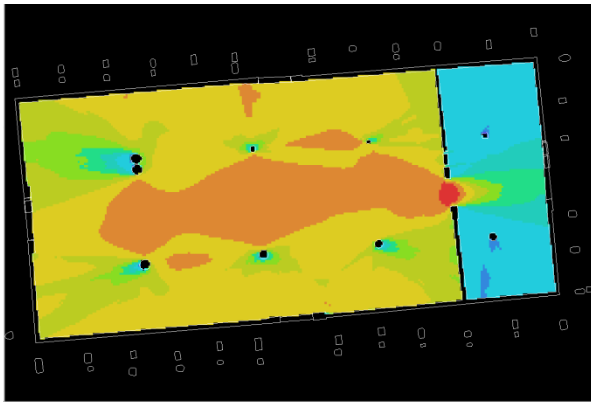
# Yeavering (Ad Gefrin) Building A4



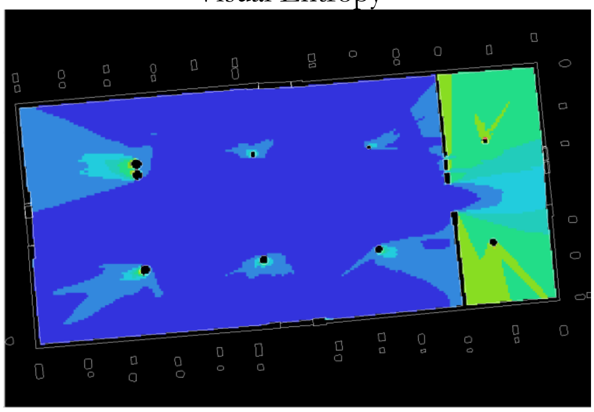

Connectivity



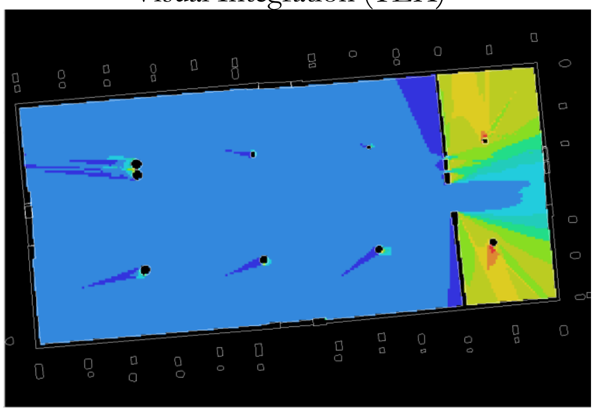
Visual Entropy



Visual Integration (TEK)

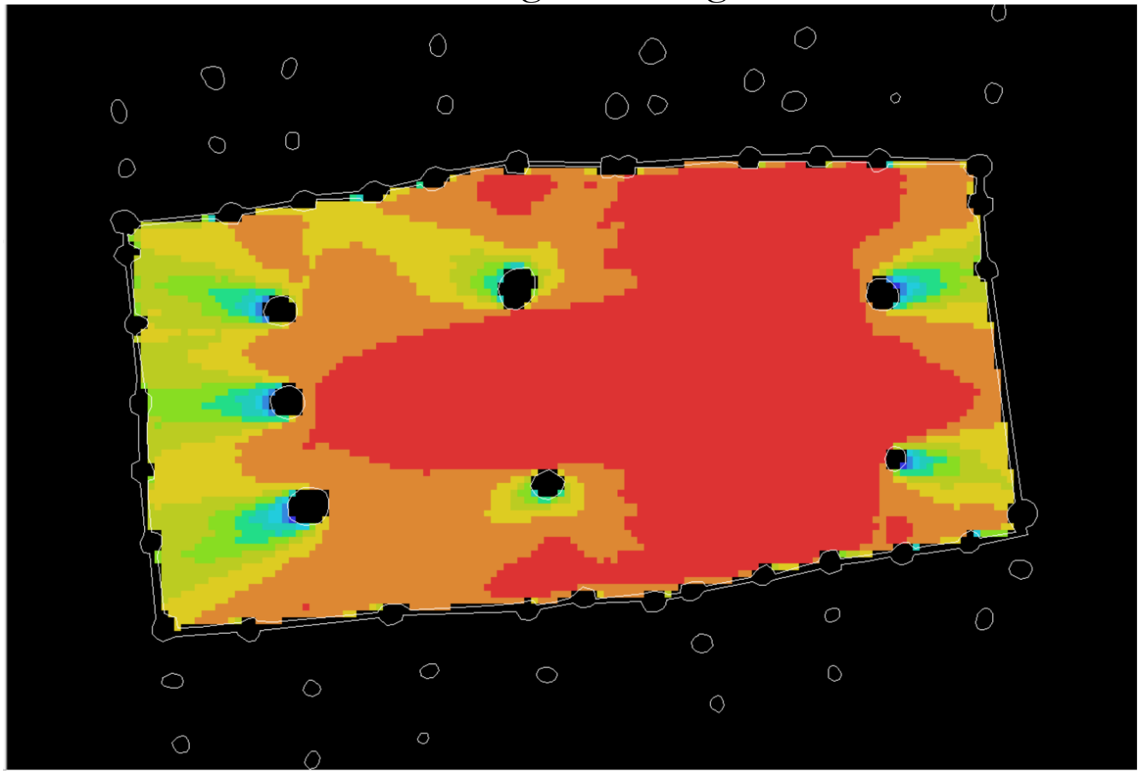


Visual Mean Depth

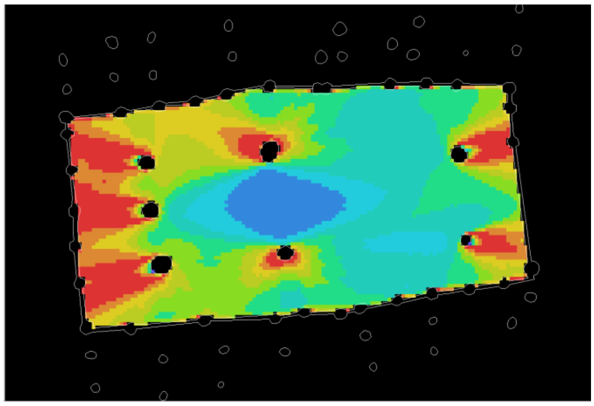


Visual Relativised Entropy

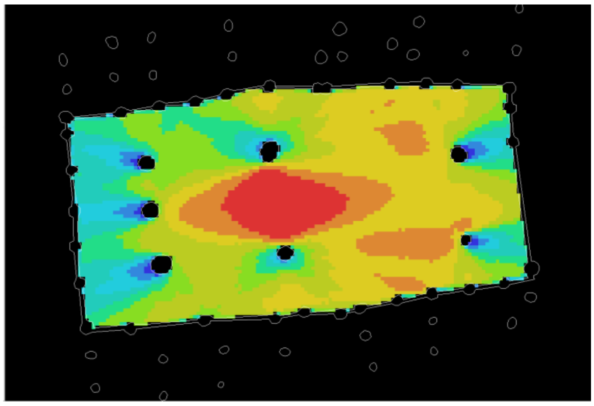
# Thirlings Building A



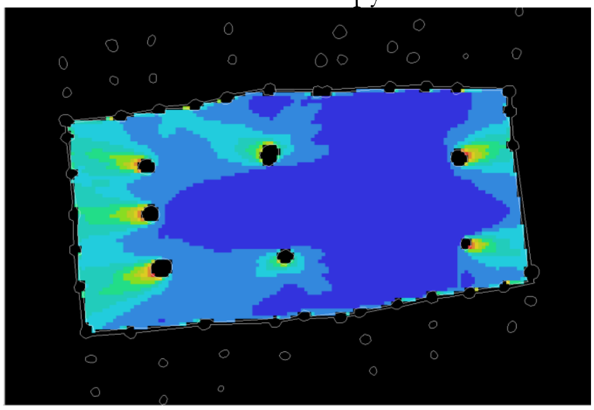
Connectivity



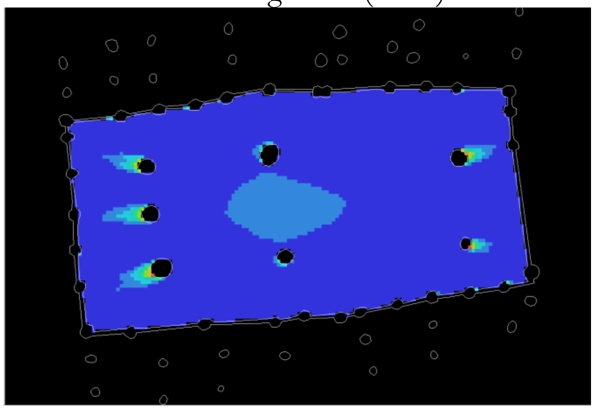
Visual Entropy



Visual Integration (TEK)

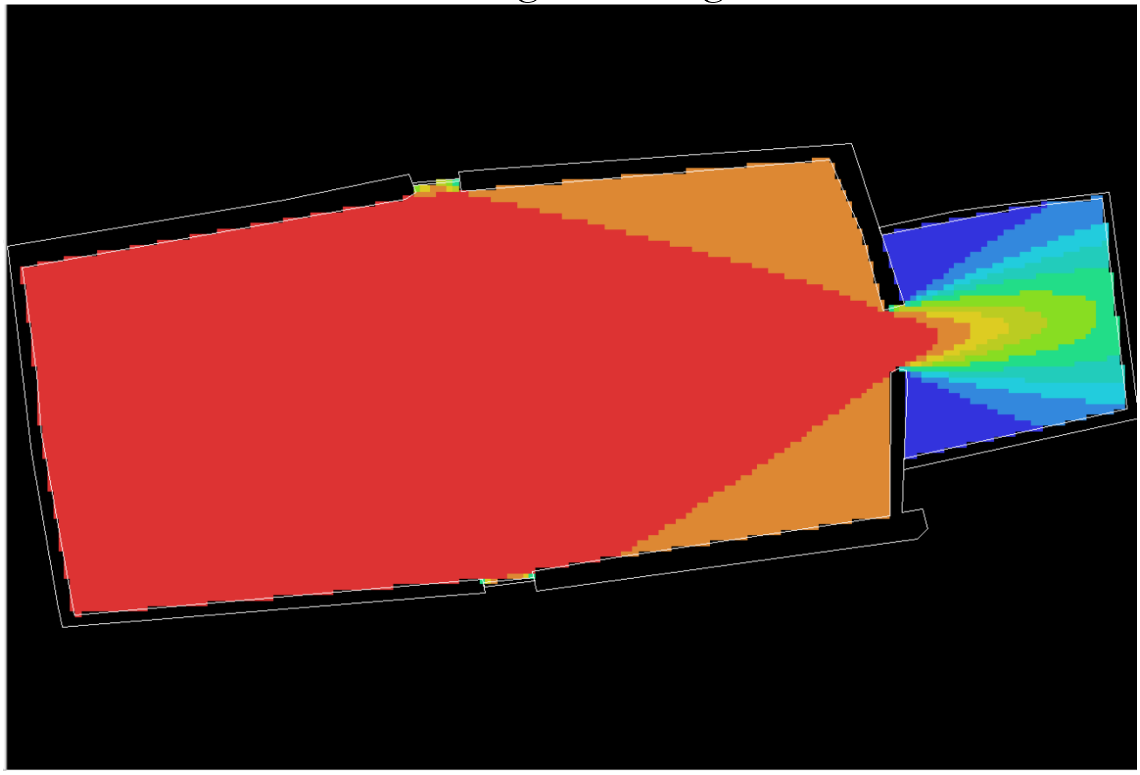


Visual Mean Depth

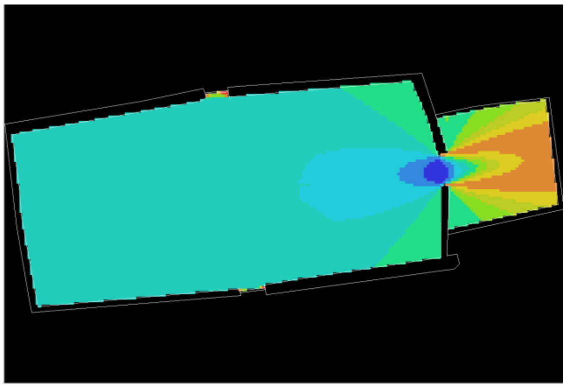


Visual Relativised Entropy

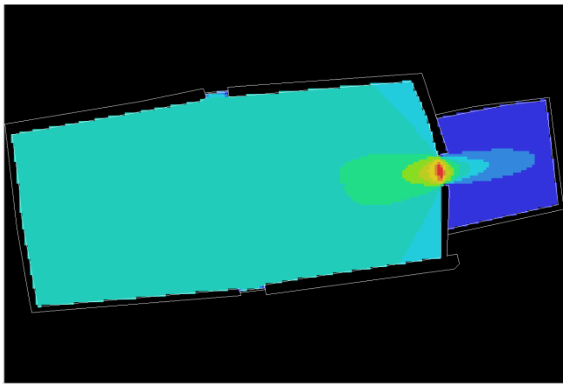
# Thirlings Building C



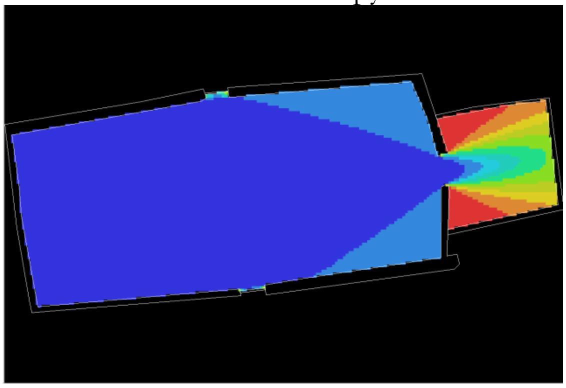
Connectivity



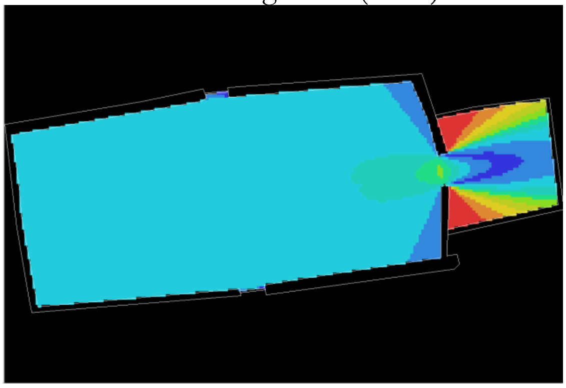
Visual Entropy



Visual Integration (TEK)



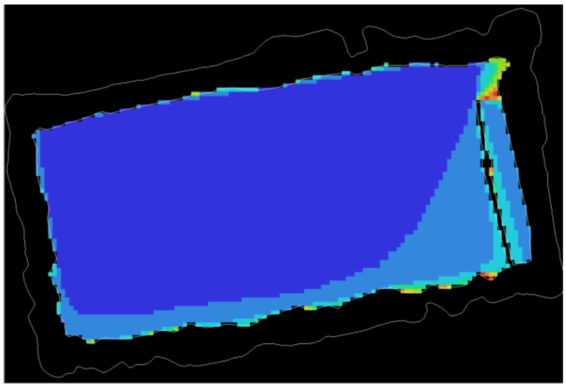
Visual Mean Depth



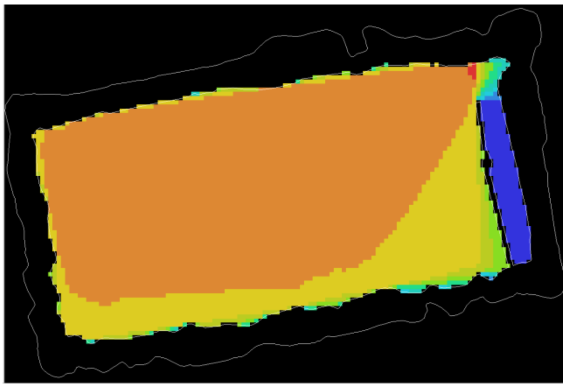
Visual Relativised Entropy

# Thirlings Building N

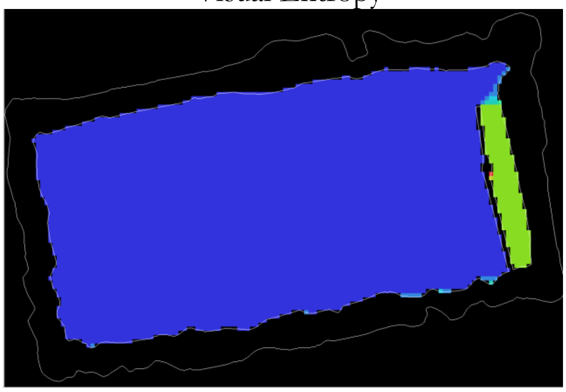
Connectivity



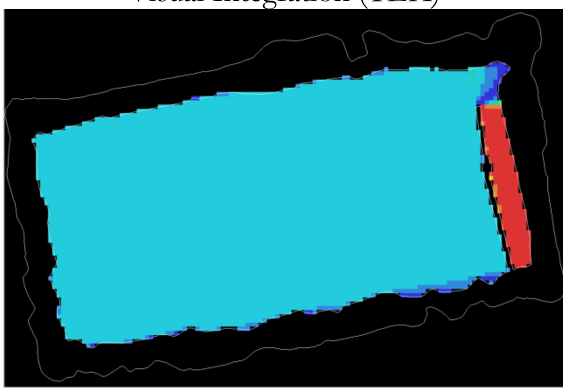
Visual Entropy



Visual Integration (TEK)

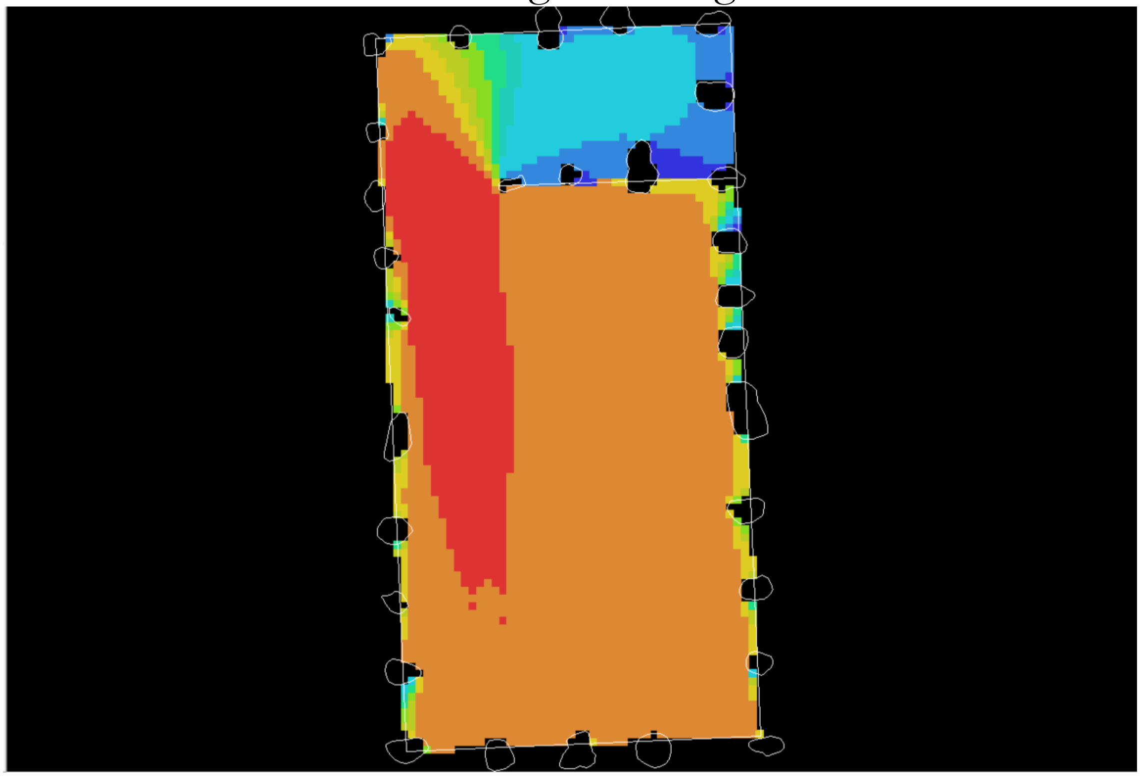


Visual Mean Depth

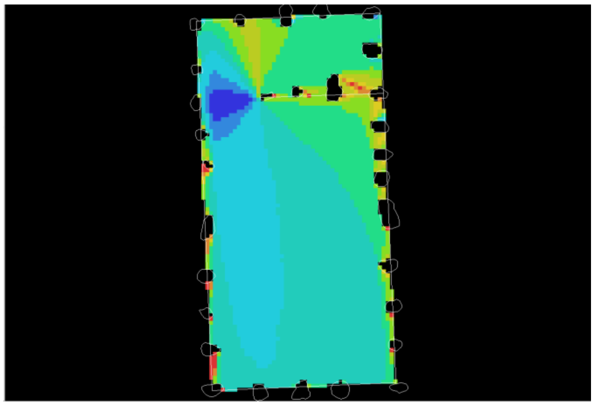


Visual Relativised Entropy

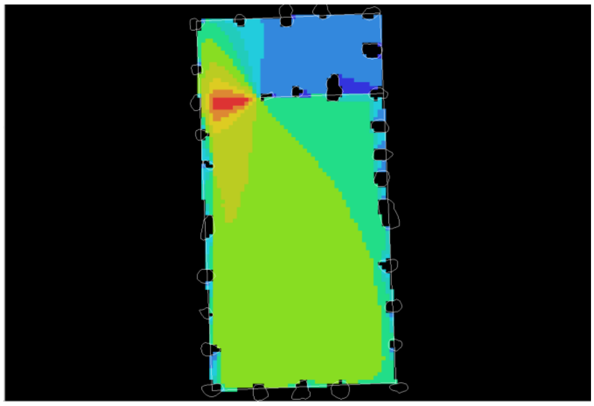
# Thirlings Building I



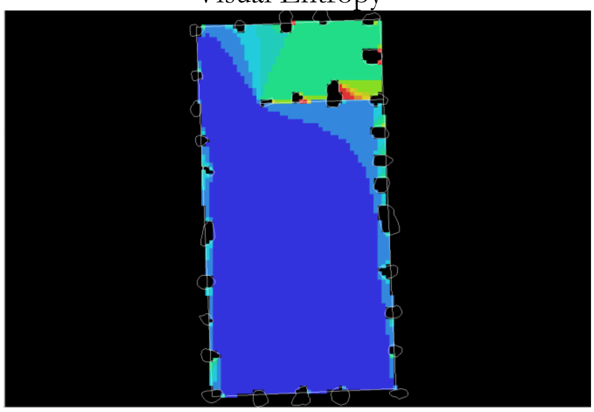
Connectivity



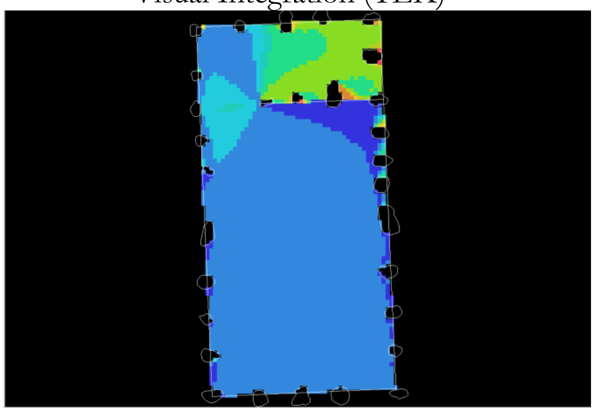
Visual Entropy



Visual Integration (TEK)



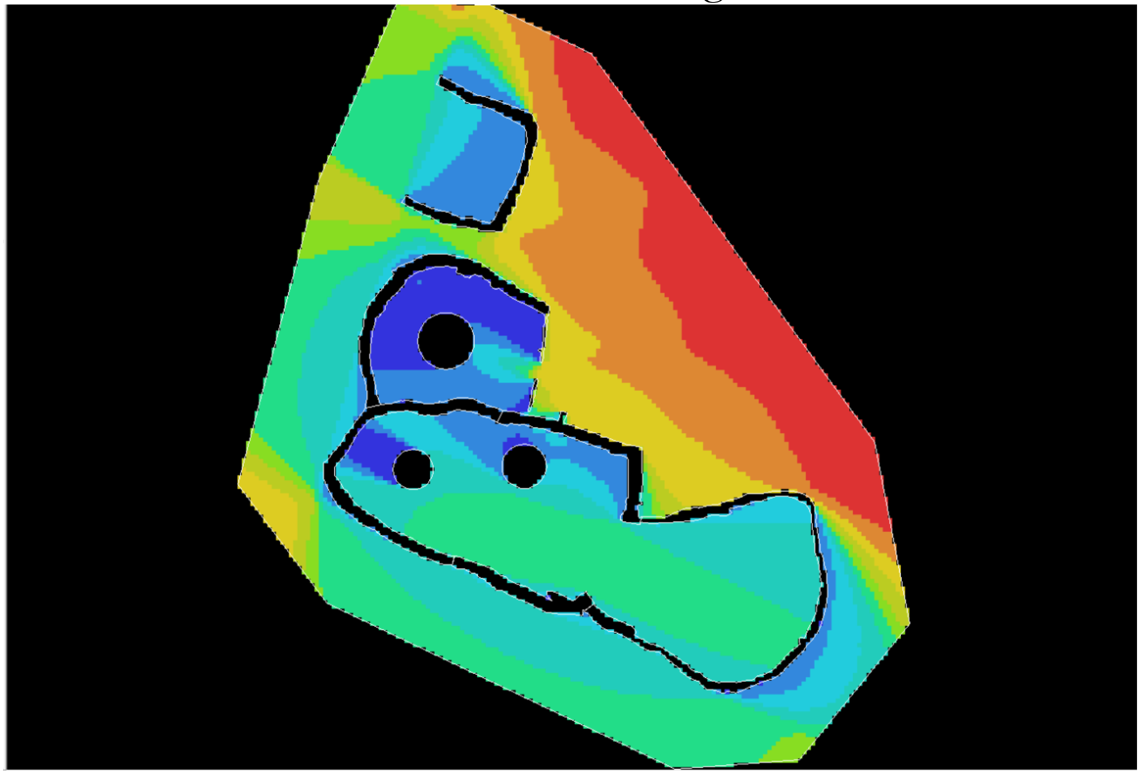
Visual Mean Depth

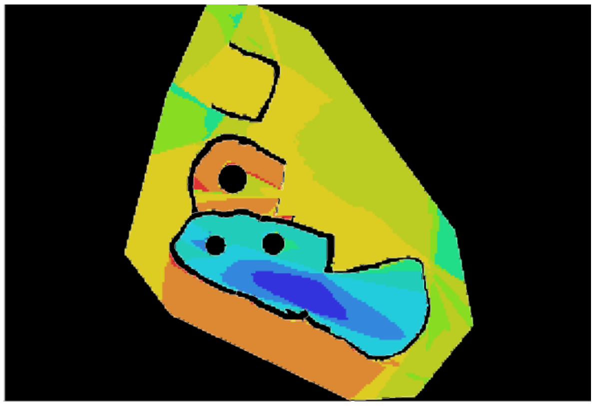


Visual Relativised Entropy

# YSR SETTLEMENTS

# Dalton Parlours Iron Age Phase 3


Connectivity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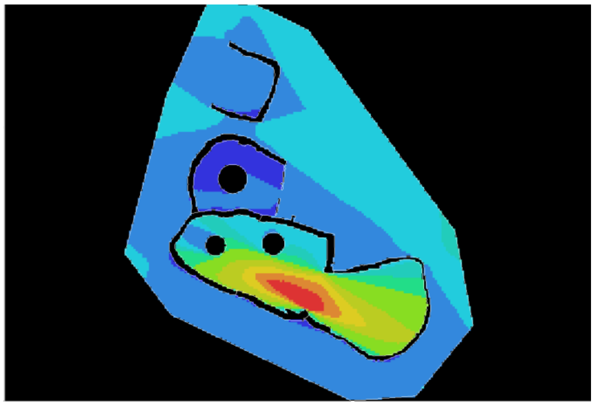
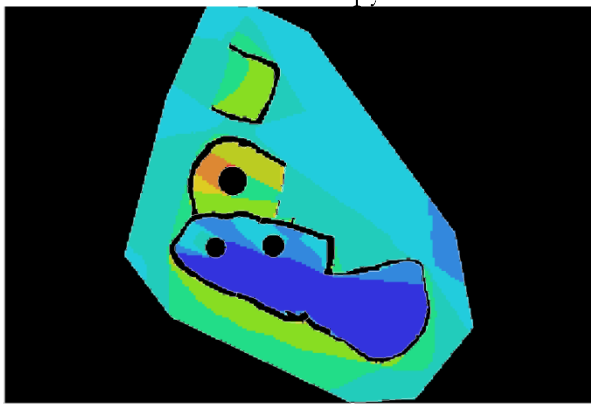

Visual Integration (TEK)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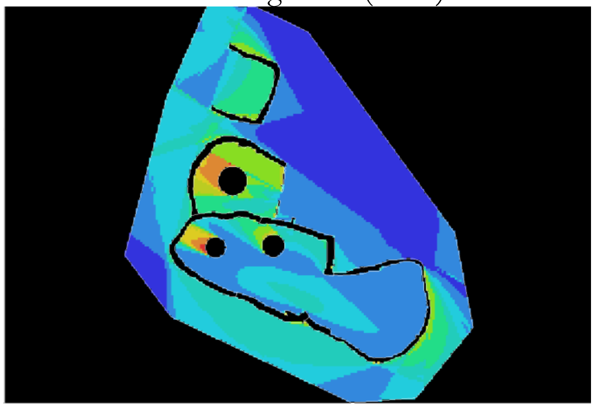
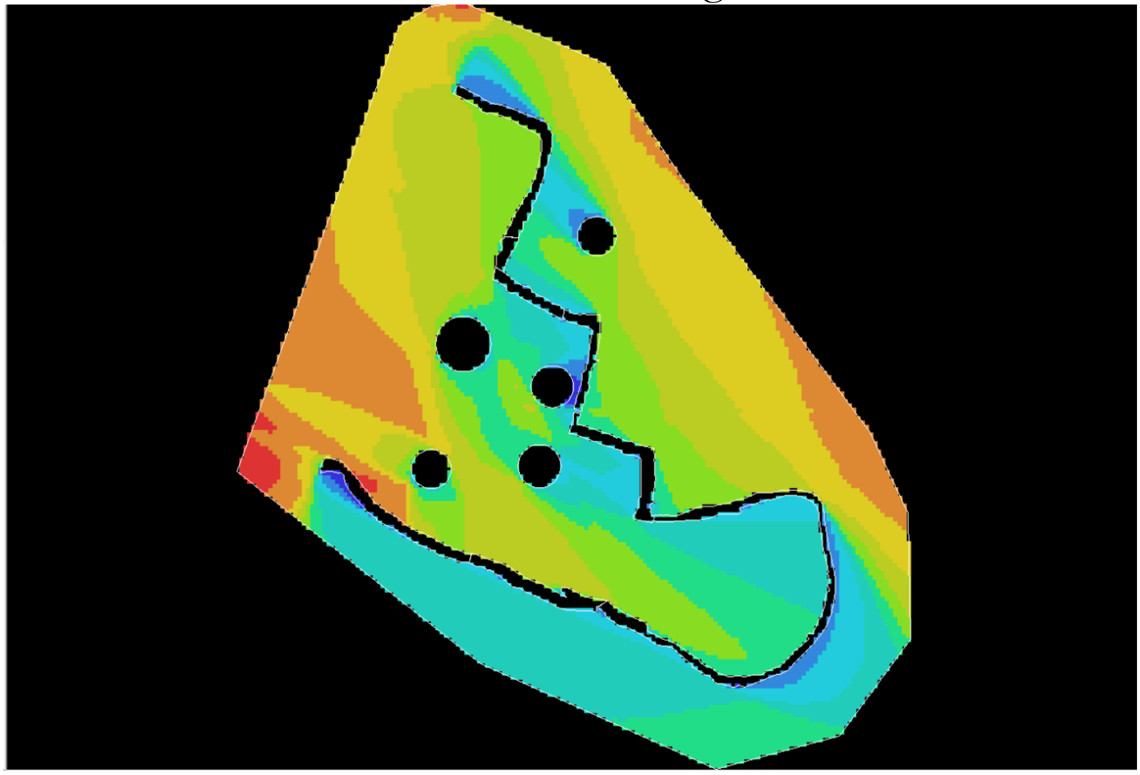

Visual Relativised Entropy

# Dalton Parlours Iron Age Phase 4



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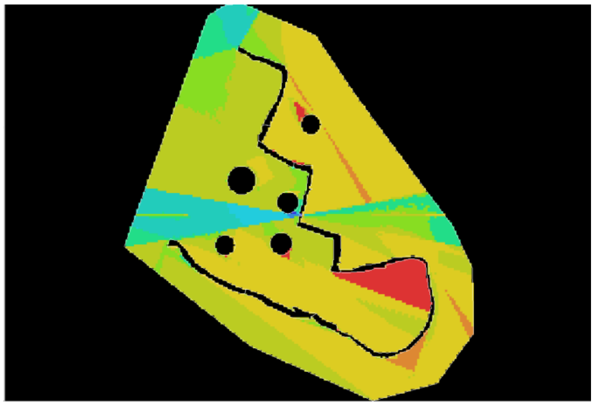
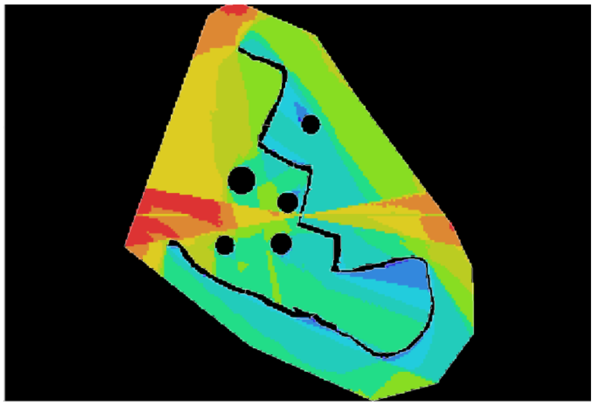


Visual Entropy



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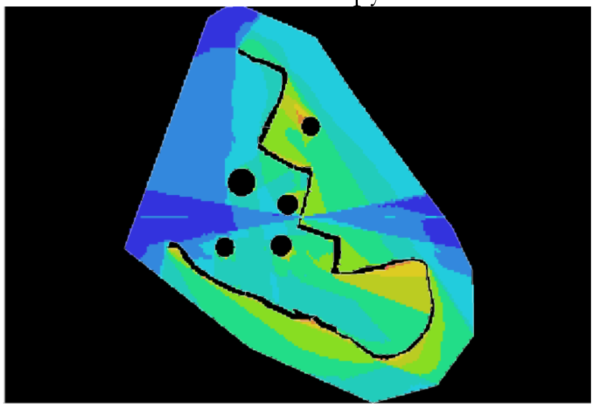

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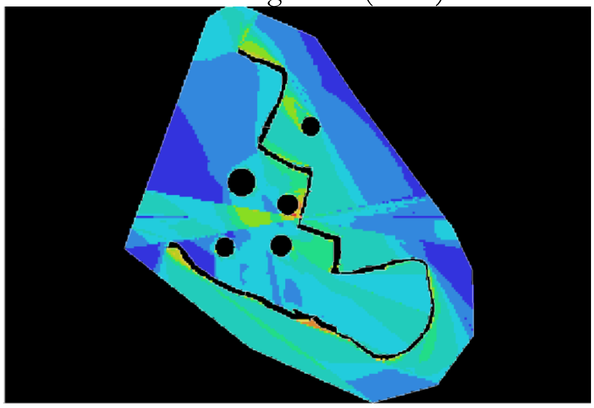
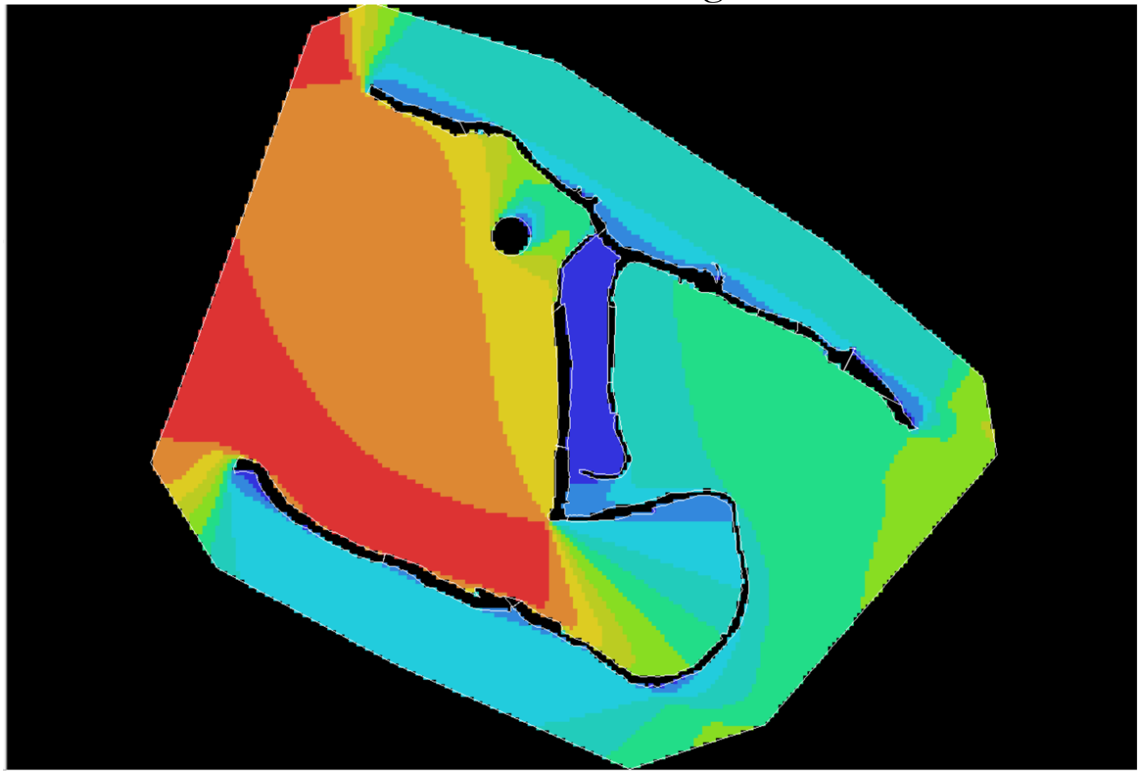
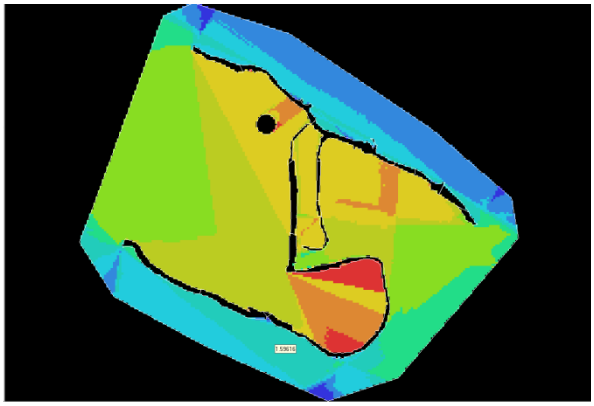


Visual Relativised Entropy

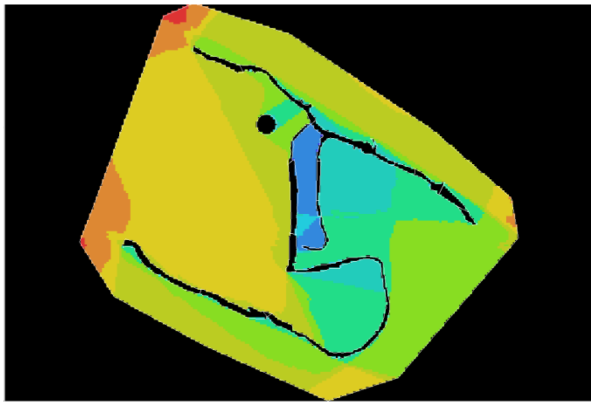
# Dalton Parlours Iron Age Phase 5



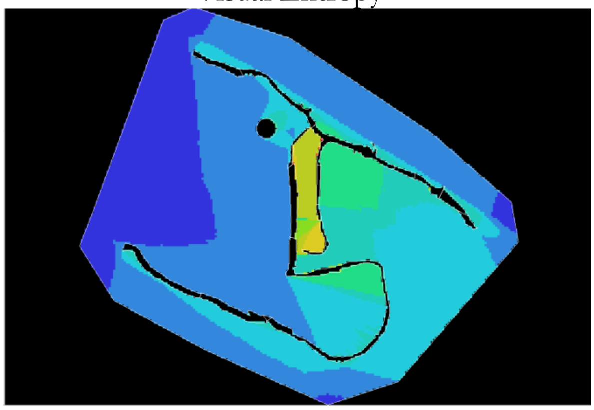
Connectivity



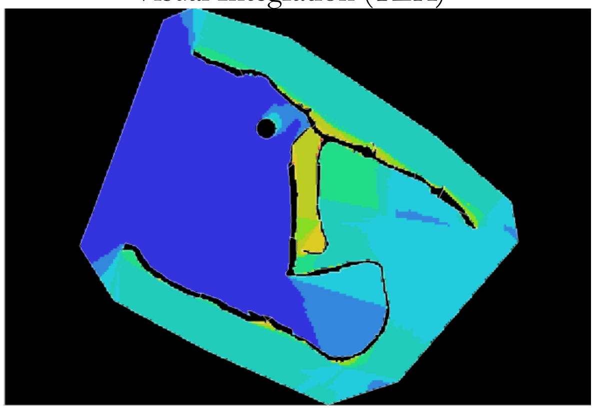
Visual Entropy



Visual Integration (TEK)

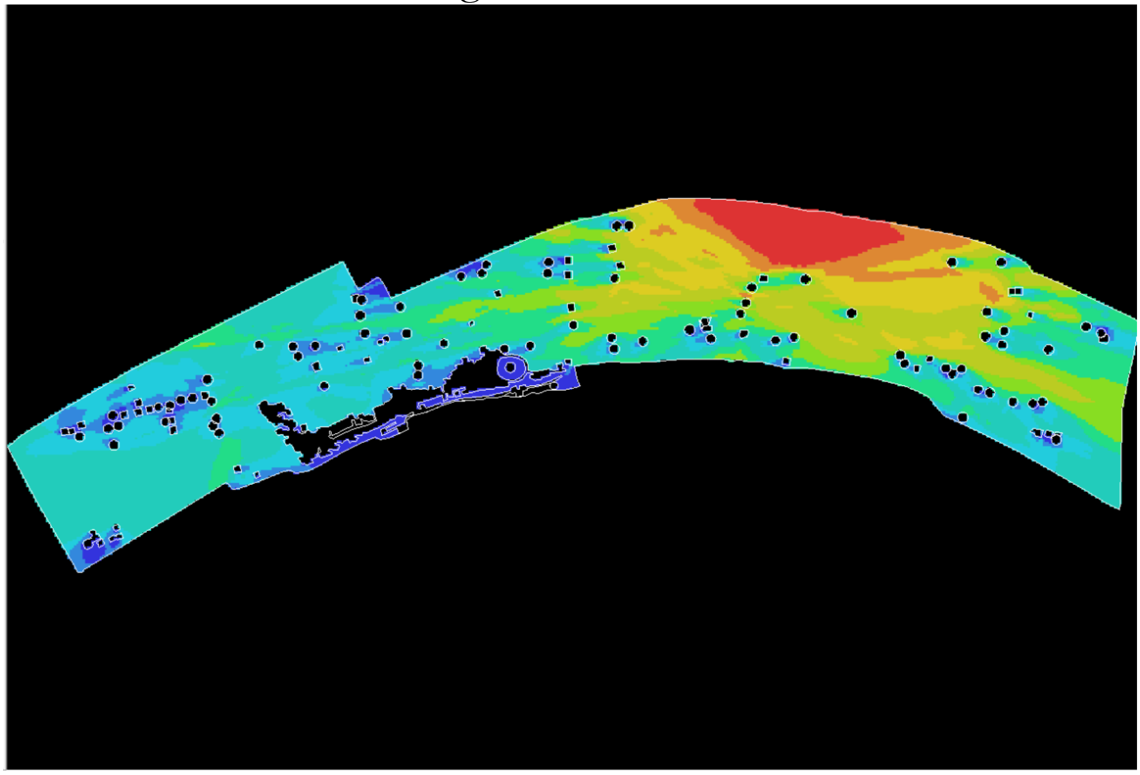


Visual Mean Depth



Visual Relativised Entropy

# Wetwang Slack/Garton Slack



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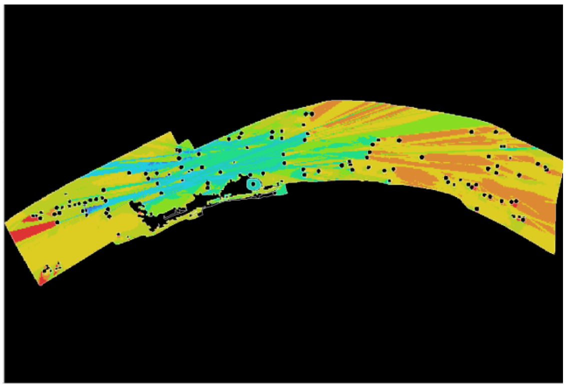
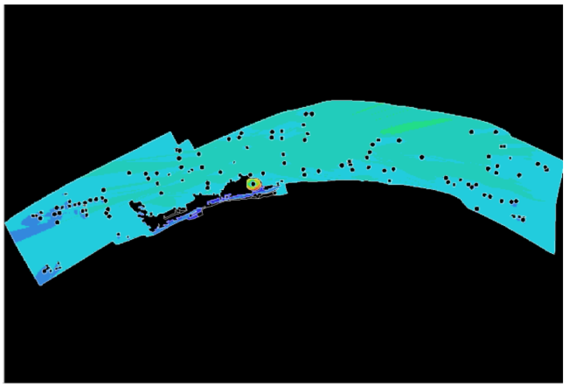


Visual Entropy



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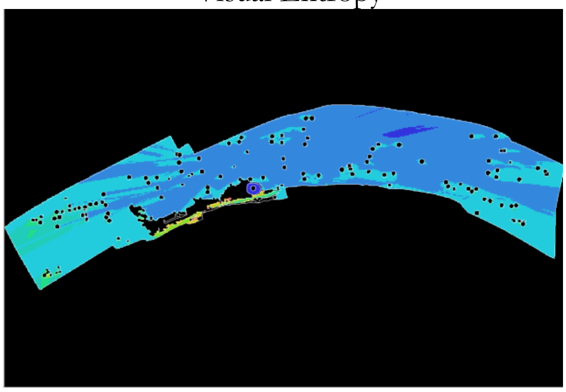

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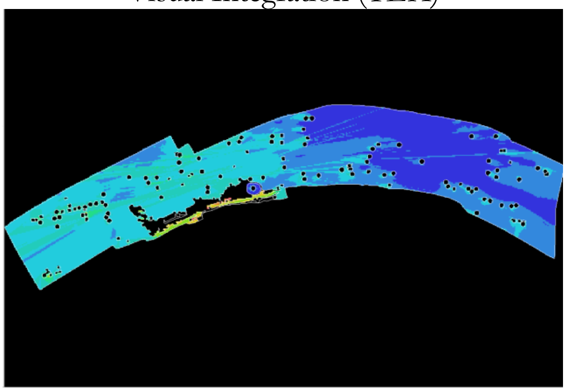
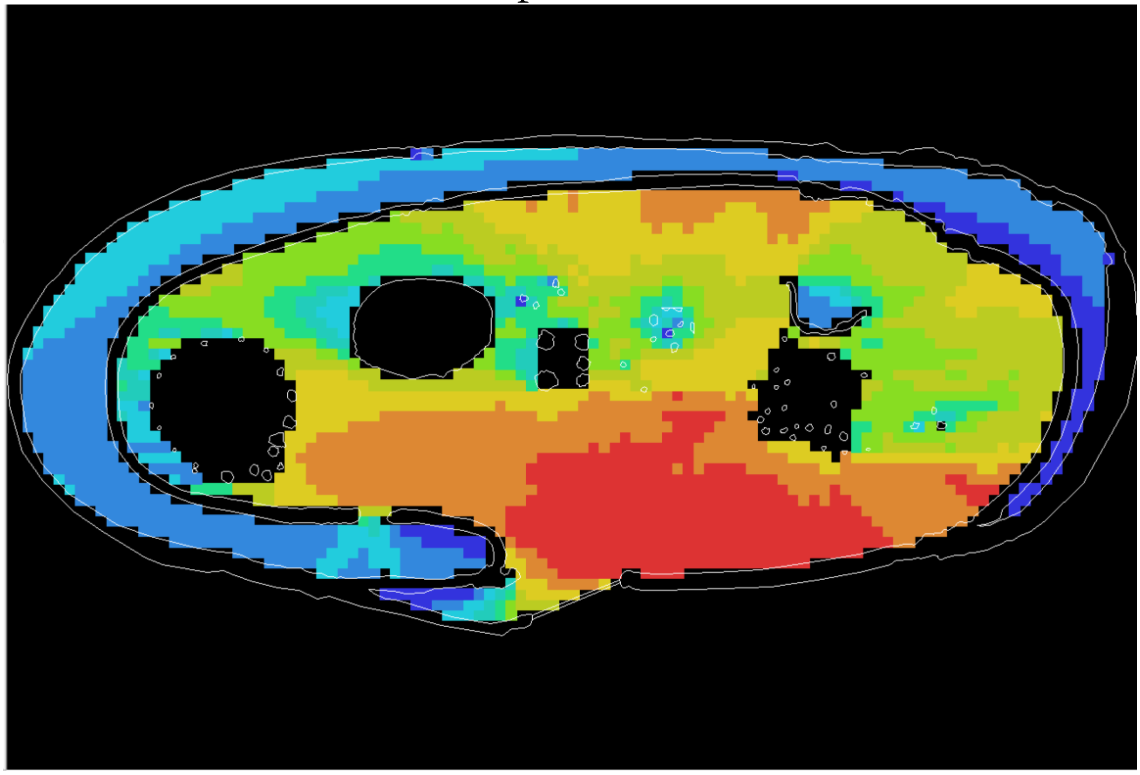
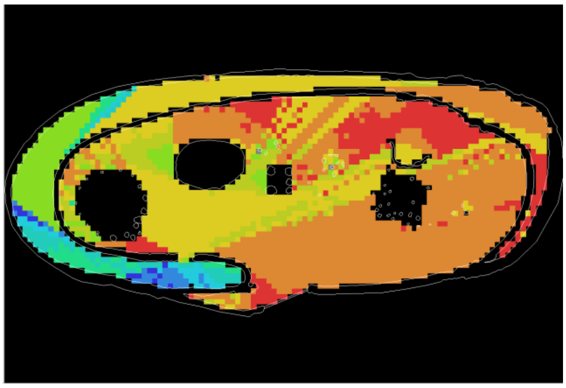


Visual Relativised Entropy

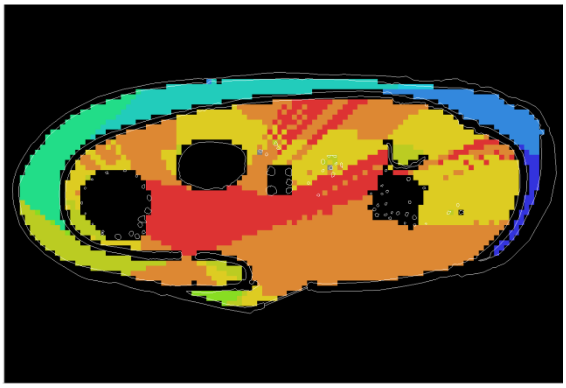
# Staple Howe



Connectivity



Visual Entropy



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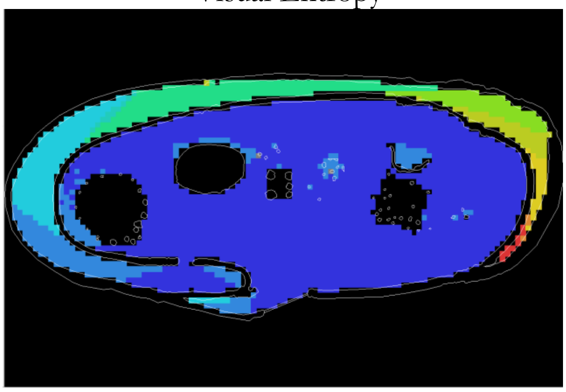

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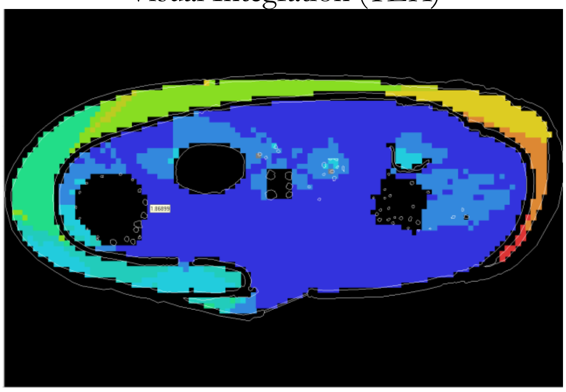
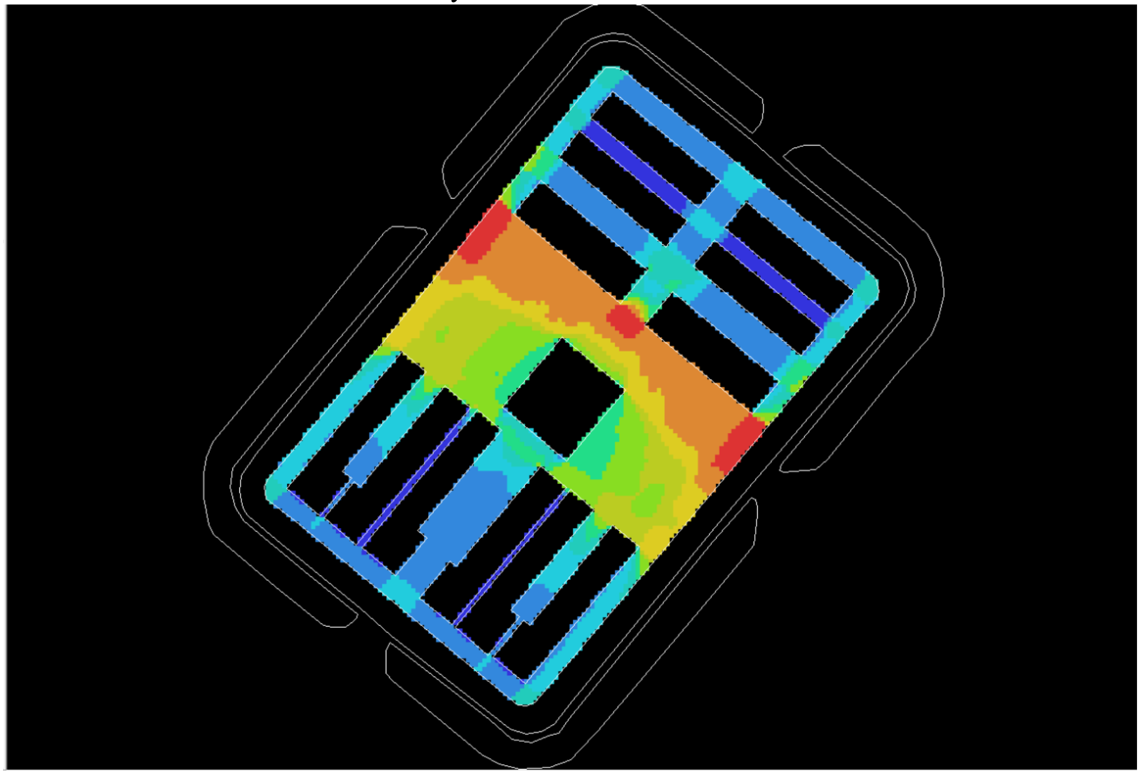


Visual Relativised Entropy

# Hayton Roman Fort



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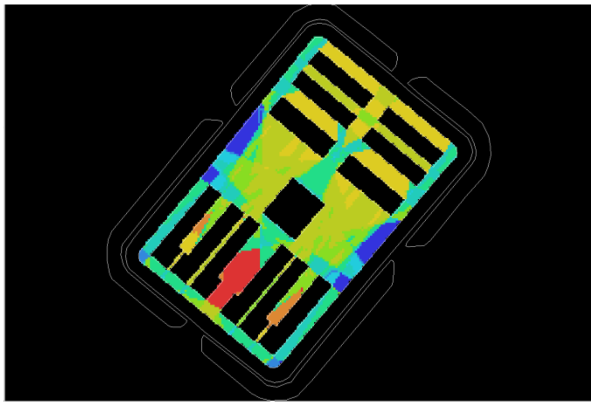
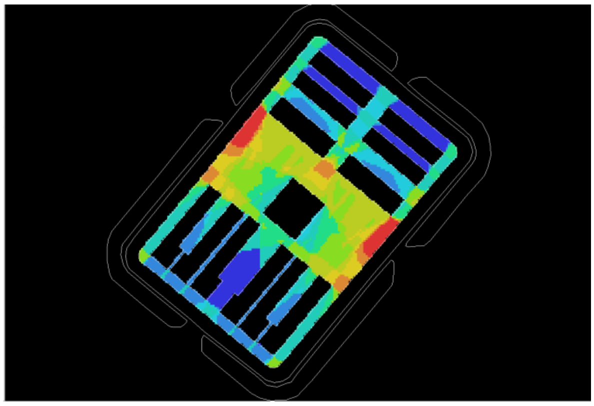


Visual Entropy



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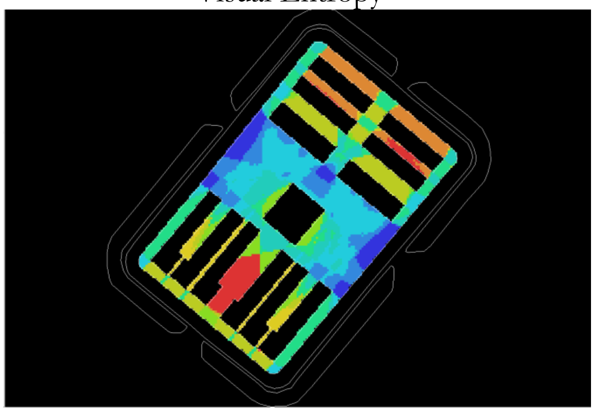

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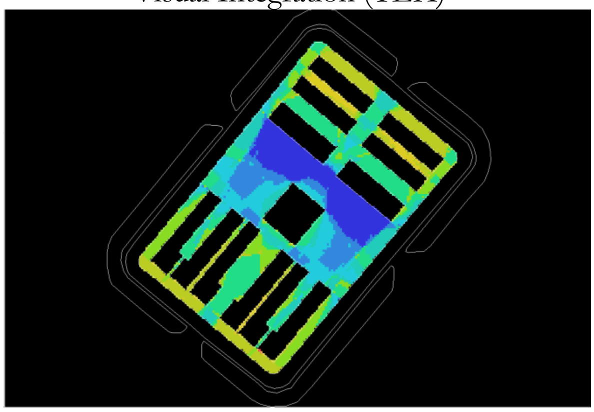
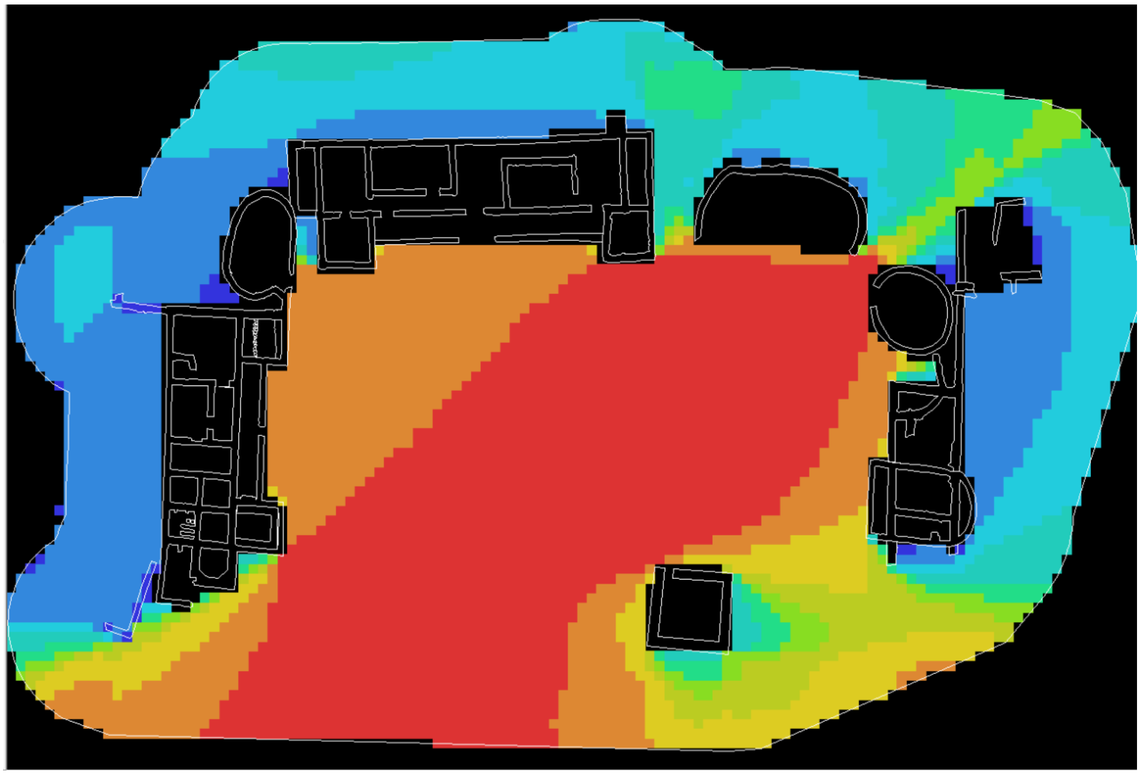


Visual Relativised Entropy

# Beadlam Villa



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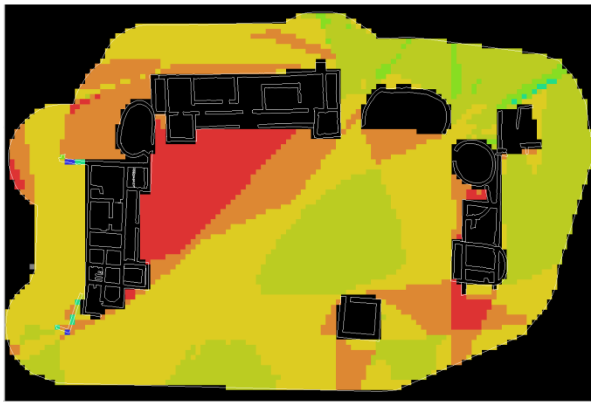

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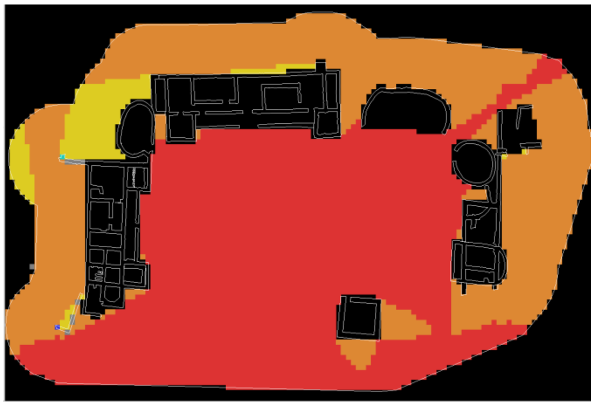

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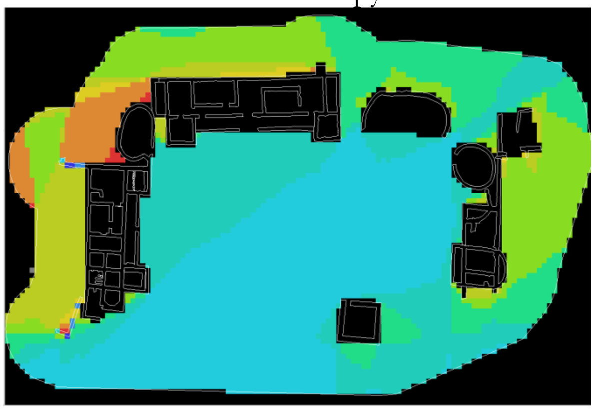

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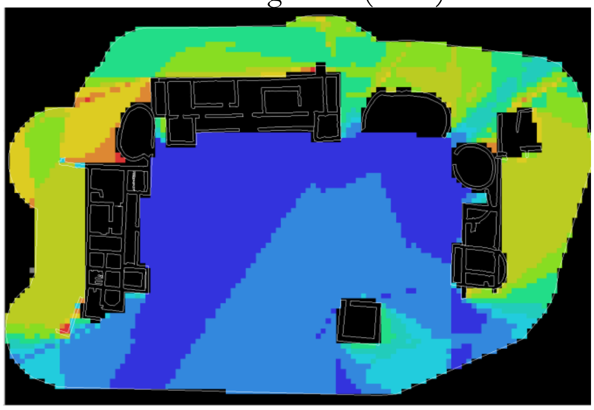
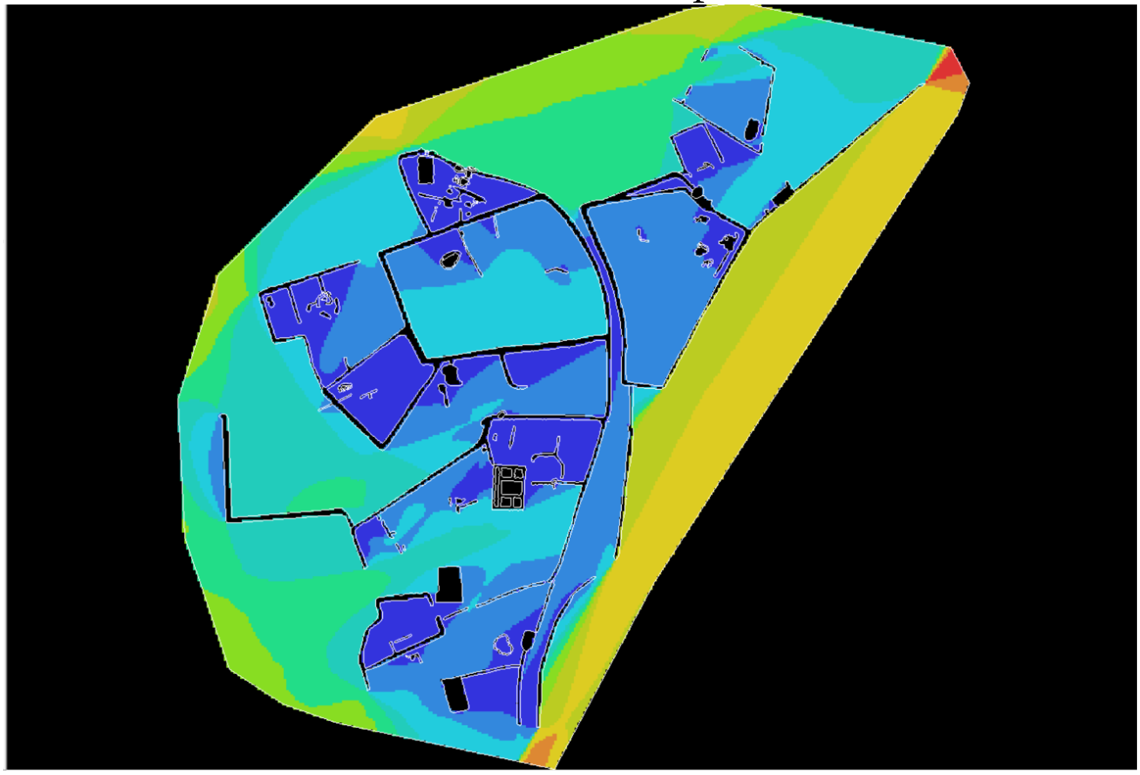


Visual Relativised Entropy

# Welton Wold Villa Complex Phase 3



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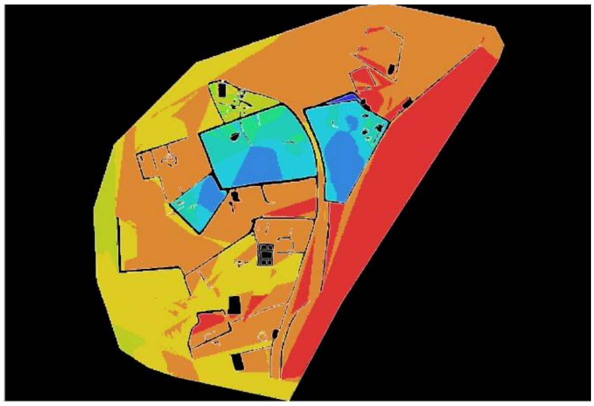
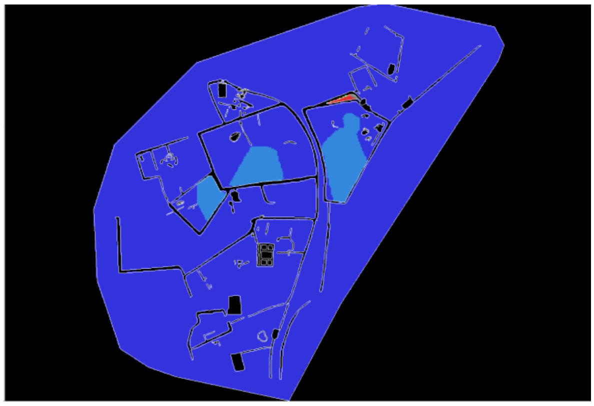
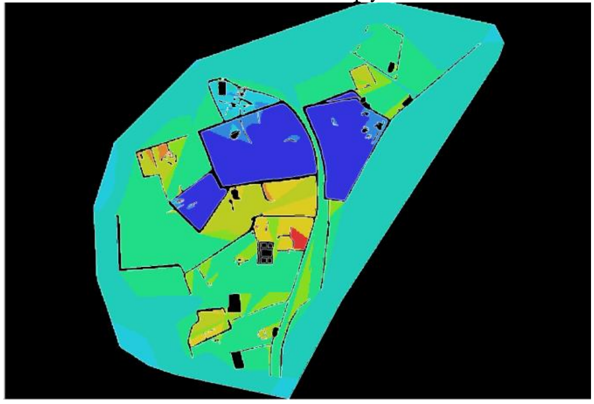


Visual Entropy



Visual Integration (TEK)



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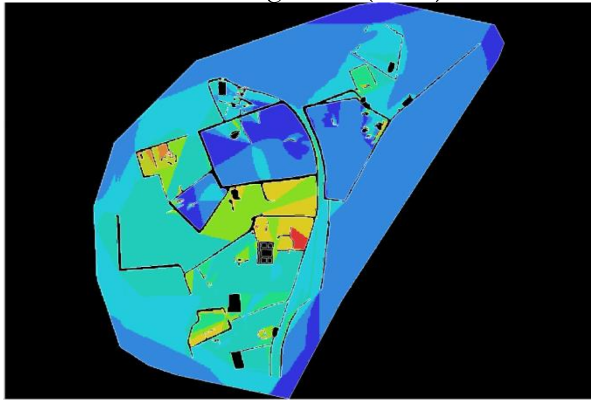
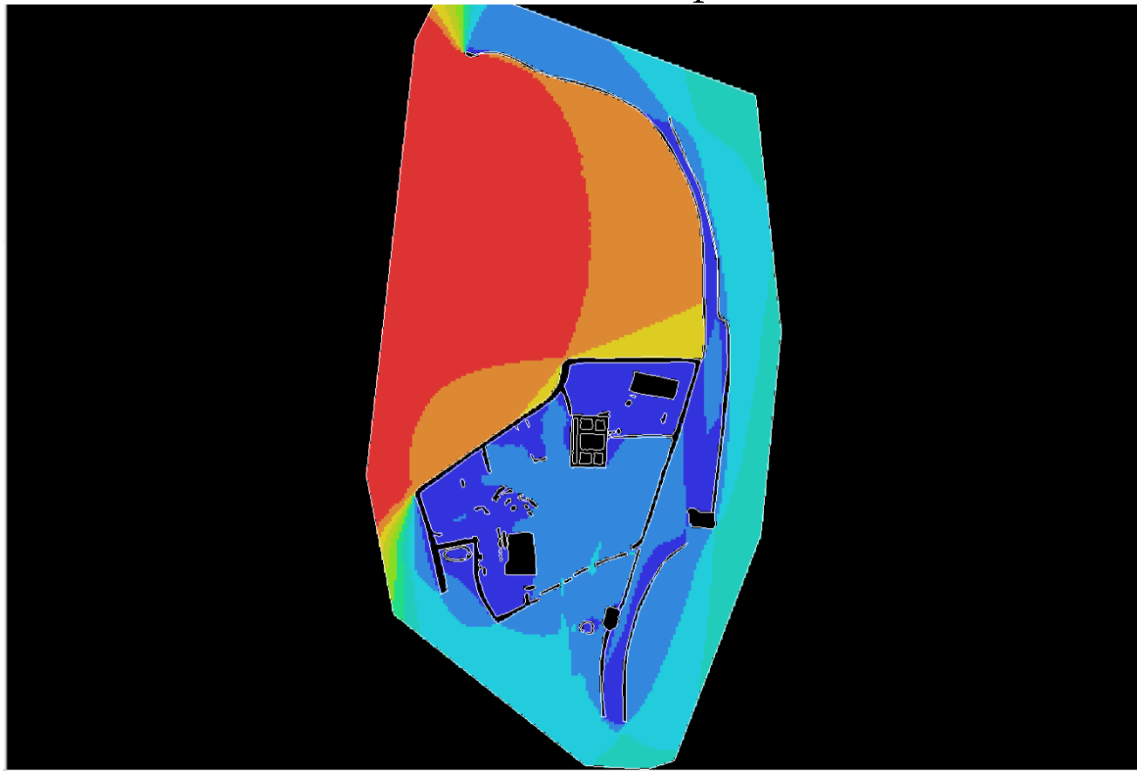


Visual Relativised Entropy

# Welton Wold Villa Complex Phase 4



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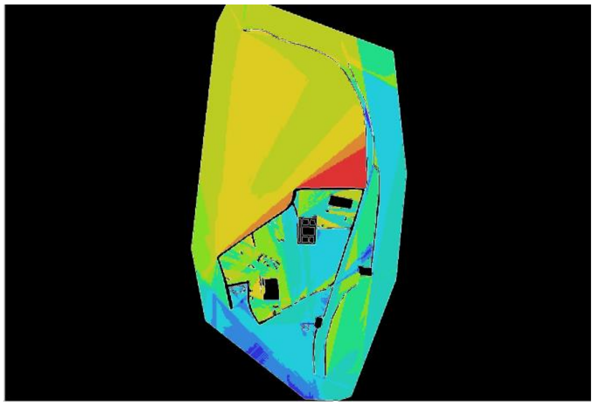
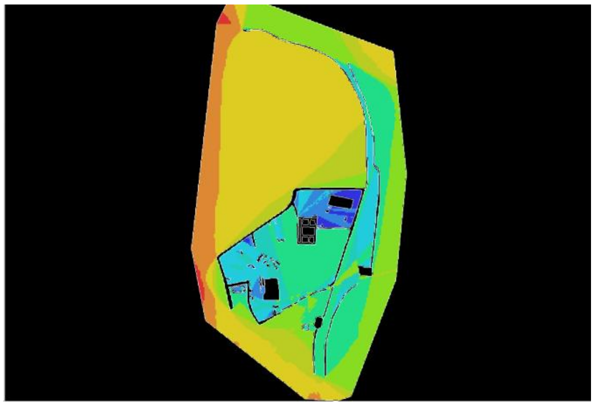
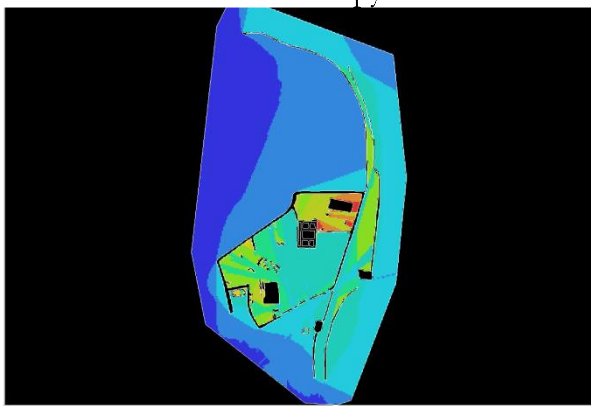


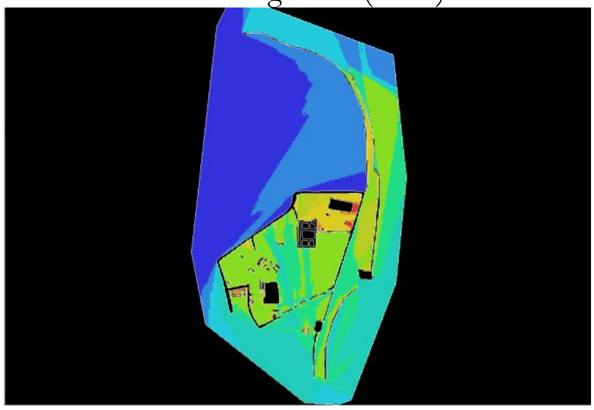
Visual Entropy



Visual Integration (TEK)

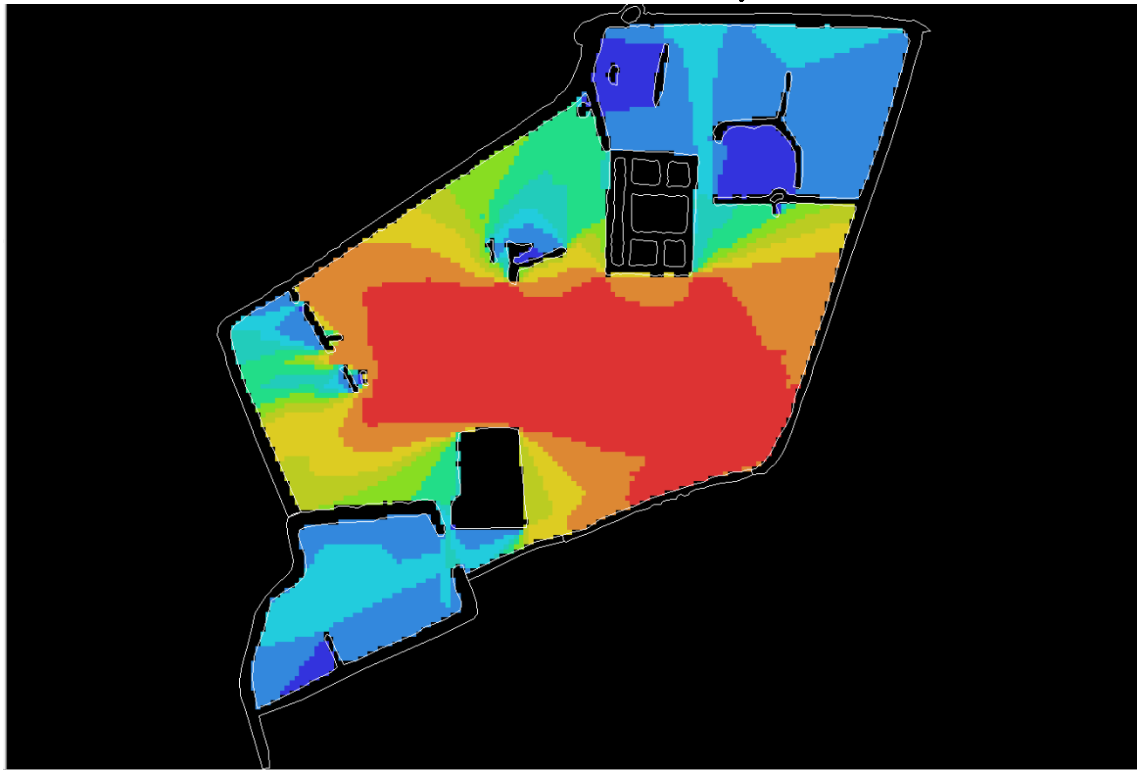


Visual Mean Depth



Visual Relativised Entropy

# Welton Wold Villa Vicinity Phase 3



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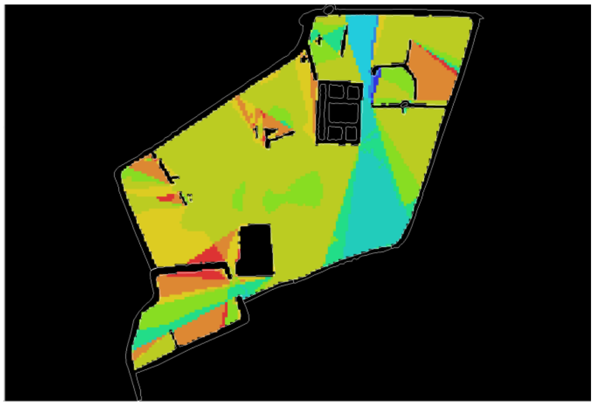
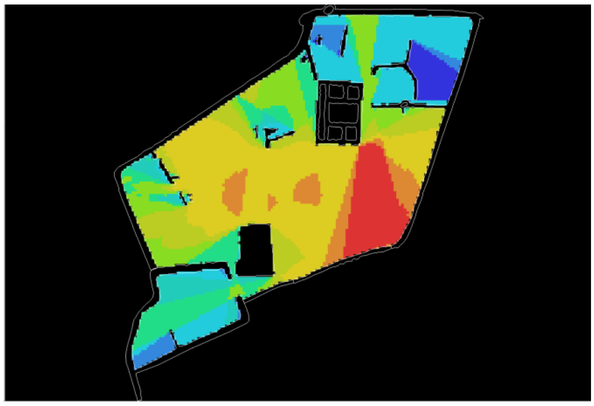


Visual Entropy

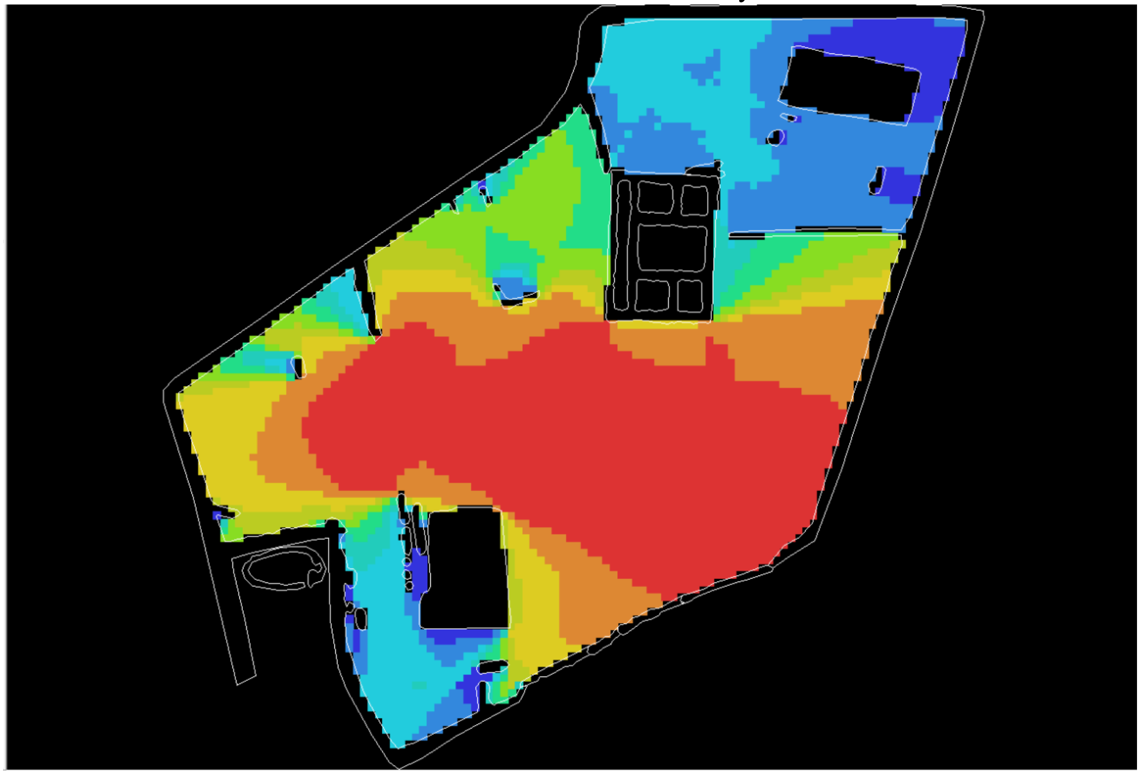


Visual Integration (TEK)

Visual Mean Depth

Visual Relativised Entropy

# Welton Wold Villa Vicinity Phase 4



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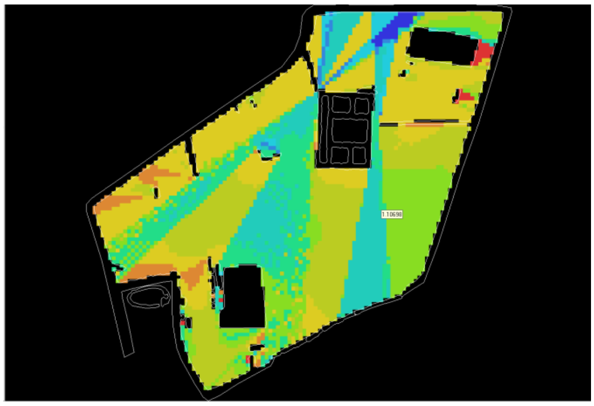

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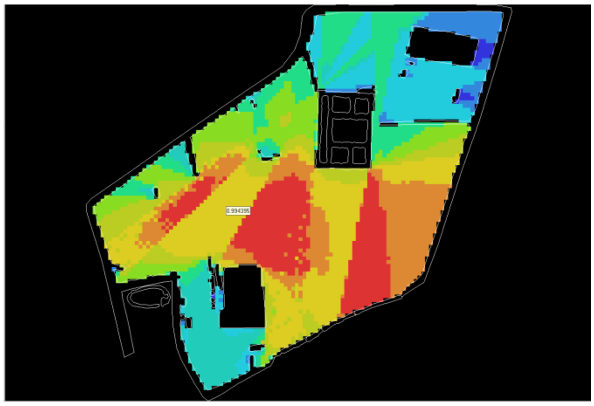

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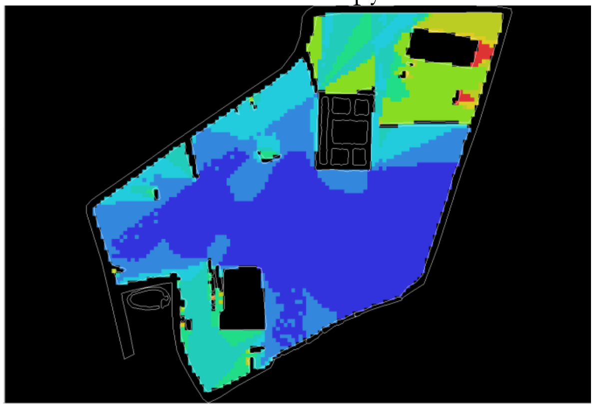
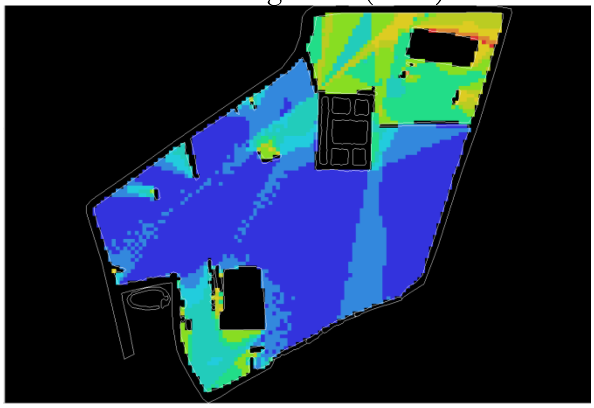
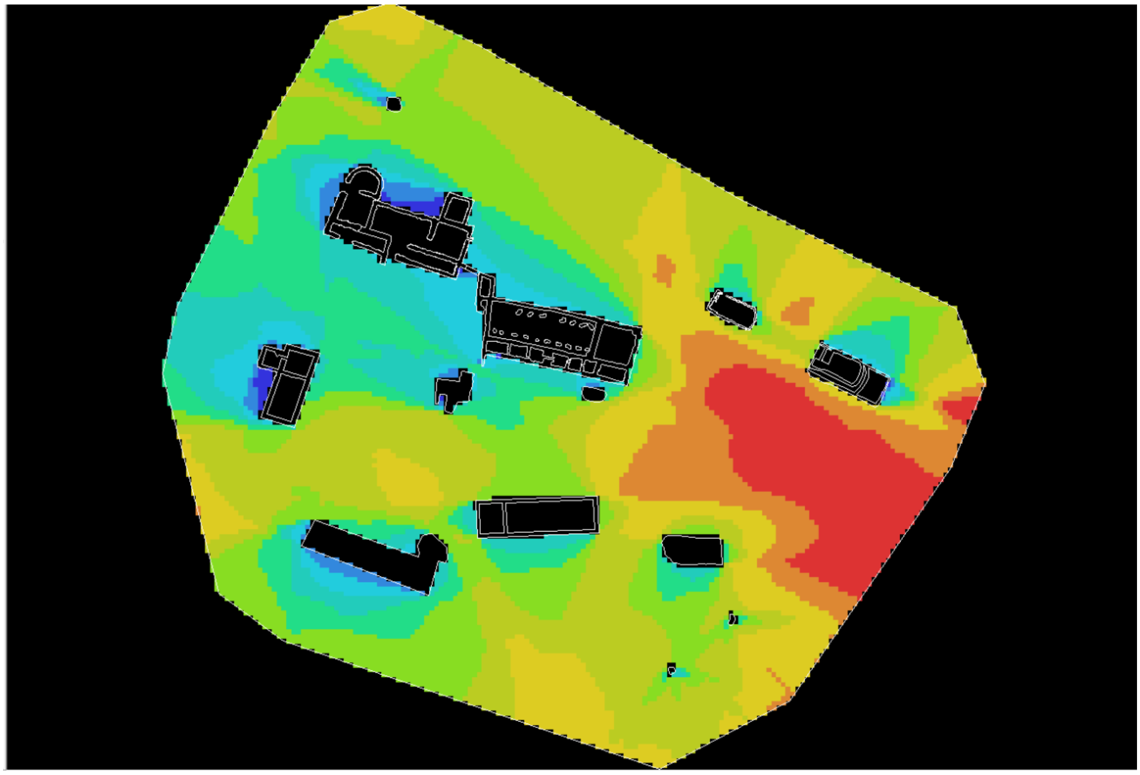


Visual Mean Depth



Visual Relativised Entropy

# Dalton Parlours Villa



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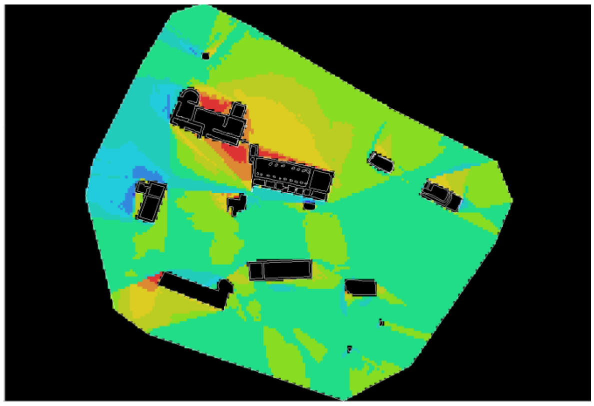

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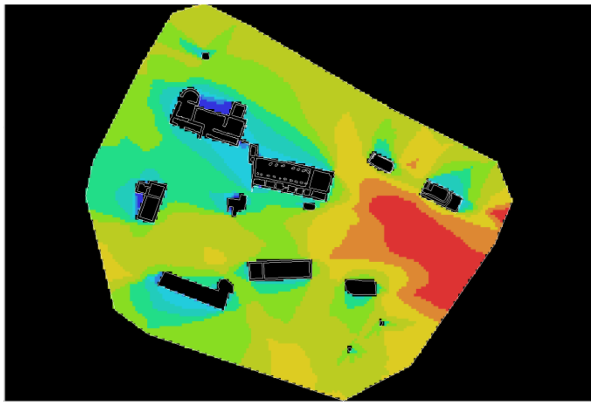

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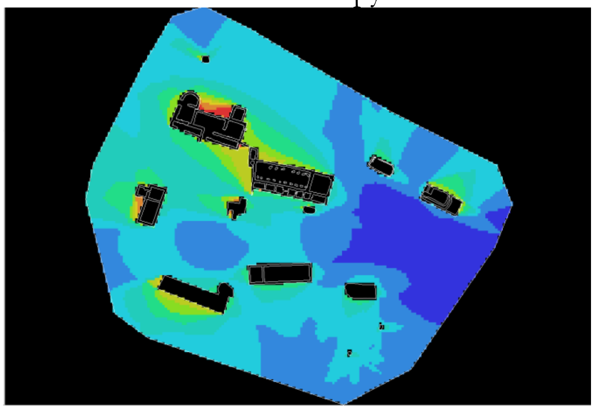

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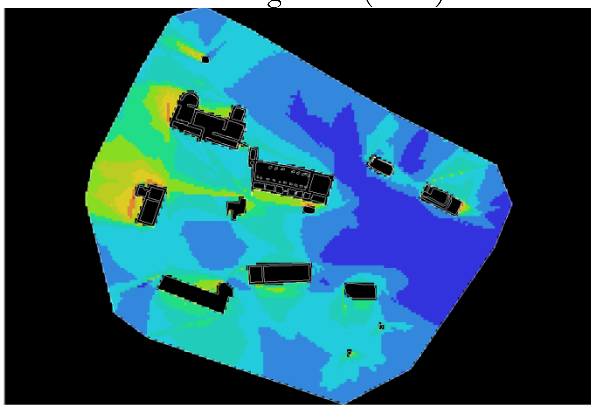
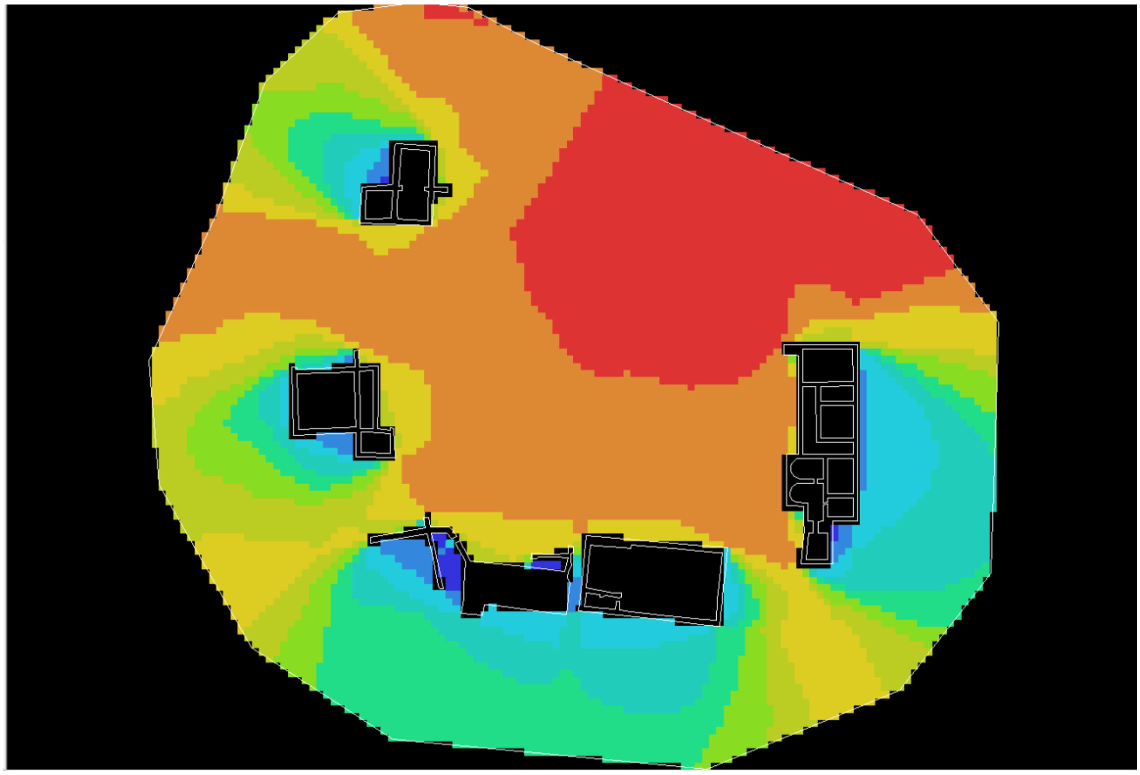
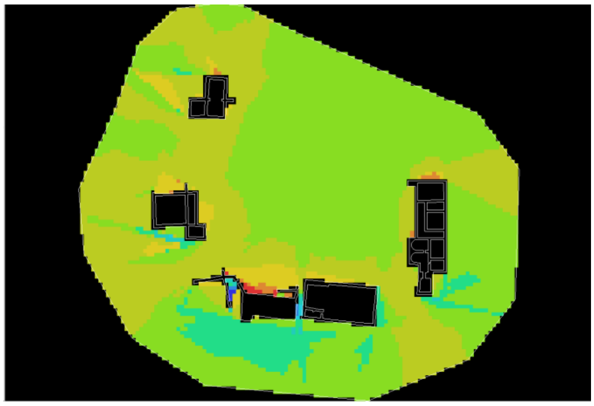


Visual Relativised Entropy

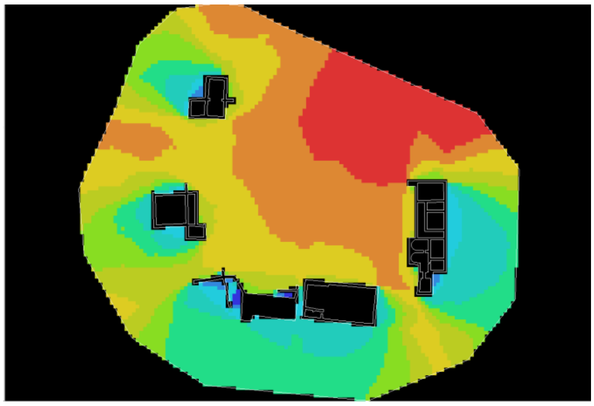
# Rudston Villa



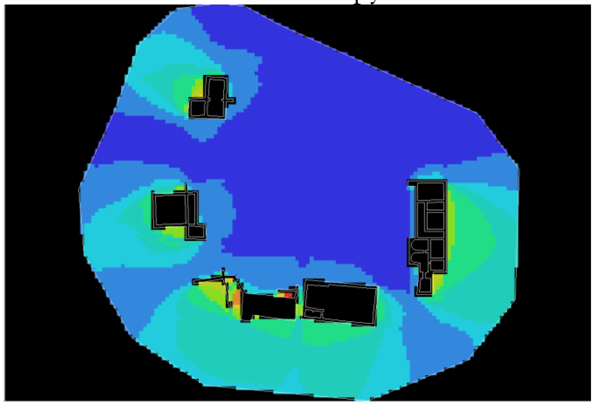
Connectivity



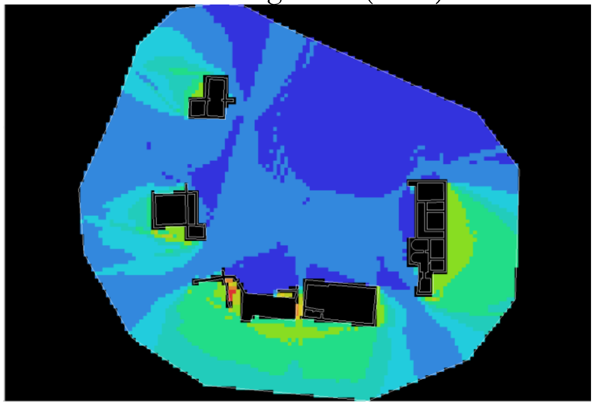
Visual Entropy



Visual Integration (TEK)

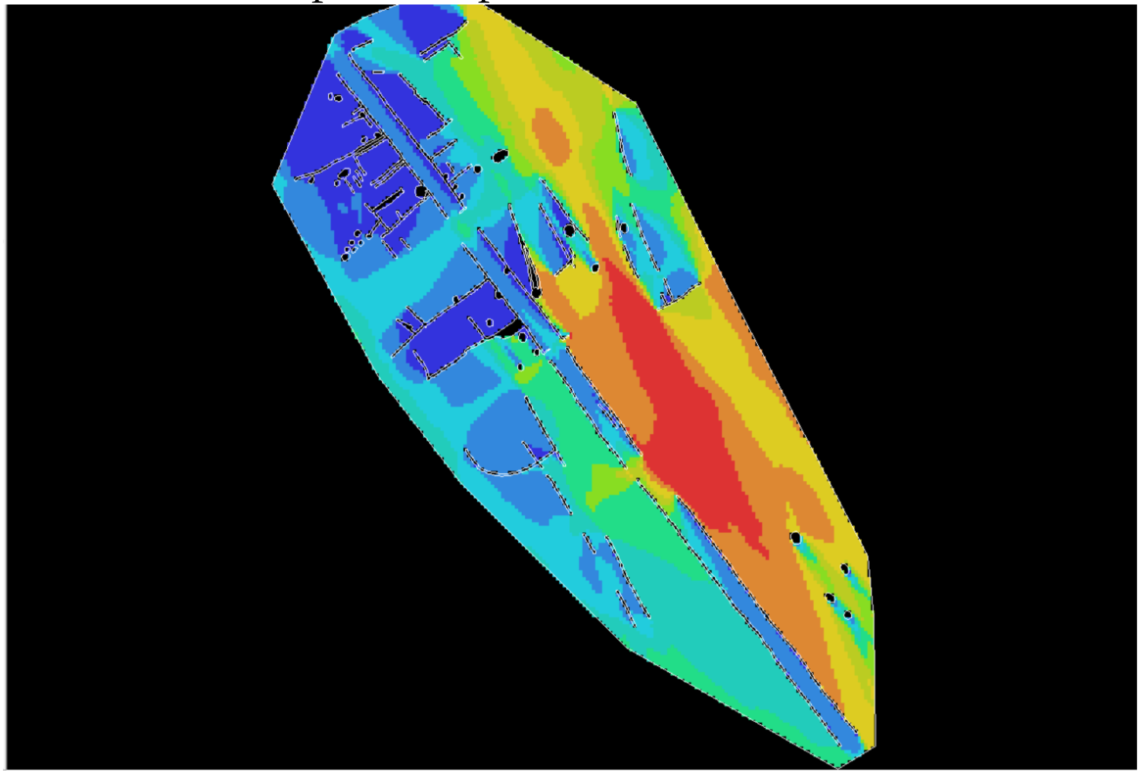


Visual Mean Depth



Visual Relativised Entropy

# Shiptonthorpe Roadside Settlement



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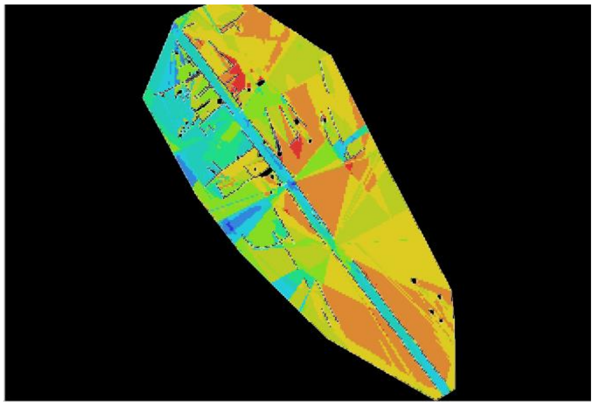
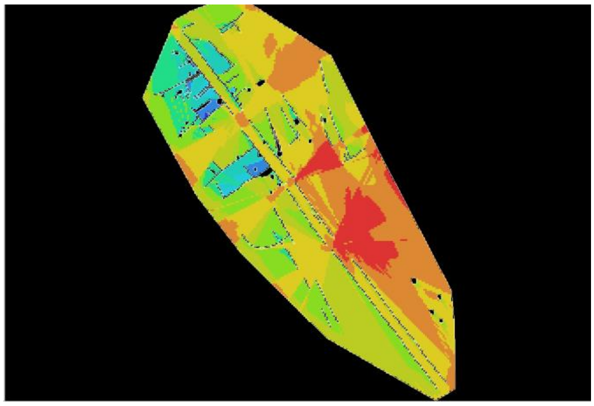
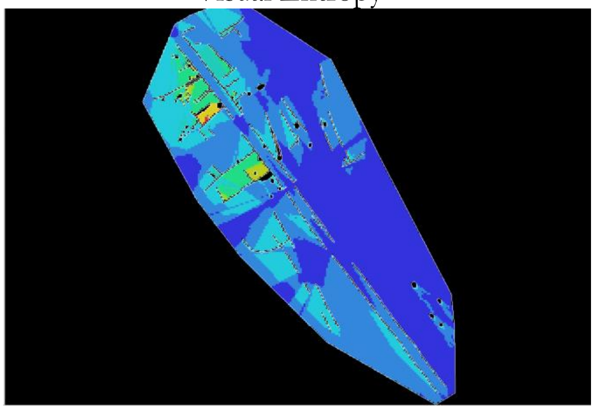


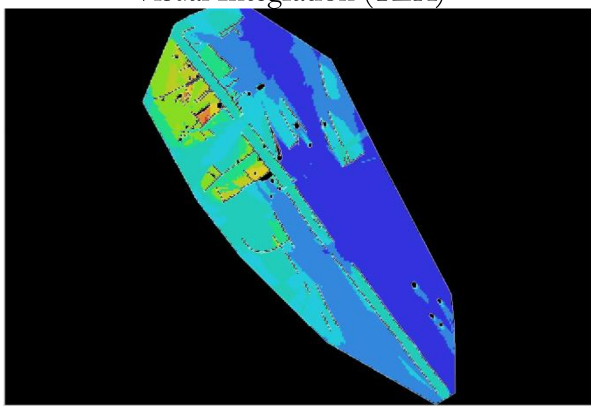
Visual Entropy



Visual Integration (TEK)

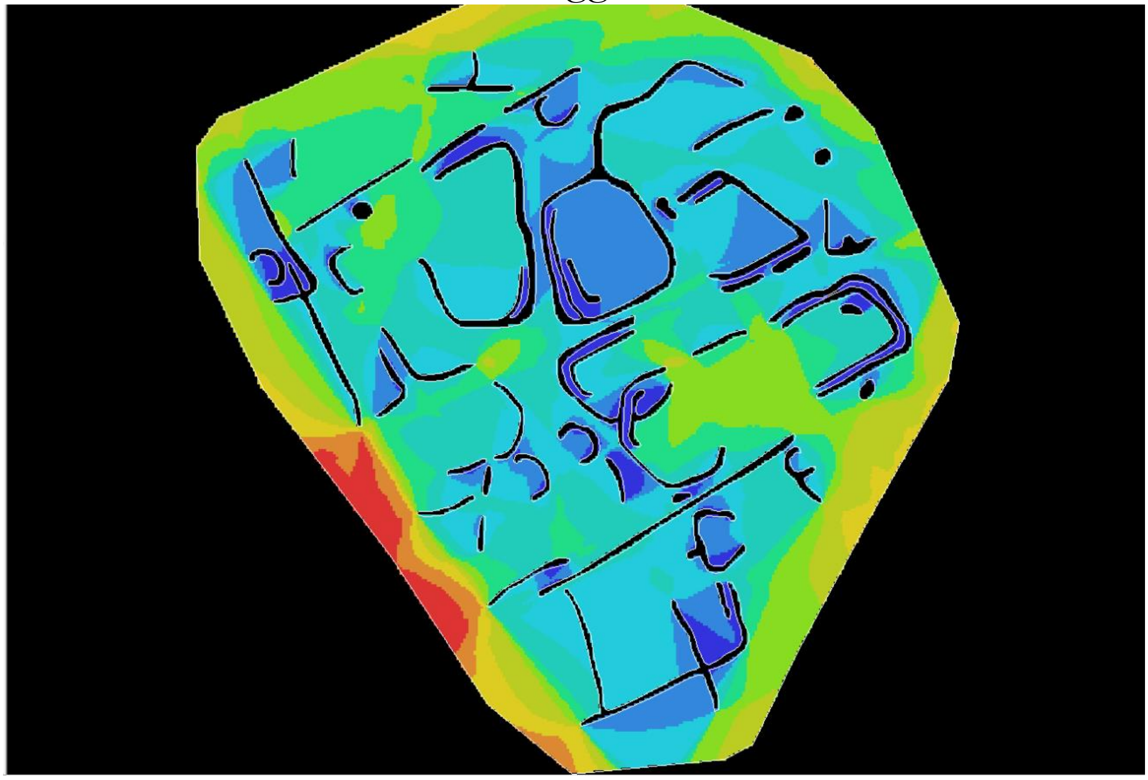


Visual Mean Depth

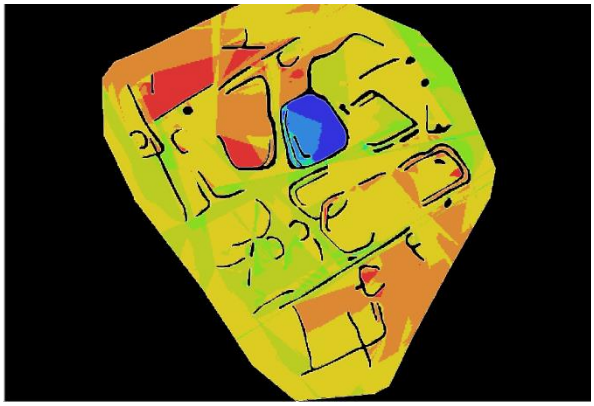


Visual Relativised Entropy

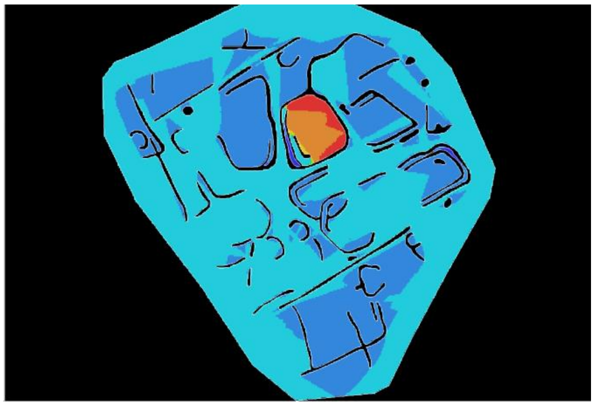
# Huggate



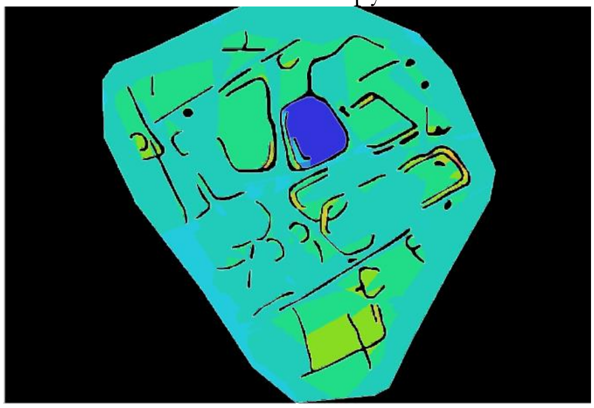
Connectivity



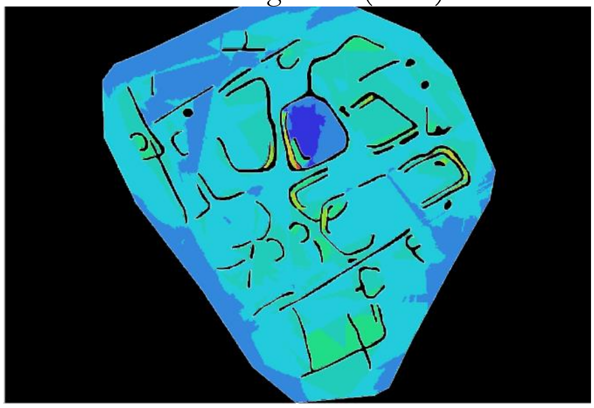
Visual Entropy



Visual Integration (TEK)

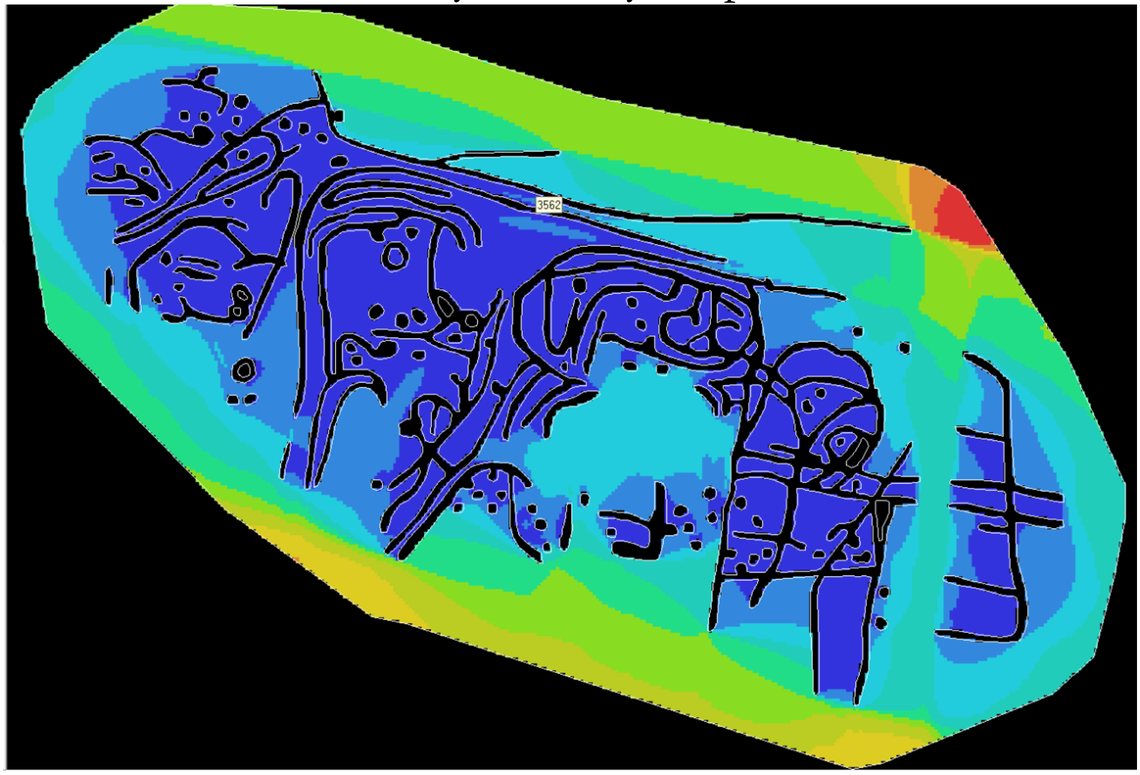


Visual Mean Depth

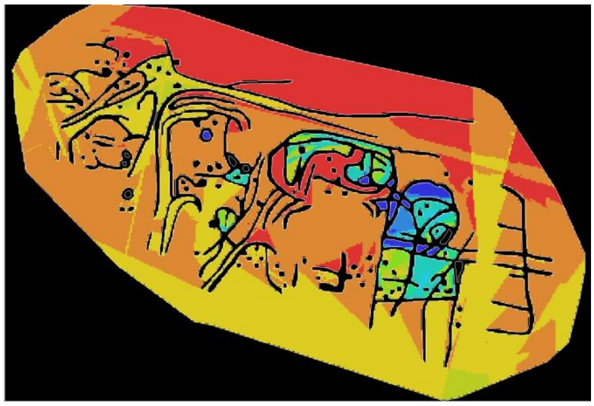


Visual Relativised Entropy

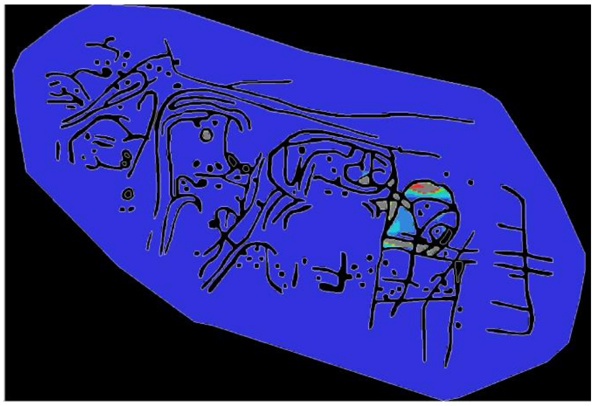
# Boynton-Caythorpe




Connectivity



Visual Entropy



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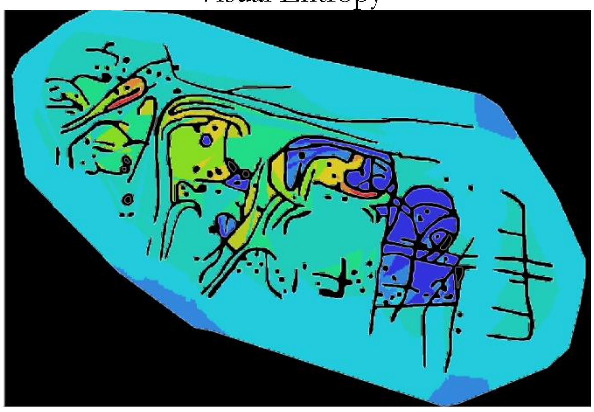
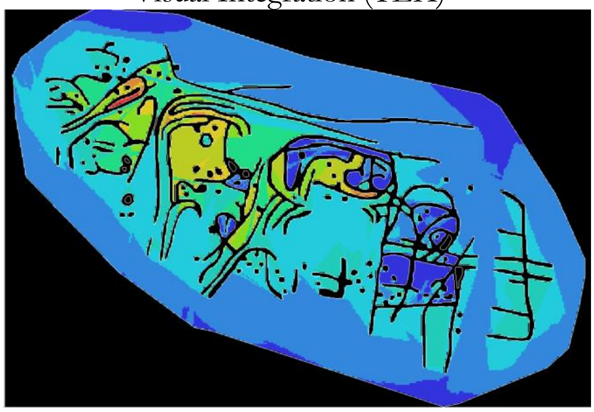
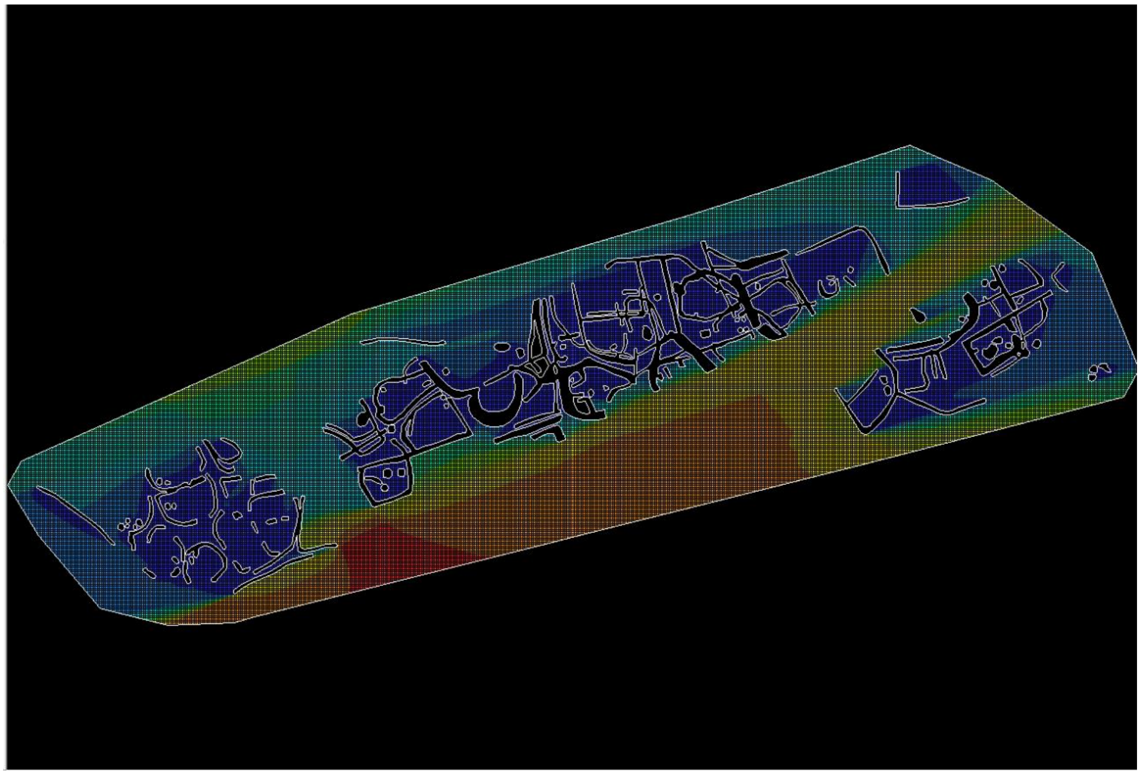


Visual Mean Depth

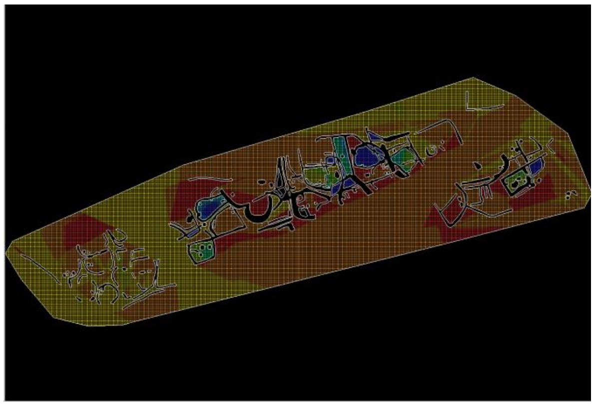


Visual Relativised Entropy

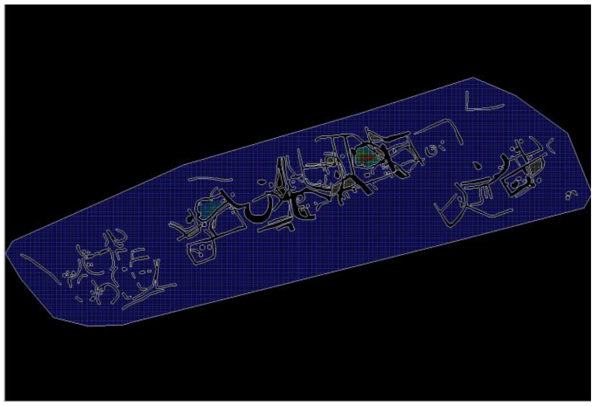
# Lutton



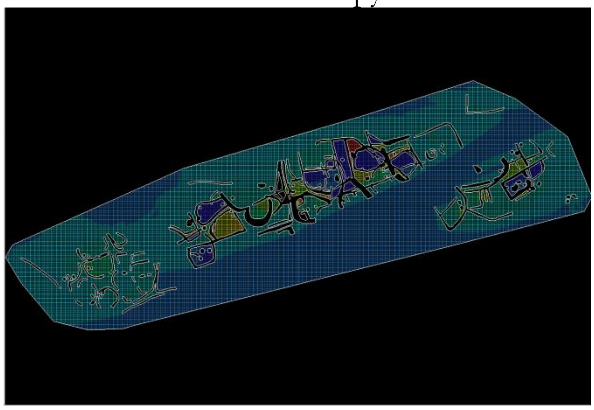
Connectivity



Visual Entropy



Visual Integration (TEK)



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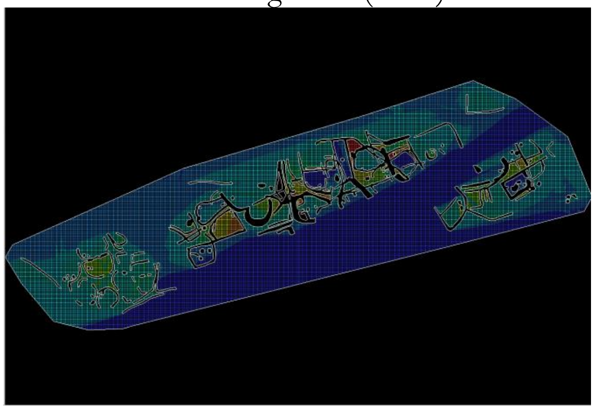
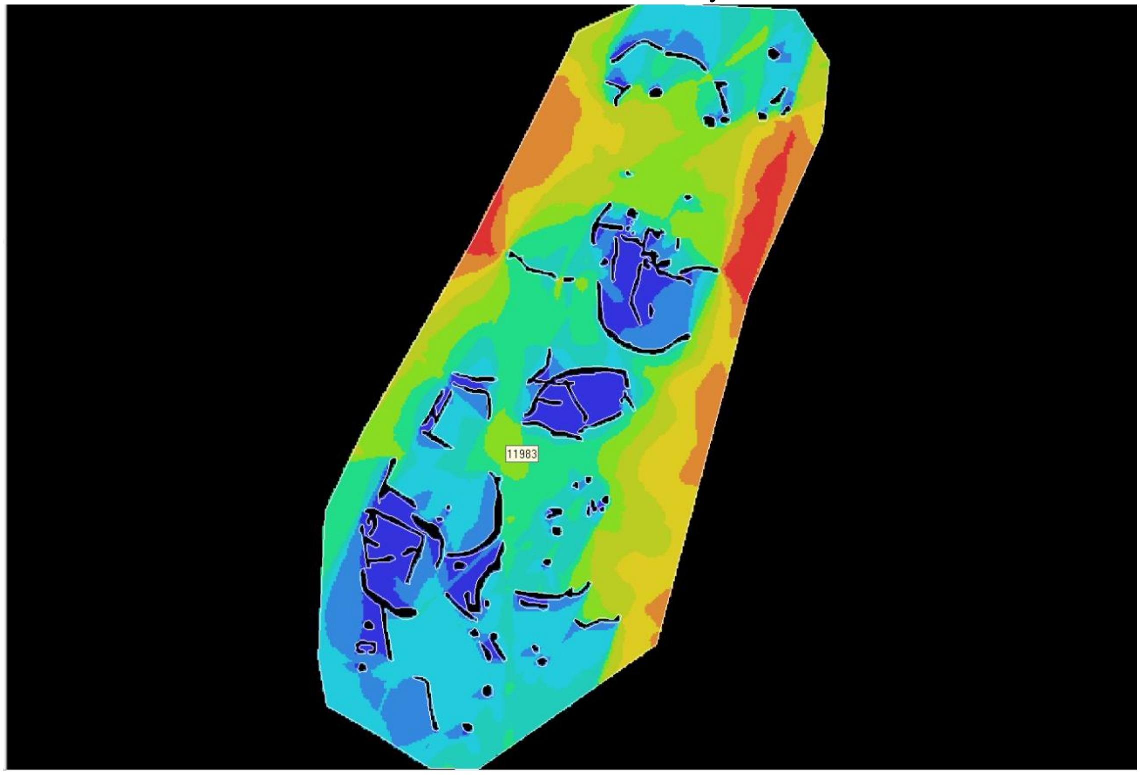
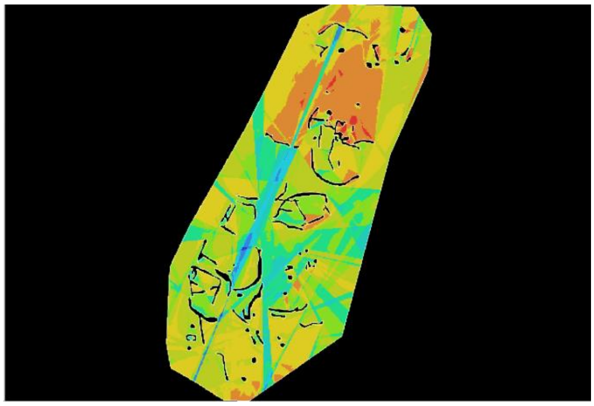


Visual Relativised Entropy

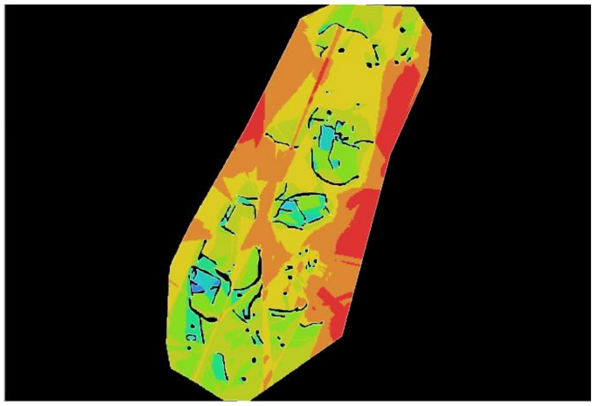
# Wharram Percy



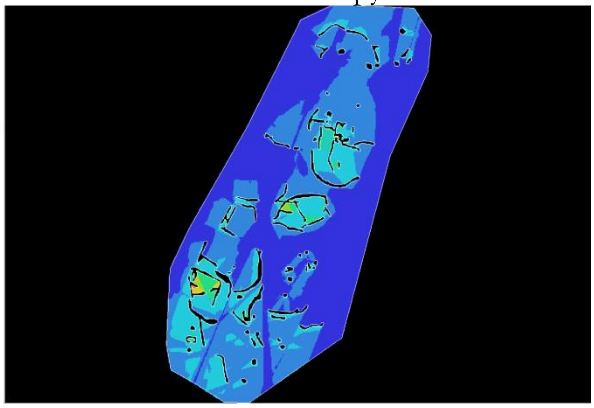

Connectivity



Visual Entropy



Visual Integration (TEK)



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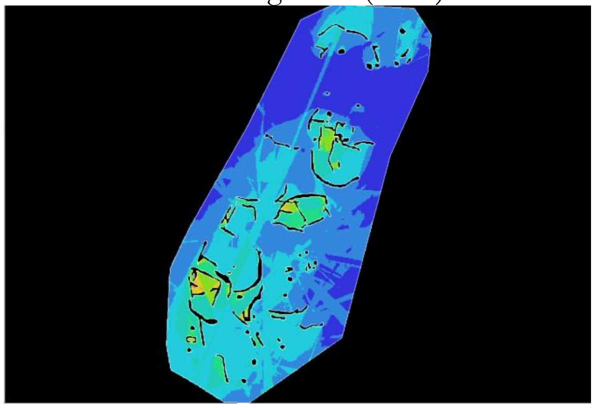
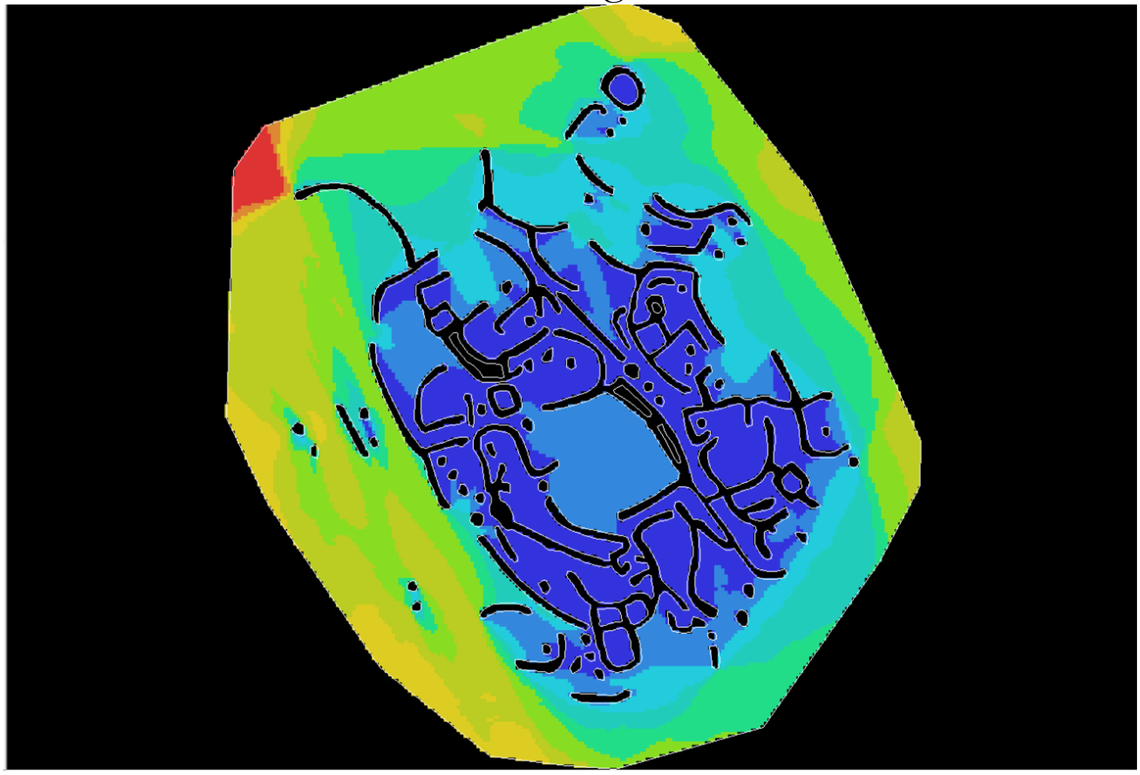
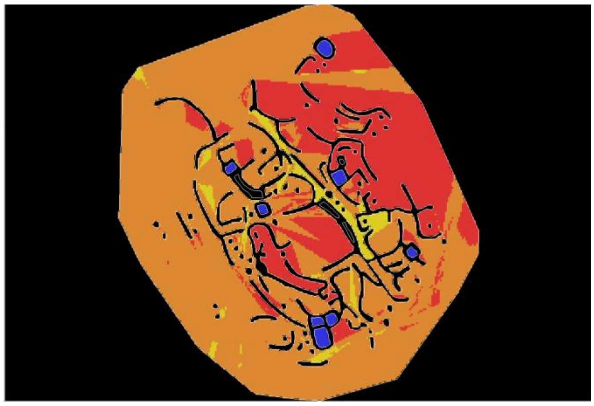


Visual Relativised Entropy

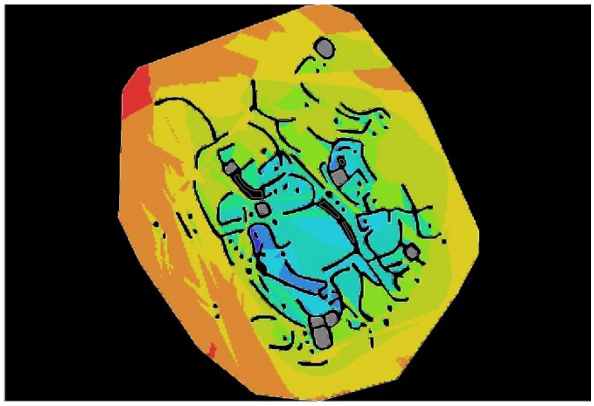
# Binnington



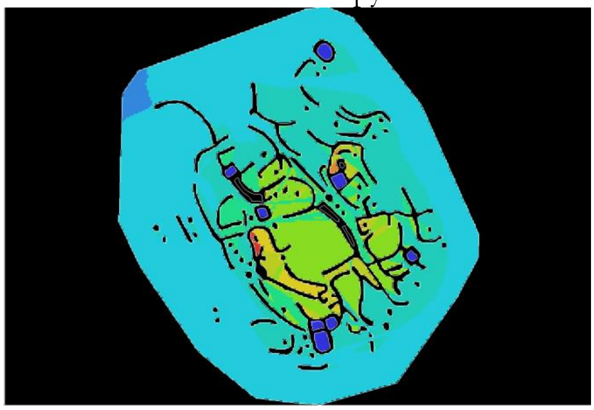
Connectivity



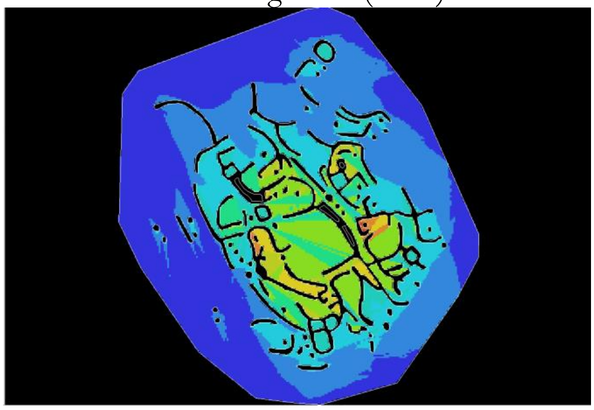
Visual Entropy



Visual Integration (TEK)

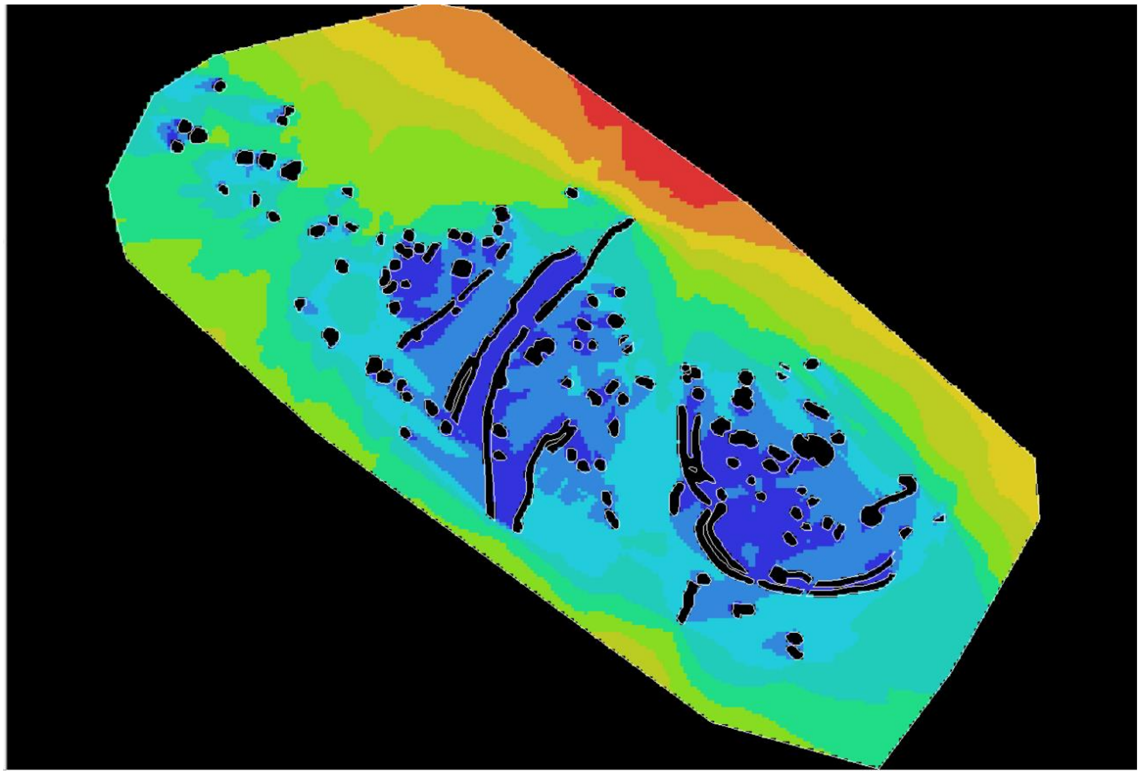


Visual Mean Depth

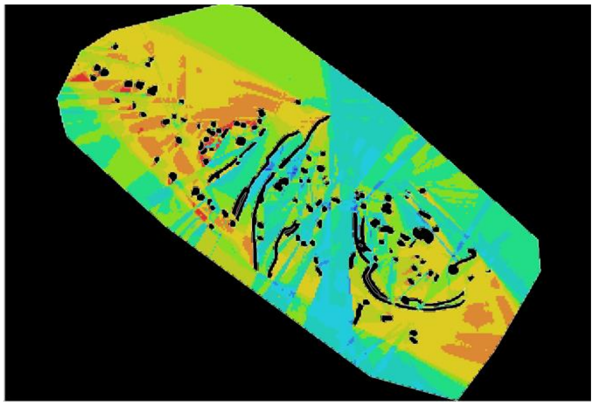


Visual Relativised Entropy

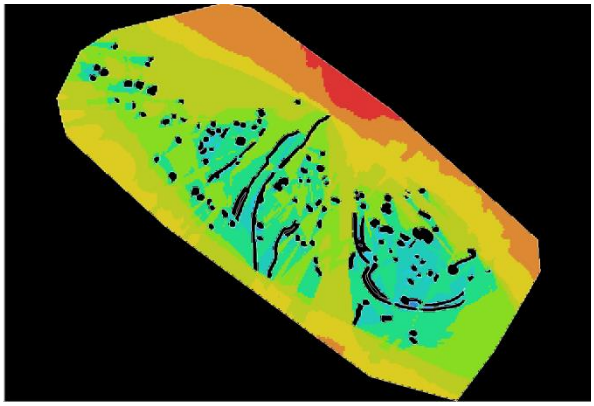
# Burdale



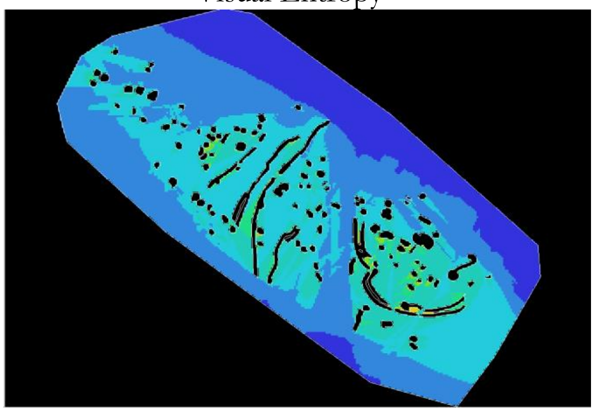
Connectivity



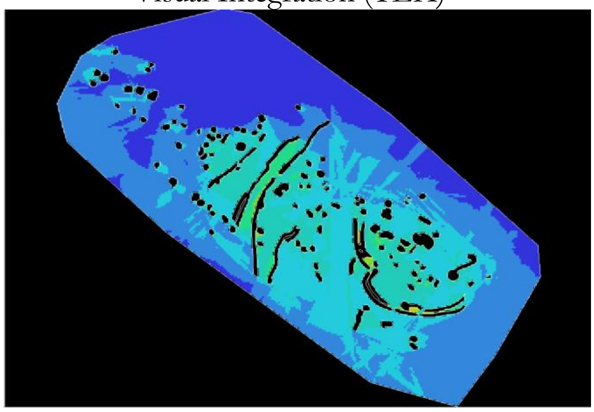
Visual Entropy



Visual Integration (TEK)

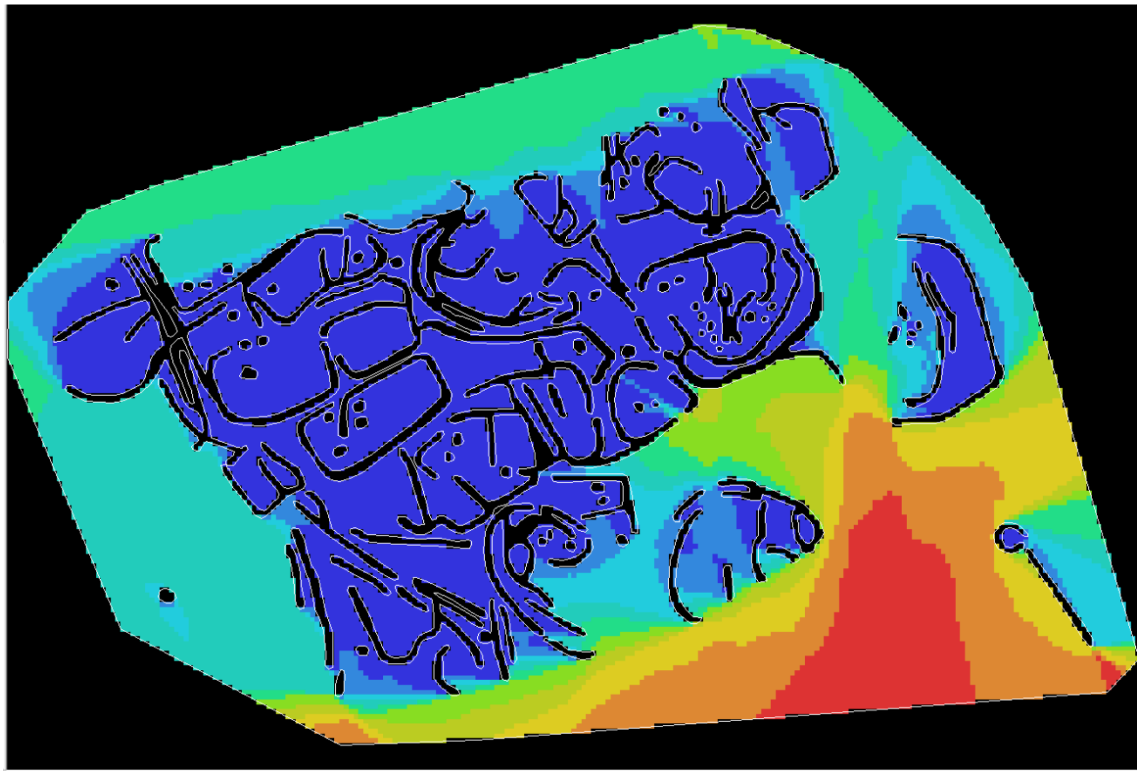


Visual Mean Depth

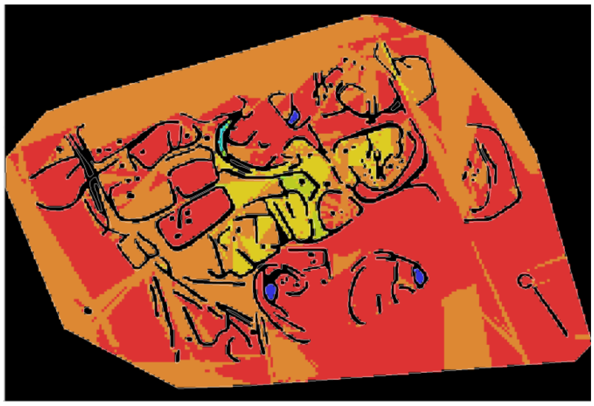


Visual Relativised Entropy

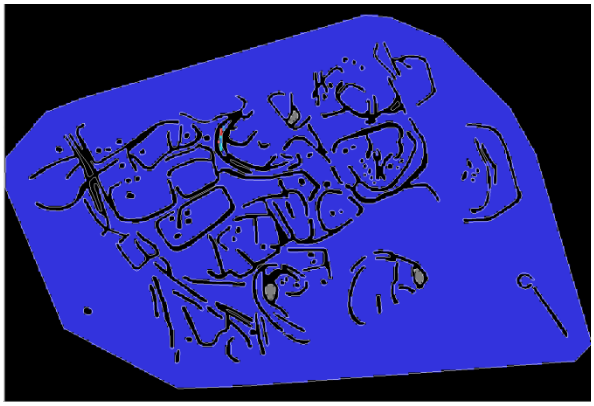
# Butterwick



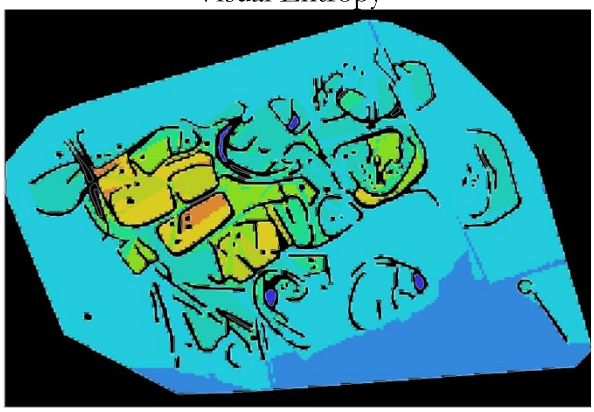
Connectivity



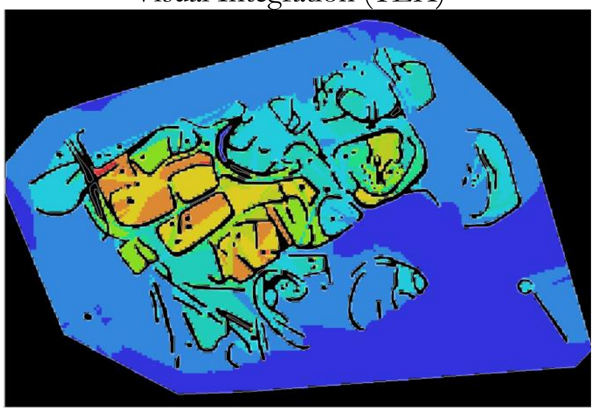
Visual Entropy



Visual Integration (TEK)

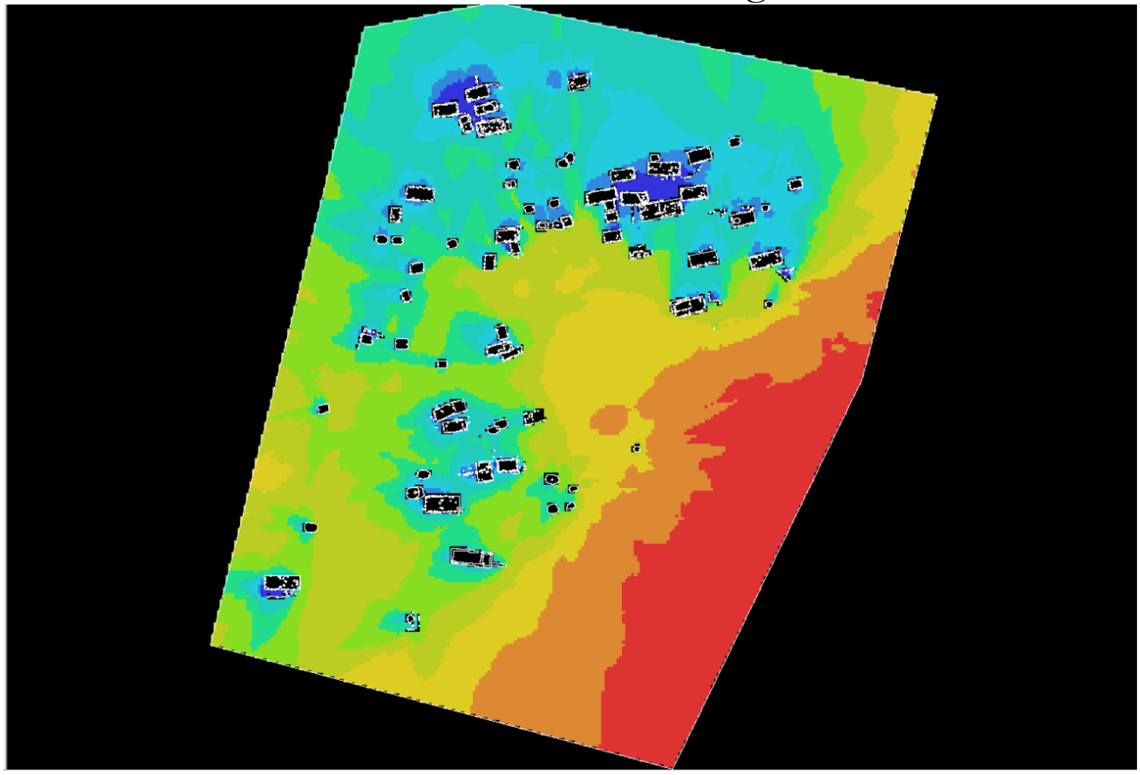


Visual Mean Depth

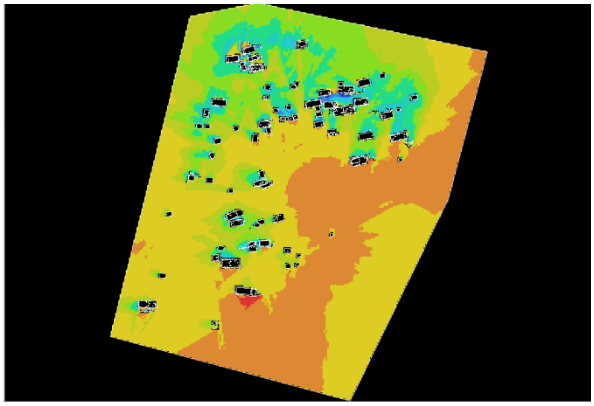


Visual Relativised Entropy

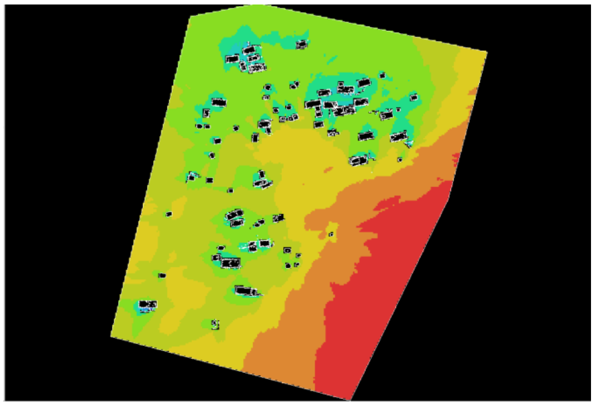
# West Heslerton Houseing Zone



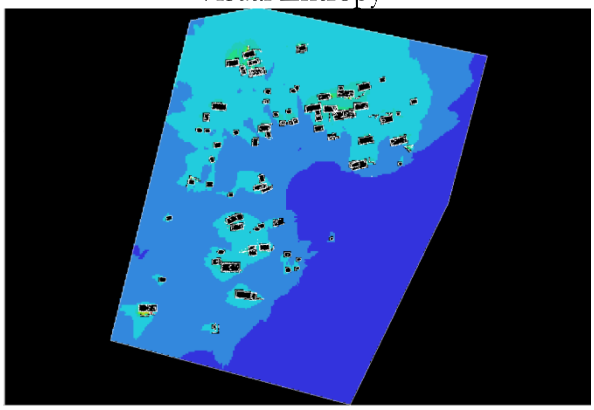
Connectivity



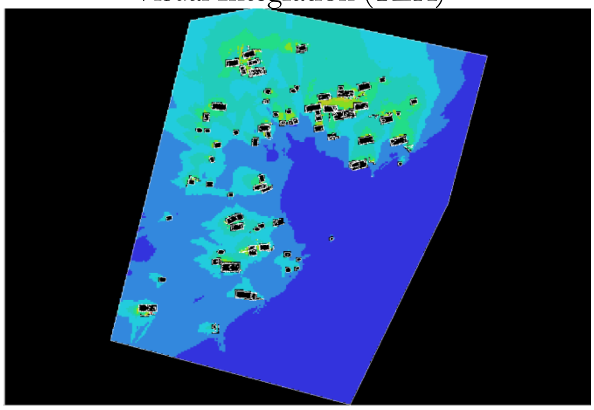
Visual Entropy



Visual Integration (TEK)

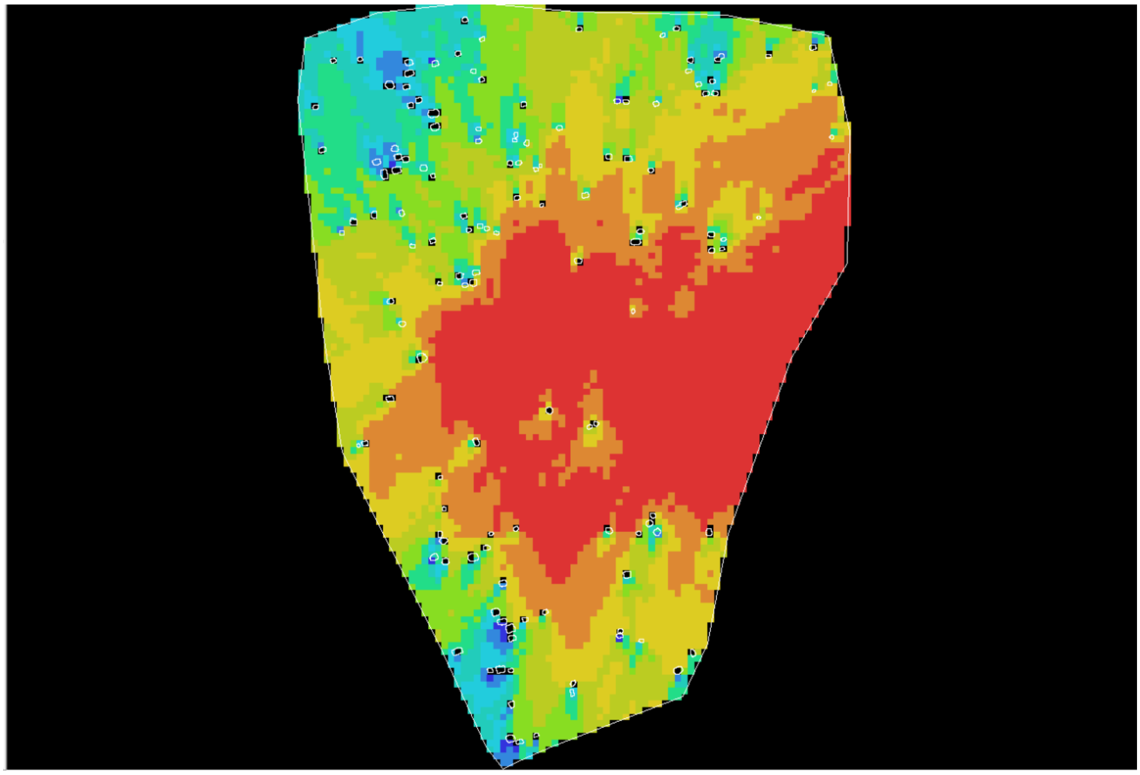


Visual Mean Depth

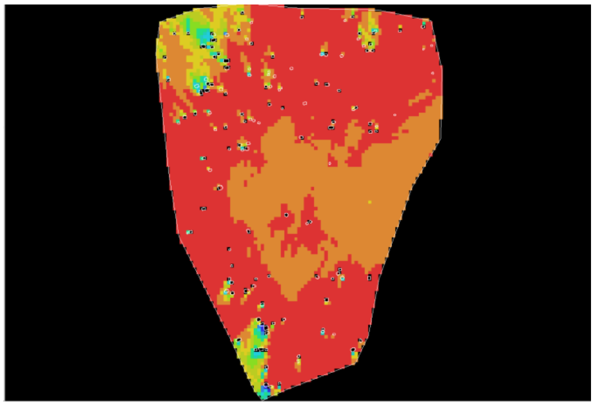


Visual Relativised Entropy

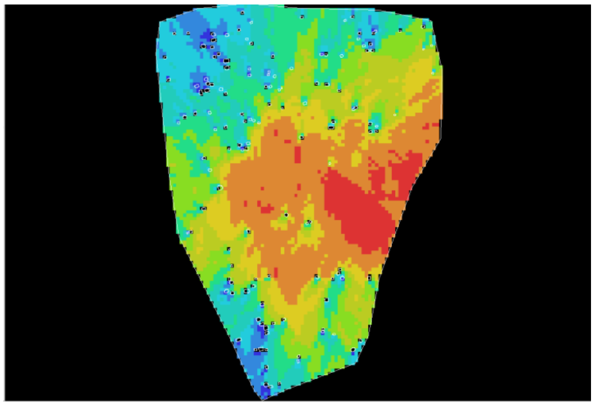
# West Heslerton Grubenhäus



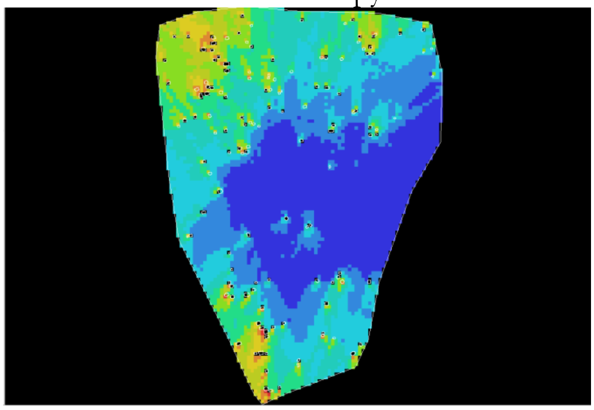
Connectivity



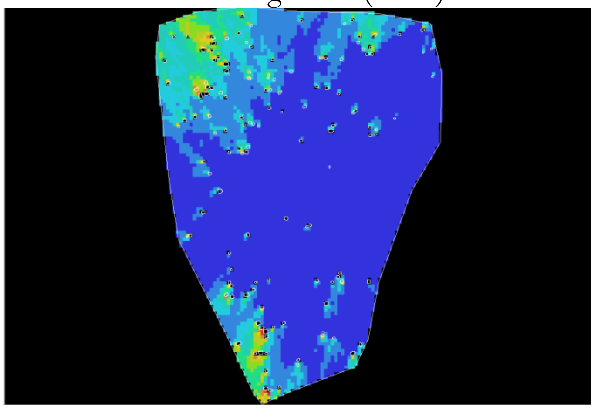
Visual Entropy



Visual Integration (TEK)

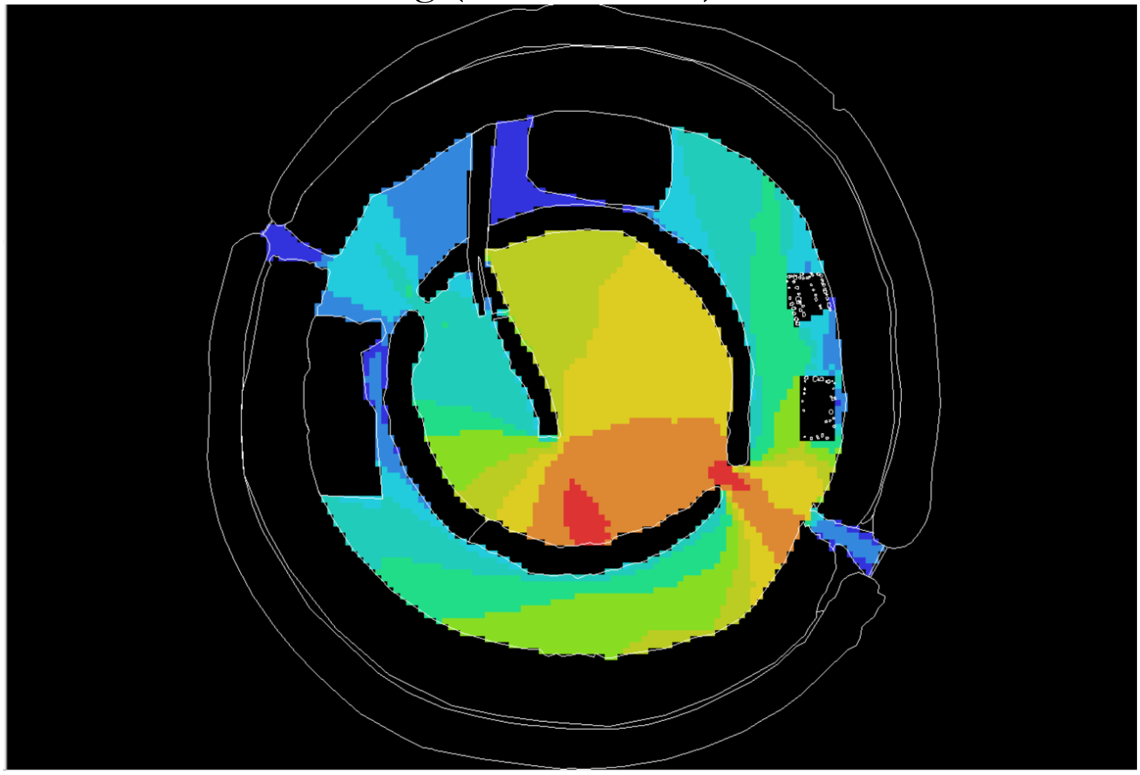


Visual Mean Depth

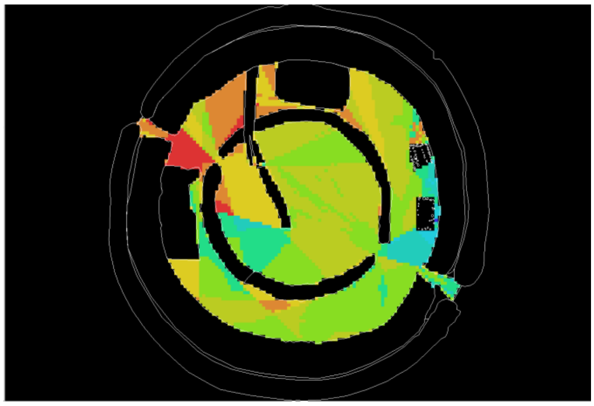


Visual Relativised Entropy

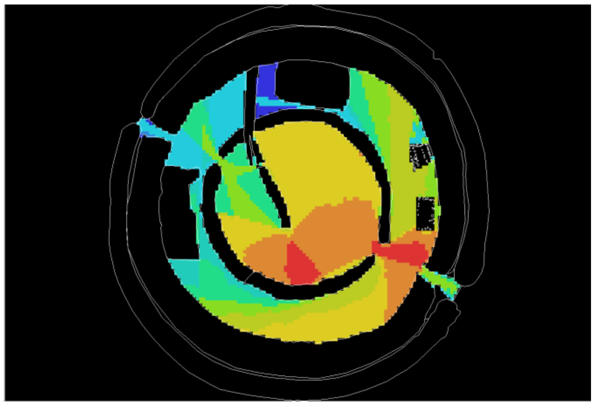
# Thwing (Paddock Hill) Phase 1



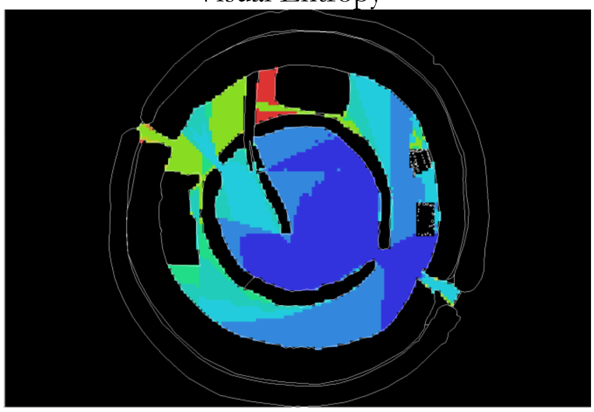
Connectivity



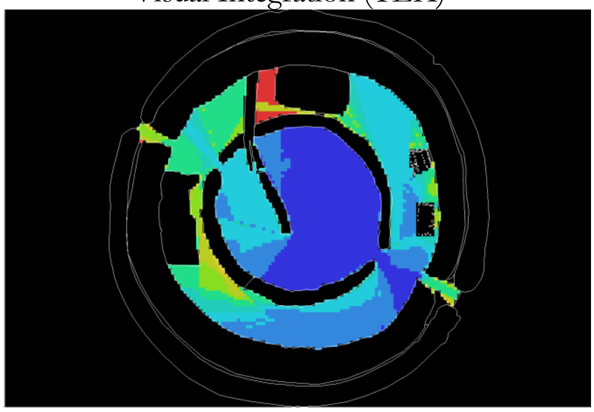
Visual Entropy



Visual Integration (TEK)

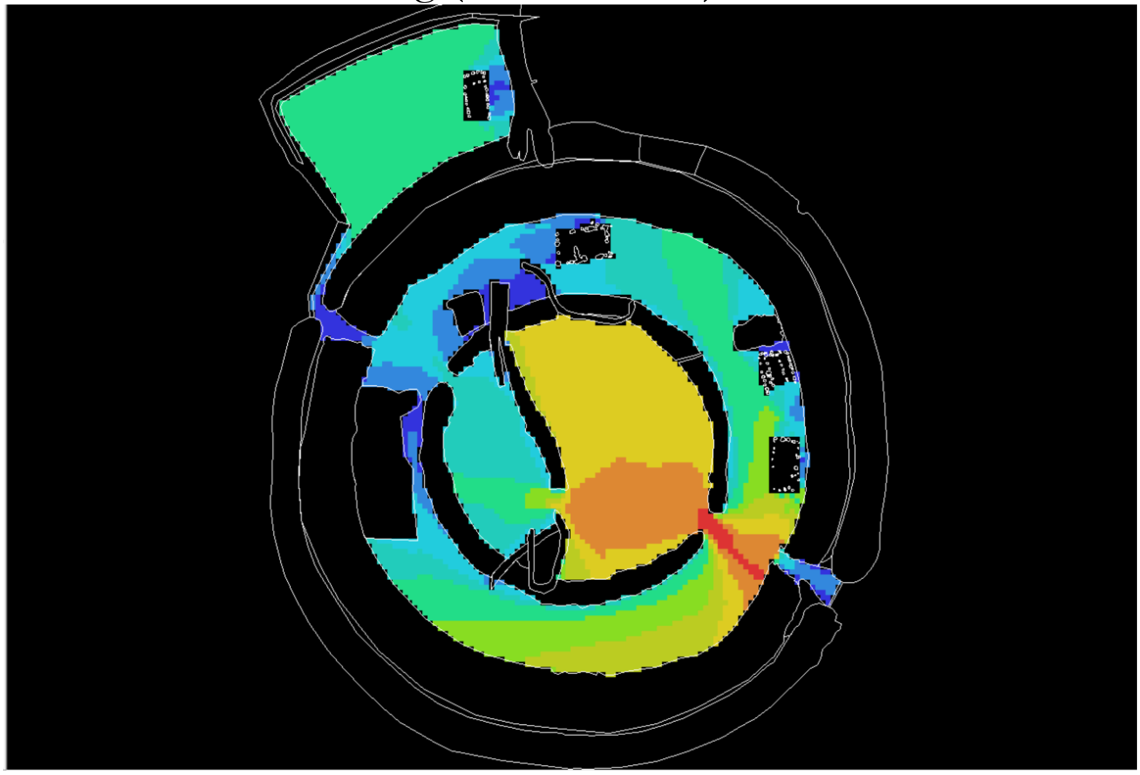


Visual Mean Depth

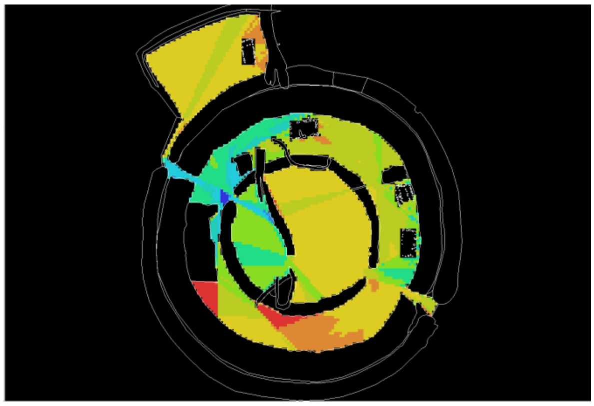


Visual Relativised Entropy

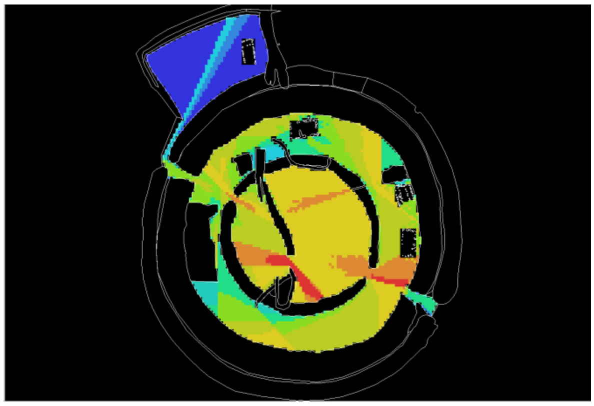
# Thwing (Paddock Hill) Phase 2



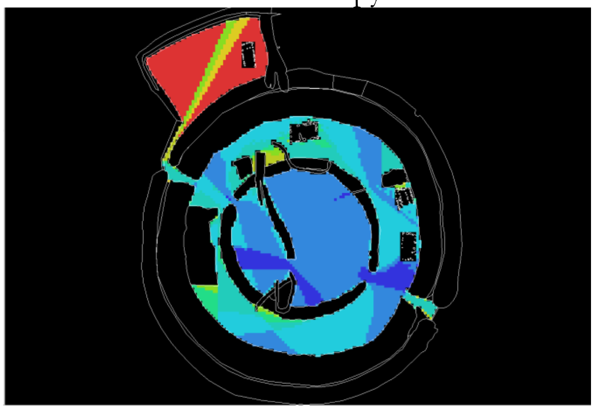
Connectivity



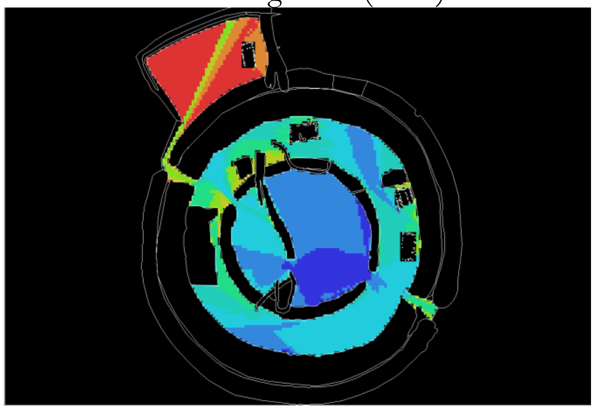
Visual Entropy



Visual Integration (TEK)

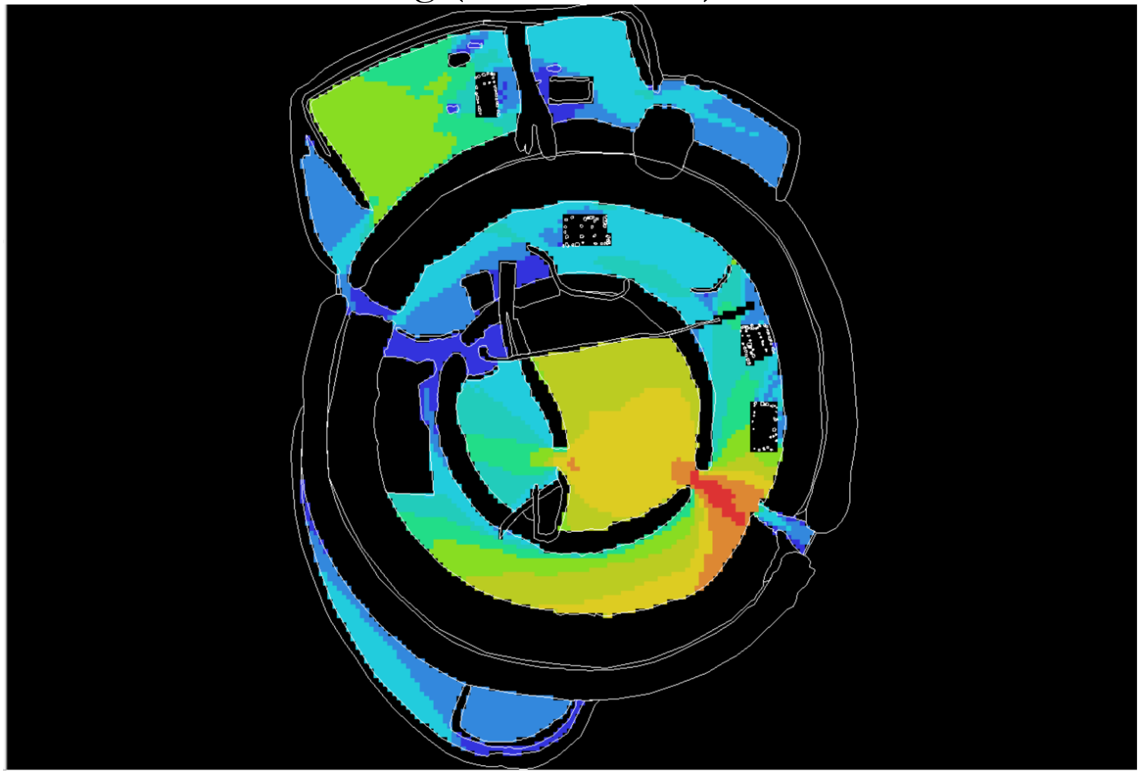


Visual Mean Depth

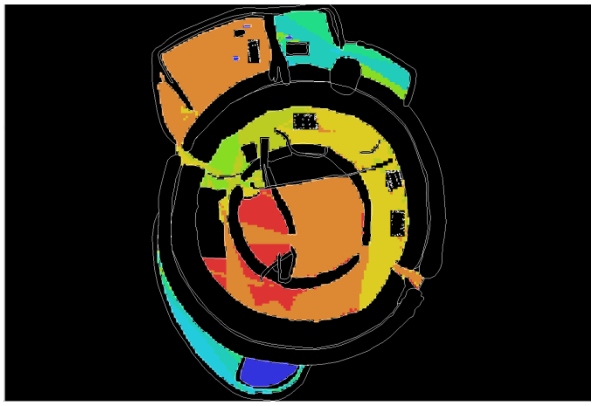


Visual Relativised Entropy

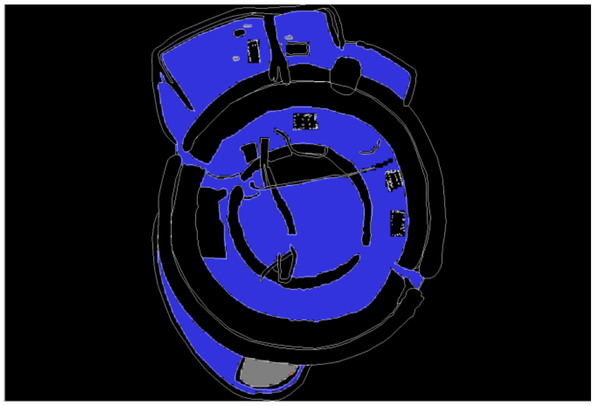
# Thwing (Paddock Hill) Phase 3



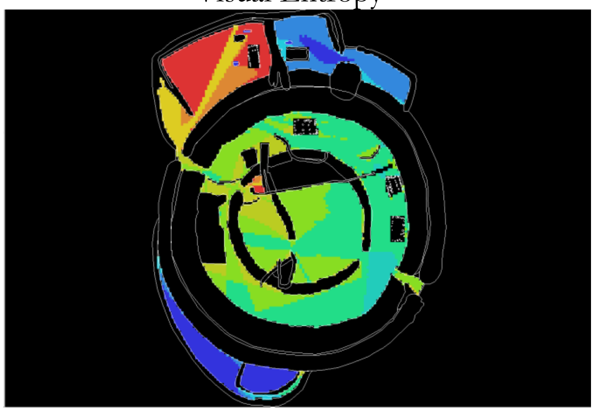
Connectivity



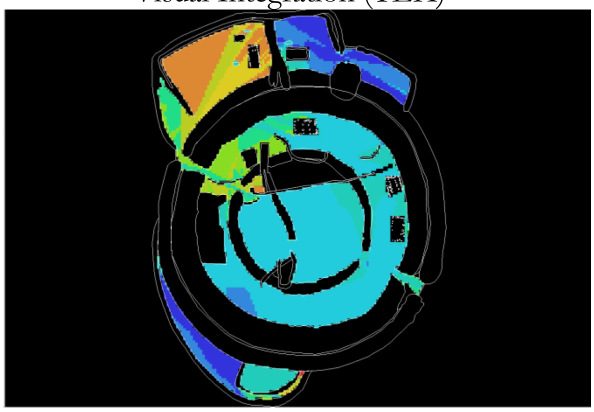
Visual Entropy



Visual Integration (TEK)

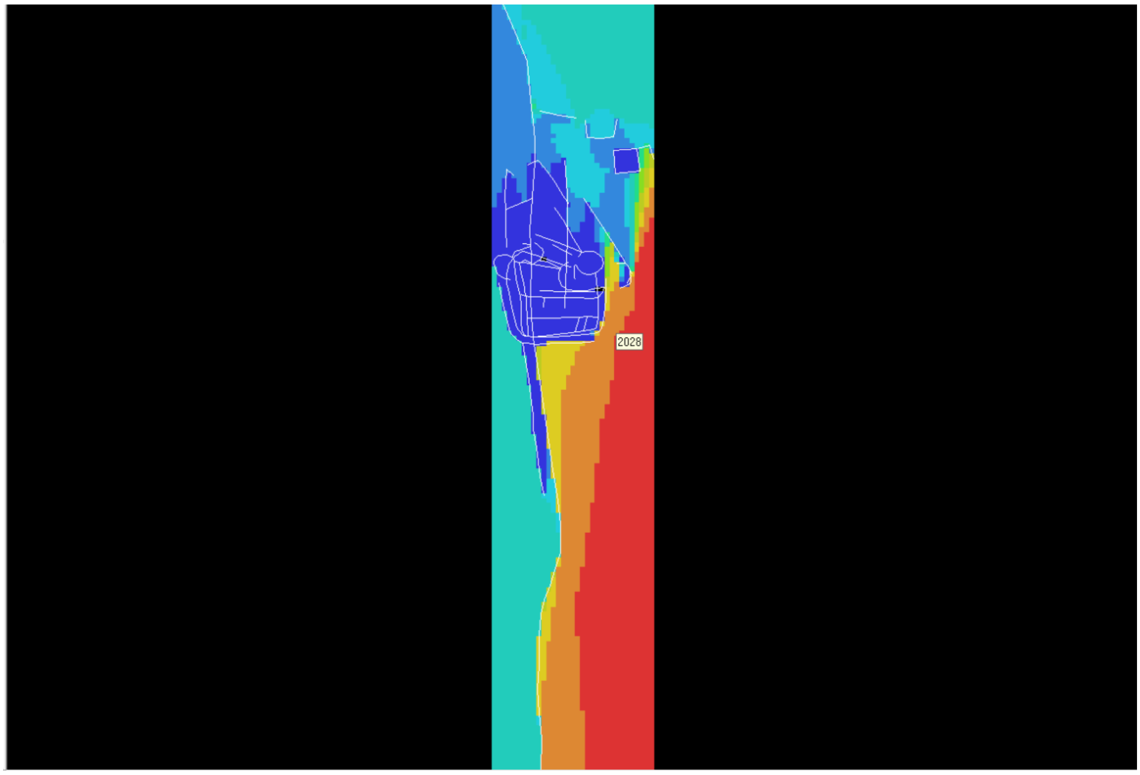


Visual Mean Depth



Visual Relativised Entropy

# Cottam

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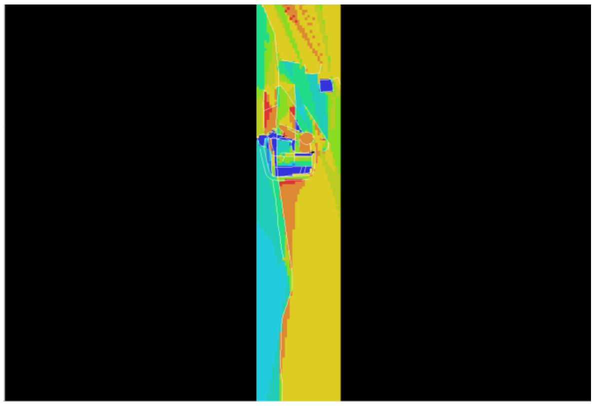
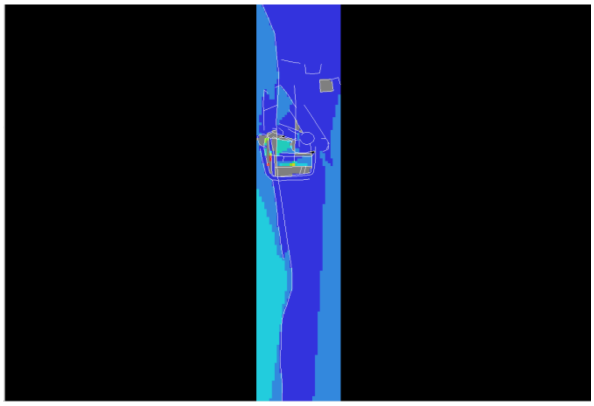
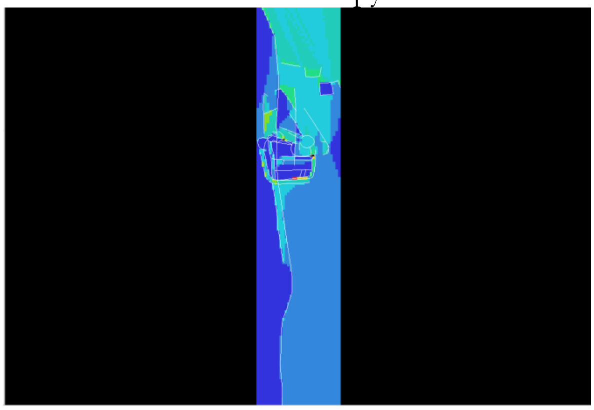


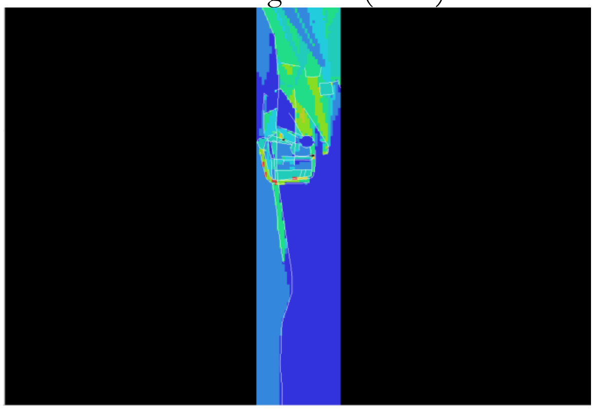
Visual Entropy



Visual Integration (TEK)



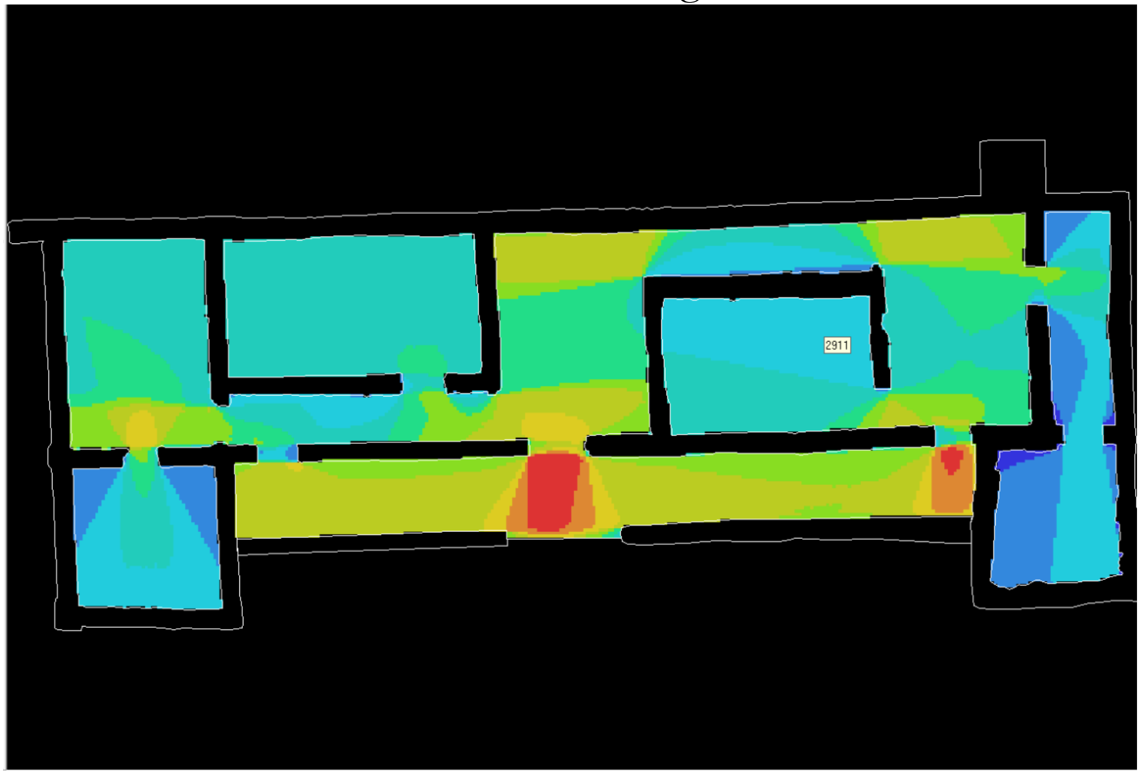
Visual Mean Depth



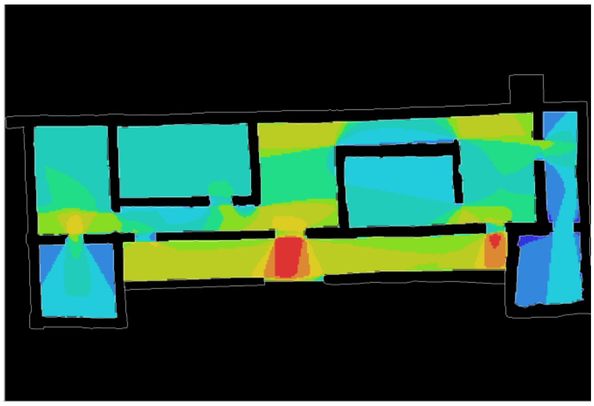
Visual Relativised Entropy

# YSR BUILDINGS

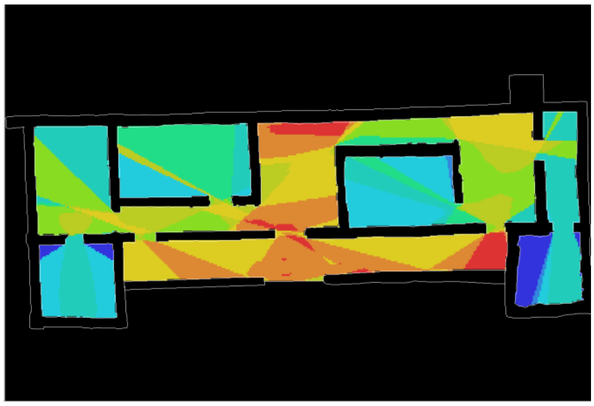
# Beadlam Villa, Building 1, Phase 2



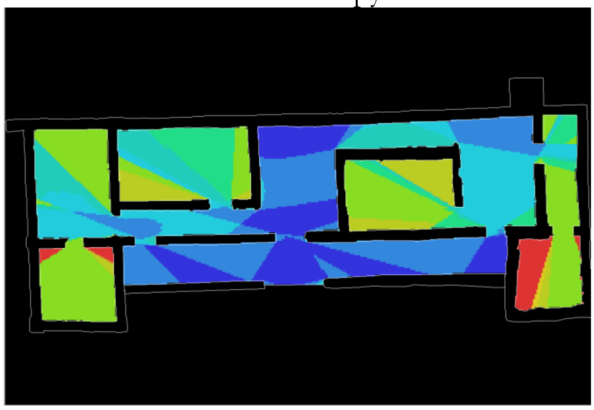

Connectivity



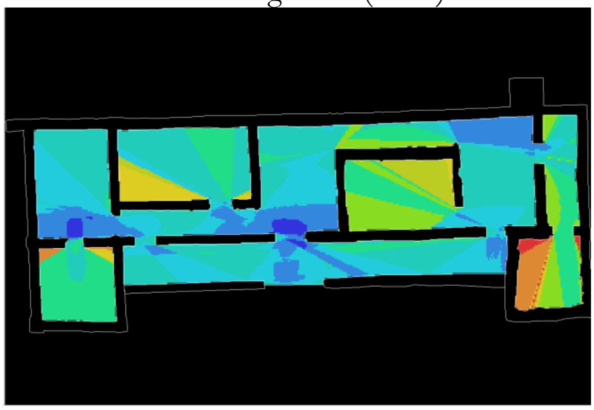
Visual Entropy



Visual Integration (TEK)

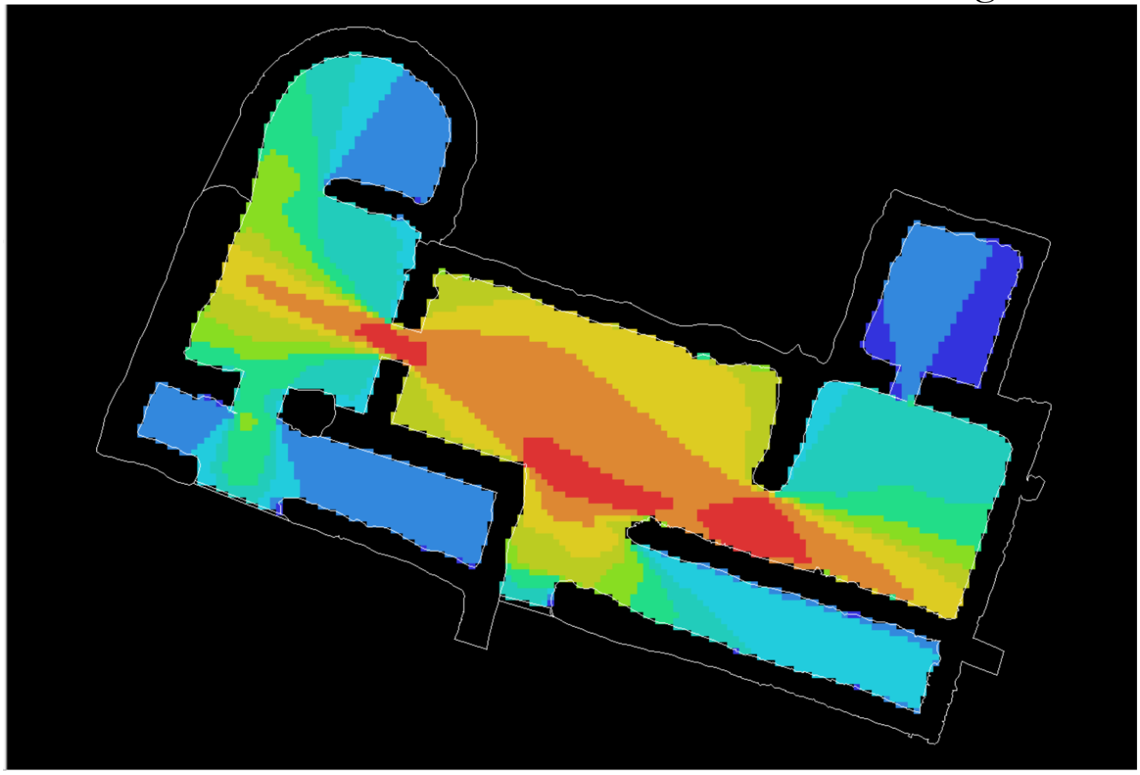


Visual Mean Depth

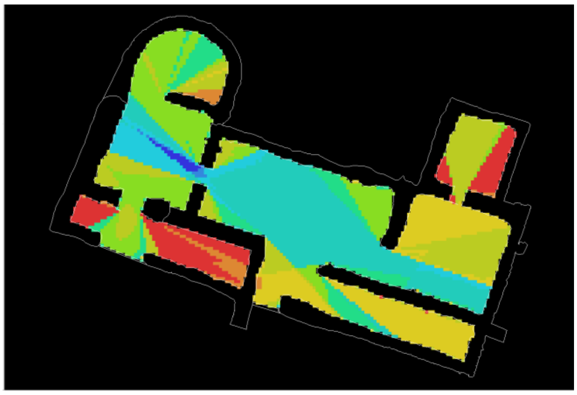


Visual Relativised Entropy

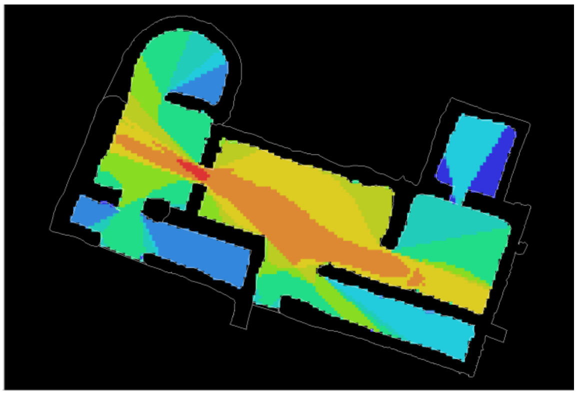
# Dalton Parlours, Roman Villa Main Building



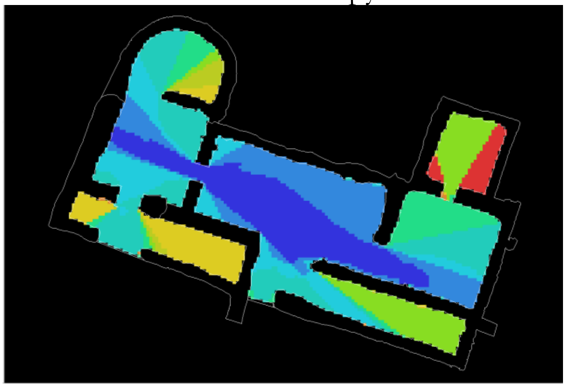
Connectivity



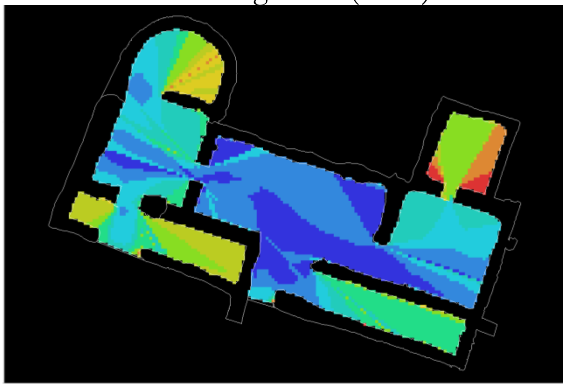
Visual Entropy



Visual Integration (TEK)

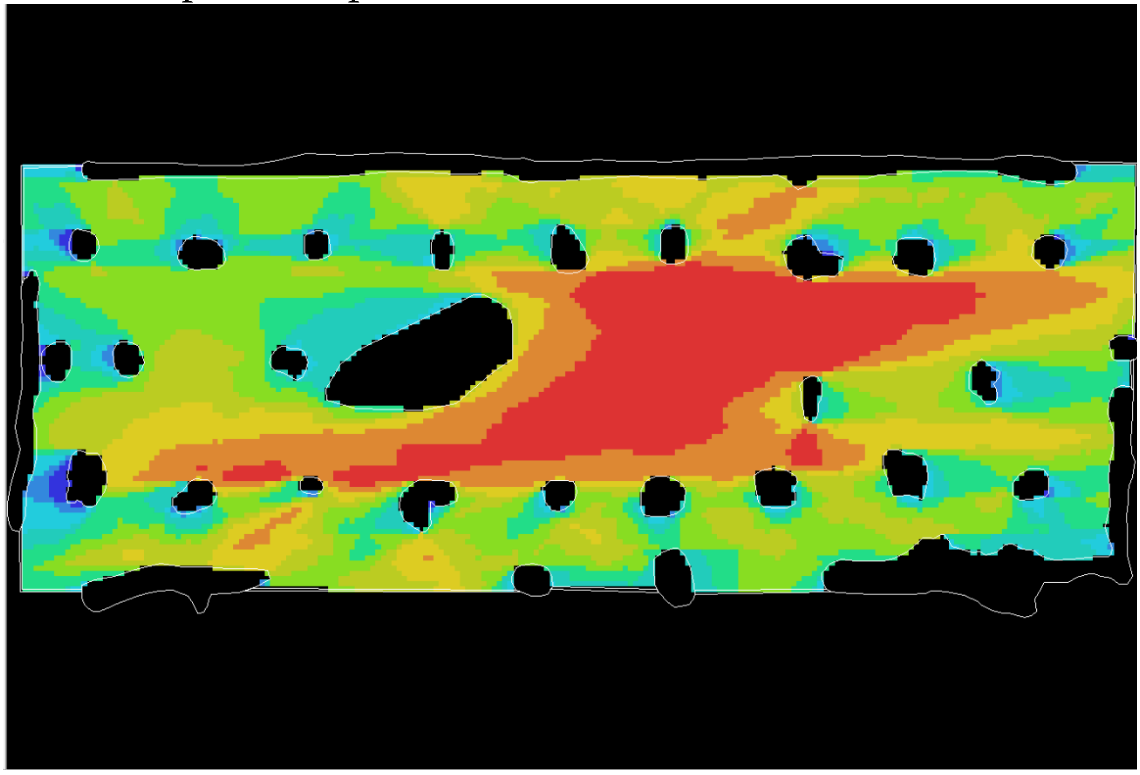


Visual Mean Depth

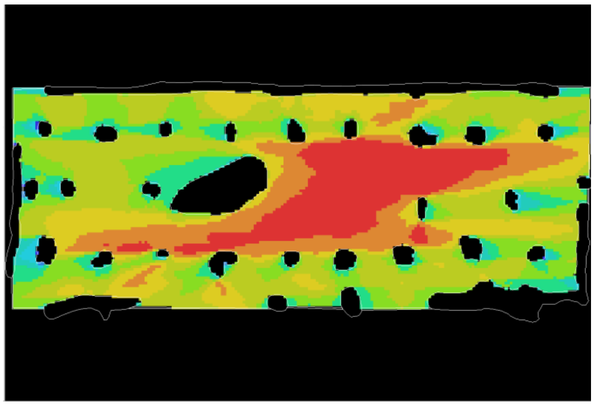


Visual Relativised Entropy

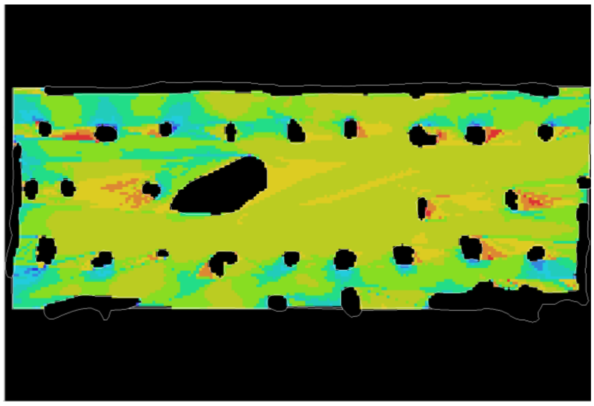
# Shiptonthorpe Roadside Settlement, Structure 3.3



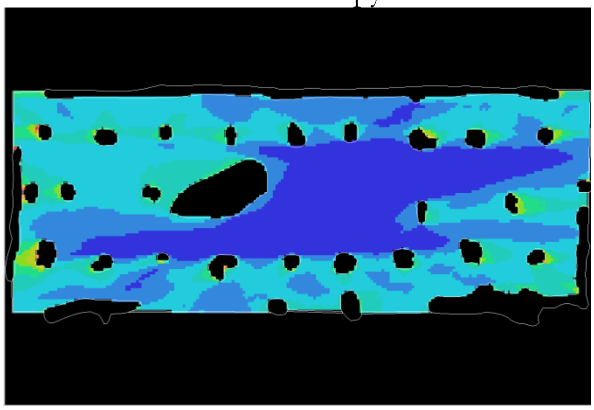
Connectivity



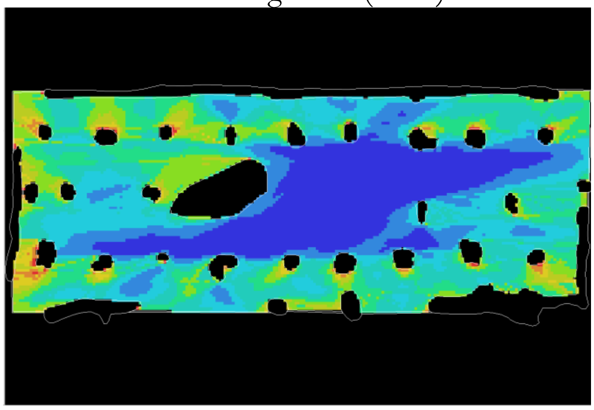
Visual Entropy



Visual Integration (TEK)



Visual Mean Depth



Visual Relativised Entropy

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