Vikings in Space
Viking Age Longhouses Through the Lens of Space Syntax and Performance

Ritgerð til MA-prófs í Viking and Medieval Norse Studies

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Abstract
Widespread in our understanding of humans is that the surrounding environment plays a large role in shaping our behavior. The artificial or built environment shaped by our own hands is one such environment. We acknowledge that structures have a special significance to our daily lives. However, when it comes to the spaces in which we interact, there has not been sufficient study on how spatial organization can facilitate certain behaviors or be used as part of a performance. This has been the case of Viking Age longhouse. Most scholarly interest until recently has dealt predominately with physical elements of these structures. Understanding how cultural or social needs gave shape to the building has been given little attention. Although that has changed in recent years, the effect of internal spatial organization on human behavior has not been looked at in connection to Viking Age longhouses. The aim of this thesis is to combine various theoretical frameworks and space syntax analytical methods to uncover how the inhabitants of Viking Age longhouses used space and the built environment to shape interactions or behaviors. This thesis makes the case that the internal spatial organization of longhouses were used both as a means to facilitate certain interactions and was also used as part of a performance undertaken by the inhabitants to convey a particular front or message, whatever it may have been. This is rooted in the notion that these structures also acted as repositories of cultural memory or experiences.

Ágrip
Það er viðtekin þekking að nærliggjandi umhverfi leiki stórt hlutverk í að móta hegðun mansins. Eitt slíkt er það umhverfi sem við hofum mótað og búið til sjálfi en vitað er að mannvirki hvers konar hafa sérstaka þýðingu fyrir daglegt lif okkar. Öllu flóknara er að skilgreina rými (e. space), vegna skorts á rannsóknum á því hvernig það hefur áhrif á hegðun okkar. Dæmi um þess konar rými eru skálar frá víkingaöld. Lengst af hefur verið lögð áhersla á að greina rýmislega skipulagningu þeirra, fremur en þau félagstegu og menningarlegu áhrif sem þess konar mannvirki miðla. Þetta er þó að breytast, einkum hin síðari ár. Markmið þessarar ritgerðar er að sameina ýmsar kennilegar nálganir og rýmisgreiningar (e. space syntax analytical methods) til að komast að því hvernig þú áóð var víkingaaldarskáls notuðu rými hans með gagnvirkum hætti til þess að móta samskipti sín og hegðun. Hér verður synt fram á að innra skipulag skálans hafi þæði verið notað til þess að auðvelda tiltekna virkni en einnig sem hluti af leið þú áóð þann til að flytja þáveðin skilaboð á milli sín, hver sem þau kunna að hafa verið. Þessi nálgun á rætur að rekja til þeirrar hugmyndar öll mannvirki virki sem geymsla minninga eða reynslu, auk þess að vera íveruhús.
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Table of Contents

LIST OF FIGURES ................................................................................................................................. 5
LIST OF TABLES ................................................................................................................................. 5

PART I .................................................................................................................................................. 6

1. INTRODUCTION ............................................................................................................................... 6
   What Do You Mean You Need Space? .............................................................................................. 6
   Problem Statement ............................................................................................................................ 7
   Structure of Thesis .............................................................................................................................. 7
   Vikings Near and Far .......................................................................................................................... 8
   This is My House! .............................................................................................................................. 9

2. RESEARCH HISTORY ....................................................................................................................... 10
   Previous Structures .......................................................................................................................... 10
   Present Construction ......................................................................................................................... 14

3. THREE LONGHOUSE CASE STUDIES ......................................................................................... 17
   Borg .................................................................................................................................................. 17
   Aggersborg ....................................................................................................................................... 21
   Hofstaðir......................................................................................................................................... 22

PART II ................................................................................................................................................. 26

4. THEORETICAL FRAMEWORK .......................................................................................................... 26
   Into the Depths of Space .................................................................................................................. 26
   Stare at Something Long Enough, It Stares Back ........................................................................... 28
   Making Space for Memory and Performance ............................................................................... 31

5. METHODS ....................................................................................................................................... 34
   Space Syntax and the Integrative Approach .................................................................................... 34
   AutoCAD 2014 and DepthMapX ..................................................................................................... 38

PART III ............................................................................................................................................. 41

6. VIKINGS IN SPACE .......................................................................................................................... 41
   Interactive Spaces ............................................................................................................................. 41
   What Do Your Eyes Tell You? .......................................................................................................... 43
   You Are Blocking the Hall-Way! ....................................................................................................... 47
   This is Our Space .............................................................................................................................. 51

7. SPACE (USING) VIKINGS! ................................................................................................................. 56
   The Stage is Set ................................................................................................................................ 58

REFERENCES ....................................................................................................................................... 62

APPENDIX ......................................................................................................................................... 67
List of Figures

Figure 1. Borg I:1b depicting post holes, fire places, and entrances. (Drawing by Dorthe Kaldal Mikkelsen and Frands Herschend; digitized by I. Radoor. Adapted from Borg in Lofoten: A Chieftain’s Farm in North Norway, 2003) ............................................................................ 18
Figure 2. Borg I:1a showing entrances, postholes and hearts. (Drawing by Dorthe Kaldal Mikkelsen and Frands Herschend; digitized by I. Radoor. Adapted from Borg in Lofoten: A Chieftain’s Farm in North Norway, 2003) ................................................................. 19
Figure 3. House D form Aggersborg orientated west to east. Arrows indicate possible entrances. (Adapted from Aggersborg: The Viking-Age Settlement and Fortress, 2014) ........................................................................................................... 21
Figure 4. Structure Phase I depicting spatial divisions. (Reproduced from Hofstaðir: Excavations of a Viking Age Feasting Hall in North-Eastern Iceland, 2009) ...................................................................................................................... 23
Figure 5. House B depicting internal areas and ceramic storage containers. Lines indicate possible pathways within the structure. (Adapted from “Behavioral Conventions and Archaeology: Methods for the Analysis of Ancient Architecture”, 1993) .............................................................................. 30
Figure 6. Sample j-graphs of two spaces in a larger spatial system. (Adapted from “Spatial Analysis and Cultural Information: the Need For Theory as Well as Method in Space Syntax Analysis”, 2014) ................................................................................................................................. 35
Figure 7. Isovist Viewfield from Entrance 2 of Borg I:1a. .................................................................................. 43
Figure 8. Isovist Viewfield from western entrance of Room C .............................................................................. 43
Figure 9. Isovist Viewfield from the north east entrance ....................................................................................... 44
Figure 10. Isovist Viewfield from within the main dwelling room ............................................................................ 44
Figure 11. Isovist Viewfields from both entrances with a) using booth interpretation of the central area and b) using platform interpretation ........................................................................................................ 46
Figure 12. Agent Analysis of Borg I:1a. Top: Released from Entrance 2. Bottom: Released from Entrance 3. ................................................................................................................................. 48
Figure 13. Agent Analysis of Borg I:1a with partitions closed. Released from north east entrance of Room C ................................................................................................................................. 48
Figure 14. Agent Analysis of House D. Agents released from north east entrance ........................................................................................................ 48
Figure 15. Agent Analysis of House D with partitions closed. Agents released from north east entrance ................................................................................................................................. 49
Figure 16. Agent Analysis of Structure AB. Agents released from northern entrance ........................................ 50
Figure 17. Convex Map of Borg I:1a depicting different distinct spaces and spatial links ........................................... 52
Figure 18. Convex Map of House D with links highlighted between the different rooms and spatial links ................................................................................................................................. 52
Figure 19. Convex Map of Structure AB. a) and b) depict links between areas based on the two central area interpretations. c) and d) depict the change of values of integration depending on the interpretation used ................................................................................................................................. 54

List of Tables

Table 1. Distances and effects on perception ........................................................................................................... 37
PART I

1. Introduction

What Do You Mean You Need Space?

Our built environs, formed out of the natural environment, have long been objects of study among archaeologists and architects alike. From mundane huts or farms to monumental constructions such as cathedrals or memorials, the role the physical constructions played has been a point of curiosity. Often the process begins with figuring out what a structure actually is. Then we move onto discussing its different relating elements: identifying its physical components, if there are signs of a building tradition, and understanding its location in the landscape. In cases where the structure contains a distribution of artifacts, within or without, what follows is a conversation of the possible function of the structure in question. At times however, this is overshadowed by the artifacts themselves and their cultural implications. Often, an aspect of the built environment that tends to be overlooked is the cultural influences or needs that go into the final form of a structure.

This pattern of the academic process or development is present in the research on Viking Age structures, particularly those associated with domestic activities or spaces. Much of the early scholarship focuses on defining building practices or styles of Viking Age structures. The Viking Age longhouse, one of the most iconic of Viking Age buildings, is at the center of much of that scholarship. Apart from the discourse on structural form and the establishing of building traditions, the focus is predominately on discussing its relation to settlement patterns or political organization. Admittedly this is changing, and yet, the internal spatial organization and its relation to interactions and performance is still a relatively understudied topic. The aim of this thesis is to expand our understanding of how space and its organization would have influenced behaviors within a Viking Age longhouse. There is a need to uncover how space may have played a part in shaping human interactions in a Viking Age context, particularly in the domestic sphere. By analyzing longhouses through different lenses, we can get a feel for what sort of interactive experiences Viking Age Scandinavian people would have had. I concede that there is no universal or pan-Scandinavia culture and this holds true for Viking Age longhouses. Different regions in Scandinavia had their own variation of a longhouse.
However, there are underlying features that are present in the many variations that allow longhouses to be viewed as part of an overall cultural practice or building form.

**Problem Statement**
The main question asked in this thesis is this:
Did Viking Age longhouses—through their internal spatial configuration—structure the behaviors of their inhabitants, and was this a result of cultural or social ideology being embedded in the overall structural design?

This question will be addressed by trying to answer the following questions: were longhouses designed in such a way to encourage or discourage movement through certain areas of the longhouse? Was visual accessibility a factor in determining what areas of the structure were physically accessible and did it have a role to play in the types of interactions that may have occurred in certain spaces? Is it possible that the internal spatial organization of the longhouse was used in conjunction with the performances of both daily and social activities?

**Structure of Thesis**
This thesis has been divided in three parts. Along with this introduction, Part I will begin by highlighting what is generally understood of Viking Age Scandinavia culture in a broad sense. Afterwards, a brief overview of the history of scholarship surrounding the Viking Age longhouse will be presented. Three longhouses, based on the availability of material and documentation, are chosen for study in this thesis and are introduced in Part I. They are Borg I:1a from Norway, House D from Aggersborg, and Structure AB from Iceland. Part I aims to give the foundation on which this thesis will be built upon.

In Part II, the theoretical frameworks which will guide this thesis will be presented. Following that, I will discuss the methodological process that will be applied in the analysis. Space Syntax analytical methods provides the primary means of extracting data from the selected data sources. This is assisted by the use of the computer program DepthMapX.

Part III consists of an analysis of the data selected through the highlighted methods. Each of the three longhouses will be examined via DepthMapX and the results interpreted through the different theoretical lenses mentioned in Part I. It is through this discussion that the research questions posed by this thesis will be addressed. Part III will end with concluding remarks regarding the resulting analysis.
**Vikings Near and Far**

As far west as the site of L'Anse aux Meadows in North America to their trade along the Volga river with Islamic merchants (Androshchuk, 2008; Montgomery, 2008), Viking presence is dispersed over a considerable portion of the Northern Hemisphere. This has led some scholars to characterize Vikings as a diasporic society (Abrams, 2012). Large numbers of Viking Age Scandinavians left their native lands and settled in new areas while at the same time keeping some traditions from their ancestral home. This of course leads to many regional differences in lifestyles among the Viking settlers. However, there are still features that link the far flung settlements to Scandinavia. One of the features of Viking settlement, both within and without Scandinavia, was the longhouse. Longhouses will be discussed in detail in a later portion of this thesis. Within Scandinavia during the Viking Age, settlements were typically small and were generally centered around farmhouses or small villages. This is a pattern that stretches back as far as the Vendel Period (Magnus, 2002). Throughout most of the Viking Age, communities were small independent land holdings typically comprised of the landowner and immediate family. More affluent farms had more structures apart from the main hall or house and other workers apart from the immediate family (Roesdahl, 1998). The political landscape during the Viking Age in Scandinavia saw power wielded mainly by wealthy farmers and cult leaders (Brink, 2008; Magnus, 2002). Things or assemblies were the main legislative and judiciary organizations, with notable examples in Iceland and Norway (Brink, 2008). They eventually come to be replaced as strong leaders start to consolidate their power (Roesdahl, 1998). There were no cities in the greater part of Scandinavia, though urbanism did start to grow during the Viking Age. Four of the well-known urban centers are Ribe, Hedeby, Birka, and Kaupang (Magnus, 2002). These urban centers have a different character of habitation than those of the more rural settlements. Scandinavian trade centers or urban sites dated to the Viking Age have received a fair amount of attention. It is through them that we can observe Scandinavian connections across Europe and the development of centralized powers in the North. However, rural settlements are the focus of this thesis as they may be more representative in general of how the people of that period would have lived.

Apart from the types of production in urban centers, craft and food production generally occurred on the farm or the individual settlement. Labor has generally been treated as being divided along gender lines (Ljungkvist, 2008). Tasks typically done by
men were metal working, hunting, herding, fishing, and construction (Roesdahl, 1998). Typically, men were also the ones who handled legal matters and participated in the larger public sphere. Women did have some autonomy and as such were allowed to own some property as well as having legal rights in some instances (Brink, 2008). Common tasks done by women include cooking, textile production, small craft production, and child rearing (Roesdahl, 1998). Combat was predominately done by males. It should be noted that such a division was not universal and that life differed between rural and urban life. For example, some Viking women’s graves in Birka, Norway, and Russia, contain scales and weights. This has been taken to indicate a more prominent or active role in trade by women in urban or trade centers (Stalsberg, 1991). In rural communities, it is argued that men also were part of the domestic sphere. They were undoubtedly involved in food processing, and in certain occasions cooked for themselves (Croix, 2012). This illustrates a reality of regional variations pertaining to the divisions of labor by gender. There are no universals edicts though there are general trends. It is important to keep that in mind throughout this paper.

This is My House!
As mentioned earlier, one of the main domestic structures of Viking Age Scandinavia is the longhouse. What is meant by longhouse here is not to be compounded with the hall. As is pointed out by Karen Milek, the “term ‘hall’ has distinct connotations of the high-status and the non-domestic” (Milek, 2006: 89). This thesis will focus mainly on structures that involve or deal with domestic or daily life, in this case the longhouse. Longhouses generally are seen to vary between two forms: an older form which has seen use since the Bronze Age and a newer form that appears similar to an overturned boat (Fallgren, 2008; Magnus, 2002). The earlier form is described as having three aisles and two rows of posts running parallel to the length of the house that were the main support for the roof (Fallgren, 2008). The location of the entrances varied from the middle of the house to the two ends of the building (Magnus, 2002). The walls were thick and low with the sides which, at times, were built into the ground. They ranged from 5 to 50 meters in length and from 6 to 8 meters in width (Fallgren, 2008). One of the largest examples of this earlier form is that of Borg in Lofoten situated in Northern Norway, which is used in this study. The second form, which starts to emerge around the end of the 9th century, is similar in design, although the sides tend to have a more prominent curve (Magnus,
They were generally wider than the previous longhouses and had more spacious rooms as a result. A shared feature between both forms is the existence of a longer and larger central area which contained the main hearth. This central area tended to be a hub of daily activity and habitation for those who occupied it. Apart from this central area, the house was generally split into two other sections. Although the function of the two ends varied between sites, there is a general trend to assign one of the side ends at least to the care and maintenance of animals (Milek, 2006). These buildings generally were also the center of most individual rural settlements.

Building materials varied between the different regions in which they are found. In Norway one observes that timber for frames and walls was widely used. In Iceland, more stone and turf usage occurs (Orri Vésteinsson, 2010). Daub and wattle are other building materials and techniques that were part of the longhouse construction in different areas (Skre, 1996). Their location also varied as to where they were constructed. Moreover, they tend to be built upon prominent or higher ground (Harrison, 2013). This can be seen wherever Viking structures have been found. They are linked in this way to certain cultural traditions related to the choice of building location. The variation of different building materials also highlights the regional variation that exists between longhouses. There are instances of Viking Age longhouses that do not fit in well with the aforementioned traits. This is partly due to potential different functions but also different regional views on how to build a house. It is also important to take into account that, on some of the sites, rooms have been added to the main structure. The reasons for this may vary, but overtime we see more rooms added to longhouse itself (Orri Vésteinsson, 2010; Fallgren, 2008). Eventually the longhouse comes to be replaced around the 13th and 14th centuries by other structures. However, the longhouse tradition was one that has seen a long and extensive life. As such, it would be difficult to image that these structures did not have a meaning beyond habitation space.

2. Research History

Previous Structures
Previous scholarship has laid the foundations for our knowledge of Viking Age longhouses, and it would not be possible to build new frameworks without discussing the research that came before the present study. The corpus of research involving the Viking Age longhouse is vast and has been written in several languages. What would be
presented here is by no means a comprehensive summary of all past research. Such an undertaking would be beyond the scope of this thesis. Instead, what I will bring to light here is a small sample of research which will give an impression of the trends of research both past and present on Viking domestic structures. In doing so, I aim to show what gains we have made in this field of research and also what further directions we can take into constructing a more complete view of not only the Viking past, but also what role the internal spatial organization of the longhouse may have played in that over all culture.

The Viking longhouse calls to mind images of the hall lined with warriors engaged in a feast. This is a common scene in the available literature. Coupled with the knowledge that it is through these houses that we can understand domestic life and social structure to a degree, it is no surprise then that longhouses have a long history of study. Indeed, how to identify and construct these structures is one of the early focuses of research. We see that in Frands Herschend’s work on Swedish house types from 500 to 1100 A.D. He outlines the potential challenges and changes that Viking builders would have had in constructing their homes (Herschend, 1989). These challenges are chiefly tied to the environment and the available technology. Herschend gives a detailed analysis of the different elements that would have given the longhouse its shape, notably the kind of supports the roof had, and how this could have been reflected in the archaeological record (1989). He highlights building traditions that have changed over time in Sweden and he attributes the changes not only to technological advances but also to the availability of materials (Herschend, 1989). Also mentioned is the connection between larger homes and social status:

In the period 500-1100 A.D there is no doubt a link between high social status and ownership of a large spacious house, but there is also a growing lack of the kind of timber that allows you to fulfil your intentions at reasonable costs…There are a lot of solutions to the main problem of house construction, but the question you should ask before you choose is whether the solutions is in line with the building tradition and whether it is socially acceptable (Herschend, 1989: 96).

Here we see a mention of external factors that might have influenced longhouse design apart from technical concerns. There is potential here for Herschend to ponder about on what the non-technical concerns are, but this line of enquiry is not pursued. Granted, Herschend is mostly concerned with identifying the available technology for
construction and in doing so, he is laying the groundwork for future research. As such, Herschend should not be too harshly criticized as he provides work to build upon.

This is echoed in longhouse scholarship of Denmark and in Norway. Holger Schmidt’s publication, *Building Customs in Viking Age Denmark*, revolves around establishing the history of longhouse construction in Denmark. Schmidt begins with introducing different sites found throughout Denmark and a brief history of each site. He proceeds to discuss the technological and environmental factors that may have influenced their construction and their layout in the settlement or site. A fair amount of space is spent on discussing large houses and sites such as Trelleborg (Schmidt, 1994). The associated longhouses are used as points of comparison between the longhouses he identifies (Schmidt, 1994). However, the conversation does not stray away from a strictly physical description. Indeed, he follows up this discussion with talking about the dimensional aspects of the longhouses he analyzed and the potential activities that occurred within: weaving, cooking, housing of animals, small crafts, sleeping and other domestic activities based on artifact finds (Schmidt, 1994). Much like Herschend, Schmidt is interested in establishing a catalog of sorts, or seeks to identify a building tradition within Denmark. This is a necessary step in the understanding of the different aspects of a culture. However, he hardly ventures into the non-physical elements of the built environment. When it does appear, it is often in relation to the potential influences on Viking Age building customs: the impact of Carolingian building traditions on fortress building practices or the increasing role that the Danish royal power played on the organization of settlement as a whole (Schmidt, 1994). Although Schmidt’s aim is not to delve into the non-tangible aspects of the sites in questions, he does provide the grounds to ask questions about the societal characteristics of each site.

In Norway, Bjørn Myhre is one of the key researchers into Viking Age. His work centers on the changing nature of different settlements throughout Norway (Myhre, 2000). In regards to rural or agrarian settlements, Myhre argues against a population increase in Norway during the Migration period and the Early Viking Age. Instead, he points out that the population increase occurs during the Late Viking Age or High Middle Ages (Myhre, 2000; 1978). When he talks about the houses of agrarian settlements, Myhre marks a difference between the South and North of Norway. The few excavated Viking Age houses in South Norway are generally small, and some share a design similar to the hall found in Scandinavia (Myhre, 2000; 1978). Myhre observes
that during the Viking Age, the byre begins to be separated from the main house. However, in North Norway, Myhre highlights that longhouses still retain the byre and that the multifunctional longhouses are still commonly found (Myhre, 2000). He uses this discussion to bring to light how people lived on their settlements and the way they responded to the changes occurring during the Viking Age (Myhre, 2000; 1978). Apart from marking a difference between North and South Norway building customs, Myhre does not delve into the different influences that may have affected longhouse design. However, his regional distinction is important and allows for others to explore the potential influences that went into longhouse design.

Dagfinn Skre expands on this in part through his analysis of the changing nature of the main house on settlements in Norway (1996). He begins with a brief overview of the shifting of scholarly focus between settlements and the longhouse itself. He underlines that in Norwegian Settlement Archaeology, the interest of research has changed from the house itself, to the settlement, and back to the house (Skre, 1996). Skre moves on to describe the physical features of the longhouse throughout different periods of time: the Migration Period and a length of time spanning from the 7th to the 14th century. When he comes to the Viking Age, Skre notes a change in construction procedures from a post technique to a cornering timber method and posits that their use may be tied to social status (Skre, 1996). Here we see an attempt to explain possible social decisions on the form of a longhouse. Expanding on Myhre’s work, Skre makes a distinction between South, East, West, and North Norway and the longhouse building customs that were found in each region. However, he does not return to expand on the social reasons as to why certain forms persist or fall out of use. There is a potential here that, again, is overlooked. Although both Myhre and Skre do not speculate as to the possible reasons why different variations of longhouses exist, they do provide useful information about the physical aspects of these structures that would make it possible for other researchers to detect foreign influence on design.

Iceland is in a unique position in that it has abundant sources of information and that a majority of it is already published. This is tied to the recent growth of archaeological interest and archaeological methods in the country (Orri Vésteinsson, 2004). However, as is mentioned by Orri Vésteinsson, there were different agendas among early excavators between the 1930s and 1940s, with a particular emphasis on relating sites to the Icelandic Sagas (2004). In his discussion, he is focused on the general
history of excavation in Iceland and the implications it has had on archaeological research within the country. Scattered throughout his study are mentions of different longhouse sites. He centers mostly on the methods of early excavators and their effect on the more recent excavations of these longhouses. Apart from that, he does not address the longhouses themselves. In a later article in which he discusses the formation of farm mounds in Iceland, there is a mention of longhouses but only in reference to their changing form in the 10th century (2010). The conversation revolves on how the form and occupants of the longhouse contributed to the formation of the farm mounds that are found later in the Medieval Period. However, Orri Vésteinsson does venture into forming some thoughts on the social sphere of people who inhabited the structures. When he talks about the addition of annexes to the longhouse proper, he postulates that

> It is very tempting to interpret this as a reflection of increased authority of the household manager, presumably the housewife…With the maid churning butter in the pantry, with no escape except past the central hearth, and the servant boy plucking feathers from ptarmigans in front of the fire, the housewife can monitor both and make sure they do not interrupt each other or are interrupted by others (Orri Vésteinsson 2010: 37).

It should be noted that there is no explanation as to how this conclusion was reached. Although this comes at the end of his study and does not really delve into the social use of space, it nonetheless reflects his pondering on societal norms that are not directly visible in the archaeological record. A response to this interpretation is seen in a recent article by Steinunn Kristjánsdóttir. She argues that Orri Vésteinsson’s interpretation stems from a functionalist approach and does not take into account the changing social ideology (Steinunn Kristjánsdóttir, 2015). Although primarily dealing with the conversion of Iceland, she nonetheless argues that “becoming Christian did not necessarily involve greater religiousness” but rather “people synchronized their everyday life – its religious and secular aspects – in accordance with Christian doctrine and laws, in church as much as at home” (Steinunn Kristjánsdóttir, 2015: 14). As a consequence, in an attempt to synchronize everyday life with newer religious ideology, the Icelandic house or longhouse was altered with the addition of annexes to the main structure to reflect that change.

**Ongoing Construction**

Interest on the social aspects and the internal space in longhouses is growing and producing thorough and insightful research. Karen Milek’s study on the longhouse at
Aðalstræti is an excellent example. In her work, she combines space syntax methods and micromorphology samples of the floor layers to come up with an accurate depiction of the location and the kinds of activities that went on in the longhouse. She was able to establish that the areas in the southern part of the house appeared to be related to textile production.

In the southeast corner of the house, there was a small room where urine, seawater, and/or lye made from a mixture of seaweed ash and water may have been used for washing, fulling, and/or dyeing wool. This room may have been accessed by stepping over a threshold, or by going through a door. If urine was collected and stored in this area in order to be used for washing wool, the room would also have functioned as a urinal (Milek, 2006:202).

She does not stop there and furthers the possibility of space shaping behavior. She describes the southeast corner as being potentially used as a urinal and also illustrates the way in which someone would enter this area of the house (Milek, 2006). Here we notice a shift away from the discussions on purely physical features of Viking longhouses. This is an attempt to infer behavior from space which has not really been discussed in detail in previous scholarship. What is important is the method employed to reach such a conclusion. It combines analytical tools that lie outside of the discipline of archaeology. This allows for a follow up conclusion in how the space was organized apart from the clear function of the room and what it might have meant.

The central post in the ‘transitional’ space at the south end of the living room may have effectively served as the boundary between the parts of the house where visitors had access, and the parts of the house where wool was washed and where other domestic activities could take place in private. The weaving area was technically on the other side of this transitional space, but unlike the other spaces towards the back of the house, it was open and visible from the living room. This is important, because it suggests that weaving was considered a domestic activity, but that it was not a particularly private activity and it was not considered advantageous or necessary to segregate it spatially (Milek, 2006: 208).

Here we see an attempt to look beyond functionality and a movement towards an understanding of how a culture viewed not only certain activities but also how spatial organization reflected a degree of social ideology. In turn, this may hint at how behaviors were structured within domestic structures. It should be noted that this by no means can be used to represent Viking Age culture as a whole. However, it does make a compelling argument in this instance.

Following Karen Milek’s example, Sarah Croix looks at how gender may have been reflected in the use of space in the Viking Age. She first draws on different
theoretical frameworks on how people relate to space. She highlights “that much as human bodies and elements of material culture, space can be charged with symbolic meaning through the performance of certain actions” (Croix, 2012: 16). Depending on the performances or actions, space as a result can become gendered. However, she also cautions that space “may be used by a gender group without necessarily leading to its gendering, or by another gender group without challenging its original gender association” (Croix, 2012: 17). An analysis of different Viking Age houses follows in her work. Croix examines artifact distributions and their implications towards activity areas. She is thorough in her review and concludes each case study with a presentation of how different regions on the site represented certain activity areas (Croix, 2012). Using the theoretical framework outlined earlier, she then looks at the implications of space and gender across longhouses in Norway, Denmark, and Iceland. Croix makes the reader aware that such a process is difficult due to problems that may lie in the archaeological record. Nonetheless, she highlights that Viking-Age gender ideology, regardless of how strict the attribution of male and female roles was, had little impact on the practical organization of space in houses and farmsteads. Likewise, the occasional hosting of guests did probably not condition how houses were built, except for the halls which had a different raison d’être than agrarian houses. The distinction male-public-outdoor versus female-private-indoor was far from clear-cut; if such associations did exist, they must have had a great degree of flexibility, especially in settlement context (Croix, 2012: 189).

Here is an excellent example of space being treated within its social context. Croix’s analysis through activity areas and their association to gender sets a great precedent on how to understand the use of space in Viking Age Scandinavia from a gendered perspective. However, her assertion that the hosting of guests may not have influenced the design of longhouse possibly stems from a public and private dichotomy. It is possible that hosting guests influenced house design from the perspective of performance. I will elaborate on this subject later on in this thesis. This is nevertheless a small critique on an otherwise very solid and thorough study.

Some Building Notes
What has been presented here so far is a limited overview of the ways in which scholarship on Viking Age longhouses has changed through the years. As been stated earlier, it is not exhaustive and only covers a fraction of the available research. That being said, the aim of this section of the thesis was to show that until recently, the
discussion of house form did not take into account the extent of social or cultural influence on design. Just as technological and environmental factors are important in understanding why a house is built a certain way, it is equally necessary to uncover the role cultural ideology had in shaping a building. Longhouses have been viewed from the perspectives of power and economics. Doing so has given us an awareness how people in Viking Age Scandinavia engaged with each other on those grounds. This is tied to settlement studies, which has been crucial in uncovering what daily life may have been like during the period in question. In that regard, much is owed to the earlier scholars presented above as they have laid the necessary groundwork from which to grow. Indeed, it is through their work that researchers such as Milek and Croix are able to provide us with interesting and important information. However, we should not limit ourselves to only to certain venues of research. As Milek and Croix highlight, there is much to be gained when we strive to look beyond just the physical dimension. That being said, it is still necessary to ground our work with both the findings of earlier scholars and the material available to us.

3. Three Longhouse Case Studies
In an effort to glimpse how space might have been used in Viking Age longhouses, three well studied longhouses will be examined in this thesis. Found in three different locations with a Viking presence, what will be sought after is not only their physical layout but also their internal spatial organization in relation to activities and overall design.

Borg
Found on the island of Vestvågøy in the Lofoten islands chain, the longhouse at Borg is perhaps one of the most famous houses dating from the Viking Age. There are many signs of humans inhabiting the Lofoten islands which go as far back as the Stone Age (Johansen and Munch, 2003). For the longest time, humans have been making use of the resources of the surrounding environment. Research and excavations at Borg started in the 1980s, and it is therefore one of the better documented sites from the Viking Age. Although there are different buildings which have been detected at the site, it is the large Viking Age structure that will be analyzed as it is the most studied. Labeled as Borg I:1, this house is the largest known excavated longhouse dating from the Viking Period. It
has two phases: Borg I:1b and Borg I:1a. Borg I:1a is the later phase and will be the phase chiefly examined in the context of this study.

Based on a series of $^{14}$C dates of charcoal samples and artifacts combined with the relative chronology of artifacts, the occupation of Borg I:1b (Fig. 1) can be dated to as early as the 5th or 6th century (Johansen and Munch, 2003). Borg I:1b has an internal length of 64m and a width varying between 7 and 8m. However, the exact length is unknown as the gable ends were not preserved (Herschend and Mikkelsen, 2003). Borg I:1b had two entrances. Both led into a central entrance room, Room C. Two hearths or fireplaces were found in two presumed rooms; Room A and Room B (Herschend and Mikkelsen, 2003). The remaining room to the north-east is labeled Room D. Borg I:1b was torn down and Borg I:1a built right on top of it. Consequently, it is difficult to define in detail the function of each room in Borg I:1b. It is possible however to identify the function of each room in a general sense. Room A is seen as a potential living or dwelling room on account of a possible hearth. The larger hearth in Room B leads to it being interpreted as a hall of sorts. Room C is labeled an entrance room as it has the two entrances into the structure. Room D is understood as a byre because this area is associated with animals in the later structure (Herschend and Mikkelsen, 2003). More information is available relating to the function of rooms and potential activities areas for Borg I:1a.

When Borg I:1b comes to be replaced by Borg I:1a (Fig. 2) is not exactly known, however it has been put forward that the change occurred around the 7th century (Johansen and Munch, 2003). There was a period of time used to prepare the site for the construction prior to building the later house (Herschend and Mikkelsen, 2003). After its construction, Borg I:1a is in use up until the 10th century when it is demolished.
(Johansen and Munch, 2003). The inner length of Borg I:1a is 80m with a width that varied between 7.5m and 9m (Herschend and Mikkelsen, 2003). There are five entrances leading into Borg I:1a. Entrance 1 is along the northern wall leading into Room B. Entrance 2 also leads into Room B from the southern wall. Entrance 3 leads into Room D from the southern wall and is wider than the other entrances. Two entrances lead into Room E. Entrances 4 and 5. Entrance 4 seems to have been used by cattle, whereas this does not appear to be the case for Entrance 5 (Herschend and Mikkelsen, 2003). Partition walls distinguish the different rooms in Borg I:1a. Two partitions bound Room B and it serves to separate rooms A and C. Room C has a partition wall separating it from Room D. Room E has a partition wall to separate it from Room D. It should be noted that no traces for the partition walls are found. Rather they are inferred from the relative positions of the roof supporting posts and the general archaeological knowledge and common-sense reasoning of the contributors of the Borg publication (Herschend and Mikkelsen, 2003). Both Rooms A and C have hearths, though Room C has two.

The longhouse at Borg yielded a large number of finds. However, a majority of them were found out of their primary context and do not aid in identifying the potential roles of the different rooms. This is especially so in the case of Borg I:1b. Despite the majority of artifacts being found out of context, several artifacts were found in situ in Borg I:1a which makes discussing room function in the later structure possible. Based on the presence of heavily trampled track made by animals outside of Entrance 4, and the occurrence of fodder plants, Room E is labeled as a byre or as stable of sorts (Herschend and Mikkelsen, 2003). The low number of finds found in Room D makes understanding its role challenging. Its lack of a hearth and its connection to Room C can possibly mark

Figure 2. Borg I:1a showing entrances, postholes and hearts. (Drawing by Dorthe Kaldal Mikkelsen and Frands Herschend; digitized by I. Radoor. Adapted from Borg in Lofoten: A Chieftain’s Farm in North Norway, 2003)
it as a storage room (Herschend and Mikkelsen, 2003). However, Room D also has the widest entrance, Entrance 3, leading into the longhouse. It has been suggested that Entrance 3 could be a gateway, and as such Room D could potentially be a coach room (Herschend and Mikkelsen, 2003). With these difficulties, it is hard to establish the probable use of Room D apart from a possible storage function. Room C contained the majority of finds found in Borg I:1a. All floor deposits pertaining to textile work and food processing were found in Room C which suggests that these activities primarily occurred in Room C (Croix, 2012). A platform is said to have run along the north-west wall in Room C which would have had a loom in the middle (Croix, 2012; Herschend and Mikkelsen, 2003). There was also a possible storage function in the north-west corner of the room which may have held prestige items (Croix, 2012; Holand, 2003). Taking also into account that Room C had two hearths and that a high number finds relating to daily items and their production are found here, Room C is safely identified as the main dwelling room (Croix, 2012; Herschend and Mikkelsen, 2003). Room C would have possibly also functioned as the main area in which visitors or social events such as banquets would have occurred (Croix, 2012; Herschend and Mikkelsen, 2003). With two entrances leading into it and the low number of finds, Room B is identified as an entrance room (Herschend and Mikkelsen, 2003). Room A might have had a similar function to Room C; that of a dwelling or work area (Croix, 2012; Herschend and Mikkelsen 2003). It has a hearth and artifacts associated with domestic activities such as food preparation (Herschend and Mikkelsen, 2003). It also appears that Room A yielded some finds relating possibly that may be related to fishing, and as a result it could have also had storage function in regards to fishing equipment (Croix, 2012). The differences between Room A and C have been taken to indicate potential social rank differences that may have existed with inhabitants of Borg I:1a. Room A could be seen as a dwelling room for the house residents of lower social rank or for the workers, while Room C could have been meant for the main family of the longhouse or for people of a higher social status (Croix, 2012; Herschend and Mikkelsen, 2003). As Borg I:1a is well documented, it serves as reasonable choice to understand how its internal spatial arrangement could have affected the people who lived there.
Aggersborg

Given its ideal location near a waterway, it is not surprising that Aggersborg has seen human use as far back as the Stone Age (Sindbæk, 2014). The archaeological site at Aggersborg is well known for its ring fortress and earlier rural settlement. This study will look at the archaeological material pertaining to the settlement preceding the construction of the ring fortress. With unearthed features numbering in the thousands (Sindbæk, 2014), it provides a unique look into the nature of everyday life in a Viking Age rural settlement. Although being composed of a large number of structures, the one that will be analyzed here is the structure labeled House D (Fig. 3).

Found underneath the rampart of the later ring fortress, House D is relatively well preserved and is suitable for examination. It has been suggested that use of House D may have begun in the 8th century (Sindbæk, 2014). It has the form similar to most longhouses: long, slightly curved walls with a wider mid-section. However, House D is set apart by its rounded gable ends and its size when compared to other houses in the settlement. It has been suggested that it could be linked or could be referring to an earlier building tradition (Sindbæk, 2014). There is also evidence of repeated repairs and different phases of construction, indicating it was rebuilt roughly three times (Sindbæk, 2014). It is one of the oldest structures in the rural settlement although not the oldest. House D has an internal length of 40.9 meters and a width of 7.1 meters in the middle. It is interpreted as being divided into nine bays and having five or possibly six rooms (Sindbæk, 2014). Four entrances into House D are identified; two along the northern wall and two along the southern wall, as indicated by arrows. The western four bays are understood to be one room, which may indicate stalls (Sindbæk, 2014). The middle three bays of House D can potentially be divided into two rooms. The eastern two bays may constitute one room bounded by two walls with doors and containing a hearth. A pair of postholes may hint at the possibility of the hearth having a frame used to suspend cook...
ware (Sindbæk, 2014). The third bay is potentially its own room with partitions on the western and eastern edges. A layer of flint was found in the second bay from the east. It has been suggested that it served as a base for a layer of chalk or clay (Sindbæk, 2014). In the eastern gable end, there are signs that may indicate that this room had internal partitions.

There were many finds in House D. A good number of them were found through sieving and as such their specific context is unknown (Sindbæk, 2014). Most of the artifacts were found along the walls. The reason for this may be due to floor maintenance practices (Croix, 2012; Milek, 2006). As the context of the finds is not always known, it makes it difficult to identify the individual functions of rooms with a high degree of specificity. The western room at the gable end is interpreted as a byre on account of the stone pavement and the possible stalls (Sindbæk, 2014). The room containing the hearth and an entrance from the north is identified as the main dwelling room. It appears that textile production occurred in the area near the doorway as indicated by the presence of loom weight fragments (Sindbæk, 2014). The role of the room immediately to the west of the main dwelling room is unclear. The eastern room seems to have served as an area for food processing or brewing (Sindbæk, 2014). The finding of a gold arm ring and eye-bead (though the eye-bead is not securely tied to House D) indicate that this structure at Aggersborg was of some status (Sindbæk, 2014; Croix, 2012). This is further supported by the unusual form of the house and also by its repeated repair and reconstruction (Sindbæk, 2012). As House D is among the best preserved houses on the site, and because it is one of the oldest which contains the largest number of finds, it is chosen for examination in this thesis.

**Hofstaðir**

Hofstaðir in the Mývatn district of Iceland is a site that has been of particular interest to scholars for a period of time stretching as long as a hundred years (Friðriksson and Lucas, 2009). Early scholars sought to link Hofstaðir to the Icelandic Sagas and as a site for a possible temple (Friðriksson and Lucas, 2009). Although its religious function is still debated, more recent research has shifted to other aspects in the interpretation of the site. The longhouse located at Hofstaðir is a complex structure comprised of different phases of construction and use. Phases I and II are the primary phases of human activity at the site (Lucas, 2009). Phase I includes the use of the longhouse, Structure AB, and
two sunken floor buildings (SFBs): G and A5. Phase II consists of Structure AB, Porch E1, Latrine E2, SFB A4, Small Hall D, and annexes C2 and A2 (Lucas, 2009). Phase I will be discussed primarily as it is the period of use which provisionally predates the addition of annexes to Structure AB (Lucas, 2009) and it is the phase in which Structure AB shares a form with the previously selected longhouses.

The period of time in which the site is in use falls between 940 and 1030 AD (Lucas, 2009). Phase I spans roughly between 940 AD and 980 AD. During this time, Structure AB (Fig. 4) has a length of roughly 45m with a width of 8 to 10m. In the publication of Hofstaðir, it is suggested that in Phase I Structure AB would have been shorter and that it gets lengthened in Phase II (Lucas, 2009). However, as is pointed out by Søren Sindbæk, this would mean that the earlier structure would have had a skewed outline prior to the lengthening or a high degree of alteration would have occurred in the middle of structure (2011). He argues that, upon closer observation, this would not have been likely (Sindbæk, 2011). I agree with his analysis and will use the full length of Structure AB in my analysis. SFBs G and A5 will be mentioned briefly as they relate to how activities may have been distributed around the site during Phase I.

There are three entrances into Structure AB. Two are along the western wall towards the northern and southern gable ends. The third is opposite the north-western entrance leading into the northern most room of the building. Structure AB is divided into three rooms; a northern room, a central hall, and a southern room (Lucas, 2009). The northern room has a series of pits and is partitioned from the other sections of the longhouse. Entrance is gained from the outside via the eastern wall entrance. The central room of Structure AB can be divided in two parts; north and south (Croix, 2012; Lucas, 2009). The northern

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As Sarah Croix points out, the publication of Hofstaðir labels structure G as a pithouse and structure A4/A5 as a SFB despite the fact that both have sunken floors and are smaller buildings. Croix highlights that there is no obvious reason for this difference, and as such both structures should be referred to as SFBs. I will follow her terminology when discussing both of these structures.
section, which comprises two-thirds of the central room, contains the hearth. There are also a series of posts and beam slots which are interpreted as sleeping berths or booths in the Hofstaðir publication (Lucas, 2009). This would make it atypical of other longhouses of the Viking Age (Sindbæk, 2011). An alternative interpretation is that the series of beam slots and postholes actually are joist for raised platforms that run the length of the walls on each side of the hearth (Sindbæk, 2011). Both interpretations will be factored into the analysis. There is also a square pit in the southern part of the northern section. The southern section of the room is absent of internal partitions and has more dispersed postholes that are not part of the main structural framework (Lucas, 2009). The southern room contained a pit and a grouping of posts that may indicate some sort of internal furniture (Lucas, 2009). SFB G is to the south of Structure AB and was 5m long by 3.4m wide, with a depth of 1.1m. It contained a hearth in the northwest corner and the walls were probably all paneled (Lucas, 2009). It has been suggested that along the eastern wall were furniture or benches (Lucas, 2009). SFB A5 measured 5.3m long and 3.25m wide. It varied between 0.4m in depth in the east and 0.2m in the west (Lucas, 2009). There was an internal timber frame that supported the turf walls. The main identifiable feature in this building is a hearth lined with stone slabs (Lucas, 2009).

Archaeological excavations at Hofstaðir have yielded a large number of finds. However, due to difficulties in distinguishing the structural sequences between Phases I and II, the association of finds to either phase is not always clear. As a result, identifying the function of the areas within Structure AB during Phase I is met with challenges (Croix, 2012; Lucas, 2009). Despite the problem of structural sequencing, it is still possible to interpret the function of rooms in a broad sense. Based on the series of pits and the scant material remains, the northern room of Structure AB may have served as a storage area or as a location for food processing. The central hall area can be seen as the main space of habitation, though it can be divided into two areas (Lucas, 2009). The northern section of the central room, based on its association with the hearth and lack of finds, can be seen as an area for sleeping (Croix, 2012; Lucas, 2009). The potential sleeping berths or platforms can further attest to this function. Cooking also occurred around the hearth. The square pit south of the booths or platforms in the eastern section of the central area is interpreted as having a storage function (Lucas, 2009). The purpose of the southern section is not as clear as the finds and the posthole arrangement may be more related to its use in Phase II. It is possible that some of the postholes in this area
may relate to furniture and might indicate that this area served as a workspace of sorts (Lucas, 2009). The southern room contained very few finds which consisted of an unidentified iron object and of animal bone fragments (Lucas, 2009). Combined with the presence of the pit, it is rather likely that the southern room functioned as a storage area (Croix, 2012; Lucas, 2009). The activities that occurred in SFBs G and A5 are much more securely identified. SFB G yielded the vast majority of artifacts relating to textile production. It was geochemical analyzed and it revealed the presence of urine that may have been related to wool dying (Milek, 2006). Based on the concentration of loom weights, it may have contained a loom along the northern wall. The material points to SFB G functioning as an area for textile production (Lucas, 2009). It is interesting that this activity is not found within the main house, Structure AB. The reasons for this may vary, though it suffices to say that it must have impacted how space was used in the larger building. A hearth in SFB G also hints at this area potentially serving as second living or habitation space (Croix, 2012). The large quantities of ash and iron materials, coupled with the presence of a stone slab hearth insulated with other stones, indicate that SFB A5 served as a smithy (Lucas, 2009). The reasons for this separation from Structure AB may have been for practical reasons. The isolating of these activities would have had an effect on the types of behaviors engaged in within Structure AB.
PART II

4. Theoretical Framework

*Into the Depths of Space*

How space is defined warrants an examination in order to highlight the focus of this study and to understand how it is conceptualized. As is common in many fields of studies, terms have changed in meaning over time. With regards to space, there have been many different definitions in the past and these vary between academic fields. What we call the physical sciences chiefly define space as relating to the physical dimensions of an object, the area within which an object exists, or the vast expanse of outer space (Feld and Basso, 1996). Social scientists often have different meanings serving different functions (Feld and Basso, 1996). For the purposes of this study, space is primarily defined as “any physical alteration of the natural environment, from hearths to cities, through construction by humans” (Lawrence and Low, 1990: 454). I would also include in that definition intangibly delineated spaces of the natural environment using mental or cultural barriers. Space can be both bounded and un-bounded with internal and external areas. Internal and external areas are referring to the expanse that one would find within or without a bounded space. The primary space discussed in this research is the internal space within the built environment, more specifically the organized space with a domestic structure. The reason for including both physical and mental alterations of space is to illustrate the diverse ways in which people, past and present, worked with and within space. A distinction need be drawn here between space and place. Both terms have seen much debate about their meaning and role among scholars, particularly human geographers (Agnew, 2011). Rather than entering into that discussion, what I will draw from that discourse between debating scholars are distinctions which are useful for this study. Place is distinguished as a location somewhere or its occupation, which includes references of ownership. Space is an area in a place in which the phenomena of human interaction occurs (Agnew, 2011). This distinction is by no means all-encompassing or universally applicable. However it is beyond the scope of this paper to try and settle that argument. Suffice to say, both space and place are connected and both are important in understanding how people used their environment in meaningful ways.

It stands to reason that defining space is insufficient. There is a necessity to clarify the way space is being handled or engaged with. One can point out that I regard
space as a substance, which can be thought to be potentially problematic. Indeed, it has been argued that space only exists “when there are entities in some sense in space and time” (Urry, 1987: 24) and cannot exist “without at least two existent objects, which occupy a relationship within time-space” (Urry, 1987: 24-25). This is tied to the notion that there is a need for two entities or objects to be present or exist so that the passage of time and the physical occupancy of space can be measured. Without these objects, there is nothing (Urry, 1987). Because of this, it has been put forth that space is a set of relations, not a substance (Urry, 1987). I agree in part with such an analysis. Space is indeed a set of relations. One cannot measure or view space without seeing how it unfolds in the natural environment or how it relates to another entity or object. Space as a set of relations also holds true for incorporeal divisions of space. However, such treatment of space ignores the reality of how people used space. In the modern western context, when we search for a desirable habitation, the price for a home or land relates in part to the amount of space within the structure or land parcel. Of course, the location of said home is also of importance, and one can argue that it is the most important in our modern world. However, regardless of where a place or structure is located, the difference in price between two structures or land parcels in the same location is ultimately linked to the amount of space to be had. The larger or more spacious home or land parcel is worth more as a general rule. People assign an economic value to space and trade it according to societal and economic rules, much like any other physical material (Wilk, 1993). This highlights the way in which space is commodified and consumed. This is not a practice of recent development. It has roots in the ancient past. We see this in the vast palaces and manors of the rich and powerful people. Large tracts of space are consumed and the relations between entities and people are put on display (Wilk, 1993). The space need not be large, it could easily be small. What is important to note is the value assigned to that space. The relationships that are displayed can range from power relations to religious ideology. Much like how light has the dual nature of being a particle and a wave, so too can space come to have a dual nature; that of a set of relations and substance that is consumed by people. In the real estate example, we see that what is being bought is the amount of space or land that is up for sale. Depending on the relationship that exists between one space and another, the price increases or decreases. In this sense, the land or structure being bought has two features that are being evaluated by people: its physical properties and its relational properties.
It has been argued that early on in the social sciences, space was seen as “absolute and infinite as well as empty and a priori in status” (Casey, 1996: 14). Space was depicted as without meaning and unaffected by it, regardless of its shaping by humans (Casey, 1996). This ignored the complexities of human agency and how people used space as a means of representations: “Man, out of his intimate experience with his body and with other people, organizes space so that it conforms with and caters to his biological needs and social relations” (Tuan, 1977: 54). It is the needs which lead to a structure being built. Some would argue that the physical environment or technological constraints are the most important factors that go into the construction of a home. Though technological and environmental factors do play a major role in the formation of the built environment, they are not the only important factors.

Given a certain climate, the availability of certain materials and the constraints and capabilities of a given level of technology, what finally decides the form of a dwelling, and moulds the spaces and their relationships, is the vision that people have of the ideal life. This is why solutions are much more varied than biological needs, technical devices, and climatic conditions…The house, the village, and the town express the fact that societies share certain generally accepted goals and life values (Rapoport, 1969: 47).

As Amos Rapoport points out, despite there being multiple ways to build a home, one style tends to be the dominate one chosen. To say they are constrained by the environment or technology is to ignore not only the reality that people were exposed to different cultures with different building traditions but also that there are meanings attached to a home. There are also multiple cultures that live in similar environmental conditions, yet their houses vary in style despite environmental similarities. There is a need to engage with the social influences on space and how a culture conceptualizes space. What is a good or bad use of space, what is that space communicating, and how meaning is placed in the built environment are important questions towards our understanding a particular culture. This requires us, as modern day interpreters of the past, to try and understand the world ancient people would have lived in.

It is by no means a stretch of the imagination that we animate things or interact with inanimate objects in some way or another. It is a phenomena found in both modern and ancient societies. In his discussion about the study of art and semiotics, Alfred Gell notes that objects abduct social agency through interactions with people, and thus become social agents (1998). He illustrates his point by using a relationship that is not
unfamiliar to modern audiences; that of a driver and his car. When functioning as intended, a car is just a car. It is inanimate and devoid of any semblance of sentience. Yet, when the car ceases to perform its duty by breaking down, it suddenly becomes a malignant entity bent on ruining your day. We may proceed to curse it and to interrogate the car, demanding an explanation as to why it no longer wants to work. We are fully aware, to a degree, that the car is not really going to respond and it is just a hunk of junk. Gell presses the point and says that in such a relationship, in the moment of our frustration and questioning, the car is alive. This is an example of what Gell labels as an agent/patient relationship (Gell, 1998). An agent is one who is exercising agency and a patient is the recipient of that agency. An agent, according to Gell, is one that “has the capacity to initiate casual events in his/her vicinity, which cannot be ascribed to the current state of the physical cosmos, but only to a special category of mental states; that is, intentions” (Gell, 1998: 19). It should be noted that Gell explains that agents and patients can switch places depending on the context of the event. Gell clarifies that the agency he describes is one based on relationships, as highlighted by the car example. Based on their relationship to humans, inanimate objects can acquire agency or animacy. Anticipating the argument that inanimate objects have no intentions or agency of their own, he outlines a useful schema to distinguish between people and objects vested with agency; that of primary and secondary agents. Sentient living beings with their own intentionality are classified as primary agents and objects with agency or intentionality given to them by humans are secondary agents. Although Gell is arguing for a theory in which to discuss or understand ‘works of art’, his schema is useful in studying other objects present in a culture’s material milieu. I suggest we invest in our built environment a sort of agency in order to influence behavior on some level. This agency would be expressed in how the built environment is designed. Although it would be interesting to make the case for the animacy of a structure and the way people may have engaged with a house as a secondary agent, it is outside of the scope of this thesis. What we should take away from Gell’s work is that there is a sense of agency which we invest into our built environment.

One can argue that the built environment does not act as a secondary agent who dictates behavior or that a house does not contain the social ideology of a culture. However, researchers such as Susan Kent and Donald Sanders make the case that it does. Collectively, they argue that there is a certain logic inherent to space and that this logic is
intrinsically tied to culture (Sanders, 1993; Kent, 1991). Through a cross-cultural analysis of a multitude of different cultures, Kent notices a pattern emerging on the use of space among similar types of cultures. She notes an increasing degree of spatial delineation when moving from egalitarian to more hierarchal societies (Kent, 1991). She illustrates this point through an examination of the different ways space is organized. One of the more striking differences she highlights is those between the Basarwa of the Kalahari Desert in Botswana and urban Euro Americans. A key example she uses is the kitchen or the cooking area. In the Basarwa domestic space, there is no delineation of space via physical or mental partitions; both men and women cook and share the space and there is no real gendering of this space (Kent, 1991). In contrast, in the homes of Euro Americans, the kitchen or cooking space has been linked predominately to women and is clearly demarcated from other parts of the home. This is accomplished through both mental and physical segregation (Kent, 1991). The behavior associated with cooking is mainly done by women (Kent, 1991). Kent links this to the notion that the more egalitarian a culture is, the less it will need to divide space. A hierarchal or segmented society would use the built environment to reflect those notions of hierarchy or separation (Kent, 1991). This is an example of how a culture encodes societal hierarchies into spatial organization.

Along the same lines, Sanders looks at the Early Bronze Age site of Myrtos in southern Crete and how its inhabitants used spatial organization to enforce notions of privacy. In particular, Sanders analyzes a house labeled House B (Fig. 5). He identifies the different areas through an examination of artifact deposits within the structure and floor composition. He establishes that House B has seven spatial areas; an entryway (area 74), a storage area (72), a transitional space into the main domestic area (73), the center of the house (81), another storage area (82), a multi-functional area (80), and a ceremonial/guest/sleeping area (79) (Sanders, 1990). The movement through the house is described almost

![Figure 5. House B depicting internal areas and ceramic storage containers. Lines indicate possible pathways within the structure. (Adapted from “Behavioral Conventions and Archaeology: Methods for the Analysis of Ancient Architecture”, 1993)](image-url)
as linear; the built environment structures movement in this space so that only one path may be followed (Sanders, 1993). He remarks on how the first thing a person would have seen from the outside is the wall of the entryway or area 74. In order to get to see another part of House B, one would have to move through area 74 and cross into area 73. It is through area 73 that one can gain access to the center of the house (area 81). To get at the sleeping area, one has to transition from area 81 to area 80 and finally into area 79 (Sanders, 1993). Because of this, Sanders posits that the role of the entryway is to segregate the outside from the inner structure, and that area 79 is intentionally kept separate according to cultural norms. In essence, area 79 is ‘deep’ in the house. This notion of depth is a way to separate a space within a larger space (Hillier and Hanson, 1988) and will be discussed later on in this study. Sanders argues that the design is influenced by the culture and that it reflects a desire to maintain a sense of privacy from the outside world (Sanders, 1993). He draws this conclusion by comparing the form of House B from others at the site and he notes that, although there are some differences, the overall pattern of spatial organization is the same (Sanders, 1993). Although this is not an entirely controversial notion, what is necessary to point out that this is a cultural ideology or practice which we may detect by analyzing both the distribution of artifacts and the internal organization of areas. Both Sanders and Kent put forward that the built environment is socially constructed and that people use the means available to them to reference cultural and social ideologies.

Making Space for Memory and Performance
As has been discussed above, space is tasked with the perpetuation of cultural ideology. However, space does not only perpetuate a cultural ideology, it also can function as a preserver of a particular event or person. We see this in the construction of monuments. These monuments serve as sites of memory or lieux de mémoire (Nora, 1989). It is an attempt by people to remove the memory from the erosion of time and to give it a permanent form. Much like how some stories are meant to preserve cultural memories, such as the Icelandic Sagas (Hermann, 2013), so too can the built environment come to store cultural memory. This is tied to the maintenance of a cultural identity by preventing people from forgetting (Hermann, 2013; Nora, 1989). The built environment accomplishes this by physically representing past deeds and being treated as a symbol of a national identity (Nora, 1989). The Statue of Liberty and the Arc de Triomphe are two
examples of this. Although Nora is speaking from the perspective of a national culture and associated grand monuments, I assert that smaller and possibly more mundane structures can serve a similar function; in particular the houses belonging to a culture. Homes can come to embody cultural memory and past experiences by their culturally recognized design. As one can surmise, what Nora is describing as a site of memory is a place as opposed to space. Based on the distinction made earlier, Nora’s views should not be relevant here. However, the case can be made that his thoughts are still applicable. At the core of Nora’s argument is the notion that sites of memory preserve identity or cultural memory and that there is the implication that one must perform said identity. To be more precise, people respond to these sites of memory and react to it, behaving or performing in a specific manner. A performance should here be understood as an action meant to communicate compliance with a social norm or a targeted behavior or role. It can be unintentional and should not be conflated with theatrical performance of a stage role. Nora states that

\[\text{[I]}\text{t is upon the individual and upon the individual alone that the constraint of memory weighs insistently as well as imperceptibly… It gives everyone the necessity to remember and to protect the trappings of identity…[it] require[s] individuals to undertake to become themselves memory- individuals, as if an inner voice were to tell each Corsican "You must be Corsican" and each Breton "You must be Breton." To understand the force and appeal of this sense of obligation, perhaps we should think of Jewish memory, which has recently been revived among many nonpracticing Jews (Nora, 1989: 16).}\]

Here we see Nora referencing that one must exhibit an identity and that one must behave according to that internalized cultural memory or identity. We see this in the saluting of a nation’s flag or crossing oneself at the foot of a cross for example. What we need to take away from this is that people perform roles and that this occurs in a space that is organized or created to facilitate the targeted performance or behavior.

Just as the built environment is designed to communicate how one should behave or interact in a space, so can space be used to enhance that performance. We can see this in a study by Melissa Tyler and Laurie Cohen. In their study, they looked at the ways in which women employed at a university used space in their performance of particular identities or personalities. They held three focus groups and had interviews with some of the attendees at a later time. The talking point they used to initiate conversation was that of a photographic exhibition on office life that depicted a woman moving through different spaces in the workspace (Tyler and Cohen, 2010). At the focus groups and
interviews, women talked about how they felt at their own workplaces and how they related to the woman in the exhibition. In large numbers, the women shared that they had feelings of constraint based on the small space of their workplace and in some cases due to sharing a space with a man (Tyler and Cohen, 2010). Another of the topics that came up in the conversation is how the women used their surrounding environment to enhance their performance of a particular personality. Tyler and Cohen took note that the women talked about how they “decorated their workspaces to please their colleagues, so that their offices, as representational spaces, were performed in accordance with how [their] respondents thought they would be perceived by others” (2010: 189). As the researchers point out, they consciously performed in a specific manner and explicitly used their workspaces to elicit a desired response from others, whatever it may be (Tyler and Cohen, 2010). This is akin to the concept of *habitus* described by Pierre Bourdieu in which past experience structures a current behavior and is organized in a particular manner (1970). Similar to how the Kabyle house has both structural elements and movable furniture to highlight what performance is expected of its occupants (Bourdieu, 2003), so did the women use their workspace in a performance on how they wanted to be perceived (Tyler and Cohen, 2010). This highlights that people are not only aware of space but that they also manipulate it to achieve specific purposes. In the case of the women in Tyler and Cohen’s study, the space was used to negotiate the women’s daily interactions and relations with people they encountered at work. It is quite possible that this was also the case among ancient people.

As has been highlighted, performance is how we maintain identity and particular roles. Such performances can be rituals or mundane activities. One can argue that they are often linked together (Connerton, 1996; Bourdieu, 1970). These performances occur in space, and space can become part of that performance. With this in mind, it might be possible to take this notion of performance a step further. As certain behaviors or performances generate a material component (a baker makes bread and a fletcher makes arrows), can it not be argued that the material product of a performance can come to stand for that performance in the absence of the performer? This can be seen in the way archaeologists use artifacts to denote the presence of people and their activities from the archaeological record. It is from our deep involvement with objects that we know both about the past and present (Jones, 2007). It is not too contentious to claim that a material object is the result of a performance. However, what about space? Can the creation of
space, not just its organization be a performance? I argue that it does and that by building a home, people are engaging in a specific performance; that of building a good house. What makes a good house is something that we learn through our experience in the built environment, much like how a potter knows how to make a good pot and a consumer can identify a good pot (Jones, 2007). It is built from our memories and performances in previous environments. The creation of a house ensures that certain behaviors occur, like the enactment of a cultural memory or national identity (Hermann, 2013; Nora, 1989), and that people would use the space within to engage in specific performances, such as people at work or people in the home (Tyler and Cohen, 2010; Bourdieu, 2003). I maintain that the built environment is an example of a performance engendering other performances within its space. A house being built is representing the cultural performance of building a good house. Once built, within the confines of the space contained within, it facilitates other cultural performances by how the space is organized. People within the space then react to the encoded cultural information and engage in their own performance which other people see and respond accordingly.

5. Methods
The spatial organization of archaeological structures is the primary data collected in this analysis, and as such it will be analyzed by using methods outlined by space syntax analysis. To facilitate the process of analysis, two programs are used in this study; AutoCAD 2014 and DepthMapX. They will be discussed briefly in the following, but it is necessary to point out that DepthMapX is the main tool used in the analysis and will receive more attention. However, DepthMapX is used to facilitate my analysis and does not present the end of the analysis. Ultimately, it is through a combination of space syntax and the previously discussed theoretical frameworks that the archaeological data will be analyzed.

Space Syntax and the Integrative Approach
As has been established earlier, space is intrinsic to human behavior and as such the built environment functions as a medium to channel that behavior. The depth of a space in relation to another is one way to understand how spatial organization is structuring behavior (Hillier, 2014). Depth is referring to how ‘deep’ a space is within the overall spatial system (Hillier and Hanson, 1988). Figuring out the depth of space begins with selecting a point of origin or root space (Hillier, 2014), and then moving through the
spatial system. As one moves further away into other spaces, the depth increases and is assigned a value. Understanding depth is straightforward when represented visually (Fig. 6). This graphical representation is the justified graph or j-graph (Hillier, 2014; Hillier and Hanson, 1988). In the example provided here, we can see that spaces 8, 2, 3, and 9 are one link or step away from space 5. As such they are assigned a depth value of one. Spaces 4, 1, and 6 are two links or steps away from space 5 giving them a depth of 2. From space 10, space 6 has a depth of one and so on. What is evident here is the ease of understanding depth from a graphical perspective. Another feature of the j-graph is that it can show the choices of directions or paths available to one who is moving in the spatial system (Hillier, 2014). When comparing the j-graphs of spaces 5 and 10, we can see that the j-graph of space 10 is more linear. This may have implications of how access to that space could be restricted. The meaningfulness of the depth of a space is rather clear in a large spatial system. However, the implications of depth in a smaller system, such as a structure with only three rooms, can be a bit harder to see. It is necessary to understand the space in the context of the larger system and determine how integrated it is. Integration can be determined via a mathematical equation developed by Bill Hillier and Julienne Hanson and is expressed as Relative Asymmetry (1988).

\[
RA = \frac{2(MD - 1)}{k-2}
\] (1.1)

MD represents the mean depth of the space in question. It gives a depth value of a space relative to the depth of other spaces within the larger spatial system. It is acquired by assigning a depth value to each space according to how many spaces it is away from the root space, then summing the values and dividing it by the number of spaces in the system less one (Hillier and Hanson, 1988). \(k\) is the number of spaces within the whole system. To compensate for the potential effect of size and to enable comparison with...
different spatial systems, it is necessary to calculate the Real Relative Asymmetry or integration value (Hillier and Hanson, 1988). The value is obtained by taking the inverse of relative asymmetry which can be calculated through DepthMapX. For the sake of brevity, the real relative asymmetry value will be referred to as the integration value, given that real relative asymmetry is indicating how integrated a space is in the overall system. The higher the integration value, the more integrated a space is. The lower the value, the less integrated it is. It is possible to illustrate both mean depth and integration values using a color spectrum featured in DepthMapX, which will be elaborated on later. This will be applied towards the selected longhouses to understand to what degree different spaces were potentially segregated. One of the limitations of this method is that it does not take into account certain features of the built environment, such as the size and shape of a room, its contents, and how it can communicate meaning and influence human behavior (Fisher, 2014). As a result, it is necessary to incorporate a qualitative or more inclusive methodology.

In an attempt to shore up the shortcomings of relying solely on integration and depth values, an integrative approach which aims to account for the other physical values of space will be used. The integrative approach, first outlined in Kevin Fisher’s study on monumental architecture in Late Bronze Age Cyprus (2007), draws on a variety of methodological underpinnings. Alongside the application of space syntax process, it also takes into account that social interaction requires the co-presence of individuals and that there are different types of interaction (Goffman, 1963). There is a need to distinguish between transitory gatherings and social occasions. Gatherings are when two or more individuals are momentarily in one another’s presence. Social occasions are events that also involve co-present individuals, but which are bounded in time and space and often are facilitated by fixed equipment (Fisher, 2014; Goffman, 1963). The fixed equipment, or the fixed/semi-fixed features (Rapoport, 1990), is what we can see in the archaeological record and which can hint at the type of interactions that may have occurred. By understanding that the physical distance between individuals can shape the way people interact, we can uncover what kind of interactions were structured by the built environment (Fisher, 2014; Hall, 1966). It would be useful to incorporate Fisher’s schema (Table 1) of perceptual distance to see how distance facilitates or inhibits certain behaviors. Although this schema may not take into account cultural idiosyncrasies, it does serve as baseline for what behaviors were possible in the defined
It should be noted that what is personal and what is social is highly cultural and the terms personal and intimate might not be applicable. However, they are used only in reference to visual perception. Not in relation to cultural ideals. In order to see what is perceived, it is necessary to create isovist viewfields or viewsheds (Hillier, 2014; Fisher, 2014). Isovist viewfield is here defined as all the points visible from a particular space (Fisher, 2014). In creating an isovist viewfield, we can establish what an individual would have been able to see when looking out to other spaces within a structure. This in turn will allow us to see what is perceived of other people in the surrounding spaces and what forms of interactions may have occurred given the distances. This highlights the layered nature of integrative methodology and also the complexities of human interaction. Rather than relying on my relatively imprecise drawings of isovist viewfields, the DepthMapX computer program will be used to give more consistent and accurate visual representations of these fields of vision.

<table>
<thead>
<tr>
<th>Proxemic Threshold</th>
<th>Intimate</th>
<th>Personal (Near Phase)</th>
<th>Social (Near Phase)</th>
<th>Social (Far Phrase)</th>
<th>Public (Near Phase)</th>
<th>Public (Far Phrase)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>0–0.45 m</td>
<td>&gt;0.45–1.2 m</td>
<td>&gt;1.2–2.15 m</td>
<td>&gt;2.15–3.65 m</td>
<td>&gt;3.65–7.6 m</td>
<td>&gt;7.6 m</td>
</tr>
<tr>
<td>Touch</td>
<td>Can touch easily; accidental contact is possible</td>
<td>Can reach out and grasp extremity at near phase; cannot touch beyond c. 0.75 m</td>
<td>2 people can pass an object back and forth by both stretching (up to c. 3 m).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral/Aural</td>
<td>Soft voice; intimate style</td>
<td>Conventional modified voice; casual or consultive style</td>
<td>Full public-speaking voice; frozen style</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed Vision</td>
<td>Details of eyes, pores on face, finest hairs visible; vision can be distorted or blurred</td>
<td>Details of face clearly visible</td>
<td>Can see head hair clearly; wear on clothing apparent</td>
<td>Fine lines of face fade; lip movement seen clearly</td>
<td>Eye color not discernable; smile vs. scowl visible</td>
<td>Difficult to see eyes or subtle expressions</td>
</tr>
<tr>
<td>60° Scanning Vision</td>
<td>1/3 of face; some distortion</td>
<td>Takes in upper body</td>
<td>Upper body and gestures</td>
<td>Whole seated body visible</td>
<td>Whole body has space around it in viewshed; postural communication becomes important</td>
<td></td>
</tr>
<tr>
<td>200° Peripheral Vision</td>
<td>Head against background visible</td>
<td>Head and shoulders visible</td>
<td>Whole body visible</td>
<td>Other people seen if present</td>
<td>Other people become important in vision</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Distances and effects on perception (Adapted from “Investigating monumental social space in Late Bronze Age Cyprus: An Integrative Approach” in Spatial Analysis and Social Spaces, 2014)
**AutoCAD 2014 and DepthMapX**

Rather than going into detail of the different uses of AutoCAD, what will be discussed here is primarily how it was used to create the floor plans and the necessary file format for use in DepthMapX. AutoCAD is an architectural drafting program with a variety of different functions and is a powerful tool in creating 2D or 3D models or floor plans of both new buildings and also archaeological structures. The version used in this study is the free 2014 student version and was downloaded from the AutoDesk website: http://www.autodesk.com/education/free-software/autocad. AutoCAD allows for precise 2D drawings through a grid system that corresponds to units of measurements set by the user. It should be pointed out that DepthMapX does not support 3D models and as such all drawings must be in 2D (Turner, 2004). The user can then draw lines or shapes that correspond to the different features of the excavated structure. As DepthMapX cannot read curved lines, the floor plan must consist of rectangles or polygons (Turner, 2001). I used the draw shape and polyline functions to create the floor plans on a grid layout with the unit of measurements in meters. Each square in the grid represented 1.5m. Once the image was drawn according to the floor plans of the longhouse, it was saved as a drawing exchange format or DXF file. It was then imported to the DepthMapX program.

DepthMap was first developed by Alasdair Turner in 1998 and was intended to be a tool to use in space syntax analysis (Turner, 2004). It has since gone through many different revisions and has acquired additional functions useful in analyzing the built environment. The version used in this study is DepthMapX 0.30 which is managed by Tasos Varoudis and is available for free at http://varoudis.github.io/depthmapX/. Instead of going through all the features of DepthMapX, what will be discussed here will relate primarily to the creation of the different graphs used in this thesis and their analytical ability. With the 2D floor plan created in AutoCAD, it is possible to create the graphs necessary for the analysis. The first step is to lay out a grid over the floor plan. DepthMapX automatically detects the dimensions of the floor plan and provides a “sensible choice” (Turner, 2004: 9) based on the detected dimensions. However, since the floor plan is that of a single building, it has been suggested to set the grid spacing to reflect a human scale or dimension (Turner, 2001). The grid spacing used for the creation of the graphs is between 0.500-0.700 which corresponding to 0.50-0.70m. Although the grid spacing could be smaller, this is to take into account the possible variations in size of individuals who would have moved within the space. Once the grid has been laid out,
it is necessary to fill the grid squares with data points which will be used in the creation of the graph. Once all the targeted areas are filled, DepthMapX can construct a visibility graph and be ready to run a visibility graph analysis (Turner, 2004). In the construction of the visibility graphs and the running of the visibility graph analysis, what is taken into account are the visual relationships that exist between each data point. Basically, how many different data points are visible from one point is calculated and given a numerical value (Turner, 2004). Once completed, what will be displayed is color coded representation of the visibility relationships of the different points in the graph. This graph is labeled as the visibility graph. The darker or closer to red, the more visual connections exist between that space or data point and other grid squares. The darker or closer to blue, the fewer visual links a space or data point has to other spaces or data points within the overall system. A grayed out area means that the space is not visually connected or is separated entirely from the spatial layout. DepthMapX can provide tables with the different quantitative values of each data point in the graph. However, the tables are vast and do not necessarily aid in understanding the connections that may have existed. Instead, the color coded graphs will be used to facilitate the discussion of the spatial relations in the longhouses. Visibility graphs were created for each of the chosen longhouses and were used in the agent analysis of the topographic features of the structures.

The agent analysis function of DepthMapX is one of the most intriguing tools of the program and it has the potential to reveal much about how the physical space may have affected human movement and behavior. It relies on computer generated agents running on algorithms that have been shown to simulate human pedestrian or natural movement (Turner, 2007; Turner and Penn, 2002). These agents, known as exosomatic visual architecture agents or EVA agents (Turner and Penn 2002), are “guided by vision of the environment through sampling the available open space location at its current location...It selects a destination from a field of view, and takes several steps towards its destination before selecting another destination. In this way it progresses through the environment” (Turner, 2007: 3). Although they do not have vision in the human sense, they do have an awareness of the environment that is provided to them by the visibility graph. It must be borne in mind that the movement is not random. Their movement is shaped by the topographical features of the environment in which they are released (Turner, 2007; Turner and Penn, 2002). Its operation through DepthMapX begins with
conducting a visibility graph analysis. Once completed, a data point or node is selected from which to release a set number of agents. The analysis runs the amount of time necessary to achieve stationary distribution (Turner and Penn, 2002). Stationary distribution is defined as being able to predict the number of people or computer agents in space at any time (Turner, 2007). In DepthMapX, the results will be depicted on a color spectrum ranging from red indicating a higher degree of foot traffic or agents to dark blue signifying a low number of agents or degree of foot traffic.

Another feature of DepthMapX is the creation of polygonal representation of the different spaces within the floor plan. This is known as a convex map (Turner, 2004). This does not rely on the creation of a grid or the analysis of different data points spread on the grid. Rather, the convex map is shaped by the researcher’s understanding of discrete spaces within the larger system. Whereas the visibility graphs take into only the physical properties of a structure, the convex map can be used to analyze spaces not demarcated by physical boundaries. These spaces are created using a polygon drawing tool. After they are drawn, the polygons or spaces can be linked in accordance to the perceived spatial organization of a structure. Once the convex map is created, it is possible to calculate their individual depth, integration in the overall system, and spatial connectivity. The creation of links between spaces functions in a similar manner as the j-graph described earlier. The difference being that, through the use of the convex map, it can be overlain on the floor plan and be color coded to correspond to different quantitative values resulting from the graph analysis. The meaning of each color varies between each calculated value. In relation to mean depth, the spectrum lies between red and blue. The shallower a space is the darker blue it is in color. The deeper a space is the closer in color it is to red. For integration values, the spectrum is repeated though in reverse. The more integrated spaces are redder in color and less integrated spaces are darker blue in color. The strength of the convex map lies in its ability to take into account possibly mentally demarcated spaces within a structure. In the archaeological record, this can correspond to activity areas within a larger open space. Convex maps were created for the chosen structures to get as much information as possible regarding the organization of the built environment.
Part III

6. Vikings in Space
What follows in this section is an application of both the theoretical frameworks discussed previously and the use of space syntax analysis on the selected longhouses. As has been introduced earlier Borg I:1a, House D, and Structure AB will be examined in this study. Identifying the main areas of human interaction is the first step in understanding how the physical environment structured behavior. Knowing where interactions may have occurred opens the way to figuring out how people may have interacted based on their field of visual perception and the distance that may have existed between two co-present individuals. Combined with the theoretical underpinnings that space can be encoded with cultural information and can structure behavior, we can potentially see how space was used in Viking Age longhouses. Most of the analysis revolves on the partitions being open. When relevant, the difference will be compared to when the partitions are closed. Many graphs were generated in the course of this analysis. Rather than placing them all here, only a few are presented in the text as part of the discussion. The rest are appended at the end of this thesis along with a brief explanation.

Interactive Spaces
In order to discuss the behavior and interactions that would have occurred in past structures, it is necessary to identify where they would have occurred. By their very definition, activity areas presuppose human activity. This activity can involve more than one person. Often, activities can occur in close proximity to each other. The longhouses at Aggersborg, Borg, and Hofstaðir each have a general area where most of the activities in the house occur: the central hearth area.

In the case of Borg I:1a, Room C is the main space in which activities occurred. Room C yielded the most finds, it is generally the most open space in the structure, and it is labeled as the main dwelling space (Croix, 2012; Herschend and Mikkelsen, 2003). This is further cemented by the presence of the hearth. The heat it provided, and the associated space, would have made a relatively comfortable and spacious environment. Although Room A also had a hearth and may be associated with certain domestic

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2 It is worth noting here that a portion of Borg I:1a was left unexcavated by researchers for future excavations. That portion was not included in the graphical analysis. It is possible that there are features that would alter the internal spatial organization. However, as it was left unexcavated, there is no way to know for certain.
activities, it does not appear to have been involved with as many potential social activities as Room C due to its possible connection with the working staff of the house (Croix, 2012; Herschend and Mikkelsen, 2003). In Aggersborg, the hearth dominates the central room and would have provided the necessary warmth and light to maintain the activities in the house. It has yielded a majority of the in situ finds and is identified as the main dwelling space (Sindbæk, 2014). The indication that textile production may have occurred in the hearth room and that cooking would have been done over the hearth point to two activities possibly occurring simultaneously in the same room. The entrance from the outside in this room also further supports that this space saw a good deal of human activity and interaction. Although the eastern room may have been linked to food processing or brewing (Sindbæk, 2014), there is not enough data to say with certainty whether these activities involved more than one person. When it comes to Hofstaðir, the picture is more complex. Although the central area yielded a large number of artifacts, the number of in situ finds was too low to give a precise image of the activities that occurred there. There is however a general impression of what activities may have taken place in the central area: cooking, sleeping, and perhaps the repairing of some objects (Croix, 2012). The areas of clearest activity were SFBs G and A5. The nature of the floor layers and the state of preservation allowed for a clear understanding of the activities. However, these areas would have had a specialized function and not have necessarily been a focal point of activity among the household members. Given that the areas of human interaction in the other houses were the areas around the hearth, it stands to reason that it maybe is the case as well for Hofstaðir, at least provisionally.

It is not too problematic to say that spaces which indicate a high number of activities also would have been a space that engendered interaction. Within the highlighted areas of the three longhouses, it is easy to conceptualize that at some point during the occupancy of the spaces, two or more people would have been within that space simultaneously at some point in time. When two people are engaged in an activity or occupying the same room, it is hard to imagine that any form of interaction was nonexistent. As is pointed out by Erving Goffman, we are social creatures and seek to ascertain information when in the presence of others (1963). This information need not be explicitly asked for or sought out. It is quite possible that the information is gained through simply by visually perceiving a person. One can argue that two people sharing a space or room does not mean that an interaction occurs automatically. However, it is
likely that even if no interaction is overtly engaged in, there still would have been an acknowledgement of the other’s presence. If and how people perceived each other will be pursued further in the following discussions. The main purpose of the preceding discourse was to identify which spaces should be given closer attention in the analysis of perception and interaction. Although other spaces within the selected longhouses could have seen a higher degree of interaction, based on the archaeological material in isolation, it is difficult to establish if this was potentially the case. There is a need to approach the available structural elements from a different perspective.

What Do Your Eyes Tell You?
Mentioned earlier was the power of visual accessibility. What was visually available is an easy indicator of what privileges a visitor or household member had in regards to accessing different spaces within a structure. As was mentioned by Sanders, the use of barriers or internal arrangements was employed to convey what was allowed to be seen from certain perspectives (1993). In the case of the selected houses, we can see how the built environment guided the sight of the individual and also what they were allowed to perceive of other occupants and associated activities. In Borg I:1a, we get a general sense that both rooms C and A were meant to be visually available when one entered the building if the partitions were open (Fig. 7). The hearth in Room C would also have been seen. There are no real visual impediments to one’s entry through (what Herschend and Mikkelsen identify as) the probable main entrance, Entrance 2 (2003). Although the post to the right of the entrance does form an obstruction in the line of sight, the impediment would not have persisted very long as people moving through the entrance would not necessarily be held there. When the individual enters, (Fig. 8), the length of the structure would have been visible via the central aisle. At first glance, a majority of the space

![Figure 7. Isovist Viewfield from Entrance 2 of Borg I:1a.](image)

![Figure 8. Isovist Viewfield from western entrance of Room C.](image)
within the structure is taken in by the viewer. This implies that the space was meant to be accessed visually by all those who would have entered the area. Any people occupying Room C or moving through the central aisle would have been seen. Although the areas closer to the sides or walls of the house were not fully visible, a large portion of those areas were seen and could indicate that these spaces were not meant to be visually segregated. What is important to take away from this is that space was relatively open and that a majority of the internal space was meant to be seen. From the perspective of the main dwelling room, what was seen of the gable ends is less accessible though the central aisle is still in view. In House D at Aggersborg, a similar pattern appears to be the case in the central area (Fig. 9). What is more, an entrance from the outside leads directly into the main dwelling area (Sindbæk, 2014), and it emphasizes that a majority of this space was potentially meant to be visually accessible even from the outside. This is of course assuming that the entrance was kept open. The small posts lining the hearth most likely did not impede the view into the main dwelling area as they are associated with the hearth and may have served as a frame for hanging cooking ware (Sindbæk, 2014) and probably were not high enough to block one’s sight. This does not change drastically once inside the main room (Fig. 10). The row of posts towards the western end of the room would most likely have been associated with the partition doors and would probably not have blocked the line of sight into other areas of the house if the partitions were open. From the western entrances, the main dwelling area might not have been as easily seen due to the presence of a separating room. It could stand to reason that the two western entrances, based on the probable function of the western room, were more
associated with providing access to western room than providing access to the rest of the house. From the perspective of the western entrances, the viewfield into main dwelling area was slightly more restrictive. It is clear that the main dwelling room of House D was an open space in which its full extent was meant to be seen.

At Hofstaðir, the situation is more complicated. As there is some debate as to whether or not the main structure is divided into individual sleeping berths or if the beam slots found represent joists for the raising of platforms, both interpretations are used. There are two entrances into the central part of the longhouse. It is worth mentioning that the northernmost entrance is relatively closer to the hearth than the southern entrance. This too would have had an effect on the visual accessibility of the main habitation area. If indeed the central area was divided into individual booths, depending on the height, it would have had a pronounced effect on the isovist viewfields. If the beam slots were indicating a raised platform or floor surface, this would not create a substantial barrier to sight. As is indicated by the different isovist viewfields (Fig. 11), the varying function of the beam slots alters substantially the potential field of vision of an individual. Another factor that needs consideration is that not all postholes shown in the images here would have been current with each other. A large portion of them show sign of reuse (Lucas, 2009) and it is not out of the question to suggest that there were fewer posts, which implies that the resulting isovist viewfields would have been different. As in the case of the previous structures, being in the entrance would have been a temporary state. Once inside, the viewfield opens up slightly for the central area but not by much on account of the line of posts.
One can raise the question as to why the preceding discussion focused predominately on having the partitions of the individual structures as being opened. It can be argued that it is more likely that the partitions were closed at any given time except for when opening them to allow for passage. Indeed, this is a possibility and there is not much that can be said to counter that line of reasoning. However, taking into account the potential smoke generated from the hearth when lit and the need for air to circulate within the structure to both vent the smoke and allow for fresh air, it is possible that there was a need to maintain the partitions opened for a stretch of time. It is of course just as possible that the roof would have had an opening to allow for ventilation, in which case there was no need to have the partitions opened for air circulation. However, the roof did not survive in the archaeological record in regards to the three longhouses presented here with sufficient detail to detect a ventilation shaft of sorts. Therefore, it is difficult to say with certainty which is the more likely scenario. Perhaps it may have been a mixture of both. Another factor worth considering is role light would
have played. In an attempt to conserve fuel, it may be possible that they were left open to allow for increased light during the day, provided the weather or seasons allowed. As may be apparent there is no easy answer to this question apart from it serving a hypothetical situation. Yet, even with the partitions closed, the isovist viewfields within each space depict an open space, with the possible exception of Structure AB\(^3\). Also considering that it is within the confines of the main dwelling room which people predominately interacted in, whether or not the partitions were closed or opened does not drastically affect behavior once people are in these interactive spaces. The isovist viewfields show that anyone in these areas would have been seen and as a consequence be perceived.

Beginning with the analysis of the viewfields from different perspectives of the three longhouses is important as it sets the stage for the later analysis. It is through what we have visual access to that we understand what we are allowed to look at and where we are allowed to go (Hillier, 2014; Fisher, 2014; Sanders, 1990). Whether or not other people in the structure or space were visible is also of key importance as it determines whether or not people could have interacted. In the cases of Aggersborg and Borg, it is within reason to say that the majority of the structures would have been visually accessible and notions of keeping spaces or people visually closed off was not particularly strong if the partitions were open. At Hofstaðir, the reality is uncertain. Knowing both the sequence of posthole usage and whether or not the central hall area was divided into booth would clear up matters. Relying on isovist viewfields alone would not give us a complete representation of the nature of the interactive spaces. However, by looking at how people would have moved in these spaces, a clearer portrait may emerge.

\textit{You Are Blocking the Hall-Way!}

Although we cannot completely reconstruct the patterns of movements of the inhabitants of the three houses, it is still possible to gain at least an idea. In Borg I:1a, there is a clear preference for the central aisle of the house for movement. When released from the different entrances with the partitions opened, the internal organization of the house seems to guide the EVA agents into the area around the hearth (Fig. 12). It

\footnote{To see the isovist viewfields generated for each structure with the partitions closed, see the appendix as space does not permit for them to be included in the main body of the text.}
can be attributed to this area of the main dwelling space as having the most visual access to the other areas of the room and structure. The movement is quite visibly affected when the agents are released with the partitions closed; they are of course denied access to other areas of the house. However, the effect on movement within the main dwelling area with the partitions closed is quite interesting (Fig. 13). There is increased movement towards the sides of the room, although the central part of the space is still favored when stationary distribution is achieved. Here we can see an alteration of behavior once the access to different spaces is modified. The movement in the main dwelling room becomes more inclusive of the other spaces. This pattern is repeated in House D. The movement with the partitions open in House D (Fig. 14) echoes the movement in Borg I:1a. The areas with the most visual access, which is to say the areas around the hearth and the central aisle, see the most foot traffic and had the most EVA agents once stationary distribution is achieved. With the partitions closed, we see the a similar pattern of increased movement towards the walls,
though perhaps not as pronounced as in Borg I:1a (Fig. 15). This further illustrates the notion of these areas seeing a large amount of human activity and presence, at least at a basic level. Both these graphs illustrate that the main path of movement occurs in the central aisle and emphasize that the sides or areas nearest the walls were not conducive to being traversed. The gable ends of both houses show they would have received substantial foot traffic based on their overall design and available space. However, their probable function of these areas might have altered how readily people moved into those areas. In the case of the byre ends, their openness is most likely related to the animals being housed there and people may have avoided these spaces, unless they were caring for animals. The longhouse at Hofstaðir provides an opportunity to see how movement would have been channeled in one building but with a different internal organization. Looking at how movement would have occurred if the central area was indeed divided by berths, we see a similar tendency of movement as in the previous

![Figure 15. Agent Analysis of House D with partitions closed. Agents released from north east entrance.](image-url)
structures (Fig 16). However, the area around the hearth does not get as much foot traffic or agent presence as in the previous two structures. Instead, it is the area south of the hearth that has a high proportion of foot traffic. Interestingly enough, this also appears to be the case if we treat the central area as lined by platforms. This may be attributed to the line of posts along the center of Structure AB and as such it would be interesting to see how different it would have been if the sequence of use was known. What both graphs show is that the central aisle functions as the main thoroughfare in Structure AB, albeit in a somewhat constrained manner.

One might argue that this type of analysis is problematic. It only examines the internal spatial organization from a topographical perspective. The ideological element of how people moved within a space cannot be simulated by computer generated agents. Also, humans at times move through space with a particular destination whereas agents are following an algorithm (Turner, 2007). However, as stated earlier, the EVA agents move through space with knowledge of the built environment provided to them. They respond to obstacles along their path of movement in a similar fashion as people (Turner,
Although they may not have a specific destination in mind, the agents still go through the different permutations available to reach the different spaces or data points within spatial system. Just as how we take up space on our way to a specific destination and respond to obstacles in our path so do the EVA agents. Both computer generated agents and humans, moving in accordance to natural movement (Turner, 2002), prefer to move in open spaces and avoid restrictive space or areas not readily accessible by sight. The agent analysis graphs of Structure AB and Borg I:1a illustrate this.

Another factor that needs be considered is that the built environment is constructed according to the needs of a culture and is encoded with a degree of cultural information (Rapoport, 1969). That the physical makeup of the three structures encourages movement in the center aisle is a feature designed by their builders. If, as is the case in Borg I:1a, weaving took place on the raised floor along the north western wall (Croix, 2012; Herschend and Mikkelsen, 2003), it would not have been good to have people intersecting that space. This may explain its placement along the side of the structure. To pursue the idea further, if most of the movement occurred along the central aisle, it could also be an indication of ensuring that activities occurring in the central area or main activity area could be perceived by people moving throughout the structure. This funneling of people through particular spaces can be interpreted as an effort of the builders of the home to ensure certain spaces or areas of the longhouse were seen. As this feature is shared between these three longhouses, it would stand to reason that this may represent a design feature influenced by a social or cultural need. An activity in a rather visible space and one that would have been frequently perceived could be interpreted as a display of sorts. The purpose of having these spaces being viewed may be tied to the notion of exhibiting the ideal front or performance of a role (Goffman, 1963; 1959). The needs of such a display may vary though what is important to realize is that these spaces were meant to be traversed. The associated spaces, along with their occupants, were meant to be seen and reacted to.

This is Our Space

A factor that computer generated agents do not take into account is that some spaces, though physically readily available, may have been marked mentally as being restricted. To account for this possibility, we use convex maps to incorporate the spaces that may
have been mentally divided in the overall spatial system. As a consequence, the convex maps differ slightly from the floor plans of the individual longhouses, as it takes into account these possibly distinct spaces. In Borg I:1a, we see roughly seven different spaces (Fig. 17). Room C is divided into three different spaces: the main floor of the room and the two spaces on the raised platform corresponding to the location of the loom and the prestige or storage area (Croix, 2012; Holland, 2003). The links here symbolize the connections that existed between spaces and highlights Room C as a central or connecting space. The two side spaces within Room C are demarcated by the difference in elevation and were possibly treated as being separate, to a degree, from the rest of Room C. However, this should not be taken to indicate that these spaces were rigidly segregated. Their mean depth and integration values (2.16667 and 0.72782 respectively) hint that they were less integrated. Nevertheless, when acknowledging that most of the movement within Borg I:1a occurred through the hearth space of Room C, their segregation is mitigated by the fact that these spaces would have been visually accessed fairly frequently as there were no barriers to sight. This is reinforced when we look at the agent analysis which illustrates that movement in the hearth space occurred close to the platforms (Fig. 12). The people moving through the hearth space undoubtedly would see anyone occupying the platforms. Based on this, people would have experienced a degree co-presence (Goffman, 1963) and would have engaged in some form of interaction, whether verbal or non-verbal. Taking into account the distances that would have existed between stationary and moving people, roughly between 1.2m and 3.65m, we can see that the types of interactions that can occur in this space are personal and also social (near and far) interactions (Fisher, 2014). Co-present individuals within this area would have been able to see the full body of each other and the space around each other. The activity associated with one of the platforms would be textile production (Croix, 2012; Herschend and Mikkelsen, 2003). Given its position on a raised surface, and its visual accessibility, the performance of activities in this area would indicate a particular value to them. The value can vary but what was important was that it was meant to be readily seen and engaged with by people moving through or occupying the spaces of Room C.
House D in Aggersborg shares a similar pattern to the one seen at Borg I:1a. Unlike the earlier structure, House D does not have a divided hearth area as in Room C. The main dwelling space, as well as the other areas or rooms, are not seen to be partitioned further into different spaces (Fig. 18). The presence of the entrance from the outside here represents a difference that would have altered the way people would have moved through this spatial system. However, the direct access from the outside highlights that this area was meant to be easily accessible, both visually and physically. The agent analysis shows that this space around the hearth was frequently traveled and the isovist viewfield reveals that, visually, this was an open space. The mean depth (1.5) and integration value (1.05598) also show this space as being relatively well integrated into the larger spatial system. The probable distance that existed between people moving through the space and working in it varies between 1.2m and 3.65m, a distance that would have facilitated co-presence. This highlights that people could have engaged in personal and social interactions (both near and far) (Fisher, 2014). Considering that there is a possibility that near one of the doorways textile production occurred (Sindbæk, 2014), the importance of certain activities being easily perceived to facilitate interaction is further reinforced. Both at Aggersborg and Borg, we see the built environment engendering, at least to some degree, interactions at some level.

As a recurring theme in this study, Hofstaðir presents more of a challenge in understanding its spatial organization. Although the central aisle is seen to be the primary space through which movement is channeled, the implications for the types of interactions that would have occurred in the areas is less obvious. Whether or not the central area was divided into individual berths plays a crucial part in understanding what sort of activities or interactions could have occurred in the main interactive space. If we work from the premise that the central hall area was divided into individual booths (Fig. 19), we see that the convex map becomes more complex and different from what was seen before. If we treat the central space as one open area with raised platforms, we see
something more akin to the previous two structures. As the internal organization changes, so do the integration and mean depth values of each space. The most integrated space oscillates between the central hearth area and the southern part of the central hall (Fig. 19, c) and d) respectively). The integration value for the central area in c) is 10.7551 (shown as red). In d) the integration value is 1.69825 (displayed as lime green).

This stark value difference is attributed to the different number of spaces. Although the agent analysis revealed a similar pattern in movement regardless of which understanding of the central hall area is used, the overall internal spatial organization is dramatically changed between perspectives. Interestingly enough, the mean depth of the central hearth space between both interpretations does not vary drastically (1.17647 for the booth interpretation and 1.5 for the raised platform interpretation). Since assigning a particular function to the different areas within the central hall space is difficult, making assertions on the types of interactions and behaviors this space would have engendered is problematic. However, if we take into account other built environments in the nearby vicinity, some light might be shed on this issue. Although SFBs G and A5 were not part

![Figure 19. Convex Map of Structure AB. a) and b) depict links between areas based on the two central area interpretations. c) and d) depict the change of values of integration depending on the interpretation used.](image-url)
of the internal spatial system of Structure AB, they still influenced how space was used within and the kinds of behaviors that went on inside. By moving both textile production and smithing into separate structures, they become symbols of the associated activity. As such, these buildings presumably become part of a performance in which the inhabitants of Structure AB visibly display and make accessible to anyone within eye sight that these two of activities did not occur within the main structure. Inside the structure, due to moving of textile production and smithing elsewhere, the types of behaviors or interactions that may have been performed inside are purposefully changed. It is possible that the structure is creating social occasions of a specific sort (Goffman, 1963). This may explain the complex nature of the structure at Hofstaðir. Different performances were engendered within the longhouse which would have been initially prevalent to anyone who would have been visiting. This would not have been unique to strangers. It is quite possible that this display or performance was meant more for regular guests that were known to the household members as well as the household members themselves. This removal of activities could have been used as a way to accentuate the different behaviors or performances occurring within Structure AB.

Knowing how much a space was trafficked or the potential distance that would have existed between two people in a space can be argued is insufficient to make claims about the interactive environment within a structure. It can be taken a step further and said that being able to see an individual does not necessarily mean any form of interaction would take place. This may be true to a point. However, we also must recognize that despite whatever actions might be occurring, two people who are in any way visible to each other must be aware of the other person’s existence at least in the physical sense. This co-presence (Goffman, 1963) would in turn affect behavior to a degree. It is doubtful that a person would move through a space occupied by another without allowing themselves to be seen, unless they have much more sinister motives. In order to make their presence known, some form of nonverbal or verbal communication would occur, however brief. This is in itself an interaction which would not have ended or begun at that exchange. Depending on the location of the sedentary person, the built environment could already be communicating something to the person moving through the space. If the space is deep within the spatial system, it could stand to reason the person is aware, at some level, of the implications that space was not meant to be readily traversed. A shallow space in the system would imply that the area was meant to be
accessed fairly easily and as a consequence, the goings on in the area were also meant to be just as easily seen. When they come within a perceptual distance, they respond in kind appropriate both to the nature of the space and to the activity that is being engaged in. The amount of times a space is crossed or used, in accordance to movement, not only hints at the number of times a potential interaction could occur but also whether or not interactions were being encouraged. The proxemic distances of perception outlined by Fisher allow us to glimpse at what types of exchanges could have occurred. It is highly unlikely that the people who lived and worked in the three longhouses would have gone about their daily business without acknowledging each other at some level. Sharing a space with another person does not necessarily guarantee some sort of interaction. However, knowing that we are social creatures, it is very likely that sharing a space, whether big or small, will at some level give us an opportunity to interact.

**Analysis Overview**

In the preceding examination, the primary purpose was to detect how space was used, how the built environment facilitated interactions, and what types of interactions may have occurred in the longhouses that we looked at. Based on the archaeological material and the topographical analysis of the different longhouses, it was established that the areas around the hearths of the longhouses were the main centers of activities. The topographical analysis was facilitated by DepthMapX via its agent analysis feature. Functioning as the main centers of activities, it can reasonably be argued that within these spaces, interactions between inhabitants would have occurred. This is lent support by the isovist viewfields generated for each longhouse. The isovist viewfields depict open spaces where the aim was not to bar visual access but to allow for visual inclusion of large portions of the interior space. Taken into account that distances that would have existed between people within these central or main activity areas ranged between 1.2 and 3.65 meters, any two people occupying these spaces would have undoubtedly perceived each other. In doing so, they would have engaged at least in some form of interaction. A factor that would have influenced the nature of the interactions is how the occupied space related to the other spaces in the spatial system.

By having the bulk of activities occurring in easily visible areas, as in the cases of Borg I:1a and Housed D, it is argued that built environment was being used as part of a performance. What is meant by this is that by the channeling of movement through or
past these main activity areas, the space was organized to ensure that anyone moving within the structure would have been forced to interact on some level with anyone occupying these spaces. This was a feature built into the structure; a creation of social occasions as opposed to a gathering space (Goffman, 1963). In ensuring that interactions occurred within the designated or desired space, it allowed for household members to put on display certain activities or their own bodies. Depending on the overall depth of the space or its integration in the overall system, the relationships between spaces are part of this performance or interaction. In this sense, space is being commodified as it can stand to reason that the different spatial relationships would have been clear to household members or guests. These relationships were used as part of the displaying or performance of interactions and activities. When these spaces were viewed, both the spatial relationships and the space itself were consumed as part of the social interaction. This can be seen in the three longhouses discussed in this analysis. In Borg I:1a we see that the hearth space in Room C would have had many people moving through it and as a consequence anyone on the raised platforms would have been perceived and interacted with at some level. As the difference in elevation can safely be said to be used to mark the space as different or convey a specific quality. People passing through or seeking to occupy that space would have been aware of the difference in the spatial organization and drawn upon that difference to react accordingly. This performance would have gone towards visitors and household members alike. By having weaving in a visible space that would have had many people passing by, House D facilitates a similar performance. Although there are no clear traces of spaces set apart within the main dwelling room, we can still see that anyone moving through or occupying it must have been with the field of perception. As such, engaging in interaction with a co-present individual while in the midst of performing an activity, an idealize front or performance would have been enacted (Goffman, 1963; 1959). At Hofstaðir, the spatial relationships are on display not within the structure but without. Having weaving and metal working removed from the longhouse allows for different activities to occur within the main structure. Keeping in mind that regardless of whether the central space was divided into booths or it had raised platform, what was being displayed by people occupying these spaces were their different spatial relations. Other people would have had to mark and consume that difference and reacted according to social or cultural expectations. The built environment functions as a physical reminder of the appropriate response.
7. Space (using) Vikings!

The Stage is Set
Much of what we know about Viking Age Scandinavian culture is changing with the advent of new technologies and interpretive frameworks. Like other cultures in the world, we understand that multiple aspects of daily life are filled with meaning. The built environment is one such aspect. Rather than being a culture with highly segregated spaces, we can see Viking Age Scandinavians as people who favored open domestic structures. The longhouse is one such example. This building represents a long history of building traditions that changed relatively little up until the Late Viking Age (Skre, 1996). Using computer generated agents in the program DepthMapX we are able to establish that within the three longhouses at Aggersborg, Borg and Hofstaðir, movement was funneled or channeled through the central aisle. Through DepthMapX, it was also possible to reconstruct, to a degree, the possible isovist viewfields or field of visions people would have had from different positions within the structures. These isovist viewfields allow us to understand what was visibly available for an individual in a particular space. Through a comprehension of what was visually accessible, we catch a potential glimpse at what Viking Age people wanted to display for themselves and others. The isovist viewfields generated through DepthMapX depict the three longhouses which, for the most part, are visually open and accessible, though Hofstaðir may represent a different reality. An understanding how people moved through a space and what was perceived when moving through the Viking Age longhouse is essential to learning about the types of interactions that would have occurred. This is aided when combined with framework of proxemic distances. Knowing the distances that existed between two people in a particular space will help us to conceptualize the ways in which both distances and spaces were used to communicate or interact. To return to the questions posed at the beginning of this thesis, I assert that the longhouse was designed in such a way as to funnel or channel movement through the central aisle of the structure, with a particular emphasis towards the main dwelling space. As the EVA agents based their movements on what would have been visually accessible, it further supports that sight played a big role in determining what spaces people had access to.

It is relatively uncontentious to say that the space containing the hearth, or the largest hearth, was the main dwelling area within the Viking Age longhouse. This is supported by the reality that a good portion of artifactual finds from the longhouses at
Borg, Aggersborg, and Hofstaðir were found within the same room or space as the hearth (Sindbæk, 2014; Lucas, 2010; Herschend and Mikkelsen, 2003). By channeling movement through the main dwelling room and having this space be visually open and accessible, the design of the built environment ensured that the main dwelling room was the main hub of human interaction. Based on the proxemic distances that occurred between people in the main dwelling space and Goffman’s notion of co-presence (Fisher, 2014; Goffman, 1963), we can see that people engaged roughly in personal and social interactions. People moving and working in the main dwelling space would be engaged in daily activities which in turn can be seen as performances. The built environment enhanced and structured these performances within the context of Viking Age culture. It is quite possible that by placing an activity in a highly visible area, such as weaving on a platform or by a doorway, a certain idea or front (Goffman, 1959) was being communicated. This would have affected how a visitor or other household members would have interacted with people engaged in the activity or the other members of the household. This reflects an attempt by the builders and the organizers of the internal space to structure how people performed their duties or interactions. Whether the performance was that of deference or inclusion, what is important to note is that space is being consumed in a manner reflecting cultural ideals.

Performances might not have been exclusively carried out on an individual basis. Looking at the separating of activities at Hofstaðir into different buildings, we can see that the whole household is engaged in a performance. It can represent a team, in this case the household members, which enacted a particular performance (Goffman, 1963). This performance could have been used to negotiate inter-settlement social relations or perhaps to convey an ideal front of a household unit (Goffman, 1959). Rather than looking solely at individual actors, we should see the household as a whole engaged in a performance. That of a household unit engaged in typical Viking Age domestic activities. There might be some times where they adopt a different role, in the presence of a leader of sorts, but ultimately the main performance could have been of a household unit. In the study by Tyler and Cohen, the women, when alone in their office, would be more relaxed and the way they used space would be more related to comfort (2010). If their offices were open and if there was a possibility of being perceived, even if the possibility was small, they would take more of a formal sitting position and take up space to reflect a degree of professionalism (Tyler and Cohen, 2010). This is a reflection
of an idealized practice or dramatization in order to convey a particular face or front (Goffman, 1959). This is undoubtedly not a recent practice. Although this could be argued is tied to notions of being perceived as professional, it can be applied to the three longhouses as well. Perhaps when there was no one being co-present, the way space was used and the performances enacted would have had a different purpose or may have been more relaxed. When there was the potential for co-present individuals, no matter if they could have been perceived directly or not, it is possible that the usage of space and the performance of daily activities changed to suit more social functions. It is within reason to suggest that Viking Age people who used the internal spaces of their homes and performed within them had different performances at different times. The built environment would have facilitated these performances and ensured that they were visually accessible.

In line with the notion that performances should not be seen solely at the individual level, it is also beneficial to see how an object can come to be a performance in its own right. The Viking Age longhouse represents a cultural performance of memory. Specifically, what it means to Viking Age people of what a good house is. As Goffman points out, experience shapes behavior (1963, 1959) and experience would have been shaped by the surrounding environment. When it came time for people to build a new home, the Viking Age builders would draw on their memories of their own experiences within a house and designed a similar structure to simulate the spaces in which their experiences occurred. The rebuilding of Borg I:1a immediately after and over Borg I:1b hints at a desire to preserve some memory of the previous structure and an attempt to recreate similar performances in the new house. House D being rebuilt and repaired over a long period of time reflects the notion of preserving a specific spatial layout, and this supports the notion of trying to keep ties with the past. As a consequence, people would have engaged with this past and performed according to the cultural memory embedded in the design of House D. This memory or experience of interaction within a building is further carried on through the construction of another longhouse. Over time this may change, but ultimately it is the memory of a good house that perpetuates the construction of a stylistically similar building. In essence they consume both the spatial relationships of the structure and the space itself. This represents a commodification of space. The performance of a good house can also be changed in order to suit specific social interactive needs. This can be the case with
Structure AB at Hofstaðir. Such an act is on its own a performance; that of a building what others can view as a good house in a new way. Once built, the longhouse would have ensured that both new and old behaviors and performances occurred among its Viking Age inhabitants in a manner desired by the people who built it. Although this paper has only dealt with three longhouses, it is possible that the decision and cultural information embedded into these structures is indicative of a larger practice. It is only through further study that this can be expanded upon.
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Appendix

DepthMapX Graphs
This appendix contains all the graphs generated for this thesis via the program DepthMapX. They are provided here to supplement the graphs and the analysis conducted in the main body of the thesis. Each type of graph contains a brief description of what is being illustrated. For a more thorough explanation of each graph type, please see the DepthMapX overview under the Methods section of this thesis.

**Borg I:1a Closed Partitions**

*Base Visibility Graph*
Depicted here is the base graph used to understand the visual relationship between the different the data points on the lain grid. Red here indicates the data point has high visual access to other spaces or data points. Blue indicates low visual access. The partitions serve to limit how many different data points are visually linked.

![Visibility Graph of Borg I:1a with closed partitions.](image)

*Agent Analysis Graphs*
In these graphs, what is shown are the stationary distribution achieved by the EVA agents when released from the five entrances leading into Borg I:1a with closed partitions. The point of release is indicated by highlighted grid square shown as a light tan square. As discussed earlier, red indicates a high degree of foot traffic or agents present at that point when stationary distribution is achieved. Blue indicates lower degree of foot traffic or agent presence.

![Agent Analysis Graph of Borg I:1a with closed partitions. Agents released from Entrance 1.](image)
The following two graphs depict an agent analysis conducted when they are released from the entrance to Room C with the partitions closed.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from Entrance 2.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from Entrance 3.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from Entrance 4.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from Entrance 5.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from the eastern entrance to Room C.

Agent Analysis Graph of Borg I.1a with closed partitions. Agents released from the western entrance to Room C.
**Isovist Viewfields**

These are the isovist viewfields generated from the five entrances into Borg I:1a. The gray area is what would have been visually accessible to an individual at the entrances with the partitions closed.

Illustrated in the following graphs are the isovist viewfields from the perspective of two entrances into Room C. The last in this group shows the overlapping isovist viewfields from both perspectives. The difference in color of the isovist viewfields is only to distinguish them from each other.
The convex map for Borg I:1a with closed partitions is presented here. Due to the premise of treating the structure with closed partitions, the spatial system is too small to be able to measure the integration value of the different spaces of Room C. However, it is still possible to calculate the mean depth and the result is shown here. The color code for mean depth has red for a depth value and blue for a low depth value relative to the whole connected system. The mean depth for hearth space (in blue) in Room C is 0.666667 indicating a shallow space. The mean depth for the other two spaces (in red) is 1 which highlights the spaces as deeper.
**Borg I:1a Open Partitions**

*Base Visibility Graph*

The base visibility graph presented here is strikingly different when the partitions are opened. This pattern will be repeated in the case of Aggersborg. Notice that the data points within the central aisle become more visually linked with the partitions opened.

![Visibility Graph of Borg I:1a with partitions open.](image)

**Agent Analysis Graphs**

As in the closed partitions analysis of Borg I:1a, agents are released from the five different entrances. In the following graphs is that the partitions are treated as opened. There is not a drastic change of the movement when the agents are released from different points.

![Agent Analysis of Borg I:1a with open partitions. Agents released from Entrance 1.](image)

![Agent Analysis of Borg I:1a with open partitions. Agents released from Entrance 2.](image)

![Agent Analysis of Borg I:1a with open partitions. Agents released from Entrance 3.](image)

![Agent Analysis of Borg I:1a with open partitions. Agents released from Entrance 4.](image)

![Agent Analysis of Borg I:1a with open partitions. Agents released from Entrance 5.](image)
Isovist Viewfields

The isovist viewfields from the different entrances with the partitions open cover a wide area. From the perspective of Entrance 3, the central hearth was removed as it would have been treated as a visual barrier when it is very likely people could see over the fire or hearth. It is possible that smoke from the fire could have clouded sight but the areas of the other side of the fire would have still been visible to some degree.

The isovist viewfields from the entrances to Room C with the partitions open would have given an individual a high degree of visual access to the other spaces of Borg I:1a along the central aisle. Only slight differences are observed between the two perspectives and when they are overlapped, a majority of the visually available space is shared.
Convex Map

With the partitions open, links can be established between the different spaces identified in Borg I:1a. We get a somewhat linear graph of the different links. The different spaces of Borg I:1a can form a larger spatial system that allow for calculating integration and mean depth of the different spaces. There are no clearly identifiable spaces in Rooms A, B, D, and E. As a result, they are each treated individually as one space.

In Room C, the integration value of the hearth space is 2.54737. The value of the two spaces on the raised floor in Room C is 0.72782. The hearth space is much more integrated in the overall spatial system and is red to reflect that. The other two spaces in Room C are not as integrated and as such are represented in blue. Rooms B and D are slightly more integrated hence the turquoise color. Their integration value is 1.01895. Rooms A and E are more removed than the other spaces and have an integration value of 0.509474 and are colored a dark blue.
The mean depth for the two spaces in Room C is 2.16667 indicating deep areas relative to the other spaces in the system. They are colored yellow. The space with the hearth has a mean depth of 1.33333 which is colored as a shallow space, in this case dark blue. Rooms B and D are deeper spaces than the hearth space in Room C but shallower than the platform spaces. Their mean depth is 1.83333. Rooms A and E have a mean depth of 2.66667 making them the deepest spaces compared to the other spaces.
**Aggersborg House D Closed Partitions**

*Base Visibility Graph*

The visibility graph of House D shows the gable end or western most section of the house as facilitating more visual connections between the various data points on the grid. This is likely related to its probable function as a byre. However, this changes slightly when the partitions are opened.

![Visibility Graph of House D with closed partitions.](image1)

*Agent Analysis Graph*

Released from the four entrances into House D, we see that the central aisle tends to have been used the most by the EVA agents. This is undoubtedly owed to fact that the central aisle allows for the most data points to be visually connected.

![Agent Analysis of House D with closed partitions. Agents released from the north western entrance.](image2)

![Agent Analysis of House D with closed partitions. Agents released from the south western entrance.](image3)

![Agent Analysis of House D with closed partitions. Agents released from the north eastern entrance.](image4)
Even with the partitions closed, the individual rooms or bays within House D are visually open. As the isovist viewfields show, there are not many impediments to sight. The few that are may not have actually obscured vision completely; the exceptions being those that relate to the partitions themselves. The four isovist viewfields generated correspond to the four entrances into House D. In the case of the entrance into the main dwelling space from the outside, the hearth has been removed as it would most likely not have completely blocked sight into the other areas of the room.
In regards to the main dwelling space or room, we see that from both entrances most of the space is visually accessible. The hearth here has been removed as it is more than likely that it was not affect the isovist viewfield. However, the smoke from the hearth may have played a role in how detailed of a view a person may have had to the other side. The posts around of the hearth may have belonged to a cooking rack and would likewise probably not have obscured vision. As a result, the isovist viewfields would have been different and there would potentially be more overlapping of the fields from both entrances into the main dwelling room.

Convex Map

It is possible that the different rooms or bays in House D may have had some internal spatial divisions. However, due to inability to detect them with certainty, each room is treated as a singular space. Having the partitions closed in House D prevents calculating the integration value and mean depth of the different spaces due to them being unlinked.
**Aggersborg House D Open Partitions**

**Base Visibility Graph**

With the opening of the partitions, we see spaces becoming visually connected. The central aisle as being the most visually connected is demonstrated though the most visually connected data points shift more towards the east section of House D. The main dwelling area also shows an increase in visual connectedness.

![Visibility Graph of House D with open partitions.](image)

**Agent Analysis Graphs**

When released from the different entrances into House D, it is apparent that the central aisle or portion of the structure contains a higher degree of agent movement. This echoes what was seen in Borg I:1a. However, there are slight changes to how much certain data points are used when released from the different entrances. The changes are most clear in the squares around the hearth. However, the changes are not drastic.

![Agent Analysis of House D with partitions open. Agents released from the north western entrance.](image)

![Agent Analysis of House D with partitions open. Agents released from the south western entrance.](image)
The most significant changes in the isovist viewfields that occur as a result of have the partitions opened is that from north western and south eastern entrance, parts of the main dwelling space can be seen. Also, from the main dwelling room, parts of the western most room can be seen. What we see here are large areas of House D being readily accessible visually.

Isovist Viewfields

Agent Analysis of House D with partitions open. Agents released from the north eastern entrance.

Agent Analysis of House D with partitions open. Agents released from the south eastern entrance.

Isovist Viewfields from the north western entrance of House D with open partitions.

Isovist Viewfield from the north western entrance of House D with open partitions.

Isovist Viewfield from the north eastern entrance of House D with open partitions.
From the perspective of the two main dwelling room entrances from within House D, more of the other areas of the house can be seen. However, there is potentially more of difference between the two isovist viewfields. From the western entrance, parts of the western room can be seen whereas the eastern room is hardly visible. The inverse is true from the eastern entrance. However, this might not accurately reflect the reality as it is two posts on the sides of the hearth that act as visual impediments in these isovist viewfields. These post may not have gone up very high as they have said to be related to a cooking rack over the hearth. Also, the partition posts for the western partition may not have all been in use at the same time.
Convex Map

The convex map of House D with the partitions open illustrates a linear set of links between each of the different spaces. It also allows for a calculating of the integration and mean depth of each of the spaces.

The main dwelling area is the most integrated space of the overall spatial system of House D with an integration value of 1.05598. The adjacent two spaces are the next most integrated spaces with an integration value of 0.703987. The spaces or rooms at the end are the least integrated and have the same integration value of 0.351994. Red signifies high integration and dark blue low integration.

In regards to mean depth, blue indicates a shallow space with a low depth and red highlights a deep space with a high depth. With a mean depth of 1.5, the main dwelling space is the least deep space in the overall spatial system. The adjoining rooms have a slightly higher depth with a mean depth of 1.75. The two gable ends are considered deep spaces with a shared depth value of 2.5.
**Hofstaðir Structure AB, Booth Interpretation**

*Base Visibility Graph*

The visibility graph for Structure AB with the central area divided as booth illustrates a somewhat restricted access to the sides of the building. The central aisle along with the southern room contains data points with the most visual links. This could be different as it is possible that the sides of the booth may not have reached up to the rafters of the structure.

*Agent Analysis Graphs*

The EVA agents seem to favor the southern portion of the central area of the longhouse and avoid the presumed central booths. It is likely that the reason for this is not linked to the individual booths but the posts that are indicate by the postholes. If it some were removed to reflect the situation when the house was in use, it is likely that a different
result would be gained from the agent analysis. Releasing the agents from the different entrances does not change the overall movement of the EVA agents.

**Isovist Viewfields**

With the booth interpretation, not much can be seen from the perspective of the two entrances. Depending on the height of booth walls, sight into the central hearth space could have been blocked significantly as the graphs show. The line of posts also impedes vision but as was stated previously, it is likely that not all were in use simultaneously and this would have altered the characteristics of this space. Once inside the main activity area, the central aisle opens up as the main source of visually available spaces. Perhaps more so than the other structures, the point of entrance plays a large role in what would have been seen. This is evident in the overlapping isovist fields.
Convex Map

Treating the beam slots as indicating booths yields a relatively complex system of links. This would have influenced greatly the quantitative values of integration and mean depth. Indeed, the integration value of the central hearth space is 10.7551 (shown as red) whereas the booths have a value of 1.69818 (dark blue). This value is shared by the northern passage way. The southern part of the central area has an integration value of 2.15103 (light blue). The southern passage and room have integration values of 1.1126 and 0.717008 respectively (both are dark blue). The difference in mean depth is less severe. The mean depth for the different areas are: 1.17647 for the central space (dark blue), 2.11765 for the northern passage and booths (turquoise), 1.88235 for the southern section of the central area (light blue), 2.70588 for the southern passage (yellow), and 3.64706 for the southern room.
**Hofstaðir Structure AB, Raised Platforms Interpretation**

*Base Visibility Graph*

The impression that we get from the visibility graph of Structure AB is quite different from the booth interpretation when treating the beam slots as indicating platforms. It is more similar to the other two structures when the partitions are treated as open. What remains similar to the booth interpretation is that the southern part of the house has the most visual links among data points.

![Visibility Graph of Structure AB. Platform interpretation.](image1)

![Agent Analysis of Structure AB. Agents released from the northern entrance. Platform interpretation.](image2)

![Agent Analysis of Structure AB. Agents released from the southern entrance. Platform interpretation.](image3)

*Agent Analysis Graphs*

It is interesting that upon conducting the agent analysis using the platform interpretation, the graph is notably similar to the one generated from booth interpretation. Although the sides are more frequented, it is still the central aisle which has the most foot traffic with the concentration being on the southern section of the central space. This further indicated that it is line of posts that influenced movement.
**Isovist Viewfields**

With potential barrier to sight created by the booths removed, we can see something much more akin to House D and Borg I:1a in regards tendency for open rooms. From both entrances, the opposite ends could have been seen. Although it is possible there could have been obtrusions to the line of sight on the platforms, it is worth noting the similarities these isovist viewfields share with the ones for the other buildings. Once inside the central area, the line of sight is similar to the booth interpretation and highlights a less visually available space when compared to other structures. However, more of the side spaces are visible though not by a significant amount. As in the previous graph, the point of entry has an effect on what would have been visible.

**Convex Map**

The map generated when regard the beam slots as platforms is more familiar and similar to Borg I:1a and House D. It depicts a somewhat linear and less complex spatial configuration. This would in turn produce quantitative values more in line with Borg I:1a
and House D. We see that for the hearth space, the integration value is 1.69825 (lime green). The value for the platforms is 1.27368 (turquoise). It is not strikingly different. The southern section of the central room is the most integrated space with a value of 2.54737 (red). The northern and southern passages have integration values of 0.849123 (dark blue) and 1.01895 (light blue) respectively. The southernmost room is the least integrated space with a value of 0.509574 (dark blue). The range of mean depth is closer to the other structures using the platform interpretation. The hearth space has a mean depth 1.5 (light blue). The platforms’ mean depth is 1.66667 (turquoise) and is not that different from the central space. Mean depth for the northern and southern passages are 2 (green) and 1.83333 (light blue) respectively. The shallowest space with a mean depth is the southern section of the central area 1.33333 (dark blue) and the deepest space is the southern room with a mean depth of 2.66667 (red).