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Conservation of Uncertain Monuments: The Case of Prehistoric Scottish Brochs

Chang Liu

Doctor of Philosophy
The University of Edinburgh
2021
Abstract

The sophisticated drystone Iron-Age brochs of Northern Scotland, called Complex Atlantic Roundhouses by archaeologists, have shown the high technological culture of the builders. Their conservation should be based on their key features (structure, materials, building type, and architectural elements), but there is little agreement on them because of the lack of confirmation for a standard broch scheme and the need for excavations for further archaeological research. This topic has an interdisciplinary complexity that should weigh both the values of the prehistoric attributes of brochs and the architectural features on sites.

Since the brochs are not fully understood, they could be seen as ‘uncertain’ monuments. This research challenges the common conservation strategies by proposing a conservation theory framework, taking prehistoric Scottish brochs as a paradigm of universal monuments conserved without knowing the origin.

The conservation of uncertain monuments would discuss the brochs' life as a whole, up to including the C19 early discoveries, current activities, as well as the potential future discoveries and site changes, leading to open-ended conceptual principles, which would help further understanding of the intrinsic relationships between brochs’ various uncertainties. Archaeological research shows the monumental brochs were indeed modified, repaired, or reconstructed in their history, possibly over 500 years, which is an important part of their characters. The conservation of brochs in our times, which is often just consolidation repairs for safety led by archaeology, is argued in this research that should be guided by typological studies to interpret the monuments from architectural perspectives. The typological study would create subtypes of brochs that demonstrate regional features and provide additional and vital layers where information from archaeology is fragmentary.

At present, the origin and design evolution of brochs are still conjectural, lacking historic evidence, while their remains are fragmentary ruins, so their conservation should include reflections of both their uncertain, intangible origin and evidence on modifications, which would be treated equally as part of the character that architectural interventions aim to conserve. The whole life of brochs should be interpreted scientifically in conservation and communicated with the ‘mystery’ that corresponds to such uncertainties to the public, also considering potential tourism.

This thesis broadly uses typological studies to understand brochs features, realising they should not be treated as individual objects in conservation but be interpreted as a collection at various levels.
Lay Summary

The Iron-Age brochs of Northern Scotland are monuments that are not fully understood, called uncertain monuments. They are round, some are tall, some are massive, and all are made of pure sand-stones. They are more complex in architectural design than other monuments built at the same time. However, most of them are in ruins with a few features visible, which is often a mixture of the original building and later modifications. The mysterious architecture and the poor surviving level of these monuments have made them difficult to be understood.

The conservation for them is needed to protect the archaeological data. The conservation should be based on the key features, while there is little agreement on them due to the lack of evidence. The uncertainty has made the brochs unique and made their conservation study special. At present, any restoration attempt is conservative. As most brochs in Scotland are fragile ruins and only a few have been scientifically explored, they have been conserved through essential consolidation for the safety reasons in very localized methods, primarily by archaeologists.

This thesis approached to study from architectural perspectives, reading the collection of brochs’ features and classifying them based on the different regions. The regional standard models are found, and the scheme of the designs can be conjectured. Understanding the models which the builders may use can help the conservation interpret the monuments and make these uncertain monuments readable.

The conclusion of this thesis is the framework of interpretive conservation, which could offer guidance and advice for the consolidation, restoration and reconstruction work. The study would argue for holistic conservation projects that go beyond consolidation to make changes on sites for stronger interpretations.
Acknowledgements

First and foremost, my thanks go to my supervisors, Dr Dimitris Theodossopoulos and John Brennan, for inspiring my thoughts throughout the long journey and always encouraging me to explore the unexpected academic world with my curiosity.

In addition, I would like to thank archaeologist, Dr John Barber, for teaching me archaeology during the journey of this interdisciplinary research. Also, I wish to thank ‘the Vaults’, the study place for PhD students in Minto House, where thoughts were shared. It is very fortunate that I receive numerous supports from my friends, with whom my research is inspiring and my life is pleasant every day in Edinburgh: Chuan, Lin, Peng, Ziwen, Pablo, Hafsa, Nick, Graham, Delia, Stella, Hao, Yiqiang, Kenneth, Effi and many others.

This study was financially supported by funding from the China Scholarship Council (2018-2021), while the University of Edinburgh provided additional funds for fieldwork costs.

The support and love of all the members of my family helped me to overcome some difficult times during this period of the research, especially during the Covid-19 lockdown, and I want to record my endless gratitude to them all.
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1 Broch background

The are many monuments that people are still on their way to knowing. The process of understanding them may need scientific excavations that would take years, decades or even centuries. They appear to be ‘uncertain’ to people for a long period. The ‘uncertain’ monuments are defined by the author as monument sites that were not fully understood due to the lack of necessary documents. Regarding this point, prehistoric monuments are typically uncertain, and they have archaeological potentials where buried archaeological artefacts are likely to survive. Compared to the conservation of well-documented monuments, the conservation of uncertain monuments could bring more challenges. The historic heritage could be restored according to the architects ’ drawings, while preserving uncertain monuments requires a different approach where there is no evidence of original form for considering restoration.

The prehistoric Scottish broch is a kind of uncertain monument which is an Iron Age drystone hollow-walled structural type built from and found only in Scotland. However, due to the vast complexity of the building structure and the long unevidenced history, the conservation of brochs encounters much difficulty as the archaeology of brochs can be very controversial. encounters much difficulty as the archaeology of brochs can be very controversial.

1.1 Brief introduction

The brochs are notable monuments in Scotland for three main characters analysed as below.

1) Brochs are double-circular-wall complex roundhouses.

This characteristic is outstanding because the other Iron Age roundhouses in Europe do not have double walls with walking passage inside, and they are pretty smaller in scale or less permanent. As for the design, the external and Internal walls demonstrated the understanding of circular space and gallery, as well as vertical circulation offered by the stairs made by ancient people. In general, it is the sophistication of the Iron Age characteristics and the building itself.

Figure 1.1 Mousa in Scotland (left photo taken by the author in May 2019) Cadbury Castle in England (right picture, image credit: Google Earth)
2) Brochs are notable Scottish monuments.

Brochs are called 'Complex Atlantic Roundhouses' (Armit, 1991, p.16), which have complexity both in plans and elevation, always in drystone masonry. Compared to the mostly known Iron Age monument in England (Figure 1.1), which are hillforts, a type of earthworks used as a fortified refuge or defended settlement like Cadbury Castle, the broch structure has typically demonstrated the Scottish highland culture as made of stones with remarkable height. The Iron Age of England ends much earlier, in 43 AD, due to the Roman invasion. However, the Scottish Iron Age, ranging from 600 BC to 500 AD (RCAHMS, 1992), lasted about 400 years more, which might offer more time to develop vernacular Iron Age building skills. Thus, the Scottish brochs could be seen as a representative symbol of Iron Age monuments in Scotland.

3) Brochs are significant Iron Age drystone structures.

The Iron Age is the final epoch of the three-age system, preceded by the Stone Age (Neolithic) and the Bronze Age. It is an archaeological era in the prehistory of Europe and the Ancient Near East. In theory, the British Iron Age lasted from the first significant use of iron for tools and weapons in Britain to the Romanisation of the southern half of the island. Also, drystone is typically local building material, even for now in the North of Scotland. As for the brochs which built without mortar, the intelligent usage of drystone from ancient people could be further studied.

The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) identified a total of 571 candidate broch sites throughout the country (Armit, 2003). Officially, there are 317 scheduled monument sites by Historic Environment Scotland (HES), which are designated as brochs. Besides, on the Canmore database, a Scottish national online database of ancient monuments maintained by Historic Environment Scotland, there are 860 archaeological sites which are brochs or possible brochs. MacKie (1975), the foremost Scottish scholar who had much academic contribution to the recording of brochs, has said that ‘brochs are among the most striking of all the prehistoric monuments of Europe’. In general, brochs are important ancient monuments to both Scotland and Europe.
1.2 The definition of brochs

Archaeologist E.W. Mackie (2002, p6) defined the brochs with five main features as 1) round plans, 2) thick walls, 3) particular size, 4) a ledge or scarcement on the inside wall face, and 5) at least one of certain hollow-walled architectural features. Also, Mackie mentioned the classification of brochs as sites with at least two of the characteristics 1 -4 and in addition No.5. Based on this, hundreds of brochs could be identified. However, due to the limited excavations or recordings, only the brochs with properly surveyed architectural plans are used for the statistical analysis. John Barber (2016, p.101) mentioned that the probable brochs in the National Monuments Record of Scotland (NMRS) identified with these criteria would be restricted to fewer than 80 because many semi-brochs have no distinct features. He suggested the Revised Standard Model for broch shown in Figure 1.2. Only 5 of the almost 600 known or probable brochs, which survived with a height around 10 meters, provide direct evidence for the existence of a high hollow-walled tower (MacKie, 1965). Based on the broch information provided by Tanja Romankiewicz (Romankiewicz, 2001), for around 120 surveyed brochs, there are no brochs that look the same to another. Even the orientations of broch entrance have no demonstration of any preferences on any directions. However, there are some similar features, like staircases that always go clockwise from the ground floor to the upper floor.

These remarkable stone-built roundhouses of the Scottish Iron Age contain some elaborate architectural features. Their drystone walls are about 3m to 6m thick, and internal diameters range between 5m and 20m. These dimensions could easily have supported tall structures, and five still survive to 9m and even higher. Presently, some diagrams of the original configuration of brochs are widely known. However, most of these images would be much like conjecture due to missing supporting evidence.
Figure 1.2 The configuration of Revised Standard Model for Brochs (Barber, 2017, p101)
1.3 Broch among Atlantic Roundhouses

The broch has long been a dominant feature in the study of the Scottish Iron Age, and its classification and development have excited much debate (MacKie, 2002; Romankiewicz, 2011). According to archaeologists, the subdivisions of Atlantic Roundhouses regarding their complexity in architecture could be two kinds, as the Simple Atlantic Roundhouses and the Complex Atlantic Roundhouse (Figure1.3). In the research field of archaeology, an Atlantic roundhouse is an Iron Age stone dwelling found in the northern and western parts of mainland Scotland, the Northern Isles, and the Hebrides. Based on the little architectural details in buildings, Ian Armit (1991) has applied the terminology of simple and complex Atlantic Roundhouses to give a clear view of related typological sequences of the numerous sites. His study also aimed to bridge the regional gap between things called brochs in the north and duns in the west. This terminological difference hiding many apparent similarities is classified as those which could be roofed (dun-houses) and those which could not (Harding, 1984, 218-219). According to this theory, they highlighted a movement away from the earlier externally unprepossessing dwelling types towards structures that were more dominating features in the landscape.

Simple Atlantic Roundhouse would include roundhouses at Bu and Toftness in Orkney. Dating from 800 BC to 400 BC, the simple Atlantic roundhouse shows a start regarding its scale and external appearance from Late Bronze Age which has no galleries or cells within the thick wall (Henderson 2007, P154). Because the surviving drystone walls at Bu, Orkney were 1.5m in height, and there is little rubble surviving, Armit (2003) suggested that the building structure should only have one storey.

The early Iron Age roundhouse at Tofts Ness, Sanday, Orkney is typical of Simple Atlantic Roundhouse. Due to the identification of anthropogenic soils in the archaeological records of the site (Stephen et al., 2009), data of management of these arable soils provides clear evidence that the building could date back to the mid-part of the first millennium BC. It could be seen from the architectural perspective that the design is simple as the circular wall has created a horizontally closed space. The idea has clarified the difference between being inside or outside through the entrance.

The complexity of Jarshof Wheelhouse, which is regarded as a type of Complex Atlantic Roundhouse, is higher than Tofts Ness because of the small cells divided from the inner circular space. It is horizontally complex in plans. However, the broch is the most complex roundhouse, horizontally with double walls and cells, which also vertical circulations offered by the staircases between the inner wall and outer wall. From Simple Atlantic Roundhouse to Complex Atlantic Roundhouse, complexity shows gradually changes in Horizontal and vertical space inside the buildings.
As the complexity of space gets higher, the spatial sequences, getting to the rooms or the possible roof from outside, would change.

As both the roundhouse at Bu and broch Coldoch have similar dimensions, including the diameters of the external and internal walls, as well as the remains height (most parts around 1-2 meters tall), a comparison study (Figure 1.4) of Bu and broch Coldoch displayed in Figure 3 makes the similarities and differences between simple and complex Atlantic roundhouses more apparent. Both roundhouses have only one entrance. However, Coldoch broch has higher circularity and complexity of architectural room sequences. Bu could be seen as an entire building with only one room, while Coldoch broch presents three corbelled cells in the central spaces and a stair-access-cell for going up to upper galleries. The design of brochs is both horizontally and vertically sophisticated as more room sequences, and more diversity of spaces are offered. Besides, other brochs could have guard cells on the ground plan, which makes it even more complex.
Therefore, Bu has shown a similar roundhouse idea from an architectural perspective but with less consideration of spatial division and less perfectness of wall circularity. As Bu was relatively built earlier than most brochs in Scotland, theoretically, the building skills should be lower. Bu’s circularity of wall could be used as a reference for the very first broch built.

Also, there are Duns in Scotland which is a type of Complex Atlantic Roundhouses placed between Bu and broch regarding their complexity. Duns could be the original inspiration for the later broch builders. Thus, the study would move to the perception of Complex Atlantic Roundhouses for deeper understanding.

The examples for ‘complex’ Atlantic roundhouse would include the brochs, duns, and wheelhouses. Among them, brochs are definitely the most complex of the roundhouses. While a study of duns and wheelhouses would offer insights into how builders working in the same period understand the spaces of these monuments.
1.3.1 Wheelhouses

A wheelhouse is a circular drystone building with a single entrance. The inner space is divided by several stone piers, arranged like the spoke of a wheel (Hothersall & Tye, 2000). A corbelled stone roof surrounds the central open space. Iain A. Crawford has mentioned that about a third of wheelhouses are double-walled and range in diameter from 4 to 11.5 meters. Those sites were dated from 25 BC to 380 AD. In the Northern Isles, about 72% of them are found in association with broch sites (Balling-Smith et al., 2002).

According to the Canmore database, there are only 50 prehistoric wheelhouses (Figure 1.5) recorded. Most of them are located in the Western Isles. Usually, wheelhouses were built near a souterrain, a type of underground Iron Age structure like a chamber or passage, as in the case of Tigh Talamhanta and Uamh Losal in the Western Isles, or near a broch. Also, sometimes, a group of wheelhouses was built together where there were walls shared by two adjacent ones, like in the case of Jarlshof in Shetland.
The wheelhouses in Jarlshof, as displayed in Figure 1.6, is one of the most famous tourist archaeological sites in Shetland and has been described as ‘one of the most remarkable archaeological sites ever excavated in the British Isles’ (Graham-Campbell et al., 1998). The Jarlshof site comprises late Neolithic houses, a Bronze Age village, Iron Age broch and wheelhouses, a sizeable Norse house, a medieval farm, a 16th-century laird's house, as well as modern buildings. Half of the Iron Age broch has been eroded into the sea.

The two wheelhouses on the north side of the broch, seen in Figure 1.6 highlighted with blue, were possibly built during the early centuries of the first millennium AD and earlier (Ritchie, 1997), and the Radiocarbon dating of plant material and a sequence of OSL dates on quartz inclusions within the deposit told the broch was possibly built during 100 BC to 100 AD (Mackie, 2002). Thus, the broch coexisted with the wheelhouses for almost 2000 years until now.

The broch was subsequently modified, and the Southern half of the broch has been lost into the sea. However, the surviving half is almost complete in plans with corbelled cells, which demonstrate skilled drystone work and architectural proof of being a broch.
At present, it would be hard to confirm the sequences of building the broch and wheelhouses. However, regarding the time of the Iron Age in the place Jarlishof, the broch seems to be higher-level production of a roundhouse idea. Firstly, the broch has a bigger size and higher perfectness of circularity. Secondly, the broch is built above the ground while wheelhouses were hidden underground whose corbelled cells have taken advantage of the surrounding landscape. Thirdly, in terms of stability, the broch has thicker walls and was built apart from other structures while the two wheelhouses were built attached and have shared part of the walls. Fourthly, considering the number of monuments here the complexity of building type, if the broch was complete at that time, the possible four wheelhouses could be seen as a lower level of building hierarchy compared to the only one broch in Jarsholf. More importantly, the contrast shows that the broch is the most complex building type in Iron Age Scotland, which has a vertical circulation using the spiral stairs and would take more time to build.

According to the comparisons of complexity in building features, the wheelhouses may develop earlier than brochs from the type of simple Atlantic roundhouse. Barry Cunliffe (2005) pointed out that the wheelhouses could have been built before the first century BC. As the origin or first building of both wheelhouses and brochs are difficult to date, the sequences of their appearance in prehistory become a tricky question. Even in the cases of wheelhouses at Sollas, North Uist, and the wheelhouses at Jarlishof, the radiocarbon dating found that the wheelhouses were built in the first or second century AD when the brochs, like places at Jarlishof and Clickhimin, were already in use.

1.3.2 Duns

It is defined by Alan G. James (2020) that a dun is a building or settlement enclosure with a thick drystone wall, generally circular or oval in plan, usually sited in an elevated position. There are rarely perfectly round duns. Duns seem to have arrived with the Celts in about the 7th century BC. Early duns had near vertical ramparts made of stone and timber. Most duns were constructed on rocky outcrops or natural defensive positions to enhance their defensive properties. Their walls were usually built using two thick drystone walls, with a solid core of rubble used as infill between them. Compared to wheelhouses, duns are pretty similar to brochs as Iron Age buildings in Scotland.
Taking the Dun Leccamore (Figure 1.7) on Luig as an example, the design features suggest some form of correlation between the broch builders and the defensive properties of these smaller dun structures. Macnaugton (1893) partially excavated this dun in 1890 and 1892. It measured 19.8 by 12.8 meters within a wall 4.0 meters to 4.9 meters thick. This dun has an entrance in the South-west and another in the Northeast. Compared to brochs that are studied in Chapter 4 as being usually at least 15m in diameter, duns are not that round, while most times oval, where the minor axis of the ellipse of external walls might be less than 15m. Also, brochs were built as cavity-walled circular structures assumed to reach three or more stories high, while duns were solid walled buildings, often sub-circular in shape, of varied sizes, fewer than three stories which meant they were not tall. Sub-circular walls would make the building less stable. Thus it would make the stairs and galleries between the internal wall and external wall-less possible. From an architectural perspective, duns are similar to brochs. Except for the monument sizes, the main difference between brochs and duns is that the latter have galleries between external and internal walls, making it possible for building stairs going up to higher levels while duns do not have them.
Figure 1.8 The distribution of duns and brochs
According to the Canmore database, 765 possible prehistoric duns (Figure 1.8) were recorded, but only a few were surveyed and partly excavated. However, most duns are located in Argyll and Bute, Western Isles, and highland, generally the Western part of Scotland. For brochs, there are 732 recorded Iron Age brochs in the database, while most brochs are located in Highland, Orkney Islands, and the Shetland Islands, which are relatively more Eastern of Scotland. As most duns are in ruins, it would be hard to judge whether a round-shaped stone base was initially built as a broch or a dun. Also, a broch, which was damaged, unfinished, or reused, could technically look the same as a dun. If no significant artefacts were found, it would be easy to confuse a broch with a dun. However, this comparison in figure 6 would suggest that the brochs on in the Orkney Islands and the Shetland Islands would be highly possible to be built as brochs. Therefore, except for the broch study in Argyll and Bute, which needs to be more careful, this research would consider the majority of brochs for analysis that are not affected by any confusion as ruins of either dun or broch.

1.3.3 Brochs compared to duns and wheelhouses

Wheelhouses, duns, and brochs are all constructed out of stone. Although they are thought to have had a conical wooden roof similar to that of the timber roundhouses found elsewhere, which support the closure of space for living, only broch has evidence of building elements, the upper scarcement, to make the roof highly possible. Moreover, the three types of Iron Age structure are different in circularity, dimensions, and, most importantly, building complexity. Regarding its stability which could make a supported roof possible, a comparative analysis of three types is displayed in Figure 7. The surveyed plans of five monuments for each type are compared.

According to the analysis in Figure 1.9, the three types of complex Atlantic roundhouses could be clearly distinguished for the features below, Wheelhouses: Wheelhouses would have piers in the central inner space contrary to the others. The external diameter ranges from 10m (Jarlshof) to 13m (South Cletrraval) for the overall dimensions. Some wheelhouses like Uamh Losal are embedded in the earth and not fully surveyed. The outer wall face was drawn but was not seen and measured in the archaeologists' notes. Regarding the other wheelhouses, the thickness of the walls ranges from 1.2m (Uamh Losal) to 2.5m (South Cletrraval). The circularity varies, as the wheelhouse Udal is much perfectly round while others are less so. However, there are no oval-shaped cases in those five wheelhouses.
Dun: Duns are similar to the ground-level broch without galleries and stairs. Duns are relatively more variable, both in shapes and dimensions. The smallest here is Dun Nighean Righ Lochlainn which is 10 in diameter, while the biggest could be Eilean Buidhe and Egg Grulin, which are around 25m in diameter. The thickness of walls ranges from 1.2m (Dun Nighean Righ Lochlainn) to 4.1m (Dun Leccamore). The shapes are somewhat oval or rectangular rather than round, except for the case of Dun Nighean Righ Lochlainn. Eilean Buidhe and Egg Grulin have bigger inner space (covering more than an 18m-diameter circle), which may be too big for a timber roof structure.

Brochs: The five brochs included in the diagram above have a ground-floor gallery or stairs, which differs from duns. In the sample, the dimensions for brochs here vary less than duns, with diameters from 15m (Ousdale) to 18m (Old Scatness). The wall thickness is similar in each case, about 4m. However, there are some brochs like the Dun Bharabhat, which is too small with an outer-wall diameter of 11 meters, and Edin’s hall, which is too large with an outer-wall diameter of around 28m.
Interestingly, both the extremely small and large brochs have not survived with a height above 4 meters. The sturdy and tall structure should require a range of diameters in design. Notably, the shapes should have a higher level of circularity, which makes the structure uniformly stressed.

Thus, for brochs surviving with a certain height, the shapes are relatively round, especially broch Ousdale and Dun Troddan are almost perfectly round. Compared to duns and wheelhouses, brochs definitely show a higher hierarchy in cells and galleries on the ground level, as well as the staircases that lead to the first floor or even the roof level.

The architectural development of roundhouses, from simple to complex, could be seen through a comparative study of Bu, dun, and broch, as shown in Figure 1.10. Dun Leccamore and broch Mousa are chosen here as they are confirmed with their clear features. Bu in Orkney has thicker walls and limited inner space, while dun Leccamore and Mousa have thinner walls which allow more inner space. Dun Leccamore has a guard cell which is also a corbelled cell. The corbelled cell also appears in the wheelhouse, which requires a critical building skill. Moving from dun to broch, the plan gets changed mainly with stair, stair access cell, corbelled cells, and galleries added. Also, the shapes of the two walls get more circular. As brochs are much taller, the space created between the two walls, like corbelled cells, gets more pronounced, demonstrating builders' confidence in building skills.

There is not enough evidence to prove the chronology sequences of the three circular stone structures in Scotland, but seen from an architectural perspective, the brochs’ ‘complexity’ could be traced.
In general, a complete broch is much taller than wheelhouses, duns, and Simple Atlantic Roundhouses. The height and circularity would require higher building skills, in which case, brochs are the hardest to build.
Most importantly, the brochs have identified recognisable architectural features. Regarding the spatial characters, the cells, galleries, and staircases between the double walls are the inventions from brochs. Also, there are some outstanding building elements for brochs, as inner wall-face voids, scarcement ledges, and entrance lintels.

The study above mainly shows the ‘complex’ did not appear unexpectedly in prehistory but may be inspired by the ‘simple’ (Bu in Orkney) or ‘simpler’ (Wheelhouses and Duns) stone buildings which coexist or appeared earlier than brochs.

Generally, the complexity in architectural typology of roundhouses from fairly simple, though sometimes substantial, roundhouses, through increasing architectural complexity to broch towers, could be seen typological-related with three main differences:

1) Brochs have higher building skills for taller double walls.

2) Brochs have more hierarchies of room sequences through corbelled cells and stairs (even upper-level galleries).

3) Brochs have higher perfectness of circularity of walls.

Thus, the brochs stand out from other Complex Atlantic Roundhouses for their unique architectural features. Conservation may start from understanding the building itself to analysing what is needed based on the present or previously done conservation.

There are a few questions to be asked initially. Like what are those features of brochs? As there are no two brochs that are the same (even just in plans), how are they different from each other? What are the possible reasons that make them various in features? What research methodology can suit the study of brochs?
1.4 Thesis structure

Conservation of uncertain monuments would analyse the special characters which distinguish them from other historic conservation. This thesis has taken the Scottish broch as the case for this conservation study.

The following chapter 2 will introduce the research questions and the thesis methodology. This chapter would claim a need for typological studies for uncertain monuments, taking brochs as cases. Moreover, a need for architectural perspectives is suggested to be integrated with archaeology working in broch conservation.

Chapter 3 will offer a literature review of brochs and typological studies. It began with understanding the 'uncertainty' in brochs which is an essential prehistoric attribute. Then the typological methodology is studied, comparing other vernacular research with previous broch studies. The typological methodology could find subtypes of broch designs that would help to deal with the subtypes of conservation problems.

In Chapter 4, the thesis would use the typological study to understand the brochs' design through reading the spatial characters and building elements. This chapter would be based on the data of previous archaeological surveys and the author's fieldwork of 12 typical broch sites. The outcome would be a systematic scheme of how the broch design will be established, demonstrating the reactions from regional broch models to different site conditions. Also, the PBM (Perpendicular Broch Model) is found, and how the PBM was applied to the design of some broch cases will be explained.

Chapter 5 aims to improve the conservation of brochs. It starts with the analysis of the weakness of the present archaeology-led conservation for brochs, which suggests the need to use typology and architectural perspective that brings interpretation on broch sites. It also contributes to the debate of broch conservation through offering frameworks of interpretive conservation, which aims to offer more interpretation through intervention on sites.

Chapter 6 are the conclusions of the whole thesis. This chapter will summarise the points made in the thesis while mentioning the limitation of this research and advice for future studies.
2 Research questions and methodology

2.1 Research questions

Broch is a kind of ‘uncertain’ monument that is not fully understood and need excavations. As part of their ‘uncertainty’, the prehistoric attributes have made conservation for brochs special, where the common restoration methods following recordings and evident documents become unsuitable. This study would take Scottish broch as a case study to discuss how to understand those uncertain monuments with broader architectural readings, significantly where features are fragmented, and eventually to improve people’s understanding of the monuments through conservation strategies on sites.

For a better understanding of brochs, this study suggests reading the brochs with their collection rather than analyzing each broch site individually. The reading may help find the subtypes and regional models which would discover the regional characters.

As for conservation, since most brochs in Scotland are fragile ruins and only a few of them have been scientifically explored, they have been conserved through primary consolidation for safety reasons in very localized methods, primarily by archaeologists. Many of the notable features that were mentioned to classify a site as a broch are not visible, so the public cannot appreciate the building features, especially in the ruins that survived from collapse.

Since all of them are open to the public, conservation is needed. However, the interpretation of broch ruins is weak at present. None of the broch sites has shown the complete features of anything close to a standard typology. Moreover, only a few have correctly interpreted the changes after the Iron Age period as modifications. The professionals like archaeologists can understand ruins with excavation reports, but the general public would find it difficult. Identifying the subtypes and their regional characteristics may lead the conservation to go beyond consolidation and clarify building features, filling gaps in the interpretation by the public and that of specialists.

The critical contribution of this thesis is to use such methodology for both the architectural reading and conservation study of brochs. Moreover, the conservation study should use the outcome of the broch architecture research to improve. Thus, the two aspects, the architecture and the conservation of brochs, would have two research questions below.
1. How can typological studies find regional subtypes and regional models to improve the understanding of brochs?

Where:

   i. **Typological studies** mean the taxonomic classification of broch characteristics (spatial features and building elements)
   ii. **Regional subtypes** mean a subdivision of a type formed based on the regional features.
   iii. **Regional models** mean the broch models that were copied or imitated for some brochs built in a certain area or region.

Study context: See Chapter 4 (Reading the features)

A deeper understanding of brochs architecture and its modifications could be offered. The regional models are conceptual broch structures that could be applied to some brochs from one same region. And the regional subtype is a type that is defined with the variant features and formed by the regional characters.

The architectural feature reading is important. It would challenge the present archaeology-led research that focuses on the material culture and considers each broch separately. The brochs are seen as a collection of monuments with clear categories both in designs and surviving sites. Their study would lead to better conservation methods with a view more meaningful to all communities involved.

2. How can typological studies bring new perspectives to the established conservation for the broch ruins??

Where:

   i. **Typological studies** mean the taxonomic classification of broch characteristics (spatial features and building elements)
   ii. **Established conservation** means the present conservation of brochs that have been mainly conducted by archaeologists so far.
   iii. **Broch ruins** mean the majority of brochs which survived with the parts of buildings and cannot be used properly anymore.

Study context: See Chapter 5 (The new perspectives of interpretive conservation)

At present, archaeology-led conservation has limits of interpreting the vague features in broch ruins. It puts much effort into individual sites but lacks a view of seeing the brochs as a whole and understanding the invariant and variant features. Viollet-le- Duc (1854) gave specificity to the knowledge and skills required of restorers, who had to know history, archaeology, ancient and modern building techniques, and they also had to possess architectural design creativity. The interpretation of sites is a creative work that intervenes with the monuments. It is much related to the last skill that would distinguish restorers from archaeologists.
The archaeology-led conservation would be challenged with thoughts from architectural perspectives, using typology and seeing the brochs as a collection of cases. The regional characters are not focused enough where the original design and modification mixture cannot be readable. The readable features would require a deeper understanding of brochs and their modifications, which can help correct past conservation errors and clarify the brochs’ architectural features for stronger interpretation regarding its complexity.

2.2 Thesis methodology

As the schematics of the thesis structure (Figure 2.1) show, the methodology starts with the architectural understanding of brochs and end with conservation study, which offers critiques on previous conservation projects and suggestions for future conservation.

This research uses qualitative methods for architectural reading and the study on conservation of typical cases. Both methods require data collection and analysis, which will be collected from surveys and reports (architecture & conservation), fieldwork (observation and recording), interviews and typological analysis.
Collect data from surveys and reports (architecture & conservation)

This includes architectural data, which can be collected through technical drawings of surveys and conservation data which come from reports and photos.

As the schematics of chapter 4 (Figure 2.2) show, many broch features can be read through technical drawings, like plans, sections, and elevations. Canmore database is used as the primary database for archaeological surveys and reports. The technical drawings derived from some archaeologists' publications are also used for supplementary data. This study mainly uses reports from Tanja Romankiewicz, Euan W. MacKie and AOC Archaeology Group, which is a commercial archaeology company.

The author has collected the conservation data from conservation management reports published. The sources include the Caithness Broch Project by AOC Archaeology, documentation of repairs and consolidations found on HES (Historic Environment Scotland) and the Canmore database.
Fieldwork (observation and recording)

During the study of this PhD, the author made three field trips for broch observations and recordings in Caithness, Orkney, and Shetland, and sites in the Lowlands are also included, like Coldoch and Torwood.

The recordings are mainly photography and videos. Also, measurements were taken in several cases like Dun Telve and Coldoch for double-checking the drawings from surveys.

Interviews

The author has selected professional conservation people and archaeologists who are researching on brochs. The interviewed people include:

- Mr. Kenneth McElroy (Caithness Broch Project)
- Mr. Iain MacLean (Caithness Broch Project)
- Dr. John Barber (Chairman of AOC Archaeology Group)
- Mrs. Julie Gibson (County Archaeologist for Orkney, University of the Highlands and Islands)
- Mr. Martin Carruthers (University of the Highlands and Island, Orkney College)
- Dr. Simon Clarke (University of the Highlands and Island, Orkney College, Shetland College)

The interviews aim to get information on how the conservation was conducted for brochs and how people would value the conservation outcome. The topics of the interviews have included broch sites: Ousdale (Caithness), Caisteal Grugaig (Skye And Lochalsh), Midhowe (Orkney), The Cairns (Orkney), Mousa (Shetland), and Clickimin (Shetland).

Typological analysis

The study sees the brochs mainly as a collection of features. The features can be classified into two kinds: the original features and later modification.

The original features mean the broch features when Iron Age people built a broch. And the later modification means the features which were added, removed or changed after the broch was built.

The original features can be divided into two kinds as the invariant and the variant. The invariant features are the fixed features that a broch must have. All the brochs share them. They could be known based on the definition of brochs, like the double-circle walls and one entrance and a set of stairs. However, the variant is the ones that are shared similarities by a part of brochs. This thesis found the regional characters can from the variant features.
The comparative studies of the features could reveal the variant and invariant ones. Importantly, the variant features may mix the original features and the later modifications. Thus, the typological analysis should use a systematic way of demonstrating and even separating those data.

The typological analysis for architectural features includes mapping (location study), architectural diagrams (comparative studies on the features), tables and diagrams of feature parameters. The measurements data are processed in excel, while the 3D model data is analyzed in software like Rhino and AutoCAD.

The typological analysis for broch conservation would aim at finding the limitation of archaeology-led conservation through comparative diagrams and building models. The interpretive conservation on brochs is suggested and explained with some typical sites.

**Research methodology structure**

![Research methodology structure diagram](image-url)
Generally, the research methodology structure is displayed in Figure 2.3. Both reading the features and studying the present situation of brochs are conducted through typological analysis on the collection of brochs. The classifications follow the architecture features to form subtypes and regional models, while those follow the surviving levels to understand the present situation for conservation study. Finally, the brochs can have stronger interpretation with the help of the subtypes and regional models. Furthermore, the conservation practice study offers case studies to demonstrate how the interpretive conservation framework can be applied.

The following Chapter 3 would narrate the literature review of brochs and typological studies.
3 Literature review of brochs and typology

3.1 The prehistoric attributes of brochs

3.1.1 The ‘uncertainty’ in brochs

The identity of brochs is uncertain is embedded in their prehistoric attributes, which make their conservation different from the widely known historical conservation. The main character is the uncertainty of the origin at present, which may be known and understood in the future. The prehistoric attributes involve the need for archaeological excavations and conservation for protection and present use, as being open to the public.

Archaeological excavation is destructive: digging something means destroying the composition of layers that have existed for a long time. Also, a sequence of archaeological excavations is not reversible once it happens due to the one-off destruction. Thus, documentation during digging is mandatory. The excitement of archaeology is in finding and recording new information, and in the case of ruins, architectural values become secondary. Same for brochs, the values of the sites seen from archaeology have made it different and unique compared to common historical conservation.

The differences in conservation caused by prehistoric attributes would mainly be the highly archaeological values of sites, which require control by archaeologists. The goal of archaeologists in conservation work is to preserve our past's physical remains and employ them in perpetuating our historical heritage (Harrington, 1965). Moreover, in this activity, the archaeologist plays a significant role in offering suggestions in the form of site development guidelines, when combined with the historical and architectural documentation, form the foundation upon which the historic site is. Stanley South (1976) also stated that sponsors of archaeological research are usually interested in 6 points whose motivations are oriented toward restoration, and reconstruction, or exposing ruins for public viewing and obtaining relics for exhibit purposes:

1. The validation of the historic site in relation to documents.
2. The discovery of architectural features.
3. The determination of the occupation sequence of the site.
4. The determination of the temporal occupation of the site.
5. The recovery and preservation of artifacts associated with occupation of the site.
6. The development of the site as an historical exhibit. (p.73)

Points 1, 2 and 6 are focused in the thesis regarding the conservation of the brochs. Under the scheduled monument legislation (Ancient Monuments and Archaeological Areas Act 1979), archaeological data has been protected and promoted as high research values are embedded there. The conservation of brochs has been led by archaeologists who have been the primary users of such data.
However, the historical exhibition of the site, as per point 6, is essential. Presently, the archaeologists, who see the broch sites mainly as remains to be investigated for data, have not interpreted well the sites of brochs and go beyond point 2. The conservation has been conservative so far. The site as an exhibit needs interpretation.

Besides, regarding the need for tourism and education, which are now parts of contemporary values, it has become quite important how the general public presently understands brochs during their site visits.

So what is a broch like to the public?

As the majority of the existing brochs are architecture ruins, visitors have to spend time reading text or diagrams to know how a complete broch looks. Some diagrams of the complete image of brochs are widely diffused among the public, but they are conjecture due to the lack of supporting evidence since most scientific studies aim to contribute to the geometric definition rather than the broader, architectural aspects of the monuments.

![Figure 3.1. The schematic board for Midhowe in Orkney.](Image)

The image of how brochs look like often uses the same characteristics and has been used as interpretation material in many sites and spread to social media nowadays, but it cannot represent all the brochs.
For example, the artistic drawing in Figure 3.1 is one of the available images found on websites or TV programs speculating on human life in brochs. Most of these images are based on fundamental concepts like a perfectly circular plan built on even ground with constant galleries at several levels, which enabled cohabitation (Harding, 2004) - the animals live on the ground floor and people in the upper floors. Such model would become problematic in the case of the sloping ground like Dun Troddan and Castle Grugaig. In these cases, the ground level does not function as the threshold between the broch interior and the exterior, and access to upper levels is uncomfortable. So this model in Figure 3.1 should be challenged. Moreover, the roof form is only a conjecture as there is no evidence for its shapes and materials.

These reconstructions evoke a standard model for the brochs but is it truly important or needed? Is there a standard model that may be referenced in Iron Age? or there are several models? Should brochs be interpreted and understood across such single models or there should be flexibility? Does conservation need standard models in general?

Prehistoric architecture is often recognized as vernacular architecture. The diversity is related to the ecological systems which would vary like a dynamic equilibrium rather than a static tradition (Asquith & Vellinga, 2006, p.116). Along with this concept, Barber (2017, p.131) observed unequal quality in the masonry of brochs and believed this could be a transferrable skill devolved from a centre of excellence, which varied naturally instead of being a typical characteristic. He made a hypothesis that a first master mason created the first broch, possibly following some initial failures, and then disseminated the concept through his peers. Thus, parallel evolutions from a diverse area of broch distribution could lead to different forms, hence the need for a standard model. Through several case studies, a revised model of the standard broch was suggested in his thesis, aiming to show they were all built to a standard canonical plan and their apparent diversity is a product of modifications and natural decay.

However, the author has found that the surviving ground level plans, which showed diversity in designs, not only the circularity levels and dimensions but also the relationships of building elements, like the orientations of entrance and stair-access-cell. These characteristics should be firmly included in reviewing the original design ideas as they varied across different brochs. This research has used typological methods to prove this point by studying several pairs of brochs that were built near each other and have shared most of the standard characters. These regional models are developed from the Barber’s Revised Standard Model and contradict his words about the standard broch form that ‘brochs were built to the standard canonical form and their apparent diversity results from anthropic and, or natural modification, not design variability’ (2017, p.iii). In other words, there is more than one standard model and some of the differences in forms (design variability) were originally conceived as such by Iron Age people.
The principle of broch design, as expressed in this standard model, is hidden within the various sites. There are mainly two causes for the differences.

1) variations of original designs.

2) later modifications on sites.

Learning from regionalism (Ozkan, 1985) and critical regionalism (Frampton, 1983), the specific conditions of a local context promote a pretty specific approach to building affected by topography, climate, light and tectonics rather than homogeneous designs from broader contexts. Here is the cyclical argument that the regional features are created based on cultural differences of material and landscape, and they also reflect the material difference. As the distribution of brochs includes a wide range of locations, from a large area in Southern mainland Scotland to the tiny isles in the Western part, regional differences may be exactly caused by the builders’ knowledge of such regional conditions.

Theoretically, a broch would be more similar to one nearby than faraway, resulting in regional variants and clusters, further differentiated by the construction skills of builders in each area. As the distribution is wide and some areas like islands are much isolated, there is a high possibility that different areas would learn only from the local standard model. For example, the brochs in Shetland may look at the first built broch there rather than elsewhere. Over 300 suspected broch cases would more likely suggest several local models than one ‘Revised Standard Model’ mentioned by John Barber (2017, p.101). A study of the regional characters would help to define the brochs more precisely.

The current definitions of brochs made by archaeologists have shaped a type that is distinct from other Iron Age monuments – using the five main features of brochs mentioned by MacKie (2002).

1) round plans
2) thick walls
3) particular size (general dimensions)
4) a ledge or scarcement on the inside wall face
5) at least one hollow-walled cell.

However, the features show a too wide range without quantisation and cannot offer a clear image. How round do the round plans for brochs are? How thick are the average walls and how big should a broch be? The lack of finer definition in the level of each feature is apparent. Although features 4 and 5 are closed questions that mainly check the existence of a feature, the broch ruins could be found difficult to claim a yes/no answer for features 1-3 without the help from long archaeological reports.
However, like other historic monuments, the prehistoric attributes of brochs may still show sort of typological sequences for three reasons:

1) Large quantity of monuments (about 600 sites exist and more than 300 are scheduled)

2) Large area of location range (most counties in Scotland).

3) Regional geographic conditions (from inner mainland, coastal area to small islands).

Therefore, the brochs can be typologically studied to understand the architectural features and possibly make brochs less ‘uncertain’.

3.1.2 Polite or vernacular design

The label ‘vernacular’ is commonly recognised. However, this study intends to ask again the very initial and fundamental question, whether the broch designs should be included in polite or vernacular architecture. This question is crucial for the identification of brochs' prehistoric attributes. Vernacular architecture can be defined as 'architecture built of local materials to suit particular local needs, usually of unknown authorship and making little reference to the chief styles or theories of architecture', where the chief styles mean the architectural expressions and designs that characterise a representative architecture over a specific period span regardless of whether it is religious or secular. (Lucie-Smith, 2003, p.196).

Vernacular architecture does not need formally schooled architects but relies on local builders' design skills and tradition. In comparison, polite architecture, in contrast, is characterised by stylistic elements of design intentionally incorporated for aesthetic purposes that go beyond a building's functional requirements. This topic has been debated by many professional architects and historians since the late 19th century, classifying previously undefined architectural styles from all over the world.

Iron-age brochs, compared to vernacular buildings, show much higher building skills, demonstrating a deeper understanding of substantial and spiritual values on architecture. Also, John Barber (2017, p.320) has reflected on vernacular variability models in brochs, which are expected to follow a harmonic variation across the range of diagnostics considered in geographical groups. He said the construction was managed by 'professionals' who possessed skill levels in the management and supervision of the build that was unattainable in the vernacular arena.
For example, blackhouses have been known as distinctively vernacular buildings in which design, materials, limitations and pretensions are all allied to a particular cultural and natural context (Brunskill, 1985, p.21). George Geddes (2010) have compared them with brochs and suggested that a broader definition of 'vernacular' could include brochs, which would address local architectural tradition, local materials and local labour. The author would suggest a 'vernacular' label as more appropriate because Iron-age brochs have at least four features that do fit this type:

1) Regions.

Brochs only exist in the North of Scotland, which could be defined as a limited range, including sites along the Northern/Eastern coasts of the mainland or on specific islands. Those on the Lowlands, however are a distinct group with no immediate connections.

2) Dates

The term ‘vernacular’ represents the majority of buildings and settlements created in pre-industrial societies (Caves, 2004, p.750). As a typical prehistoric date, Iron Age would commonly suggest the buildings being vernacular due to the simplicity of architecture, compared to the architecture created after the Industrial Revolution. Iron Age wheelhouses in Scotland have been labelled ‘vernacular’ by the Vernacular Architecture Group (Hutton, 1976). ‘Polite architecture’ defined by the architectural historian Ronald Brunskill (1971, p.27), as the opposite term for ‘vernacular architecture’ suggested the designed features go beyond functional requirements. Regarding this point, the Iron Age brochs are highly possible to be labelled vernacular architecture due to their Iron Age dates.

3) Local materials.

Scottish Vernacular architecture is a form that uses and depends on local materials (McKean, 2010), primarily stones. The reason is that stones were plentiful in Scotland while the long-span timber was in short supply. Although the appearance and soundness might differ from Orkney to Sutherland, most of the brochs that survived in Scotland are made of local stones.

4) Relatively fixed models

Brochs are relatively fixed models or patterns of houses that have not been found to improve their functions according to the development of their culture. What could be seen as an improvement for brochs? For example, brochs could have had extensions which added more rooms to the broch circular plan, or even three brochs could have been built and merged together as a new building form, and the hierarchies of different brochs could be seen - then the brochs would not follow fixed models due to these developments of building designs. However, all the brochs surveyed are built as a single building in none of these configurations, which indicates relatively fixed models.
Generally, according to the brochs’ features, brochs should be considered as a kind of vernacular architecture. Therefore, this study intends to learn from previous vernacular architectural studies to figure out a way to understand brochs deeply.

3.1.3 Literature review of research on vernacular architecture

The term ‘Vernacular’ is discussed by Bernard Rudofsky in his book ‘Architecture without Architects’ (1964) as immutable, indeed and unimprovable. Vernacular architecture could most likely be a static, closed or precisely defined architectural type instead of a thinking process of improving a type due to their very confined geographic range and cultural treats rather than a result of civilization. Another important text, the ‘Encyclopedia of Vernacular Architecture of the World’ written by Paul Oliver (1997), focused the analysis even more and considered vernacular architecture within its (local) culture rather than its (broader) national contexts. It follows a brilliant logical scheme of presentation which has involved the cultural, geographical, and typological areas. Oliver disagreed with Bernard Rudofsky’s emphasis on building as an object due to the lack of cognition of the difference between builders and inhabitants in distinct cultures (Sharp, 1998). Both authors have regarded the types as the organic sum of the morphological invariant features of a group of buildings from the same period and cultural area. In this strand, Henry Glassie (2000), among others, has studied forms and causes of vernacular buildings through comparisons of different types and demonstrated how houses lived in histories, claiming that developing a method of comparisons, free from mere chronology, will help to understand the general principles of historic action through the field of material culture. Regarding the definition of a type, Dell Upton (1986) stated that the identity of a type of vernacular architecture embodies collective ideas. A type is also seen as an established and undisputed tradition. Thus, Attilio Petruccioli (2016) introduced the concept of type as the organic sum of the morphological invariant features of a group of buildings from the same time and cultural context. Heinrich Tessenow (1989) has addressed subtle differences between each building object within one type of architecture, and the importance of differences would be based on characterized uniformity and order of the type. The vernacular buildings can be studied by typological science to produce a clear view of their conceptual features and the features of the subtle differences among each building object.
Types of vernacular buildings are often classified according to their regions, materials, details or building forms. Regions, in particular, relate strongly to materials, site conditions or even builders culture and produce the variants in each particular area.

Their intimate relationship with the environment possibly caused the regional features. Barry Dawson and John Gillow (1994, p.19) hold the influence of the environment to be even more critical, stating each regional variant in response to the conditions and materials as determined by the local climate and vegetation. Therefore, the typological study of vernacular buildings could start with the regions to set groups: if the sites from one region have an outstanding character which none from other places have shown, these sites could be regarded as a type.

For example, the blackhouse in Scotland, known as a standard dwelling type of vernacular architecture, have distinct regional variations responding to timescale, geological, geographical and economic influences. The typical blackhouse form is a long linear dwelling containing the byre and living areas with adjoining barn areas connected by passageways through the wall (Scott, 2007). It is especially with half of the dwelling area given over to animals. Thus, a sloping site was preferred to deal with the drain of liquid manure, and the wall height of the two sides in the rectangle shape was not the same. Clive Aslet (2011) stated that the nineteenth-century blackhouses were built with a double wall thickness, more than two meters (p.580). For example, a Blackhouse in St Kilda (Figure 3.2), which was built during post-Medieval times, measures 6.24m from N to S by 2.91m transversely within walls up to 1.4m thick and 1.8m high on the sides and 2.6m high at the ends (Wordsworth, 2017). While Blackhouse 42 in Arnol (Scott, 2007) measures internally 19 m by 4 m with an average wall thickness at the ground level of 2m, reducing at head height to 1.6m. ‘The walls of the blackhouse are constructed as two masonry faces to a tempered earth core’ (Walker&McGregor, 1996, p.4). The walls do not contain throughs.

Figure 3.2 The comparisons between the Blackhouses, Arnol and St Kilda.
and vary in thickness from 1.5 m to 2.1 m. The top of the wall is 1.5 m to 1.8 m high and is slightly sloping to the outside face to discharge rainfall away from the thatch (Scott, 2007). The later built blackhouse (42 Arnol) was much bigger in plan than the post-medieval one (St Kilda) but with similar wall height. St Kilda is an isolated archipelago that is about 130 km away from Arnol located on the Isle of Lewis. The bigger scale is a tread in the blackhouse family, which could be found in the near sites of 42 Arnol, like 39 Arnol blackhouse. The regional factors could be used to group the type and study their standard features for further understanding of the buildings.

Similarly, typological studies could bring a firmer identity to brochs’ features and fill our limited understanding due to their obscure 700-year date range. Therefore, a map of locations, a chart of circularity levels, and a diagram of comparative broch plans could offer a deeper understanding.

Therefore, the thesis intends to use typology for the research on brochs. First of all, what is typology and what is a type for brochs?

3.2 Typology used in architectural analysis

In the theory of architecture, ‘Typology’ and ‘type’ have different definitions, which has been in transformation.

Typology is commonly defined as a taxonomic classification of (usually physical) characteristics commonly found in buildings and urban places, according to their association with various categories. Typology can also be defined as a common language in designs that can provide coherence and shared meaning in the built environment (Kelbaugh, 1996).

Anthony Vidler (1976) argues that the invention of the enterprise of typology was as much about seeking validation for architectural form-making as it was about the systematization of evidence. He summarized three currents of typologies in a broad survey of the history of the idea since the mid-18th century: the first typology is the architecture corresponding to nature (c 1750-1860), while the second corresponds to production (1860-1950) and the third to the city (1960–). For the first two currents:

...two distinct typologies have informed the production of architecture. The first, developed out of the rationalist philosophy of the Enlightenment, and initially formulated by Abbé Laugier, who proposed that a natural basis for design was to be found in the model of the primitive hut. The second, growing out of the need to confront the question of mass production at the end of the nineteenth century, and most clearly stated by Le Corbusier, proposed that the model of architectural design should be founded in the production process itself... (Vidler, 1976, p.14)
Laugier’s Primitive Hut sets up an analogy. Thus, the principles of architecture emerge from similarly natural points of origin, which is similar in the way complex natural phenomena emerge out of the simple geometrical laws of Newtonian physic. The built form is thus returning to its original condition as the natural form.

While the second typology is referring to the industrial revolution where the idea of architecture is coming from individuals and should be founded in the process. A new set of types is shaped by the building elements based on new inventions and technologies, the phenomenon of mass production, and the maximized efficiency.

The first two typologies are made out of quantitative elements. The brochs have a quantity of more than 300 which fit this point. However, piling one stone on another to build a broch takes skills to make it tall and safe, which would not make it so primitive as a ‘hut’. Furthermore, the ideas of brochs have shown some levels of design, whose process may be traced through the typological study of their architectural features, in which case a basic model of broch may exist.

For example, if the minimum configuration of a broch, which can be known as the basic model, would be the double circle walls with one entrance and one set of staircases, then guard cells can be seen as an additional character compared to the basic model in broch type. If the ones with additional features have demonstrated some levels of similarity regarding their features, they can be studied as the ‘subtypes’.

The ‘model’ is a different term from ‘type’. Antoine-Chrysostome Quatremère de Quincy (1755 – 1849) formally introduced the notion of ‘type’ into architectural discourse in the Dictionnaire historique d’architecture (1825) and defined this as the tendency to classify group buildings according to use. The word ‘type’ demonstrates the idea of an element that ought itself to serve as a rule for the model. He defined ‘model’ as a mechanical reproduction of an object and ‘type’ as a metaphorical entity. Thus, the model should be a form that can be copied or imitated. While ‘Type’ should be something that can act as a basis for the conception of works.

In this thesis, it is worth exploring whether the brochs have followed models that were reproduced in different places as (sub)types that could be formed with similarities in features. The subtypes of brochs can now appear after the classification process of the feature reading. Knowing the subtypes if they exist can complete the fragmented image of possibly original brochs which were built in different places. The typological study for brochs can be essential to offer further understanding.
Although modernists have eschewed typology in their rejection of precedent and style, this methodology is still widely used in historical architecture studies as it reveals historical continuity and spatial hierarchy in buildings. Especially for buildings like brochs which are usually seen as vernacular, the typology concept is also used to understand the relationships among different sites of one type. Continuities, mentioned by Maria Philokyprou (2015) in vernacular architecture are closely related to space, time and materiality and involve typological issues with multiple readings and interpretations.

Therefore, the typological thoughts and actions for brochs in this thesis would presuppose two things for architectural reading as below.

1) The first goal is to recognize and discover basic types for brochs, using previous studies like John Barber’s Revised Broch Model. However, there may be ‘subtypes’ where a feature differentiates some brochs from others. Moreover, subtypes could be understood based on their regions. The thesis will discover further where the regional models exist.

2) Secondly, they offer the chance to see the brochs in complementary relationships. There is a value in studying how the brochs are different from each other, or similar somehow. This approach would help to understand the spread of a model through types.

Typological sequences are often used as a surrogate to chronology and culture history in terms of historical studies. For example, there were various regional differences in Gothic architecture so that certain features were much more likely to be found in certain areas. The features usually vary with a part of the building, like towers (Figure 3.3). The two towers of Burgos Cathedral in Spain, which are in the style of French Gothic architecture have an exceptional cluster of openwork spires, towers, and pinnacles, drenched with ornament, which Northern Europe more inspired.
While in Toledo, around 300km south of the Cathedral, the Gothic style there was greatly influenced by the French Gothic style of the 13th century but adapted to Spanish taste. The only tower was designed and built mainly by Alvar Martínez with some decorative Mudéjar influence, while the top level of the tower with its octagonal body was designed by the architect Hanequin de Bruselas. The pinnacle with its buttressed arches rests on the octagonal barrel of the fifth level and is topped with a spire that supports three crowns imitating a papal tiara. The papal tiara was worn by popes of the Catholic Church from as early as the 8th century to the mid-20th.

Both the towers from two cathedrals have shown the sense of verticality, which is known for French-style Gothic cathedrals. They both have spires influenced by German gothic built on an octagonal base. However, the regional difference in the monuments may have a different influence on the details of the tower design.
Commonly, a typical change of one site among gothic architecture ‘family’ may have an influence on the near ones constructed in the later time. Thus, a particular regional character could be summarized. Moreover, their relationships can be even more complex as the building could be a mixture inspired by several different styles. From a typological view, the ‘family’ or collection of a type involves the classic features or forms (which are fixed) and the variant features, which are flexible like a trend or style. Furthermore, the ‘family’ or collection of a gothic style could indicate both the chronology (14th and 15th century) and culture history (including the locations, Spain and Italy). Also, other architecture types like Romanesque and Baroque have been found with a similar ‘family’ system as a particular variant feature could be found in a specific country or region.

...Gothic architecture uses a consistent typology of constructional and compositional elements. Quality lies in the internal perfection or consistency of the typology and in the wealth of expressions achieved within a typology... (Grabar, 2006, p.565)

Similarly, typology could fit the study of the concept of brochs which lies in the complexity and the quality of design for each building and the type of variations among different brochs. Thus, the brochs could be analyzed by collecting features regarding a type of building when the features and their connections can be read. A typological study can promote a way of looking at buildings that can help us recognize and discover basic types, if existing, and enhance our ability to see the differences and similarities among architectural artefacts by recognizing the invisible connections between them. It is worth exploring whether the typological study can support both archaeological study and architectural conservation, offering a comprehensive understanding of the identity of ‘brochs’ which now appears to be fragmented

3.2.1 Typological studies on regional characters

There are other studies on prehistoric monuments which have applied typology methods comparing sites for regional differences.

Regional variation is common in prehistoric societies, which was stated by Joanne Trudie Clarke (1998). She explained it with a study on ceramics of Neolithic in Cyprus: economic factors in different regions conditioned social interaction and thereby contributed to regional diversity expressed in stylistic variations in ceramics.
Matthew Shelley (2009) studied Scottish loch settlements (Figure 3.4), starting with two cases (Eilean Craggan and Isle of Loch Clunie) and analyzed their links in a map that included the confirmed settlements and possible settlements. The mapping of the sites is important to show both the distance and the geographic conditions and helped discuss the roles that the sites have fulfilled for particular families and groups.
Toby Driver (2018) studied the Iron Age hillforts of North Ceredigion in mid-Wales (Figure 3.5). Since there are one hundred diverse and unusual hillforts and defended enclosures known in this typographically distinctive landscape, this research used comparative diagrams to demonstrate the links between several hillfort cases. This thesis also used comparative diagrams to study the features of different brochs. The typographical method allowed the research to define the architecture, chronology, and the dynamic use of regional terrain in later prehistory through understanding the features collected from sites.

3.2.2 Typological studies on brochs

The typological study can be used for understanding the understanding and complementing the fragmented context of architectural features, which could help with the conservation considerations for different broch sites. There are two points of how the typological study can help:

1) Determining salient features to be studied across a population of brochs, arguing that they constitute the ‘typological models’ of broch architecture. Based on the broch 5-point definition, the parameters of each point could be collected on various degrees of accuracy to highlight regional features.
2) Conducting comparative statistical study through mapping, drawing, and grouping variations, and finally following the highlighted regional features to form subtypes.

Similarly to the above study, broch sites show their reactions to the regional conditions, thus could be seen as a design collection that follows the same design principles and then produces subtypes where a feature differentiates some brochs from others and makes them unique.

The subtypes are important. They could reveal more details of the designers' thoughts. Thus the character of brochs can expand to include intangible concepts as well. In brochs, the relationships of various positions of the building elements like entrance and stairs could be used to create subtypes.

However, there are no typological studies on brochs conducted from an architectural perspective at the moment. A statistical analysis of these broch features is a good starting point to show regional variation or the definition of different regions. There is some past research on this direction, but generally has not produced a clear idea of broch regional features. The reason might be that limited numbers of brochs were studied, and the relationships among the building elements were not focused enough.

Notably, the lack of professional surveys before 1910 cannot offer reliable research material. The early excavations were done chiefly by antiquarians. For example, in Caithness, where the most brochs are located, between 1890 and 1904, Tress Barry and Nicolson had excavated 14 brochs in 14 years. The sites with double red circles (Figure 3.6) indicate the brochs excavated by wealthy Keiss-based landowner and mining magnate Francis Tress Barry, John Barber (2017, p.295) called it 'awful excavations in Caithness' due to the significant volumes of artefacts discarded in debris and artificial features re-created during the work. Thus, these early research works done by antiquarians failed to support typological studies.
It was not until 1965 when Euan MacKie, in his study of the brochs, set out his fundamental categorization of brochs (MacKie, 1965). Then in 1995, the project of 'RCAHMS: Exploring Scotland's Heritage - The Highlands' involved more broch studies in depth.
However, they are limited to the sites on the mainland listed with reference numbers as (Close-Brooks, 1995):

Broch - Caisteal Grugaig (Monument) (MHG9249)  
Broch - Dun an Ruigh Ruadh (Monument)  
(MHG7808) Broch, Dun Dornaigil (Monument)  
(MHG12928) Broch, Dun Mhaigh (Monument)  
(MHG12872)  
Broch, Kilphedir (Monument) (MHG9856)  
Broch, Loch of Yarrows (Monument) (MHG1937) (MHG42399)  
(MHG42400) Burial - Clachtoll Broch, An Dun (Monument) (MHG40904)  
(MHG13002) Dun Telve Broch - Glenelg, Lochalsh (Monument)  
(MHG5355)  
Dun Troddan Broch - Glenelg, Lochalsh (Monument)  
(MHG5354) Possible Broch, Castlehill (Monument) (MHG1496)  
Norse Burial in Possible Broch, Castlehill (Monument) (MHG39803)  

During the first decade of 2000, Mackie (2002, 2007) pointed out that most writers about brochs in the past have tended to rely for their conclusions on a relatively small number of well-known sites and a systematic attempt to collate all the available data about brochs is needed. He collected information for nearly 100 broch sites with illustrations, plans, photographs, and maps, as well as an Index of site names and an Appendix of over 400 Iron Age artefacts drawn by him.

In 2011, Tanja Romankiewicz (2011) published ‘The complex roundhouses of the Scottish Iron Age: an architectural analysis of complex Atlantic roundhouses (brochs and galleried duns), with reference to wheelhouses and timber roundhouses’ collecting 147 surveyed broch or possible broch sites. She studied brochs classified into eight regions with the order from the North to the South (from Shetland to the Rest Area in this thesis) based on field inspections, survey drawings by the RCAHMS and surprisingly few modern excavation reports. She studied the analogies for broch reconstructions, which have shown a similar regional feature regarding material and construction. The result of her study suggested that there was no evidence for strict standardization as brochs were architecturally highly developed buildings. There was extensive focus on the fabric and the architectural features were collected through technical drawings but not well studied with typology.

There is research focused on the architectural features of brochs that archaeologists conducted. However, except for the limited number of brochs involved, the research mainly focuses on parts and specific building elements without reading the spatial features. So this thesis has used typological methods and found that the brochs have standard models, which are different based on the regions.
Figure 3.7 The stair-bases in courts studied by Angus Graham (1947)

For example, Angus Graham (1947) studied the stair-bases (near the position of the stair-access cell) using a clock for demonstration (Figure 3.7). He found the majority (31 out of 45) stair-bases were on the left side of the entrance (facing the entrance from outside) and suggested this is a deliberate choice of the builder. He also mentioned that most figures were from the Northern Mainland (mainly Sutherland and Caithness) and West Coast & Inner Islands, while the rest were too scanty. This thesis studied 108 brochs and found that most brochs have their entrance-center perpendicular to the stairs-center.

In another example, Mike Parker-Pearson and Niall Sharples (1999) studied entrance orientations of 90 brochs (Figure 3.8, top) and suggested a strong preference for doorway facing East and West, but with a reasonably wide scatter on either side. E.W. Mackie (2010) suggested that any connection with the sun has to be studied more systematically. This research also examined the various orientations of 108 brochs and made a deeper study of the relationships between the entrance, broch center, and the stair-access cell.
Mackie (2010) also found that none of the possible relationships between astronomical orientation and doorway orientations (Figure 3.8, bottom) appears if the directions are plotted as simple azimuths. According to features of 46 brochs studied, he suggested the pattern may give us a valuable insight into the calendar used by the broch builders and probably into the dates of some critical festivals in it. However, the 108 brochs studied in this thesis have shown that the orientation arrows almost cover the 360° of a circle. The orientations did not show any relationships to a calendar but at least some preferences for several directions. It suggested that the doorway (entrance) orientations possibly relate to the seasonal wind (explained in Chapter 4). Mackie’s conclusion on this was limited by the number of brochs he analyzed.

More recently, John Barber (2017, pp.59-63) used the taxonomy concept, defining it as the logic behind the criteria to distinguish between one set of things and another, and found standardization, in other words, a canonical broch model. He critiqued Ian Armit’s taxonomies of brochs (1992) (Figure 3.9), stating that the positioning of individual categories of monuments in his dendrogram conveys no information on their interrelationships, especially on their chronology.
Besides, in that study, each category was not defined with attributes, like a precise range of parameters from circular/oval to linear, for the membership of the various sets. He denied the axiom offered by Armit’s taxonomy and suggested the Revised Standard Model of the broch (Figure 1.2) through fieldwork methods, post-fieldwork primary analyses, and generic analyses, hypothesizing the existence of a canonical broch tower. John Barber cleared out the oddities caused by the consequences of secondary structural modifications and proved the presence of the features characterizing the Revised Standard Model. Also, Barber used excavated evidence and emerging patterns of radiocarbon dates to reject the process of Simple Atlantic Roundhouses developing to Complex Atlantic Roundhouses and then brochs and finally broch towers, which was mentioned in the ScARF panel report (ScARF, 2010).

![Diagram](image)

Figure 3.9 The axiomatic taxonomy from Armit (1992), reproduced by Barber (2017, p.69).

The typological study is reductive, where the collection of the types reveals deeper realities governing the members of the typological dataset. This method is usually used to study artificial works that involve different individual works with various features rather than reproduced rigid models. It is an analysis that leads to the understanding of the concept or ideas.

The typological study for brochs could offer a deeper understanding of their attributes in different regions, distinguishing the original features, including both the classic and the variant. John Barber’s work challenges the pre-2012 paradigm by testing the hypothesis that brochs were built to the standard canonical form and that their apparent diversity results from anthropic and, or natural modification, not design variability.
However, this thesis found that the brochs have regional models, where the perpendicular broch model is suggested, and the diversity of other features (like dimensions and guard-cells) are regional features, which are design variability. The regional models can be used as references to help the conservation be interpreted.

At present, conservation still works with each site individually, mainly based on the archaeological excavation reports. Barber’s finding RSM (Revised Standard Model) is significant progress for understanding brochs but cannot offer precise parameters as references in broch conservation. So, this thesis aimed at regional models which can work as references in consideration of broch conservation. Thus, the typological reading of brochs could be used to help the understanding improve, interpreting, even celebrating the brochs’ differences across the regions, instead of following one generic model offered by previous archaeological studies, and also help the conservation.

3.3 Typological studies on conservation

Typology can help with the conservation of monuments in general, and there has been some applied research so far.

Figure 3.10 The illustration of the typological classifications of the pointed domes over the historic era (Soler- Estrela & Soler-Verdú 2016)
The study of the restoration techniques applied to tile dome conservation around Valencia, Spain (Soler-Estrela & Soler-Verdú, 2016) proposed prioritizing previous in-depth knowledge of the typology. This study found that the restoration process of different cases sharing the same methodology, construction criteria and solutions is scientifically valid. The aim is to document the interventions carried out following international restoration charters and to contribute to further research. It is based on the pointed dome architecture in the Middle East and Central Asia (Ashkan et al., 2012), which offered critical variations in the construction and generation of double shells with intermediate cavities of different characteristics.

As the apparent uniformity of form, in fact, conceals many variables depending on the type of building, the typological classifications of the pointed domes over the historic era (Figure 3.10) were made as a programmatic approach for clarifying their typological commonality and their subtypes according to chronological architectural configurations.

Figure 3.11 Ground level plan of a housing unit of domus fabbricata (Agliata & Mollo 2020)
Also, there is a typological study of the historical center of Calvizzano in Naples’ suburban area (Agliata & Mollo, 2020) which stated that before carrying out any building refurbishment intervention, it is necessary to gather as much information as possible about the building itself and the built context surrounding it. The authors, Agliata and Mollo, stated the typological studies could be used to understand the character of the built area, which could be then fed into the design of the renovation intervention.

The study used a methodological procedure to carry out a typological analysis of the built heritage at different levels, from the urban scale to the building and technological ones. The study used technical drawings for demonstrating typology. The ground level plan (Figure 3.11) could be seen as typical ones in the study area and are a simplification of the classic scheme called domus fabbricata, a usual residence, widespread among the rural bourgeoisie in the Campania Plain.

There is another case of typology used for ‘waenhuise’ in the vernacular farm architecture of the Transvaal River region. There is a lack of fieldwork research and published material regarding vernacular architecture in the region, So this study used typology to determine trends and building traditions associated with this building type. Spatial configuration and organization of the floor plan are useful criteria to create such a typology (Naudé, 2010).

The study of elevations demonstrated the ‘Waenhuis’ types (Figure 3.12). The author emphasized its museological origin. He believed the information is needed for conservation, maintenance, restoration, and reconstruction purposes on historic sites and museums. The typological information is essential for restoration, and without it, not even academic reconstructions will be possible.

There is a study using typology in studying the historical layers of Kocaeli city through a case analysis of Kapanca Street. This study has focused on the differences among the houses in this city, which the author believed can contribute to the city’s identity and provide cultural continuity (Ayyıldız et al., 2017).
As traditional houses are often formed depending on the society’s different cultural values, the typological features of Kapanca Street could be read to know the historical layers (Figure 3.13). The positioning of traditional houses on the plot, plan, and design elements reveal typological properties, which offer clues about the natural and social environments. The historical values of Kapanca Street need to be recorded to provide cultural continuity and to be transferred to the future through conservation.
There is also a case of using typology in conservation practice through establishing guidelines, those for the recovery, maintenance and reuse of buildings and rural assets (Italian: ‘Linee Guida per il recupero, la manutenzione ed il riuso dell’edilizia e dei beni rurali pugliesi’) in Apulia, one of the richest archaeological regions located in the southern peninsular section of Italy.

The need to describe and interpret the Apulian territory from the point of view of land use, its agricultural plots and types of crops, orographic and hydro-geomorphological systems is supplied with the study displayed in Figure 3.14. The study helps to understand their connection with the settlement systems and anthropogenic characteristics, leading to drafting the formulation with a map of rural morphotypes.

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**Figure 3.13** Architectural features of the houses on Kapanca Street (parts of the orginal diagram) (Ayyıldız et al., 2017)
The ‘Rural morphotypes’ identifies on a regional scale, mapping the rural morphotypes recognizable on the Apulian territory. The map (Figure 3.14) demonstrated the morphotypes formed with a certain recursiveness within multiple contexts. they are identified and divided into five main categories:

**CATEGORY 1:** prevalent monocultures;
**CATEGORY 2:** prevalent associations;
**CATEGORY 3:** agricultural mosaics;
**CATEGORY 4:** agro-forestry-pastoral mosaics;
**CATEGORY 5:** strongly characterized landscapes

The use of typological methods is to trace the close connection between rural morphotypes and recurring building types. It offers an approach that tends to stimulate the in-depth knowledge in identifying characteristics of such heritage in order to protect and enhance the environmental context and, at the same time, become a valuable tool for restoration.

These Guidelines emphasized the conservation of the morph-typological characteristics and the maintenance of the Landscape rurality. Other destinations (like seasonal tourist activities, permanent tourist activities, hotels, and wellness centers) must be foreseen in the preparation of the provincial urban planning instrumentation.
Generally, these five cases of research using typology in conservation have shown what typological method can contribute to the debate.

Firstly, the typology works as information or built context, maybe for museological purpose (like the case of Naples' suburban area and ‘Waenhuis’); Secondly, typology can interpret the variants through analyzing architectural features (like the case of tile dome conservation); Thirdly, the typological architectural analysis could help the understanding of the features, contributing in finding the identity of the monuments and the regions (like the case of Kocaeli). Fourthly, the typological studies could help systematically, providing a set of cognitive, technical, and construction information and linking the surrounding conditions with the buildings.

Similarly, the conservation of brochs needs typological studies. The typological study could systematically collect the built context, analyze the variant features among brochs and find the identity of the regional brochs, which could be used for museological purposes. The conservation of brochs could interpret the ‘uncertain monuments' attributes in brochs with the help of typology, appreciating the architectural values of sites.

3.4 The subtypes of brochs

Subgroups in the typology could be redefined with analysis of the brochs’ similarities among different sites. Regarding brochs as a collection and a type of architecture, this thesis found subtypes of brochs based on the regional characters, which could support new definitions of brochs.

3.4.1 Subtypes of broch designs

Giovanetti (1998) in his understanding of types, mentioned that any extent specimen demonstrates the result of balancing three components: structural features, technological features and quality. The quality, seen as the precision of workmanship and finish, would be difficult to know for brochs. Although brochs like Dun Telve show significant precision, most of them have not survived above a 2nd level height, showing the lower scar cement at least. However, classifications according to the first two components could be sought. The structural features regarded as the capacity of an element to respond to ordinary or pathological stress would mean the (intuitive) design for strength, collapse patterns or the repair/consolidation of walls.

Furthermore, the technical features considered as the number, peculiarity, and assembling of elements, could manifest in the dimensions (number of stones), triangle/square lintels (peculiarity), and different plans/sections (resulting from assembling the elements). Both could be seen and measured based on the plans provided by scientific surveys operated on sites. This study aims to use these data to test whether possible broch features were shared among adjacent sites, which means subtypes could be created.
Overall, there are four significant aspects of broch information (provided by the archaeological or architectural study) which could be used as a reference for types: the builders, the building dates and the surrounding condition and the building architectural (stylistic) features, in line with Giovanetti’s thoughts.

As mentioned in chapter 1, the building date cannot always be precise to tell the sequences of brochs construction and identify the different builders. However, among them, the building architectural features are firmly related to the broch identity and the surrounding conditions regarding the locations and the environment, for brochs include ground conditions, accessibility, stone availability, wind, and sunlight can be studied. Thus, This thesis would focus on understanding the building design and surroundings to set the categories for subtypes. Then the building design can be about two aspects as the building elements and design features.

Architects create an ordered expression in buildings sometimes through the process of composing essential elements, which in our times can be openings, stairs and elevators. A design is the composition of the elements or units of proportion and relations, and the sequence involves the concept of motion. The element-to-whole relationship is a formative idea that relates elements to other elements and the whole in specific ways to create a form of building (Clark & Pause, 2012, p.5).

The elements in design can be divided into two kinds: the repetitive and the unique. The unique elements for brochs could be the only entrance and the stairs (in most broch cases). Furthermore, the repetitive elements could be the parts of the ground-level gallery, just like a slice of a round cake where each slice is the same. Also, the internal openings, cells, and corbels are repetitively built at different positions of the broch circle.

The idea of the building would be then a collection of building elements (openings and their lintels, cells, stairs, stack voids, etc.) and spatial characters. The urge to build becomes the need to reference a framework because every aspect of every building results from conscious cognitive processes. (Rykwert, 1981).

The design features for brochs mean the way those building elements are arranged rather than an assembly of parts. For example, the features would include the circularity of broch walls and the orientation of the broch entrances and staircases (and their relationships). This part could reveal the circulations of people in this monument and eventually its use. The inner wall circle has openings to cells, broch entrance, ground-level gallery, and stair-access-cell. There are circulations or implied ‘walking paths’, like from broch entrance to stairs, which may divide the broch central space. Dun Telve and Dun Troddan (Figure 3.15) can have this path not placed in the middle of the inner circle and leave a large area on one side of the path. The features could be seen as clues to conjecture the design ideas of the Iron Age people.
3.4.2 Subtypes of conservation problems

The problems or challenges in conservation for each type are different based on the classification. For the only one broch which is complete, Mousa, the main problem is defining the origin of the reconstruction, since the monument does not offer a ‘perfect’ broch model as it is assumed to have been modified by a Norseman who completed the staircase up to the parapet (Fojut, 1981). Mousa created a slightly overhanging upper part of the tower, which does not appear in the other four tall brochs (Figure 3.16). Since Mousa is the only complete surviving broch, it has set a stereotype for the general public. However, its features should not work as a standard for reference in other brochs’ conservation.
For damaged brochs like Dun Telve and Dun Carloway, treating the later modifications is crucial as they usually overlap with the original features and make for a complex situation. For example, there are proved added walls in Clickimin and Carn Liath, making the walls thicker than the original size. In those cases, the origin of brochs is hard to visualize.

For the most brochs which are in ruins, the quality of visiting experience is underdeveloped due to too few surviving features, but the quantity matters as they are hundreds of them and could offer more genuine ideas what the standard broch is. In general, the subtypes can be created based on the surviving levels.

3.5 The conservation of brochs as uncertain monuments

As explained in the previous paragraphs, the uncertainty of brochs is mainly about the unknown history, which might become clear after long-term archaeological research. Brandi (1965) defines restoration as the methodological moment. The work of art is recognized as a physical object with both aesthetic and historical value. Its transmission to the future is important. He emphasized the use of conservation, which aimed at keeping both values embedded in the physical object last longer.

‘Restoration should aim to re-establish the potential oneness of the work of art, as long as this is possible without committing artistic or historical forgery, and without erasing every trace of the passage through time of the work of art’ (Brandi, 1965, p.50).
In other words, Brandi identified a timeless dimension of the artwork for its conservation which should preserve the work as a whole with signs of the passage through time. He also stated the ‘imperative of conservation’ where the original objects are highly concentrated. However, the original objects are still ‘uncertain’ and may become clear in the future if enough excavations are done. While at present, the potential oneness of brochs which could be the data of the whole broch collection from a general view, can be established through a typological study.

The conservation of uncertain monuments would discuss how to use the typological study to interpret the uncertainty of monuments, like the prehistoric attributes in building information. The thesis sees the brochs’ life as a whole, from built-in Iron Age and mostly abandoned around the 6th century AD up to the C19 early discoveries, current activities (excavations and public engagement), as well as the potential future discoveries and site changes, putting an open end with conceptual principles, which would help further understanding of the intrinsic relationships influenced by brochs’ various uncertainties. Archaeological research shows the monumental brochs were indeed modified, repaired, or reconstructed in their history, possibly over 500 years, which is an important part of their character. The conservation of brochs in our time, which is mainly basic repairs for security at the moment, is argued in this research that the later modifications are just as important and need to be integrated with critical theoretical frameworks.

The origin and design evolution of brochs are still conjectural, while the remains of brochs are ruins that need preservation and occasionally even reconstruction. The significant repair events that happened in their history condition our understanding therefore should be analyzed and given the right weight on the identity of the monument. Further understanding of brochs can be accessed through typological study. Francesco Giovanetti (1998) stated the reasons for typological research in conservation as:

...The reason for historical, typological, and constructive analysis is to determine the typology of the transformation process and detect the values held inside a historical building. It is essential to the training of any conservation designer of today, who is supposed to be able to detect, inside an apparently Unitarian architecture, evidence of pre-existing buildings which have been swallowed up by new construction over the course of time... (p.92)
He classified the conservation approach into two kinds: 1) select single structures worth preserving from an artistic or historic point of view and establish them as part of a network of (scattered) buildings that constitute the monumental heritage of a town or nation. 2) look at the built environment of historical significance as a whole and seek to preserve it as a whole. (Ibid.)

Historic sites have their individual history of being analyzed, like the case of damaged churches. Thus, they suit the first approach. Also, brochs are single structures classified in the first category. However, there are areas of broch locations where they can be treated with the second approach, as ensembles. The prehistoric broch conservation could be studied with a 'whole' because of the missing of one 'perfect' site and the existing fragmented buildings. Here the 'whole' means the collection.

Notably, he stated that the typological study could help find any original building (which belongs to a type) and distinguish it among later, radical changes. Especially for brochs that have no perfect images for reference, the fragments of ruined features could be made up to a whole image with the help of typological studies. Furthermore, these studies can reveal the design concepts to understand why the brochs vary from site to site and distinguish the original characters from later modifications. The original idea could be detected through typological studies to help conservation improve in these two levels.

In general, typological studies are suitable for vernacular and prehistoric attributes of brochs. Understanding their architecture and improving their conservation need the architectural perspectives of studying the brochs as a collection.

The following chapter will discuss the broch features and uses typological methods to analyze 108 surveyed sites and understand them architecturally. Perpendicular Broch Model (PBM) and regional models for different areas will be outlined, which could help distinguish variant features with later modifications in the conservation study.
4 Reading the features

Research Question 1:
How can typological studies find regional subtypes and regional models to improve the understanding of brochs?

Reading the features

Site conditions
Architectural features

Spatial characters
Building elements

Subtypes and regional models

Chapter 5
Conservation study

Figure 4.1 The research question for Chapter 4

This chapter focuses on the first research question 'how can typological studies find regional subtypes and regional models to improve the understanding of brochs'. It is shown in Figure 4.1, which explores the brochs’ design features through an architectural reading that involves quantitative analysis of surveyed brochs, and qualitative research, which offer insights on the underlying reasons for those features. The outcomes of this chapter would offer information to be used for conservation study in chapter 5.
The brochs’ variations demonstrate that the concept of building a ‘broch’ does not follow a precise design whose parameters are all fixed, in which case brochs should have been all similar. The collection of brochs has demonstrated their builders’ choices of the building elements involved and how they would be set. Firstly, based on the standard model suggested by John Barber, the present surviving brochs are mixtures of original features and later modifications. However, it would be hard to classify the modifications as archaeologists cannot broadly confirm the history of brochs, even the sequences of habitation. Theoretically, the modification would happen at the ‘softer’ upper parts of the building (like repairs, reuse, reconfiguration), while the ground plans of brochs are less easy to modify, so features there should be original. Therefore, using base plans should be suitable here for the definition of individual architectures as well as to frame their wider geographic distribution. Both the regional and architectural characters could be used for classifications, and whether they match or not would be a means to test the methodology.

This distribution may vary according to the (slow) spreading of ideas in the Iron Age. Abstractly, the vernacular is only seldom represented by single structures. It is stated in the Charter on the Built Vernacular Heritage (ICOMOS, 1999) that such buildings would be best conserved by maintaining and preserving groups and settlements of a representative character, region by region. Moreover, their conservation is suggested to be a continuing process including necessary changes and continuous adaptation to respond to social and environmental constraints.

Figure 4.2 Broch models response to site conditions
As geological conditions and local environment may differ even within the same type of vernacular buildings, the design developed around local materials, suitable spatial designs, construction, and the site conditions’ broader limits (Figure 4.2). This chapter studies the idea of local models for brochs and the specific reasons underlying their variations. The author intends to interpret these variations through an adapting process as the original designs get changed or modified to suit the site conditions. Then, the study would discuss design responses in different cases, which offers a glimpse of the mind of the broch builders.

The basic level of reading of broch features following the methodology mentioned in Chapter 3 could be the definition of the brochs offered by Mackie (2002), which stated five main features listed as below, which are broadly associated with the plan.

1) Round plans
2) Thick walls
3) Particular size
4) A ledge or scarcement on the inside wall face
5) At least one of certain hollow-walled architectural features

Mackie classified brochs as sites with at least two characteristics of points 1 - 4 and in addition point 5. As all these features are shown on the ground level of brochs, the definition is related to surviving brochs which are mostly ruined. Compared to other Iron Age stone monuments whose inner wall face is complete, other features like the stacked voids in brochs are outstanding, demonstrating a higher level of architecture and construction skills. Besides, the spatial characters are important and complex relationships probably existed among cells and central space, while the duns and wheelhouses mentioned in chapter 1 only have one entire space inside. This study would therefore suggest that more features could be involved to define a broch.

The broch’s architectural features, which was suggested to be typologically studied could be divided into two parts as building elements and spatial characters. Elements are the assembled, tangible fundamentals of the fabric like lintels, scarcement and stacked voids. Spatial characters are the design arrangements of these elements, like circularity, entrance orientations, stairs orientations and corbelled cell locations.

As most brochs survived with a height no more than 3 meters, the study will mainly relate to surveyed plans of the ground floor. Theoretically, the ground floor sequence of the brochs going from outside to inside, ground level to the roof, would be depicted in the diagram below (Figure 4.3). There are four terms in the sequence, each of which means a point where multiple choice is offered to select a path to a different space, and only term 2 and term 3 have single options to either cells or the guard cell. As survived brochs would have two or more corbelled cells, the central space would be a point where major circulations met.
Figure 4.3 Ground floor sequences and main features of the standard broch
From level 1 to the roof, any route to higher levels closer to the roof is one way without offering alternative space options in the middle. As all the galleries are around 1m wide or even less at a higher level, which could not support 2 or more people’s activities, the central space on the ground floor would be the most functional space. Thus, the most possibly used space in the broch is the central space. The scheme of the spatial sequence is assumed to be fixed and suitable for all the brochs.

At the same time, there are some flexible features. For example, the staircases found in brochs are all clockwise (going from ground to top), while the entrances of brochs do not show any preferences in orientation. The fixed features could be the ‘fabric’ of brochs while the flexible features could be known as ‘style’ of brochs, and this can vary from broch to broch or between periods.

As the brochs are widely distributed on mainland and isles of Scotland, the style could be the most prominent response to their locations. A typological study of broch features responding to their regions would be a way to know the possible ‘subtypes’ in this vernacular architecture.

There has to be quantitative research on reading the features rather than establishing models based on typical cases as the typological study should reply on relatively big and representative data. Studying the characters case by case would fail to reach a standard type as a general commonality is hard to find based on 300 various building conditions on sites. Even the five tall brochs cannot determine the features of broch design because their forms were different, their locations were in different Scottish regions, and they have been proved to be not original. Archaeological reports show there are around 150 brochs that have been surveyed or recorded. Although most of them are ruins, the clear plan of ground floor level that they offer is very important in this study. The spatial sequences above the ground floor are just the stairs, and galleries reaching the top could only be speculated. Therefore, reading the plans is the only way to get close to the original design idea.

The primary database will be the Canmore database (canmore.org.uk) and archaeological publications. There are two critical books as ‘ The complex roundhouses of the Scottish Iron Age : an architectural analysis of complex Atlantic roundhouses (brochs and galleried duns), with reference to wheelhouses and timber roundhouses ’ written by Tanja Romankiewicz (2011) and ‘The roundhouses, brochs and wheelhouses of Atlantic Scotland c.700 BC- AD 500: architecture and material culture’ written by Euan W. MacKie (2002). The latest of these texts used previous broch researches, covering 147 surveyed brochs which include 20 brochs for Shetland, 23 for Orkney, 16 for Caithness, 16 for Sutherland, 16 for Western Isles, 19 for Skye region, 26 for Argyll and 11 for lowlands. However, some of the brochs were recorded as descriptions rather than ground level plans or sections with clear outlines.
This study has focused on a selection of brochs following further precise criteria and set conditions more similar to the standard broch:

1) Precise outlines of walls.

2) Dimensions referring to the standard model.

The 1st point is compulsory as some of the available plans are speculated and cannot be used for further analysis since this research's outline is fundamental. The 2nd point is set to eliminate controversial issues as some possible brochs may be duns and offer more potential exploration of the features. The sites with a high possibility of being duns were not involved in the selection for this study.

For example, the brochs like Fugla Ness in Shetland and Dun Ibrig in Argyll (Figure 4.4) should not be included in this research. Fugla Ness had no clear outlines due to the poorly preserved conditions (Romankiewicz, 2011). Only two tops of the guard cell were visible, and the entrance was buried under the rubble. More importantly, both the dimensions and circularity of the plans cannot be relatively precise, affecting the analysis. The walls of Dun Ibrig are too irregular, whose thickness of the Western side is almost three times as much as that of the Eastern side. Compared to the standard broch model, the Western part has been possibly modified with additional stones or has collapsed. Both two cases have no visible staircases. If the two cases are involved in the study, the ruins level might mislead the analysis and lead to inappropriate local models. Therefore, the study should select the broch cases with more possibility of being original.
4.1 Site Conditions

4.1.1 Locations

In terms of the period background, the travel distance was limited in the Iron Age due to people’s short life span and the lack of fast transportation means. Based on the Early and Middle Bronze Age date, the total life expectancy (Angle, 1969) would be 28–36 years. Besides, around half of the brochs are on the isles separated by harsh sea conditions, making human travel between the different isles difficult.
Based on the locations, the distribution (Figure 4.5) was classified in eight areas by MacKie (2002) and Romankiewicz (2011), named from North to South as Shetland, Orkney, Caithness, Sutherland, Outer Hebrides, Sky and Lochalsh, Argyll and rest area or central belt. Primarily, the divisions follow the geographic conditions of Scotland. For example, Shetland, Orkney, Outer Hebrides and Argyll are mostly Islands, while Skye & Lochalsh are peninsulas but are all relatively geographically isolated. However, as displayed in Figure 4.6, Sutherland and Caithness are relatively closer, and there are many brochs located near the border (cases like Ousdale, Kilphedir and Feranach). This study would eventually propose an alternative way of classification, which merges the brochs in Sutherland and Caithness into a whole cluster.
The 108 brochs involved in this research have their locations distributed widely without preference for a particular type of place. However, most brochs are located near waters, like lakes, rivers or sea. There is no doubt that water access is fundamental for people’s living in Iron Age, so this could be an essential part of the site condition for further study.
4.1.2 Locations and waters

Water is a fundamental living resource in the Iron Age, found naturally close to brochs or inside as possible water tanks. A spring-fed water tank was found on the floor at Midhowe in Orkney. There have been studies showing that water tanks appear to be largest in the Middle Iron Age (0.59m²) in structures from the Outer Hebrides (0.67m²) (Summers, 2011). There should be a place near the broch site to get water for Iron Age people. Thus, a mapping study of the locations to waters for brochs has been made, taking Caithness as an example.

In Caithness, based on the Stravaiging Around Scotland Ancient Sites Database (2020), the data has shown 184 Iron Age sites that were possible brochs, and the majority are near the Northern coast and Eastern coast.

There are only three groups (Caithness, Sutherland and ‘Rest area’) out of the eight ones in Figure 4.5 where brochs are predominantly inland or far from the seacoast, but some are located near rivers or lakes. The brochs shown could be classified as three types: near sea, near lake, and inner land (Figure 4.7). Nearly half (48.91%) of the sites are near sea and fewer (10.33%) are near lakes. However, there are still links to water in the ‘The rest’ group which occupy 40.76% of the total.

However, Due to the small scale of the map (Figure 4.7), possible water resources like rivers or streams cannot be recognized. Therefore, the study zoom in to find broch sits located in
Figure 4.7 The locations of brochs (including possible brochs) in Caithness
The eight brochs near Westerdale in Caithness
For example, the area where there is the highest record of broch numbers (8) in Caithness is Westerdale, is located between Dorrery and Spital. The eight brochs, including some possible ones, shown in Figure 4.8, surrounded the rivers and related streams. ‘The rest’ in the diagram (Figure 4.7) as coloured brown does not mean that there are no waters near the sites. After reading the further details with zoom-in map, there are in total 23 sites found with no near waters (200m) in Caithness, which are listed as below:

Ballachly (2 sites) / Greenhill / Toftgun (possible) (site of) / Warehouse/ Golsary Rumster/Scottag (possible) / Cogle (site of) / Gearsay Cairn (possible)/ Mybster Torr an Fhidhlier (possible) / Achanarras Farm (possible) / Achcomhairle (possible) Achies East /Achies (possible) / Achies West (possible) (site of) / Durran/ Stemster(possible)/ Ha’ of Bowermadden/ Scoolary (possible) (site of)/ Cairn of Achoy (possible) / Brabstermire

However, these listed sites with no near waters only occupy 12.5% of the total number, which indicates that most brochs were built near waters.
Figure 4.9 The locations of brochs (including possible brochs) in Sutherland
Sutherland has a similar situation (Figure 4.9). The brochs in Sutherland are counted based on the records from Historic Environment Scotland, and the European Marine Observation and Data Network, which has included both brochs (or possible brochs) and other types of Iron Age roundhouses sites. This data has involved many more sites than what had been studied by Romankiewicz (2011) and Mackie (2007). It has shown that less than half of the sites (40.23%) are near seacoast and some sites (11.49%) are near inner land lakes, while nearly half of the total (48.28%) is in the ‘The rest’ group. The distribution is similar, as the density of brochs is relatively low in the middle land than in the Northern and Eastern coastal areas.

As mentioned above, rivers are an important water resource for brochs in inner land. The distributions of the sites were found to be near the big rivers in Sutherland and Caithness. Halladale River in Sutherland and River Thurso in Caithness are typical examples (Figure 4.10). Melvich and Thurso are the estuaries for the two rivers, showing the orientations from North to South. All the brochs/possible brochs are shown in the picture are in the surrounding area of Halladale Rivers, as shown in the left picture. However, for River Thurso, there only are approximately four brochs near the river, while most sites were built far away from the waters.

The site distribution around Halladale River appeared to be linear, as the sites appeared to be linked with the river. Possibly, the builders would start from the seaside and move towards the South along the river. While the distribution of sites around River Thurso has shown a sort of zonal characters, with no evident link between site and rivers, the distribution appeared to form a range of areas where sites gathered. Alternatively, the flatter geological situations in Caithness could be easier to travel in the inner land in Iron Age. Thus the rivers are less important for broch site locations.

Similarly, this linear and zonal distribution is found in other places. Then, a general view of the distribution in two counties, Caithness and Sutherland, is needed for a deeper understanding.
Figure 4.10 Sites around Halladale River (Sutherland) and River Thurso (Caithness)
4 Reading the features

Figure 4.11 Brochs’ distribution in Sutherland and Caithness

Generally, the brochs’ distribution depicted in Figure 4.11 can be organized in two clusters, according to linear or zonal distribution. Apparently, Caithness has more zonal distribution and less linear distribution, while in Sutherland, most brochs could be linked with lines which might be the transportation routes. Also, the approximate axis of symmetry on the NE of Figure 4.11 could reflect a more meaningful land area division and distribution of brochs.

1) Linear distribution.

In most cases of linear distribution, the line is linking brochs near the sea and the brochs of inner land like most lines drawn in the Sutherland area. As the brochs near the coasts were continuously distributed on the North-western area, the lines may be the paths people take to find new territories, like the two groups of zonal brochs in the middle of Caithness.
2) Zonal distribution.

This type has covered most cases of Caithness, the majority of which are located near Northern and Eastern coasts and form clusters. However, there are only two clusters of this type in Sutherland that are obliviously located near lakes. In the middle, there are two clusters as well. One is surrounding a lake while the other is mostly hill land.
Figure 4.12 Northern and Eastern division of brochs’ location in Sutherland and Caithness
Compared with the geographic characters of North Scotland, it is evident that the differences in distribution were affected by the mountainous area in Sutherland and flat land in Caithness. Caithness, whose brochs are more in quantity and more zonally distributed, could be the ‘start’ of the first generation of Iron Age brochs. Then people would move to the South as the territories expanded along the coasts both North and East while exploring the inner land. When they reached Sutherland, there were fewer people, according to fewer settlements found, which might cause the distribution to change linearly. For the settlements built inner land, rivers are commonly used as paths for Iron Age people to stretch their territory. As watering places for humans and other animals mentioned by Peta Jones (2007) in a settlement typology study on Iron Age Klip River, Rivers would offer basin or valleys that have more possibly flat ground for building construction and water resources. Iron Age settlements are similarly located near rivers, such as moated sites of the Iron Age in the Mun River Valley (O’Reilly et al., 2015) and Iron Age houses along the Yarkon River, Israel (Gadot, 2011).

However, there are still two zonal clusters in the middle of Sutherland. Both of them were built near lakes, where the surrounding geographic conditions are relatively flat. The rejection of building a broch in mountainous inner land could be further understood through a more typical study of looking at the ground situations in section 4.1.3.

If the maps of Caithness and Sutherland are merged, the land demonstrates a possible symmetry along a South West to North East axis in Figure 4.12. Then, as the sites near the symmetric line have formed clusters, a division of the Northern and Eastern parts could be made.

<table>
<thead>
<tr>
<th></th>
<th>Near sea</th>
<th>Near Lake</th>
<th>The rest</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caithness Number of brochs</td>
<td>90</td>
<td>19</td>
<td>75</td>
<td>184</td>
</tr>
<tr>
<td>Percentage</td>
<td>48.91%</td>
<td>10.33%</td>
<td>40.76%</td>
<td></td>
</tr>
<tr>
<td>Sutherland Number of brochs</td>
<td>35</td>
<td>10</td>
<td>42</td>
<td>87</td>
</tr>
<tr>
<td>Percentage</td>
<td>40.23%</td>
<td>11.49%</td>
<td>48.28%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.13 The comparisons between number of brochs in Caithness and Sutherland.
As Figure 4.13 displays, the general location preference in Caithness and Sutherland is similar. The sites which are near lakes are around 10% in both groups. Moreover, the percentages of ‘Near sea’ and ‘The rest’ groups are nearly equivalent, taking roughly 45%.

Figure 4.14 has displayed the proportions occupied in the Northern and Eastern parts, which are similar and approximately equal to 1:2 in all three location conditions. While the proportion numbers for Sutherland are similar as well, which equals 2 : 3 except there are the same amount of brochs near coasts in the Northern and Eastern parts. Hypothetically, broch builders would start from the North-Eastern Caithness and stretch towards the South, while 1/3 of them took the Northern coast path and 2/3 of them took the Southern coast path. So, the brochs in the two counties were roughly coherent in terms of both locations and location features.

Possibly, the population difference might have led to the consequences that Caithness has more brochs than Sutherland. However, the percentages have shown that both counties have similar characteristics in the location preferences on waters and distribution between the Northern and Southern parts. This study believes then that those brochs were built under ‘the same ideas of Iron Age people’. The same ideas does not mean the same people who built brochs or the same time when the brochs were built. It is about the way of thinking about this building, whose design process would start with a location preference shown in the study above. Although the distribution types differ between the two counties, it reflects similar responses to the mountainous/ flat conditions.
Therefore, the brochs in Caithness and Sutherland are much related, with a similar principle of finding locations for buildings. The brochs in the Northern highland of Scotland could be better divided according to this scheme, which offers a more meaningful geographic classification to the ‘classic’ ones made by Romankiewicz (2011) and Mackie (2007). This study plans to start with the ‘classic’ classification in data collecting and conduct comparative studies with the new way which merges Sutherland and Caithness into a whole group.

As many sites are controversial to be brochs and have not be scientifically surveyed, like some sites in Figure 4.7 and Figure 4.9, this study has to start with the sites with scientifically surveyed plans of brochs. There are 106 brochs found with clear plans from publications made by MacKie (2002) and Romankiewicz (2011). The archaeological reports published in the last ten years offered surveys of Thrumster and Nybster. Thus, this study has collected 108 brochs plans which build up the data pool for further statistic research.

Generally, the selected cases are approximately 1/3 of the brochs considered to exist in Scotland, which covers all the geographic range to gain the representativeness for the ‘design’ of this building type. The apparent weakness of this study would be the plans of different ages, origin and precision, and possible errors in understanding the original scheme due to later modifications, restoration or even reconstruction. Because the study has collected as many as possible valuable cases, the mean distribution could minimize the weakness and approach to the ‘truth’ of the original architectural idea. The 108 brochs used in the following study are shown with a map in Figure 4.15.
Figure 4.15 The map of the brochs studied in this research
Most brochs were built near coasts as Figure 4.16 displays. There is no doubt that the groups which are primarily islands, isles or peninsulas, would have more brochs near the sea. While Caithness, Sutherland and ‘Rest Area’ have more inner land brochs, possibly because of their relatively larger inner area. Waters are fundamental to human’s living, and the; coast area would offer possible defensive purpose, which has also been interpreted from brochs’ closed shape with a small entrance on the facade.

It would be difficult to imagine that a large number of monuments, whose range covers both isles and inner land, still follow a similar principle in choosing site locations. Is there any major difference among the areas? This study would go further into the precise locations to understand the surrounding conditions.

This study considers that the shore was much more static water resources than lakes and rivers, which may dry up. The relationships between the brochs’ location and water resources nearby can be read through the distances between them. For shore, the edges of accessible beach could be counted as an end of a line which links brochs and water. For rivers and lakes, the study would use the current outlines of them to measure the distances. Since most of the measured distances are 50m and 100m, the site locations’ relationship with the waters nearby can be classified into four types below.

<table>
<thead>
<tr>
<th>Region</th>
<th>Coastal</th>
<th>Inland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shetland</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Orkney</td>
<td>14</td>
<td>2</td>
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<td>Rest Area</td>
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</table>

Figure 4.16 Broch Location study regarding relationships to coast in eight regions
A) Inner land
   The broch is not near a river, sea or lake (the distance between them is more than 100m).

B) Near coast or lake
   the broch is near a sea or lake but not built on the edge of a shore, or at a distance around 50m -100m. Usually there would be at least grassland in the middle of the direct path to nearest waters.

C) On the Coast or Lakeside.
   The broch is on the coast (the edge of beach) or lakeside where the distance between the broch and nearest sea or lake is less than 50m

D) Near River
   The broch is near river where the distance between the broch and nearest river is less than 50m away.

The examples of this classification are shown in Figure 4.17. The map data were taken from the Canmore database with land contours that could depict the geographic situations. For example, Broch Clumlie in Shetland was an inner land site with no rivers, lakes, and coasts. Broch Culswick was located near a lake named ‘Loch of the Brough’. Burland was built surrounded by seawater where there may be a walking path that has been submerged due to possibly rising sea level in last 100 years while broch Jarlshof was located almost on the coast. Both of the two are classified as group C where water is entirely around. Group D is about those brochs which were built near rivers, whose water resources might be unstable as the streams and rivers would be affected by seasonal changes.
Figure 4.17 The legend of four types regarding site locations’ relationship with the waters nearby
Figure 4.18 General distribution studied with the distance to nearest waters
Figure 4.19 The 108 brochs' location studied with maps (part 1)
Figure 4.19 The 108 brochs’ location studied with maps (part 2)
According to the precise geographic locations of 108 brochs in Figure 4.18 and Figure 4.19, a table could be made with groups in terms of the distances between brochs and different waters (Figure 4.20).

From a general view, the preferences on setting a certain distance to waters are pretty diverse. Group A has a few numbers in Shetland and Orkney due to the isles’ locations. Nevertheless, those in Outer Hebrides and Argyll, which are also isles and islands, are more in numbers which might indicate the brochs in the North (Orkney and Shetland) are relatively different. The brochs built on coasts have dominant numbers in Caithness and Outer Hebrides. However, if Caithness and Sutherland are considered being merged into one group, the brochs built in the range of 200m of waters (combining Group B and Group C), could reach almost equal numbers of group A in Skye&Lochalsh, Caithness, Sutherland. Thus, the distances to waters have not shown a critical role to be considered for broch locations by Iron Age people.

However, Figure 4.20 has shown that Shetland and Orkney could be different from other groups. The isles in Argyll and Outer Hebrides are unique places compared to those in mainland Scotland. Those differences would be linked with other features in the following feature readings.
The topographical conditions are also essential factors to be considered when a location is determined. The riverside or seaside are both flat areas with quite an open view. As for those brochs built not on the coasts, most are located in the mountainous area, hidden in forests or exposed on the hilltop.

![Color/Area: Shetland Orkney Outer Hebrides Argyll](image)

- West Burra Firth
- Russland
- Dun An Duna
- Dun Bharabhat
- Dun An Sticir
- Dun Torcuill
- Dun Cromore
- Dun Nan Gall

Figure 4.21 The eight brochs which currently located in the middle of a lake.

The lake levels have been unstable for years. Thus, their level in Iron Age would be even hard to track. However, there are eight brochs listed in Figure 4.21 which are currently located in the middle of a lake. Except Dun Cromore had a walking path that was faintly visible under the water, most of them have a narrow walking path to bigger land nearby. The locations indicate the possible defensive purposes, which is also shown in the broch facade with only one small entrance in most cases. If the lake level was below the present level in Iron Age, the eight brochs were built at a higher elevation than the surrounding land elevation. The study would consider the variety of topography where brochs were built worthy for further study.
Figure 4.22 Three types of brochs’ location in hills.
According to the contours in the maps (Figure 4.22), the examples of the three types regarding brochs’ locations in hills are clear classified as summit, ridge, and others. Culswick in Shetland lies at a typical location as the summit of a hill, which is higher than the surrounding land. There are some brochs built on the ridge of a hill, like Ousdale, where there is a gentler slope. ‘Others’ group means the sites that were not built on the top of a hill or the ridges of a hill. Following the three typography groups, their reading could offer a more profound understanding, speculating how the Iron Age builder considers the different locations.
Figure 4.23 The maps of brochs which were built on summits.
1) Summit.

In the hills, the summits would be the most possibly flat places in hills. As displayed in Figure 4.23, the summits are predominantly a small area, ranging from 300 to 2000 m$^2$. However, most of them were built near the summit’s edge rather than the center of the summit. The summit's edge would offer a more expansive surrounding vision as the center of flat summits could not make it. Especially, cases like Torwood, East Kinnauld, and Dun Bhoraraig are placed with a broad view of the slope if trees were not many. Generally, the summits are chosen by Iron Age people possible because of the flat ground conditions and broader vision of the surrounding conditions.

2) Ridge.

The brochs built on ridges of hills are shown in Figure 4.24. Ridge offers a gentler slope rather than a steep slope for monuments to be built. Especially, cases like Allt Breac, Edin’s Hall, and Torwoodlee have been built on the slope whose angle was half of the angles of surrounding slope area in degrees. The gentlest slope would be in cases Hill Head and Kilminster. The angles are roughly 0.5° -1°, i.e. almost flat. The steepest slope would be the site where Caisteal Grugaig was placed. a ground angle around 11°-16°. Interestingly, broch Teroy had a ground angle around 2.3° while the nearest ridge area below was quite steep with an angle of 16.6°. Through a comparative study between brochs’ site location and nearest ridge area, a conjecture could be made that the brochs location preferred ridges of hills for their relatively flat ground.

3) Others.

The group of ‘Others’ also demonstrated a similar principle of finding a better site to build brochs, as shown in Figure 4.25. The sites located at the ‘bubble’ formed by the contours appear the most in this group. Those site places are theoretically the flatter places in the hills. It could be the choice made on existing geographic locations or built on earthwork of banks and ditches by the Iron Age people, as was suggested by archaeologists (Chadwick, 2016). Besides, there are about 1000 Iron Age hillforts built in Scotland, the majority of which are circular and follow the contours of a hill (Lepage, 2012). As the earthwork skills and the acknowledgements of utilizing contours were evidenced in other Iron Age works, changes of contours to form a ‘bubble’ flat place should not be hard for Iron Age people. However, compared to the summit and ridge groups where there are no classified locations that dominate, the majority of brochs in this group are in Skye & Lochalsh and Sutherland. The possible reason may be that those areas have more hills than the nearby Caithness and Rest Area. The bubble place could be seen as a ‘short ridge’ that shared the idea of gentler slop but with limited area.
Figure 4.24 The maps of brochs built on ridges.
To sum up, brochs built on summits, ridges, and the ‘bubble’ places in contours have shown that the locations have aimed at a flatter place where the contours are sparse. Also, a place with a higher elevation was preferred possibly to get rid of flooding due to rain. Considering that the majority of brochs were built near the coast where the sites are mostly flat, the location preferences studied have shown that a relatively flat ground with near waters was much ideal for building brochs.

Figure 4.25 The maps of brochs in group ‘Others’.
4.1.3 Even/sloping ground

The ground situations, either even or sloping, are essential to the brochs. The sloping ground would theoretically make it harder for brochs to achieve higher circularity and stronger building structures. From another point of view, the slope may make it easier for a staircase to be built, like Caisteal Grugaig, a perfectly round-shaped broch set on a steep slope. As the study above mentioned that Iron Age broch builders might more prefer a flat place, a study of the even/sloping ground may tell the relationships behind.

It would be hard to define the sloping of the ground and set the parameters to differentiate the ground features. Sloping or even ground could be easily judged from the sections of sites. However, due to the lack of scientific excavations, the study of ground conditions would reply to the photos and broader contours on maps. Nevertheless, mostly, the sloping ground for broch sites means one end of a diameter line measured of the wall circles is at least 1m vertically higher than the other end of this line.

The ground conditions of these 108 brochs are shown in diagram Figure 4.26. The plans of brochs have been scaled to suit the same size circle for demonstration. The slope was used for the description if the broch base has an elevation ranging more than 1 meter.
Figure 4.26 The ground conditions of 108 brochs (part 1)
Figure 4.26 The ground conditions of 108 brochs (part 2)
In a general view of the numbers (Figure 4.27), 60 out of 108 brochs have been built on sloping ground. Except for ‘rest area’, each area has a preferred ground level condition, where the smaller number in those comparisons are less than 5. Geographically, the even ground conditions are dominant in Shetland, Caithness and Outer Hebrides, while in Sutherland, Skye and Lochalsh and Argyll, the sloping ground is dominant. The ‘Rest Area’ covered the brochs distributed in a vast area, where the ground and sloping ground conditions are almost equal. Considering the relationships of Caithness and Sutherland, if they are merged, they would have 16 brochs on sloping ground and 15 brochs on even ground, which very much match the situation for the ‘Rest Area’ with almost equal numbers. Figure 4.27 tells that Sutherland would fit more with the Southern mainland part as it has similar numbers with Skye&Lochalsh, and Argyll. So, it could be seen that Caithness & Sutherland have the Mainland features and the variety between Northern and Eastern parts of the land.

Since there are dominant numbers in seven groups, it could be deduced that the sloping or even ground could be a local ‘style’ that was differentiated by the locations. As Figure 4.28 displays, the even ground is dominant in the Northern and Western places, also isles or coastal land. Furthermore, the sloping ground for brochs is mainly the mainland area. Although the general geographic conditions vary in eight areas, the study indicates that the builders’ preferences for ground conditions are different based on the regions. The regional differences can form a ‘style’ in the design of brochs, which also can form a subtype.
Figure 4.28 The diagram of brochs locations regarding sloping ground or even ground.
Figure 4.29 The bubble chart of the locations with similar features regarding different site conditions.
The study on site conditions has shown two major points:

1) Broad similarity

   The broch locations prefer flatter and more coastal places. Most brochs were built on coasts. While for brochs located in inland, there are some built near lakes or rivers.

2) Regional Variety

   Variety appears almost in all the studies on different condition features, which means two locations share the same circumstances. Nevertheless, regional or partial similarities could be called `style` in the variety, as displayed in Figure 4.29. The places in the circles with the same colour have some features in common. Generally, the diagram follows the map of the locations from North to South, which indicate that the geographic location could be the reason for varieties in site conditions.

The study on site condition has offered some insights into the varieties and similarities among brochs based on their locations. For further analysis, the same methodology could be used to understand the architectural features of brochs. Whether the brochs have a standard feature which all the brochs have? Or all the architectural features in brochs have shown no principles or orders to follow, as being generally variable in broch design? Are there brochs that have the regional similarity in terms of some typical characters?
4.2 Architectural features

The reading of architecture features is classified into two parts as spatial characters and building elements. The design of architectural features would be seen as a response to site conditions, which explore the possible relationships between a type of condition and a feature in architecture.

4.2.1 Spatial characters

Dimensions of brochs.

Generally, the dimensions of brochs are essential parameters, as they are much related to the building materials and the space for people living inside. The height and outer walls are visible and easily measurable, while the inner wall circle decides how ample the space was inside. As most brochs are ruins in Scotland, the dimensions of brochs could be analysed based on basic parameters such as the diameters in plans. Since the thickness ranges from 3 to 5.5m, the thickness differences would be firmly related to the whole broch diameter. The ratio of the wall thickness and diameters is more important. Thus, this study would mainly analyse the inner and outer wall diameters, where the thickness issue is involved.

Figure 4.30 Only five brochs survived with a certain height of more than six meters.

Height

They are only five brochs survived with a certain height of more than six meters (Figure 4.30), which are Dun Telve, Dun Troddan, Dun Carloway and Dun Dornaigil, and the complete broch, Mousa. Their heights are 10.2m, 7m, 9.2m, 7m, and 12.2m, respectively. Mousa is the tallest due to its Completeness, but it has been proved to be heavily modified. Since the limited quantity and quality of the broch heights have been the present situation, the height of standard brochs could be hard to conjecture.

Diameters
Often brochs have two walls, the outer wall and the inner wall, which are easily measurable on sites, especially those built on even ground. As this study intends to use the site plans from a combination of current scanning data and old archaeological surveys, an initial question would be asked here: Are they precise to lead to meaningful analysis?

Apart from other unknown factors like measure errors or drawing mistakes, there are mainly two factors that may make the data inaccurate or even wrong:

1) As the outer wall is leaning compared to the almost vertical inner wall in the building profile, different levels of plans taken may be different.

2) Since some brochs were built on the sloping ground, the surveyed plans might be difficult to draw and decide which horizontal section to take for the plan.

As for the 1st point, the diagram of Figure 4.31 has taken Dun Telve to test the measurement accuracy. The section derived from DP 223163 Collection (Society of Antiquaries of Scotland) was drawn at the diameter (approximately North-South) of the broch circle. As the inner wall almost stands still and straight, the major measurement problem should be on the outer wall, which leans towards the inner wall. The tangent values of angles have been highlighted in the picture as 0.32 and 0.30. It means a plan drawn at a 0.5 m lower level would add 0.3 – 0.32 meters to the diameter measurement. Besides, for the brochs built on the slope, the outer wall has not shown an apparent leaning angle, like Caisteal Grugaig in Figure 4.32.

Figure 4.31 The section of Dun Telve (approximately North-South).
As for the 2nd point, the study has taken the section (AOC Archaeology Group, 2010) of Caisteal Grugaig (Figure 4.32), built on the steepest slope to test the accuracy of measurements. This site has walls that survived at least 1.5m, and the tallest part would be 5.79 meters high if measured in its inner side. However, the diameter measurement at the higher level of the slope should be within the tolerance of 0.52 m, which is just an error range of 3%. For most brochs built on a slope that is comparatively gentler than that of Caisteal Grugaig, the possible errors could be in a smaller range.

Generally, as the study intends to use the round diameters and focus on the overall data, the measurements extracted from surveyed plans are still valid.

This analysis below has taken numbers directly from the round broch site. The oval or even irregular shaped broch is replaced with the most similar circle when measured in this study. The diameters of the outer wall vary from different cases in Figure 4.33 (Northern part) and Figure 4.34 (Southern part). The classification is rounded to the nearest whole numbers.
### Shetland
- Mousie
- Callevick
- Clewiston
- Lennickwick
- West Burr Firth
- Old Stichness
- Jarrold
- Clumbe
- Sjutland
- Clickman
- Oldmo

### Orkney
- Nestler
- Hill Of Broomholm
- Ayn
- Burtian
- Howe
- Lamb Head
- Girt Buray
- Oldmo

### Caithness
- Norrwell
- Oxudale
- Nybster
- Hill Of Works
- Freswick
- Yarmos
- Hillhead
- Cogle
- Carrn O Elsag
- Keiss Head
- Keiss
- Kilmester
- Cooskirk
- Thrums

### Sutherland
- Castrew
- Ness
- Castle Linkies
- Dunbeath
- Keiss
- Kilphedder
- East Kinnawaid
- Kintorewell
- Ferriach
- Cam Lieth
- Dun An Ragh Naith

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Figure 4.33 Outer wall diameter study (Northern part)
### Outer Hebrides

- Dun Manacleat
- Dun Cruicnaig
- Dun Jannett
- Dun Lusir
- Dun Sheil
- Dun Tuathal

### Skye and Lochalsh

- Caol na Brigida
- Dun Beag
- Dun Erdag
- Dun Lephsaige
- Dun Macduf

### Argyll

- Dun Asgean
- An Sean Dun
- Dun Ardcharrich
- Dun Ardcharich
- Dun Ardcharich
- Dun Ardcharich

### Rest Area

- Stornoway
- Inverness
- Inverlochy
- Inverness
- Inverness
- Inverness

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**Figure 4.34** Outer wall diameter study (Southern part)
For the Northern part (Figure 4.33), there are plans of 54 brochs from Shetland, Orkney, Caithness and Sutherland, which are relatively in the North. While in the Southern part (Figure 4.34), there are also 54 brochs located in those four areas, as Outer Hebrides, Skye&Lochalsh, Argyll and 'Rest Area', are relatively in the Southern part of Scotland. Since there are nearly few brochs in the vast area between Sutherland and Skye&Lochalsh, this following analysis would divide the Northern and Southern parts.

According to the diagram of the Northern part (Figure 4.33), the outer wall diameters of these brochs vary from 14m to 22m. the largest one, Thrumster in Caithness, is almost double the size of the smallest one, Norwall.

However, the dimension situations for brochs in the Southern part (Figure 4.34) are more diverse with a more extensive range. The smallest broch found in the chart, Dun Bharabhat, has a relatively oval shape. The outer wall ellipse has a long axis of about 11m and a short axis of about 9.6m. Either of them is much shorter than an average outer wall diameter. In contrast, the biggest broch, Edin's Hall, is roughly round-shaped with an outer wall diameter of around 28.2m, almost as three times big as Dun Bharabhat.

Comparing the measurements, the biggest broch and smallest broch are both found in the Southern part, which has a more extensive range than the Northern part. Also, the brochs in the Northern part seems more likely to be close to a standard number as size while the southern brochs are much various. Geographically, comparing the islands area, both Outer Hebrides and Argyll consist of many small islands distributed in a large span in latitude. However, Orkney and Shetland have isles that are much closer to each other, which might lead to the result that brochs are similar in size as their distributions are geographically more concentrated.
From a general view regarding the number of brochs that share the same outer wall diameter, the diagram (Figure 4.35) has shown that it roughly follows a normal distribution, including the curves for both the Northern and Southern parts. Moreover, the Overall curve reflects both the Northern and Southern characters. The Southern part curve has this symmetric peak at 17m. However, the Southern part curve has a low figure of 11 at 17m but has two peak numbers at 16m and 18m, forming an approximately symmetric axis.

The curve in Figure 4.35 could be a theoretical description of how the broch idea was spread in Scotland in the Iron Age. The centre of the curve is both the symmetric axis and the peak of values, which stands for the standard model taken as buildings references for most sites. Nevertheless, the standard model may not be an accurate number due to the limitations of the researches. It could be the middle part of the curve to allow the standard deviations, which could be caused by the differences of builders, locations, construction materials and even the changes of the model during the spreading process. Also, the errors in construction are an important reason for some brochs being different from the standard model. For example, the two ends of the curve would be more special cases rather than close to standard, as Dun Bharabhat with the smallest value and Edin’s Hall with the largest values in outer wall dimensions. Dun Bharabhat was argued to be a broch tower (Barber, 2017, p.80), which was situated on a small islet in a loch in Outer Hebrides. Edin’s Hall, located in the Scottish Borders, was suggested by Mackie (2002) as a late, outsize, crude copy of the broch tradition, which might make the monument closer to a substantial Iron Age roundhouse whose extraordinary 28m diameter would be more common. Both cases have uncommon locations, which are also far away from the area with a high density of brochs.
Therefore, the Bell Curve of brochs’ outer wall diameters indicates that the majority of brochs stand in the middle of the curve, and the standard broch would have an outer wall diameter ranging from 16m to 19m. Therefore, the sites with peak values in Figure 4.35 would be closer to the ‘standard broch’, which includes seven groups of locations in the map except for the ‘Rest Area’. It means the brochs in ‘Rest Area’ would be least have standard brochs as they are far from the center of broch distribution. Also, the Northern part curve matches more with the curve overall than the Southern part curve.

The understanding of the inner wall diameter could be obtained through the same analysis method. Figure 4.36 has displayed the Northern part, and Figure 4.37 has analyzed the Southern part. The measurements are taken on the most approximate circle of inner walls. Similarly, the Southern part (6 – 17m) range is wider than that of the Northern part (6 -15m). Also, the ranges of the majority are different. Most brochs in the Northern part have an inner wall diameter of 6 - 10m, while most brochs in the Southern part have an inner wall diameter of 8 – 13m.
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Figure 4.36 Inner wall diameter study (Northern part)
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**Figure 4.37 Inner wall diameter study (Southern part)**

112
The diagram of inner wall diameters (Figure 4.38) shows a curve for the overall values with a peak at 9m. Unlike the outer wall diagram where three curves (Overall, Northern part, Southern part) shared the same axis at 17m, the center/peak for the Northern part is roughly around 9m while the Southern part shows a center value around 10m. Comparing Figure 4.35 with Figure 4.38, the author found that the curve shapes for the Southern part and overall roughly match. Similarly, the standard values for inner wall diameters could be extracted as 8m – 11m.

Accordingly, the ‘Standard zone’ of broch diameters were established as 8m-11m for inner walls and 16m - 19m for outer walls. Apart from those in ‘standard Zone’, there are also sites that are non-standard brochs, whose outer and inner parameters do not fit the range and semi-standard brochs which had only one parameter regarded as standard. Then, through a percentage study of non-standard, semi-standard, and standard dimensions (Figure 4.39), better locations to find standard-dimensional brochs could be suggested.

Orkney has the highest percentage at 77% for standard, followed by the high level, which includes Skye&Lochalsh, Outer Hebrides, Shetland, Sutherland, and Caithness (percentage decreasing). Argyll (47%) has a low percentage while the
‘Rest Area’ (20%) has the least standard brochs. The semi-standard percentage is comparatively lower than the percentages of non-standard, except for the places Sutherland and Skye&Lochalsh. The main reason may be that the wall thickness ranges from 3 to 5.5m, a comparatively smaller range than diameters. Therefore, a non-standard inner wall diameter would more likely go with a non-standard outer wall diameter.

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<tr>
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<th>Non-standard</th>
<th>Semi-standard</th>
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<tr>
<td>Shetland</td>
<td>20.00%</td>
<td>10.00%</td>
<td>70.00%</td>
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<td>Orkney</td>
<td>15.38%</td>
<td>7.69%</td>
<td>76.92%</td>
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<td>Caithness</td>
<td>33.33%</td>
<td>5.56%</td>
<td>61.11%</td>
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<tr>
<td>Sutherland</td>
<td>7.69%</td>
<td>23.08%</td>
<td>69.23%</td>
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<tr>
<td>Outer Hebrides</td>
<td>20.00%</td>
<td>10.00%</td>
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<td>Sky and Lochalsh</td>
<td>11.76%</td>
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<td>Argyll</td>
<td>29.41%</td>
<td>23.53%</td>
<td>47.06%</td>
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<tr>
<td>Rest Area</td>
<td>40.00%</td>
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![Figure 4.39 The variation of dimensions regarding standard diameter.](image)

However, if Caithness and Sutherland are combined into one cluster as they are pretty near each other, the non-standard, semi-standard, and standard percentages would be 22.58%, 12.90% and 64.52%, respectively. Then only Argyll and ‘Rest Area’ become the places where brochs are less likely to be standard.

Hypothetically, the brochs built later could be influenced by the near one which was built earlier. The earlier one could work as a template. So, there might be some brochs which are near and similarly shaped of a similar building scale. In Figure 4.40, each site is attached with a label O/I, which means outer wall diameter(m) / inner wall diameter(m). The red numbers are the ones within the ‘Standard Zone’ of broch dimensions.

Generally, the map could be a piece of evidence that some brochs are more dimensional similar to the near ones, especially in those high-density areas. Also, the brochs in the range of ‘Standard Zone’ are more gathered, and those which are not included in ‘Standard Zone’ are more likely to be somewhere far from the broch gathered places or isolated isles.
Figure 4.40 The map of brochs with dimensions highlighted
The high concentration of broch locations, as shown in Figure 4.41, could be observed as the South of Shetland, the central area of Orkney, the Eastern side of Caithness, the Central area of Sutherland, the Western coasts of Outer Hebrides, the Western coasts of Skye and Lochalsh, the North of Argyll and none of ‘Rest Area’. Western coasts of mainland Scotland is obvious where the builders may travel along the seaside.
**Percentage-wall-base PWB**

There is a value commonly used by archaeologists to classify brochs, the percentage-wall-base value (PWB), the ratio of the overall outer diameter (ED) taken up by the wall-base, first defined by MacKie (1974). Fojut (1981) believed that there would be a specific range of diameters that keep the broch structurally stable under the same conditions of wall thickness. He suggested that these parameters would bear a direct relationship to stability.

\[
PWB = \frac{(ED - ID)}{ED} \times 100\%
\]

There are mainly two requirements when PWB could be calculated.

1) Concentric.
2) Round rather than an ellipse.

PWB demonstrates a critical point in the understanding of brochs as spaces as it shows the relationships between a certain amount of solid part and how much space the solid creates. There are overall 82 brochs in this research that can have PWB calculated, and they are sorted accordingly in the diagram in Figure 4.42. In some cases, the wall circle with a missing part of an additional part, cannot fit the perfect circle. If most of the wall (above 3/4) matches, the site can still be selected in this study.
Figure 4.42 The diagram of PWB analysis (Part 1)
Figure 4.42 The diagram of PWB analysis (Part 2)
The PWB curve of broch plans demonstrates the distribution of the 82 brochs on different percentages (Figure 4.42 and Figure 4.43). The curve has missing points rather than staying constant. The study intends to classify the PWB with two boundary lines set around the missing points: the blank between Nybster and Backies; the blank between Dun Borve and Dun Hallin. The High boundary line is set at the range PWB 57%-60% because there are no broch plans in this range, and there are only five brochs higher than 60%. The low boundary line is set at PWB 37% because there are only six brochs under this value, and there is a dramatic drop in the number of brochs from 4(38%) to 1(37%). Dun Aisgain, a significant but thin ring wall, has the lowest figure(32%). Therefore, the brochs could be classified into three clusters.

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<th>PWB</th>
<th>Shetland</th>
<th>Orkney</th>
<th>Caithness</th>
<th>Sutherland</th>
<th>Outer Hebrides</th>
<th>Skye&amp;Lochalsh</th>
<th>Argyll</th>
<th>Rest Area</th>
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Figure 4.43 The detailed table of PWB data
Cluster A (PWB ranging 60%- 62%)
Cluster B (PWB ranging 39%-57%)
Cluster C (PWB ranging 32%-37%)

According to the normal distribution shown in Figure 4.42, the middle part should be possibly the standard PWB numbers for brochs, which means cluster B should be more likely to be standard. Also, the diagram has shown a clear regional distribution of PWB that the Northern part (Shetland, Orkney, Caithness, Sutherland) has higher PWB values while the Southern part (Outer Hebrides, Skye&Lochalsh, Argyll and Rest Area) have a lower value.

Cluster A is these five brochs: Mousa in Shetland, Howe in Orkney, Ness and Nybster in Caithness, and Cairn Liath in Sutherland (Figure 4.44). The highest PWB belongs to Mousa, which leads to the most substantial structure for survival.

Mousa in Shetland, as mentioned previously, is not a standard broch due to the heavy modifications. Howe in Orkney was found no clear evidence as a broch. The site was suggested more likely as a roundhouse that copied the broch idea but failed to build or did not wish to build due to its being partly made of clay which was not suitable for high towers (MacKie, 2002). The original interior wall should have been considerably larger than at present in Ness because the broch has been heavily eroded, leading to a possibly high PWB. Carn Liath was suggested to be consolidated with extra walls attached to its original wall and also broch Nybster could have supported any type of buildings (like Howe) due to the lack of evidence.

Therefore, the five brochs of cluster A are monuments heavily modified, either eroded or consolidated, rather than the original broch, where the original dimensions are missing.
For Cluster C, there are six broch plans shown in Figure 4.45. All these brochs shown in the picture above do not survive in a relatively good height as the walls are too thin for the ample inner space. The low PWB may be the reason for the structures being unsuitable to be built taller.

Dun Hallin is a well-preserved broch (height as 3.8m) with evident circularity (MacKie, 2002). Keiss originated as a 1st phase broch (1st centuries BC and AD) and was subsequently modified and re-used about the 2nd century AD (Heald & Jackson, 2000). Oxtro is a probable solid-based broch in Harray with exceptionally thin walls and standing on flat ground near a loch (MacKie, 2002). Dun Sleadale is a big broch (outer wall diameter as 17.7m) with a fine scarcement found while the wall thickness is just 3.1m (MacKie, 2007). Dun A’ Chon Duibh was built of large blocks that have made 3.25m thick walls and enclosed an area some 13m in diameter (RCAHMS, 1988), making it more likely to be a dun than a broch. Also, Dun Aisgain had a wall thickness average of about 2.86m (Mackie, 2007), which cannot support a tall wall, but it is a broch site due to its level 2 gallery and clear scarcement. This broch may have been reconstructed in later times, which had changed the PWB.

Generally, most of Cluster C is still proven brochs. Nevertheless, the point around the broch minimum PWB found in this research theoretically cannot support a tall tower. Most of them have a wall thickness below 3.2m, while the outer wall diameter is more than 17m. Considering the 1m-wide gallery built and the average 1.1m-wide inner/outer wall thickness, it would fail to make a solid diameter-17m broch. Further research could be on whether there is the lowest PWB for firmly built brochs, with a 10m height. The author believes the low PWB may be the pre-broch in the Iron Age site failed in construction as it could not get taller due to the weak structure, where the scarcement and stairs had been finished before getting abandoned.
Unlike the normal distribution, the PWB bar chart shows two peaks at around the PWB 53% and 41% (Figure 4.46). The high PWB peak pointed to the brochs from the North, mainly Caithness and Orkney, while the low PWB peak pointed to the brochs from the West, mainly the Skye&Lochalsh area.

**Dimensional similarity clusters**

Zooming to each area on Figure 4.40 offers some further and detailed insights.
Shetland
The South point of the island is dense with 5 brochs which are divided into two groups due to their similar dimensions:
Levenwick, Clevigarth (O16/I9)
Clumlie, Old Scatness and Jarlshof (O18-19/I9-10)

Orkney
There are 3 groups of similar dimensions:
Gurness and Midhowe (O18/I10)
Lingro and Ayre (O17/I9)
Also, Borwick, Netlater and Hillock of Burroughston (O16/I9-10) (similar latitude).

Caithness
There are similar dimensions appearing both in ‘Standard Zone’ and non-standard ranges:
Hill Head and Cairn of Elsay (O18/I9)
Freswick and Hill of works (O16/I9)
Cogle and Kilminster (O18/I9-10)
Ness and Nybster (O15/I6)
Norwall and Bail A’ Chairn (O14/7)

Sutherland
These brochs have the characteristic that the Northern and Southern ones are bigger than those at the center. There are groups of dimension similarity among adjacent brochs as well:
Kintradwell and Carn Liath (O19-20/I9)
Allt Breac, Carrol and Backies (O16/I8-10)
Sallachadh and East Kinnauld (O18-19/I9-10)

Outer Hebrides
All the brochs are built in the coastal area, on the Western or Eastern side, and are represented by two groups:
Dun An Sticr and Dun Torcuill (O18/I11)
Dun An Duna and Dun Cromore (O14-16/I9)

Skye&Lochalsh
There are five couples of brochs that have dimensional similarity. four of them are near the Western coasts of Skye and the other one group is near the Western Coast of Lochalsh. They are listed as below.
Dun Borrafiach and Dun Hallin (O17/I9-11)
Dun Fiadhairt and Dun Colbost (O16/I9-10)
Dun Osdale and Dun Beag (O18-19/I11)
Dun Ard An T-sabhail and Dun Sleadale (O17-18/I11-12)
Dun Telve and Dun Troddan (O18/I9-10)
Argyll
There is only one group of brochs which are similarly dimensional and located on the same island, Lismore: Tirefour Castle and Loch Fiart (O21-22/I13)

Rest Area
There are no brochs to group according to dimensional similarity.

Above all, this discussion proves that the later-built brochs sites could take references from the nearest earlier-built sites, which is why they appear to be similar. However, the similarities could not be just limited in dimensions. Apart from the scale of buildings, other unique characteristics may also show similarities. Therefore, the similar-broch clusters mentioned above are studied with the broch plans.

Figure 4.47 The similar-broch clusters (O indicates outer diameter and I is internal)
The brochs framed in clusters in Figure 4.47 are organized with similarity in the entrance orientation or the general shapes, except for Clumlie, Old Scatness, and Jarsholf due to their surviving conditions. Cluster Hill of Works & Freswick has the highest similarity, even including one corbelled cell's location and size. Another case would be Dun Telve & Dun Troddan, which have similar orientations of both entrances and stair access cells.

The orientation of entrances for brochs is a critical spatial characteristic as the entrance is the only opening on the outer wall. The clusters in orange frames demonstrate that their builders made similar decisions on this element. For example, the entrances of cluster Cogle & Kilminster were built towards West while Dun Osdale & Dun Beag and Dun Sleadale & Dun Ard An T-sabhail have entrances towards East.

The degree of circularity is vital to evaluate similarity in shape. The clusters with blue frames in Figure 4.47 have similar shapes. Caithness, followed by Orkney and Sutherland, has the highest circularity clusters as the brochs’ circles are similar. However, there are brochs with a deficient level of circularity, like cases in Skye&Lochalsh, Argyll, and Outer Hebrides, where the outlines of outer walls are still similar. For example, Dun Torcuill and Dun An Sticir are oval-shaped but share the same major axis orientation, which also appeared in the cluster Dun Sleadale&Dun Ard An T-sabhail and Midhowe & Gurness.
Since nearly half of the clusters have not shown any similarity on orientations of entrances, it indicates that the builders may not have much attention to this building feature. As a circle is centroymmetric, the template of a broch, if it existed, could apply to other places with rotation of the circle, which would not change the inner relationships among the building elements inside. Inspired by the cluster Loch Fiart & Tirefour Castle, whose shapes would look more similar if one of their plans could be rotated, another comparative study could focus on the similarity with plan rotation. There are four clusters involved in this comparative study (Figure 4.48). After rotation, the plans are almost the same to the broch at right side, which is a nearby broch with the same dimensions.

The author found that the key of the designs in the Iron Age broch is how to design the relationships with the inner building elements, which means circularity and how the cells, stairs and entrances are linked to the broch center. The Iron Age designers might have imitated, repeated or improved the solutions of previous generations while constructing, which led to the results above. The typological study could dig deeper into the designs at a macro level (general features) and a micro level (a particular region). Therefore, the following sections would analyse these features starting with the circularity study.
Plan circularity

The concentric circles that brochs are widely believed to demonstrate through their double walls could be defined by two parameters, the radii of the inner and outer circles. However, observations show that the inner circle is rounder than the outer one. It would be easily understood that the inner circle is more controllable during construction set out, as the outer wall radius is hard to be measured or viewed directly when the building is growing taller. Also, conservation state and clarity of the debris outside may play a role as well in defining the exact footprint. In this way, the brochs’ circularity should be more reasonably defined around the radius of the inner circle and the thickness of the walls as the diagram below.

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**Figure 4.49** The examples of concentric and non-concentric Brochs
The examples (Figure 4.49) above demonstrate two typical ways that deviate from the standard circular broch. Broch Stair Haven has a roughly round outer wall but an oval inner one, not concentric circles. Broch Dun Mor Vaul has two ellipses as walls while they are concentric.

Through simulating the construction method of using two radii for the inner wall and outer wall, the radius is hard to measure and control when the walls get taller, as the external wall should lean towards the center level by level while the inner wall should stand vertical. Any building errors would lead to walls in two non-concentric circles if the outer wall circle did not ‘shrink’ uniformly as it was built taller. However, if the builders were building the broch by controlling the thickness of the broch construction circle (the distance between inner wall-face and outer wall-face), which is more feasible, the broch could be round or oval, but concentricity of the walls can be better achieved.

Concentric is an important factor of building a standard broch, but are all the brochs concentric? Here is a further study on concentricity. Among the 108 broch plans, the study selected the 83 brochs whose wall circles are seen as round and concentric, while the other 25 broch plans cannot have PWB due to the lack of either reason above.
From a general perspective, the majority of the brochs, as seen in Figure 4.50, are not round nor concentric are located in Outer Hebrides, Skye & Lochalsh and Argyll, which are all the Western part of Scotland. The diagram may explain the result of geographic isolation that gives to the design and construction of brochs a very different dynamic. Most areas have brochs with high circularity except Outer Hebrides (60% no circularity), Skye & Lochalsh (35% no circularity) and Argyll (53% no circularity). Argyll and Outer Hebrides have the least circularity in brochs which may be a local trend or style due to the isles’ geography.

As the dimensions of brochs have been studied in previous sections, the following diagrams have used scaled broch plans to fit the same circle pattern to make the comparisons of other architectural features more apparent.
The 26 brochs displayed in Figure 4.51 are those that cannot have a PWB number. Most of them have shown an ellipse shape with a clear semimajor axis, where the entrance was built one end of the axis. The shapes of walls could be used for a basic-level classification for deeper study, which is divided into three categories of broch plans in the diagram: the concentric brochs, non-concentric brochs and incomplete brochs. These three categories are also analysed according to their regions.

In Figure 4.51, all the brochs Skye & Lochalsh, Argyll and Rest Area was built on a slope. However, most brochs from Outer Hebrides appear in this diagram were built on even ground. From a general view, the less circularity may be caused by the sloping ground conditions, which could make it hard to achieve round-shaped walls.
The majority of brochs without PWB (Figure 4.52) are concentric. Considering the numbers of round brochs, the ratio of concentric brochs are counted as 103 out of 108. Concentricity is the significant feature of brochs.

There are three noticeably incomplete brochs as Borwick and Lamb head in Orkney, Dun Ard An T-Sabhail in Skye and Lochalsh, and Leckie in the ‘Rest Area’ which cannot offer a clue of the circularity.

However, only two non-centric brochs, as An Dun in Argyll and Stair Haven, are in ‘Rest Area’. Each of them is worthy of a deeper study to understand why the shapes fail to be concentric. The location and ground level plan of An Dun is shown as below in Figure 4.53.
This site may be a dun as the outwork consists of a wall up to 3.9m wide, and there are no clear scarcement and cells found (Childe, 1932). The side, as being very ruinous, only have a few facing-stones remain in position. Therefore, And Dun could be other buildings with non-concentric circles of walls as it has. Besides, Due to the limited height of the site, a partial collapse would easily make the concentric sites look non-concentric.

As for Stair Haven in the ‘Rest Area’ (Figure 4.54), it has a high possibility of not being an original broch. As Yates (1983) and Mackie (2007) described, the two staircases at the Northside are unusual as one goes clockwise and another goes anti-clockwise. Due to the presently collapsed wall head, Tanja (2011) suggested that the anti-clockwise stair might be a secondary addition after a partial collapse. Also, the circularity is hugely affected by the partial collapse. So, the non-concentric circle at Stair Haven may be caused by modifications rather than the original.

Generally, the two exceptional cases where brochs are not concentric were affected by the collapses or uncertainty of brochs identification. Concentricity, as shown in the majority of brochs being not round, should be pretty crucial to the concept of ‘broch’ as an intentional will that presents the full awareness and understanding of round shapes.

If the circularity becomes the compulsory feature for brochs, the non-circularity, regarded as a failure in this aspect, should tell the obstacles that make the round shape challenging to achieve.
Figure 4.55 The plans of incomplete, concentric and non-concentric brochs
The 26 brochs which are not round can be re-ordered according to their shapes (Fig. 4.55). It can be seen that the oval brochs in the two main areas, as Outer Hebrides, Skye and Lochalsh, are ellipse-shaped with arrows highlighting the semimajor axis. The concentric category could be defined as two kinds of shapes as oval-like shape and polygon-like shape.

In the oval group, there are 9 out of 11 brochs (except for Dun Bharabhat and Dun An Sticir) where the broch entrance is built near one end of its semimajor axis. The circular plan could be rotated to reuse the designs so that the entrance would not ‘influence’ any inner architectural relationships. However, for an oval broch, the diagram above seems to indicate that the entrance should be specially positioned. Therefore, there is a high possibility that the entrance is used for locating the symmetry axis, defined by the entrance and the broch center. Also, as a vacated space of an average area of 1.2m x 3m, entrances would influence the stability. Thus, as ellipses would be more unstable than circles, the entrance positioned on the axis would make the structure relatively stronger.

The polygon-shaped group have six brochs out of 9 brochs where the entrance is roughly placed on the approximate symmetric axis of some triangle or rectangle-shaped walls. Therefore, the entrance was possibly considered by the builders for the stability of the structure.

This study above indicates that the brochs should be concentric when the builders originally built them. The construction process would hugely rely on the control of the thickness of the walls and the round-shaped base of the brochs. So, based on the characteristics studied, which the majority of cases would have, the circularity study tells that:

1. Concentricity and circularity are purposely controlled in brochs.
2. The broch entrance has a high possibility of being used as the symmetry axis.
Orientations

The only orientation of a circular broch viewed from onsite is the entrance. The entrance of the broch is defined as a closed passage with lintel built in the outer wall. From the inner view of the space, the orientations could affect the position of the staircase room and how it is linked to the broch center.

![Diagram showing orientations of broch entrances](image)

Figure 4.56 Orientation of broch entrances

Entrances are in various places in the brochs involved in this study (Figure 4.56). The majority of the entrance is not on the Northside (only four brochs among the 108 studied cases). As South means where the sunlight comes during most of the day, the entrance in the Southside could make more sense. However, the overall entrances diagram (right picture in Figure 4.56) shows that most entrances are towards the East or the West. Other Iron Age monuments were found with entrances mainly built towards the East, such as chambered cairns in Orkney.

This diversity of entrance could mean an absolute orientation preference is missing here. If all the 300 brochs’ entrance features were counted, the orientation of the broch entrance could cover any direction. Neither in clusters based on locations brochs share a dominant direction. It indicates the ancient builders did not respond to the four cardinal directions, which involve the sunlight and shadows in a year.

For the orientation of the stair-access cell, a similar diversity appears (Figure 4.57). For the Northern part of Scotland (Shetland, Orkney, Caithness and Sutherland), the similarity appears in orientations of the stair-access cell to center as North for Shetland, South-west for Orkney, South for Caithness and South-west & North for Sutherland. The southern part of Scotland has various orientations without a major trend.
Staircases appear to be always clockwise, spiralling up from the ground floor. It is one of the mysterious questions about broch. The growth rings and curves on shells would have the commonalities of being clockwise or anticlockwise. The author would believe there is a high possibility that clockwise staircases were inspired by the shadows going clockwise from morning to dusk. The clockwise stars have to climb up above the entrance lintels to reach the first level. Therefore, the entrance and stair-access-cell may form a spatial relationship in design. As both the entrance and stair-access cell have lintels and orientations and could be linked to the same broch center, there could be a relationship between the two orientations. The relationships will be further discussed in section 4.3.3.

Based on the understanding of broch ‘response’ to site conditions, the various orientations may respond to some factors which are also various—for example, the links between entrance and slope or the relationships between the entrances and stairs.

The map showing the orientations of brochs is displayed in Figure 4.58. Each arrow starts with the broch center and points to the entrance position. Different colors of the arrows mean the different relationships to the nearest waters. The reading of the map tells that there is no particular regional trend and the relationships to nearest waters are weak.

Figure 4.57 Orientations of the stair-access-cell
Figure 4.58 The orientations of entrances in 108 brochs shown with a map.
However, the orientation map could be compared with the prevailing wind of Scotland, taking Figure 4.59 as an example, where the red arrows representing the major orientations of broch entrances in each area have various directions. Scotland’s prevailing wind is from the southwest, as shown with the blue arrow (Met Office, 2011). The solid facade of brochs which has only one entrance, may have high humidity inside. However, most entrances that bring fresh air were not positioned facing the prevailing wind. Thus, the entrance may not be used for ventilation in brochs.
Cells/galleries

The cells and galleries are found on the ground level of most brochs. Some brochs also have second-level galleries due to the surviving level. The cells have applied corbelling mason skill, while the ceiling of galleries is mostly long slabs of stones connecting the walls on the two sides.

![Figure 4.60 Scanning of corbelled cell in broch Clachtoll (AOC Archaeology Group, 2017)](image)

Generally, there are two kinds of cells, the corbelled cells and guard cells. Both of them have applied corbelled stones. From the Figure 4.60 above, the positions of two kinds of cells appear to be different or not quite related in one broch. The opening of the guard cell is to the entrance passage while that of the corbelled cell is to the inner wall. Thus, the study would analyze them separately. The corbelled cells are usually the stair-access cells or a cell nearby, which could be linked with the ground-level gallery, if existing, to study positions in plans. In contrast, the guard cell should be more related to the broch entrance, possibly for guarding purpose. Corbelled cell is commonly found on ground floor, which creates a small room. The corbelled stones need building skills, but the method is a smart way which didn’t need a huge slab to for the roof. Taking a corbelled cell in broch Clachtoll as an example, if a slab longer than 3m could be used for completing the ceiling of cells, the cell inner space would more likely to be a void box, rather than the present space with curved section.
Figure 4.61 The diagram of the middle circle/curve between the inner wall circle and outer wall circle. (broch plans are scaled for display)
There would be a fundamental question regarding the ground level plan: Are they built in the middle of the wall circles. Figure 4.61 demonstrates the plans of 108 brochs with highlighted middle circle/curve of the walls and Figure 4.62 offers the analysis of the cell positions.

According to Figure 4.61 and Figure 4.62, most brochs have corbelled cells or guard cells. Notably, most of the broch cells and galleries were built near or on the middle circle between the inner wall and outer wall. All the oval-shaped or irregular-shaped brochs displayed in Figure 4.61 have set the cells in the middle of the inner and outer walls. Those brochs have a deficiency in structural behaviour; thus, cells set in the middle would make the broch possible to be taller.

The cavity of any cells would be better positioned in the middle for a more solid structure. The cells set near the inner or outer wall were possibly caused by mistakes in the construction process or limited by ground conditions, like a steep slope.

Guard cell is positioned in the entrance passage on the ground floor, which is less common than the corbelled cell observed in brochs. Guard cell could be built on the left side or right side in entrance passageways beside the entrance. Some brochs have guard cells on both sides. Figure 4.63 shows the plans of the broch with guard cells, in which the plans are scaled to make the diagram more focused on the inner relationships between cells and other building elements.

<table>
<thead>
<tr>
<th></th>
<th>Near inner wall</th>
<th>Middle</th>
<th>Near outer wall</th>
<th>Broch with cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shetland</td>
<td>0</td>
<td>8</td>
<td>2</td>
<td>100.00%</td>
</tr>
<tr>
<td>Orkney</td>
<td>3</td>
<td>10</td>
<td>0</td>
<td>100.00%</td>
</tr>
<tr>
<td>Caithness</td>
<td>2</td>
<td>14</td>
<td>1</td>
<td>94.44%</td>
</tr>
<tr>
<td>Sutherland</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>92.31%</td>
</tr>
<tr>
<td>Outer Hebrides</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>90.00%</td>
</tr>
<tr>
<td>Sky&amp;Lochalsh</td>
<td>3</td>
<td>12</td>
<td>0</td>
<td>88.24%</td>
</tr>
<tr>
<td>Argyll</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>76.47%</td>
</tr>
<tr>
<td>Rest Area</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>70.00%</td>
</tr>
</tbody>
</table>

Figure 4.62 The table of cell position in brochs.
There are 33 brochs out of 108 sites that have been found with guard cells (Figure 4.63). However, according to their ratios of brochs with guard cells, the middle of the geographic distribution has the most sites, Sutherland. Furthermore, the ratios decrease as the counted area moves towards the North and South areas. The numbers cannot tell which side is more preferred except Sutherland, where the majority of sites have right guard cell, and there is no broch surveyed and found with only left side guard cell. The ‘Rest area’ have none broch found with guard cells.

Archaeologists suggested the guard cells in the broch for the defensive purpose. However, there is also doubt how the Iron Age people defended it as some guard cells are too low. For example, the guard cell found in Gurness is only half a human’s height.
Guard cell could be a stylish thing that should be regional as the locations are different. The islands and isles are relatively safer for fewer inner land, indicating fewer populations and wild animals. It could explain why Shetland and Argyll have low numbers in guard cell ratios.

<table>
<thead>
<tr>
<th>Region</th>
<th>Only left guard cell</th>
<th>Only right guard cell</th>
<th>Guard cell on both sides</th>
<th>The number of brochs with guard cells/over all broch sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shetland</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>10.00%</td>
</tr>
<tr>
<td>Orkney</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>38.46%</td>
</tr>
<tr>
<td>Caithness</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>38.89%</td>
</tr>
<tr>
<td>Sutherland</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>69.23%</td>
</tr>
<tr>
<td>Outer Hebrides</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>30.00%</td>
</tr>
<tr>
<td>Sky and Lochalsh</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>35.29%</td>
</tr>
<tr>
<td>Argyll</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>11.76%</td>
</tr>
<tr>
<td>Rest Area</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Figure 4.64 The table of broch with guard cells.

Derived from Figure 4.64, the guard cell of broch appear most in Sutherland. There are four other places with a similar percentage: Orkney, Caithness, Outer Hebrides, and Skye&Lochalsh. As mentioned above, there are four pairs (Figure 4.48) located in Caithness and Sutherland, the group Caithness & Sutherland would have the highest ratios while the other three places, ranging from 30% to 39%, are comparatively near the Caithness & Sutherland. Also, the area with high ratios is more inland, while the low ratios appear more likely in isles, indicating the possible defensive function for animals inland. Also, another possibility would be that the idea of a guard cell was spread from Sutherland to the rest area.

After features reading, the study would move to some key building elements of brochs, which can be used for identification.
4.2.2 Building elements

Lintels

There are mainly two types of lintels (Figure 4.65). A horizontal stone slab on the top of two sides of the entrance passage or well-bonded wall returns is mostly used. Another type is a triangle stone.

The flat stone as lintel is usually an element formed in line with the available type of stone (relatively flat flagstones in Midhowe, for example, in Figure 4.65). The lintel stone should cover the entrance passage, so it is longer than average length of the slabs use to build walls.
The triangle lintel is commonly an equilateral one which is the most stable in shapes compared to other unequal ones. Also, this is a perfect shape that agrees with the circles used in generating broch plans. There are six brochs (Figure 4.66) with triangle lintel found in four areas: Sutherland, Skye & Lochalsh, Shetland and Argyll. The triangle shaped lintel would need small and thin slabs to fit in the gaps between the lintel and walls. However, the equilateral shape would be easier for construction than irregular-triangle shaped stone. The lintels are very local features that could also be changed in an entrance re-configuration not to influence the debate.

<table>
<thead>
<tr>
<th>Color/Area:</th>
<th>Sutherland</th>
<th>Skye &amp; Lochalsh</th>
<th>Shetland</th>
<th>Argyll</th>
</tr>
</thead>
</table>

Dun A’ Choin Duibh, Dun Mor Vaul, Culswick, Dun Dornaigil, Caisteal Grugaig, Clachtoll

Figure 4.66 The triangle lintel in brochs
**Scarcement**

Broch could have two scarcements judging from the five tall brochs, where lower scarcement is around 1.2 meters above ground, and higher scarcement is near the wall head. A scarcement is defined as the stones that jut out from the inner wall, which probably supported a raised annular floor and perhaps also a low roof.

![Diagram of Broch](image)

**Figure 4.67 The section of Dun Troddan**

As the scarcement is constantly on the same plane, which might not be fully horizontal but stay parallel to the sloping ground in some cases, the idea of the inner floor is much possible. Without a scarcement, the tall double walls could only serve as the structure for staircases between them. Central inner space of average 80m² is available, and the low scarcement would make floor area at least double, while the high scarcement would make the roof possible.
Stacked voids

People still doubt ancient people's measurements, but the sizing of stones on the two sides of stacked voids seems to have an order. In the example of Dun Telve, it could be evident that stone slabs near the stacked voids were much thicker stones at each level. The slabs on the two sides seem to have an asymmetric look, with roughly the same number of stones on each level. In order to keep the connection stone as horizontal as possible, the easiest way should be to use the same amount of similar size stones on two sides.

It could be seen that there is a noticeable difference about stacked voids between built on the entrance and away. When built on the entrance, the stacked voids would have the numbers of the horizontal stones supporting the slabs of the stacked voids, decreasing progressively from the ground to the top (Figure 4.68). While the stacked voids built away from the entrance would have a constant number of blocks around four. Comparing the two kinds of stacked voids in Dun Telve indicates a tapering shape over the entrance because of the ample space underneath, making the structure unstable.

The voids are believed to have a function of ventilation for the inner space, which in the case of Dun Telve aligns well with the extensive galleries on two levels. Therefore, the recognition of this element cannot help the understanding of the collection. While reading the relationships between the building features and site conditions may help to explain.
Figure 4.68 The analysis of the inner wall of Dun Telve
4.3 The relationships among site conditions and architectural features

4.3.1 The relationships between circularity and ground conditions

A deep analysis into the sloping/even difference, the study of the relationships of broch circularity and broch geographical conditions are displayed in Figure 4.69. It would make sense that it is more difficult to build a broch with circularity on a sloping ground rather than even ground. However, the number of round brochs built on even ground (39%) almost equals those on the sloping ground (38%). This same distribution also appears in every cluster of locations in Scotland. If there was a cluster where no brochs were round, it might indicate that the idea of broch circularity was not confirmed; otherwise, what the study shows would much emphasize again that the circularity is compulsory for the broch image.

Among the minority of brochs which are not round, the sloping ground (17.5%) seems to have an effect on brochs’ circularity as the sites being not round and were built even ground only appear as 5.5%. So, the sloping ground is definitely an obstacle for the builders to make broch round. It would be hard to know to what extent would the sloping ground affect the circularity due to the lack of accurate data of each degree of slope. However, some typical cases might give a clue. Among concentric brochs which are not oval, there might be a reason which stops the builders from achieving circularity. As the diagrams displayed below (Figure 4.70), there are eight brochs in total which are not round and oval. Six of them are
located in Argyll. These shapes are similar to polygons like triangles and rectangles, which are determined by 3 or 4 points rather than center and radius. There are always parts of the external wall being linear rather than curved, which seems to be limited by the geographic conditions. Except for Dun Vulan in Outer Hebrides, all the brochs with polygon-shaped are built on sloping ground. Besides, they are all located in the Western part of Scotland.

Figure 4.70 The irregular shapes of brochs

For example, taking Druim An Duin as a case study, the wall face at the East and West are much straight, forming a rectangle instead of building a curved circle. From the diagram above (Figure 4.71), the contour line crossed the limitation line with a slight angle around 30 degrees, where the two sides of the straight wall surface could be explained by the contour lines going parallel in a similar direction. Therefore, the contour lines may affect the shape of the broch constructed where the partial area of the uneven slope could be the limitation or obstacles.

Figure 4.71 Broch example: Druim An Duin
The relationships between the broch shape and surrounding contours are displayed in Figure 4.72. The limitation line is the straight part of walls highlighted in the broch plan, where the circularity was missing.
Dun Vulcan was the only one broch in the diagram which was built at the coast. The contour lines are almost parallel to the coastline except for the parts where the broch was embedded. Therefore, the southern wall of broch was prominent linear seen as a response to the contour lines. Dun Borodale was built on the mountain ridge, which was a better place for construction than other steep parts of the mountain. Also, here the orientations of limitation lines were similar to the contours. The other seven brochs, all located at Argyll, were built on the top of small hills, where the ground was still sloping. A clear parallel relationship could be seen between the linear parts of walls and the nearest contour lines.

Generally, the brochs in this group were built on the ridge, top of hills or near the coast where less steep slope could be found, which demonstrate the negative attitudes towards sloping ground. The outcome of the broch group seems to have been shaped by the contour lines, which could be linear rather than curved to outline polygon-like shapes.

Entrance is not on the vertex of the polygon-like shape. As is mentioned above that the entrance is a closed passage space rather than solid walls, it would make it hard to measure the wall length if the entrance passage is at the corner of a rectangle-shaped broch. Also, it is the point between the inner wall and external wall where people can stand there and see the circularity of Central space. More likely, the entrance is a symmetry axis.
4.3.2 The relationships between ground conditions and entrances

Since brochs’ entrances have various directions (Figure 4.58 and Figure 4.56) and brochs are circular, ideally, even ground cannot demonstrate the preference of entrances’ orientations while the brochs built on slop could be focused on studying the possible relationships between entrance and topographical features.

An example of Culswick in Shetland is shown in Figure 4.73. The green arrows offer the direction from a high elevation to a low elevation of the slope. The broch entrance is highlighted with dotted blue lines. Then, the 60 out of 108 brochs are built on a slope are demonstrated in the diagram, Figure 4.74. The slope directions are judged from archaeological reports and photos.

![Figure 4.73 The slope at broch Culswick, Shetland. (Photo credit: Canmore database)](image)

The broch center-to-entrance line and slope direction have formed an angle. The degrees of the angles can be divided into three types: Low (maximum 60° to low point direction), Middle (almost perpendicular to the arrow) and High (maximum 60° to the high point in direction).
Figure 4.74 The slope directions of 60 brochs (broch plans are scaled for display)
According to Figure 4.75, except for Rest Area, the entrance set in the middle of the slope direction, which shows a perpendicular relationship, takes a dominant role. Entrance set on the high elevation side appeared only in Skye & Lochalsh and Rest Area. Regarding the entrance of Irregular-shape brochs which was supposed to be set near the axis for asymmetric structure, most cases have the entrance in the middle of the sloping ground level.

This study has not shown a trend of entrance positions, but some regional differences in design preferences are apparent. However, the perpendicular relationships have inspired further study. The study wishes to find out whether the same relationship appears with other building features.

### 4.3.3 The relationships between staircases and entrances

Since the clockwise staircase is a fixed feature in the broch, the variety of the entrance orientations might be the response to some elements of the building, which changes among the brochs. The staircase-access-cell at the inner wall face would work conceptually similar to the broch entrance as the critical point of two different atmospheres as relatively open space verse narrow corridors, as the diagram shows. Therefore, the angle between entrance-to-center and stair-access cell to-center (Figure 4.76) could be examined.
Figure 4.76 The angle between entrance-to-center and stair-access-cell-to-center in Dun Troddan (Photo Taken on Oct. 13th 2017)

Figure 4.77 The study of two interfaces in Torwood
However, this stair entrance is another element that has lintel and works similar to the main broch entrance as an interface of changes in the architectural atmosphere. The entrance could be understood as the transfer from outside open space to closed/narrow passage space, where the staircase-access-cell is also a transfer from inside open space to closed/narrow stairs/gallery space. Those lintels could be understood as an icon of change. Thus the link between those two similar interfaces, shown with a plan example of Torwood (Figure 4.77) and a section example of Caisteal Grugaig (Figure 4.78), could be meaningful to study.

![Figure 4.78 The study of two Interfaces in Caisteal Grugaig](image)

As shown in Figure 4.79, there are only two opening parts on the inner wall (apart from cells) which could lead to climbing up or going out sequences. The two interfaces are similarly built with lintels and functional as a notice of spatial changes. The study wishes to link them in the ground level plan. The diagrams below (Figure 4.80) show the typical angles between the entrance-to-centre and stair-access-cell-to-centre as 45°, 90° and 135°, where 45° represents 30 to 60°. Thus, the data of entrance and stairs in 108 brochs can be transformed to the diagram in Figure 4.81.
Figure 4.79 The analysis of the angle between stair-access cell to center and entrance to center.

Figure 4.80 Three typical angles in brochs
Figure 4.81 The diagram of angle relationships in brochs (part 1) (broch plans are scaled for display)
Figure 4.81 The diagram of angle relationships in brochs (part 2) (broch plans are scaled for display)
The research work led by Mike Pearson and Niall Sharples (1999) (Figure 3.8) attempted to show how differences between broch entrance orientations were linked to status distinctions between the occupants. However, he used limited cases for data. This table (Figure 4.82) has proved that the majority of stair-access-cell has preferred a position of the wall circle where the line centre-entrance would meet the line center-stair-access-cell at the right angle. It is similar to the relationships between the entrance position and the slope direction - being perpendicular.
Also, the shortest walking path could be imaginable based on the plans. In the hypothesis that the center of the broch was full of goods or occupied by a fireplace, the shortest walking path between the broch entrance and the stair access cell should be along the inner wall.

Taking Ousdale (Figure 4.83) as an example, the walking path of the first level stairs would be \( \frac{1}{4} \) of the inner wall circle. The stars built on the Northside can leave three-quarters of the circle for climbing up, making it safe to go over the entrance passage.

Figure 4.83 The diagram of stairs taking \( \frac{1}{4} \) circle : Ousdale
Typical case- Caisteal Grugaig

The well-known Caisteal Grugaig, as being a round broch built on the steepest slope could be interpreted using the findings from its site conditions and architectural features.

Caisteal Grugaig (Figure 4.84) is a typical case where circularity is achieved on the steep slope. The difference in level between the broch entrance and the 1st step of staircases is about 3.5 meters compared to the outer wall diameter as 16.3m, which makes a steep slope to walk on. The perfectly round plan of Casteal Grugaig shows some intelligence in design as to respond to the slope's contours. The entrance of this broch is placed parallelly to the near contour lines. Then, the walking path from the gated entrance to the stair-access-cell follows a curve. However, inside the broch, the general contour of the slope was seen as counterclockwise rotated for around 30 degrees. If a smooth curve could be drawn linking the broch entrance and staircases while following the path from the entrance, the curve would closely keep the perpendicular relationships to the contours at the center of the broch. It indicates the activity that people were climbing up slopes inside the broch where the streamlines would follow the normal vectors of slope contours, which has a similar perpendicularity relationship to other activities like people climbing upstairs and stepping through the entrance.
As the only entrance found, the void parts in the walls could be regarded as a corridor that involves two interfaces (the openings on the inner wall-face and outer wall-face) to separate different spaces while the walking streamline is perpendicular to each interface when they meet.

4.4 Conclusive remarks

Figure 4.85 The six pairs of brochs with similar design characters and locations except the orientations.

The study above (Figure 4.85) suggested a broch design scheme that most importantly has an inner relationship between stair-access cell and entrance. However, six pairs of brochs which have similar dimensions, locations and even plan if rotation could be made. There is a high possibility that one in each pair was reproduced, taking the other in the same pair for reference. Interestingly, they all demonstrate the 90-degree angle between entrance-to-center and stair-access-cell-to-center. This thesis name this broch model with the perpendicular angle relationships PBM (Perpendicular Broch Model).

It is almost a reciprocal causation here. The features of standard models are defined to be the ones that appear in most cases. Furthermore, from a general view, the brochs which have been high-possibly reproduced have those features of suggested standard models. The two events have a simultaneously possible causal effect upon each other. So, the brochs in Figure 4.85 are the standard brochs and could be seen as regional models.
Therefore, the scheme of building a broch is displayed as below (Figure 4.86). The major challenge is to build a broch with high circularity. Therefore, the same wall thickness and high concentricity of wall circles are mandatory in construction. Since the inner-relationship angle of 90° (entrance_center_stair-access-cell) would allow rotation of broch plans, when facing a sloping ground, the builder would use rotations of wall circle to position the broch for suitable orientations. Also, the contours of the sloping ground should be well used. Those responses are the conjectures based on a typological study of reading broch features of both the building and the surrounding conditions.

![Figure 4.86 The scheme of building a broch](image)

Since the criteria for the definition of a broch were set out (MacKie, 2002) as a circular plan, thick wall, large size, one of two scarcecents and possession of at least one of an upper gallery, chamber over the entrance, stacked voids in inner wall-face and an intra-mural stair, the typological study here suggested more detailed attributes of brochs in different regions, rather than checking the existence of each building element or feature, which could be called the regional broch models. Moreover, the regional characters of brochs can be used to find subtypes.

Then, the subtypes of brochs regarding regional variant characters are listed in Figure 4.87.
Finally, the typological studies here have brought a firmer identity to brochs’ features and fill our limited understanding due to their obscure 700-year date range. From general designs to building elements, from the PMB to the equilateral triangle lintels, the brochs has demonstrated the high technological culture of the builders, intending to make brochs stronger and taller.

A profound understanding of features can help the conservation of sites. The next chapter will find out how can typological studies bring new perspectives to established conservation for brochs.
5 The new perspectives of interpretive conservation

This chapter focuses on the second research question, ‘how can typological studies bring new perspectives to the established conservation for the broch ruins’. Figure 5.1 makes a case for a deeper analysis of the potentials to improve conservation. The research started with analysing present situations of brochs, as mostly being ruins, and discovered the need for interpretations. With the help of the subtypes and regional models found in Chapter 4, this chapter discusses the frameworks of interpretive conservation for broch conservation practice.

5.1 The present situations of brochs

At present, the conservation of brochs is mainly led by archaeology. Archaeology has the potential to provide ‘people without history’—that is, people poorly represented in the documentary record—with a history, this one written from the ground (King, 2012).
Their main methods are excavations. However, an excavation site is ‘inhabited’ by its excavators (and their actions) shaping and suggesting interpretations for the past following the material evidence they uncover. They also draw upon their own/personal embodied and cognitive experiences (Theou & Kopaka, 2019). Archaeologists have developed a body of highly specialized excavation and laboratory techniques to extract information from the monument ground, but they must also grapple with severe data limitations and epistemological problems peculiar to their field. Actually, they excavate sites to recover information about the past by simultaneously destroying the object of their study.

This higher degree of reading means that brochs conservation should work with archaeology. Extensive archaeological research is required, beyond watching briefs, for a profound understanding of the building. Architectural conservation, though, should inform future archaeological excavations. If identified with a date, what happened to brochs, damage, or later repairs has already become a historic event that needs to be considered in conservation.

Since most of the brochs are in ruins, their architecture has been disjointed or hidden in fragments on sites. What is unique about the character of broch as ruins nowadays for their architectural values and conservation methods?

**5.1.1 Characters of ruins**

Most brochs in Scotland are described as ruins in archaeological surveys, while some sites are famous for the different levels of building completeness. So what is the minimal definition of ruins? Furthermore, what is the minimal attributes of a broch ruin to be conserved? Gionata Rizzi (2007, p.82) defined ruins as ‘buildings that have been gnawed, mutilated and reduced to a state that bears no relation to their original purpose; buildings that have sometimes deteriorated to a point where their original form can hardly be recognised; buildings that only survive in the form of isolated fragments’. All brochs have lost their original functions, and their original form is too hard to recognize. Also, some of the brochs survive less than 2 meters in height, which is a small part of the original structure, becoming isolated fragments.

Following the definition, except for Mousa, all brochs are regarded as ruins. Ruins are usually preserved or maintained and visited by a growing number of people who appreciate their values and significance. However, how much value could be appreciated depends on many factors, which include their conditions.

Based on the surviving level, the brochs' conditions could be classified into five categories: Complete, Tall, Low&Round, Half Round, and Vague Ruins. The ‘Complete’ means the completeness of broch walls and features. The ‘Tall’ means roughly 10m in height. ‘Low Circle’ brochs are those with a lower height, at least above the 1st floor, which still has circularity and some essential elements like lintels. The ‘Half Circle’ includes the brochs that survived with only half of the wall circles but are similar to the category ‘Low Circle’. In contrast, ‘Vague Ruins’ include those sites with less than 1m in height and do not have recognizable forms of wall circles.
Figure 5.2 The photos of 108 brochs studied (part 1)
Figure 5.2 The photos of 108 brochs studied (part 2)
The conservation study used the data of Chapter 4, the surveyed 108 brochs and analysed the conservation outcome of different sites. The photos of brochs were demonstrated in Figure 5.2, and here (Figure 5.3) is a table showing the number of them in each category. The category Complete and Tall consists of only five brochs, which have been well-known and preserved. While among the rest sites which were less-known, fewer than 20 brochs have been preserved. The table (Figure 5.3) indicates that more than half of the cases (56 out of 108) are in Vague Ruins. Most of these sites can not be readable due to the basic feature of circularity being vague. Even after tidying up, these sites fail to support an excellent architectural experience, which may require intriguing spatial sequences in the building. Their values would mainly be the archaeological ones.

However, group Low Circle and Half Circle make nearly half of the total. Those sites have fundamental circularity and at least one of the spatial characters, like cells, ground floor galleries, or stairs. Comparatively, these sites have much potential to be readable, which could even demonstrate a similar quality of architectural information to the Tall and Complete categories. Thus, this study would focus on the potential conservation efforts is on the readability of the sites.

James and Zabel (1958, p.120) wrote that the beauty in architecture is 'participatory and relative', stating that the purest enjoyment was to be had among the ruins of great buildings. In other words, it is the building's greatness that makes the ruin valuable. However, it would be even better if the greatness of the monument could be visible, accessible, and readable, where the 'participatory' can happen. The readability would require the conditions of the ruins not to be architecturally too poor. Brochs are definitely great buildings, remarkably complex structures with peak building skills, in Iron Age in Scotland or Europe.

The ruin remains can be read in their figurative and physical consistency and framed in the historical moment that generated them (Picone, 2012). But the present understanding of the 'ruin' has to be set in the contemporaneity of a new era, updating it and relocating it in a context full of new meanings. Interventions can help with these transitions and bring unreadable prehistoric ruins to the readable heritage at the moment. Also, preserving the authenticity of the archaeological rest or the fragment of architecture means increasing its value, including its market value. (Ibid.)
5.1.2 Broch ruins as scheduled monuments

A scheduled monument in Scotland is a nationally important archaeological site or monument which is given legal protection by being placed on a list (or ‘schedule’) maintained by Historic Environment Scotland (HES) and is governed by the Ancient Monuments and Archaeological Areas Act 1979 (Scarre, 2015). Scheduling is the process of adding monuments to this list to give legal protection.

Ruins of buildings do have values. The archaeological values rely on the artifacts found on each site which are unpredictable, in which case the ruins share almost the same level of archaeological values before any excavations taken. However, the architectural values vary from place to place based on the surviving conditions. From a general view, the values of brochs have been examined before they are scheduled. Whether a broch is scheduled could be an initial criteria to study its present situation.

There have been many statements of significance for broch sites published by Historic Environment Scotland. The label ‘scheduled’ is an important part of brochs’ identity. Ruins with least surviving level, which is the missing of architecture, have almost none of architectural values, but they still have values to be excavated for archaeological data. Are those ruins scheduled? Are all the brochs scheduled? Is there a minimum acceptable fragmentation for brochs being scheduled?

At present, the legislation by Historic Environment Scotland (2019) protecting ancient monuments has brochs registered as scheduled monuments, which gives the maximum protection against unauthorised change. A type of permission called ‘scheduled monument consent’ is needed before any changes made or any work is carried out. Schedule monuments show their national importance through three headings: intrinsic, contextual and associative characteristics. Brochs are at high regard due to their intrinsic characteristics as their structural and architectural schemes are very significant for Scotland and Europe’s past history. Notably, the contextual and associative characteristics may require a reading of the collection, dividing groups.

Brochs, as monuments with complex architectural features and controversy in dating, require deeper study for their conservation compared to other, historic monuments where the origin of buildings were documented. The typological study has attempted to fill many of the gaps that the limited archaeology of the sites has not addressed, firming up their listing as scheduled monuments. That study can also contribute to the inclusion of the un-scheduled monuments that will be discussed next.

There is a total of 317 scheduled monument references of which one reference include at least one broch (HES, 2019, seen in Appendix for details). For example, reference SM90152 represents Dun Telve and Dun Troddan.
Also, there are some cases included in 108 brochs that were registered as Duns in 1997, like Dun Ardtreck. However, 17 sites (Figure 5.4) out of the 108 studied in Chapter 4 are un-scheduled, such as Cogle, Kilminster, Dun Vulan, East Kinnauld, Dun Bharabhat.

All of them are in the Vague Ruin group in the previous study. One reason they are not scheduled may be the long scheduling process for brochs which needs enough excavations and surveys. However, Dun Vulan and Dun Bharabhat have been studied extensively by archaeologists, in which case the understanding of the two brochs should be more profound than some scheduled brochs. Thus, the building surviving level may be a more critical factor to be considered.

With comparatively less survived architectural features, those ruins might find it hard to meet the requirements of national importance with only archaeological values. Moreover, some may not be noticed as too few features fail to create a meaningful monument and attract the public and professional conservation attention. The un-scheduled ruins have not been protected by any legislation, leading to a loss of archaeological data.
Therefore, besides the archaeological values of brochs, their architectural values are also important for better protection. However, the latter mainly depend on the surviving level and features.

Since a ruin conserved as a new ruin through repairs would not change its architectural values, the archaeology-led conservation for brochs, which is mostly consolidation at present, should start involving architectural perspectives to improve the architectural values.

Action taken on-site would mainly rely on the conservation planning and management following the regulations, and this study examines this in more detail in the next section.

5.1.3 Conservation planning of brochs

According to HES (2000), built heritage needs to be managed and maintained, and a conservation plan is a helpful tool to assist those with responsibility for the built heritage to consider the needs of their site or building. Conservation planning usually offers guidance both for an initial project and for reviews in future conservation processes based on systematic and regulatory logic. James Kerr (1996) defined the conservation plan as a common ground for debate, a method and a common language to help resolve differences and balance the old and the new.

Scheduled Monument Consents (SMC) given by HES, which is mandatory for broch conservation, does not mention the necessity of a whole conservation planning. Such planning is done when applying for funding projects organized by communities, like the National Lottery Grants from the Heritage Fund (www.heritagefund.org.uk).

Generally, conservation planning would benefit the brochs both as a record and guidance—the more detailed, the better outcome. The initial stage for broch conservation is to prepare the statements of significance, which would outline the history and development of the site and highlight the key features that make it unique. The statement of significance of brochs, taking Midhowe (HES, 2018) as a cases tells common values to be assessed for brochs are listed in Figure 5.5.
Assessment of values

Background
Evidential values
Historical values
Architectural and artistic values
Landscape and aesthetic values
Natural heritage values
Contemporary/use values

Figure 5.5 Common values assessed for brochs

After about two centuries of study, very few brochs have been confirmed in the way they were built and used, making them a mysterious monument for a long time. The revision of explanatory interpretations will continue as new evidence emerges and the old one is reviewed. Furthermore, the conservation planning would go through the following process to assess the site’s significance and how it should be managed to conserve it.

Generally, the structure of a conservation plan (Figure 5.6) is a questions-to-answers mode: the ‘action plan’ would meet the requirements of the conservation needs through assessment and analysis. The conservation plan should be pretty detailed, written for a broch with precise parameters of local conditions. However, the principles for most of the conservation planning for brochs are almost the same: consolidations and some basic site arrangements for tourist visiting, with more emphasis on the fragments or building elements repair. The conservation needs for brochs should address the lack of understanding regional features, and the ‘action plan’ should promote an architecture to deal with this problem.

For example, a programme could be set up to read the brochs through clusters. In Caithness, broch projects have been promoting their monuments with support from their community. However, the sites seem too separate, exhibiting images of them individually within a map just showing their locations. The similarity among different Caithness brochs was not demonstrated. Regional dimensions for Caithness are 17m for the outer-wall-diameter, and 9m for the inner-wall-diameter, and most of them are standard dimensions according to the study in Chapter 4. Also, Caithness has the most broch couples (5 couples studied in Chapter 4), which share similar plans like Hillhead and Cairn of Elsay, if the orientations are not considered. Besides, they all fit the PBM. This use for education is stronger than in other areas with fewer brochs and fewer PBM brochs. The assessment of values for brochs could be improved with this information, as there is something about their relationships among the unknown prehistoric sites.
CONSERVATION PLAN: DRAFT CONTENTS PAGE

**Introduction:**
- Address
- Brief description of the site
- Authorship
- Date of preparation
- Stakeholders
- Recipients
- List of those consulted

**Summary:**
- Main conclusions and recommendations

**The Site:**
- Name
- Address
- Location
- Grid reference
- Current ownership
- Any statutory or non-statutory designations

**Assessment of Significance:**
- Assessment and analysis of the historical and cultural significance of the site, noting any features of related interest
  - Resources audit, including:
    - a site survey;
    - a schedule of elements of interest, within the site and the immediate and wider setting;
    - a statement of the recorded history of the site and its contents;
    - details of construction, materials and decoration;
    - hard and soft landscaping;
    - information on previous interventions and repairs, and earlier and current uses;
    - identification of any gaps in the knowledge of the site.

Assessment and Analysis of Conservation Needs

Action Plan

Review Arrangements

Supplementary Information/Appendices

Figure 5.6 Conservation plan: Draft contents (HES, 2000)
5.2 The objects of broch conservation

Before making the conservation planning and management, the objects to be repaired or restored must be clear. As for brochs’, these could be classified into two types: style (architectural design) and fabric (surviving building materials).

Viollet-le-Duc (1854) defined the ‘style’ as ‘the manifestation of an idea based on a principle’. In architecture, a style would mean a structure with a design system. The style of brochs is a set of characteristics and features that make them historically and architecturally identifiable. This could be the basic features mentioned in the definition of a broch and may be further identified with regional features.

5.2.1 The style of brochs

Brochs are known as ‘Complex Atlantic Roundhouse’, but they are much simpler than other monuments like gothic churches and medieval castles, whose conservation would address materials, forms or structures, and even the decorations. As brochs appear as pure stone monuments, the original fabric is still clear, and reconstructions are possible if the structure safety is confirmed.

Brandi (1963) stated, ‘Ruin is all that documents human history but with a quite different aspect, almost unrecognizable compared to the aspect it previously had’. The transformation from complete monuments to ruins leads to their changes in values. Brochs ruins are often unrecognizable and unreadable, so their conservation should restore our understanding of the original design ideas rather than renew ruins into cleaner ruins. The variety of surviving broch features are the fragments of the style of brochs which can be read with their collection. Also, conservation of the style can provide more interpretations.

The conservation aiming at the design should be different from the present fabric-focused conservation. The design should have precise forms of architecture to be understood, which also help to interpret the original fabrics. Specialised scholars like archaeologists can understand the ruins, but a broad audience would need interpretation. Here is an example of the Archaeological Park of Bysiah and Salūt.

The collapse of the Bronze Age grave structures (Figure 5.7) were focused on in the restoration process. After stratigraphic excavation and documentation of the surviving structures, the tombs (Esposti & Bizzarri, 2021) were restored and, in some cases, reconstructed to make them entirely understandable to the broader public visiting the Park. Archaeological literature has supported the squared entrance, which was in ruins on site. The restoration regarded the entrance as an essential architectural element and planned to make it visible.
The results, the partial reconstruction of walls and a replica of a turret-shape tomb (Figure 5.8), would contribute to a significant understanding of ancient building techniques, logistics, and the style of the buildings. The replica can carry the critical features to demonstrate the architecture if the ruins cannot be restored to their complete forms. At the same time, those works contribute to the wider public’s enjoyment of the Archaeological Park of Bysiah and Salūt, and provide a clear picture of ancient burial architecture that goes beyond the insight of a few specialised scholars (Ibid).

Figure 5.7 A partially decayed grave on Jabal Salūt (Esposti & Bizzarri, 2021).

Figure 5.8 Left: Restoration and partial reconstruction on Jabal Salūt which allows a view of the inner structure; Right: The didactic replica of a turret-shape tomb built along the path (Esposti & Bizzarri, 2021)
Similarly, for brochs, the design has been compromised in ruins, and it could be re-interpreted following the regional models and any reasonable stone van be used.

As Brandi’s conceptualisation of art integrates commitments to historical truth, scientific precision, and aesthetic experience (Burnett, 2011), he criticised the archaeological restorers—positivists, men of science, who failed to understand that restoring a work of art is fundamentally different from restoring the puzzle bits of a broken millstone. Cesare Brandi emphasised the ‘wholeness’ of artworks, similar to ‘concept’ in architecture.

For historic monuments, a conservation project would commonly add a new layer of materials and time linked aesthetic values to the monument, which is inevitable, and should not affect the identity of the original work. Earlier archaeology-led conservation stages have not followed the ‘idea of broch’. The regional models have shown that forms were designed with logic. The form of a broch should be understood to guide the conservation. The information of the regional model is not currently visible in ruins. Better conservation could transmit information from academic research, both architectural and archaeological, to the sites. The conservation for brochs has involved many aspects like archaeology, history, tourism, architecture and education etc., and all of them would benefit from an easily-understood demonstration on site. One method to make them easily-understood is interpretation.

Interpretation is defined as ‘all the ways of presenting the cultural significance of a place’ (ICOMOS Australia, 1987, Article 1.17). The aim of interpretation is to reveal and help retain the significance — natural, cultural or both — of that place. The interpretive works, like removable structures, would not affect the building’s identity. Since most broch sites are ruins without a clear and complete shape, interpretive works on site are in need. For example, removable steel bars could apply to the site for a scale of complete broch monument, like making up the missing half of the broch walls in Dun Telve. However, the consolidation of broch ruins is actually turning an old stone ruin into a newly repaired ruin, where conserved ones are still weak in demonstrating a recognisable architectural work. For ancient ruins, the origin is hugely important as a mystery that tells a story.

Nevertheless, ruins would fail to tell stories to the audience without an architectural treatment due to the surviving mess of stones, whose shapes are too vague to be memorised. As the objects for conserving brochs are the designs made by Iron Age builders, the conservation for brochs should take the extra step and explore the architectural features. Thus, the sites have to show or suggest a ‘clear image’ of brochs, with clear broch shapes, clear broch interior atmosphere, clear broch spacial sequences and several key broch elements, in which case a readable broch rather than a ‘clear image’ of unreadable broch ruins after the conservation finished.
5.2.2 The fabric of brochs

The fabric of brochs means the surviving parts of the original building are purely made of sandstones. The surviving fabric should be original in most conditions. However, the values of conserving for just keeping the fabric is doubtful.

![Figure 5.9 The dry-stone analysis of broch Midhowe.](image-url)
The building materials for brochs are just stones without any binding materials like mortars. Unlike historic structures where the building elements have been carefully fabricated and may have significance as art pieces, brochs’ stones are very simple and natural, almost as they were extracted from a quarry. The ‘artistic’ building elements (lintels, orthostats, relieving triangles) indicate a marking of time in the history and can be central in a conservation project, while any stones found near the broch sites could be used for the reconstruction of the bulk of the volume.

The initial reading of the fabric could be the observations on the broch sites. The study would firstly look at the sandstone material and then analyse the building elements.

The stone walls in broch Midhowe could show the typical material problems to survey. As Figure 5.9 displays, the Orkney flagstone shows different levels of decay on elevation. In some brochs which survived to a certain height, blocks could be replaced, especially in inner galleries and chambers. However, if this building plans to be open to the public for visitors or future archaeological excavations, it must be consolidated for safety reasons. In the case of Mousa, the interior and exterior wall faces were repinned, and the corbelled walls of internal passages were fixed even with steel structures so that people could climb up the stairs safely. Consolidation is needed for long-existing monuments as the structures would become quite fragile to collapse due to their material decay. It is essential to document the situations before consolidation. Regarding the pattern of the wall face, any stone replacement would change it, and whether new or old sandstones are used, they should stand out easily, like with different colours or textures.

The building elements that survived with poor structural quality need consolidations for safety reasons. For example, the conservation project of Caisteal Grugaig recorded some stones of the inner wall face that had collapsed and fell on the entrance. Figure 5.10 was taken before the conservation action planned in the summer of 2018. The lintel stone level was exposed to heavy snow and wind, which may cause structural problems. The lintel stone is the original fabric that should be protected. Reconstruction of the wall face on the two sides is the solution recommended but may produce a distinct new pattern of stones, which should be defined carefully to avoid sharp contrasts or structural incompatibilities (shedding of load on weak existing blocks).
This present archaeology-led project has aimed both at protecting the fabric (material) and restoring the building from collapses (structure). From an architectural perspective, this intervention will bring more information to be read than the existing fabric. There is an opportunity for the features of buildings to be more intensively interpreted if the style was focused on, highlighting more the unreadable features. In this case, the reconstructed face around the lintel will start indicating the architecture of the missing second level and it is worth questioning how far things can go: is there any notion of stacked voids that has to be introduced? Is the wall vertical internally? Should the reconstruction extend to the external wall face, in which case the slope should be highlighted? Since visitors (and animals) can walk on the wallheads, should that be made level to ensure footfall will not break stones? Would an impermeable finish be given the wallheads (turf or stone slabs)? If pinnings are used to stabilise the new stonework, should they be inserted in the surrounding original blocks to improve durability?

The surviving fabric is just the body, while the soul of brochs lies in the style of architecture. Conservation of the fabric should serve the conservation of the style. The style of brochs, derived from the features, can tell how far the fabric and newly added structures can be integrated. This study would discover what should be needed in the conservation, which might offer advice on how the balance between style and fabric can be set.
5.3 The need for interpretations

The Article 25 of the Burra Charter (ICOMOS Australia, 1987) states ‘the cultural significance of many places is not readily apparent, and should be explained by interpretation’. Interpretation should enhance understanding and engagement, and be culturally appropriate. Therefore, the unreadable ruins would have the need for interpretations.

At present, conservation for brochs is limited in essential consolidation and repairs, which mainly could be seen as ‘broch house-keeping’, which conservatively focuses on maintenance. The limited budget for broch projects would be the cause in many cases. Indeed, there are stronger drivers of reconsidering conservation practice, which is primarily led by archaeology with little architectural perspective. Archaeological reports focus on the material findings on sites and recommend critical dates of the building. Broch sites are then conserved individually. As the research in chapter 4 demonstrated, their understanding can be extended by reading them as part of a collection, where their original character can be framed in the regional features.

Additionally, there is the need for more interpretation on sites to improve a visitor's ability to understand the monuments. The present Archaeology-led conservation management has rarely promoted links among brochs. Since the conservation goal in most management documents is to make them open and develop cultural tourism, like in the case of Clachtoll (AOC Archaeology Group, 2009), rarely questions of how to make broch architecture readable for visitors emerge, beyond tiding up.

Cesare Brandi (1965) has emphasized the aesthetic value of a work of art, saying ‘once that artistic nature is lost, nothing but a relic remains’ (p.50). The importance of attributing oneness to work is very high— specifically, the oneness that refers to the whole, not to a unity achieved by the sum of its parts. Ruins, as have been parts of the original work, should not be taken into a museum or an archaeological park even with the aim to re-constitute such a unity, as the atmosphere, including light, is as crucial as the broch stones itself. A part of a broch, like stairs or wall circles, cannot represent what a broch is.

However, several broch cases cannot represent what a broch is either. As there is no perfect broch survived, the broch remains are the parts, and the ‘whole’ or oneness refers to the collection. Hence, restoration should aim to emphasize this by re-establishing a potential oneness of a broch's architecture, as long as this is possible without committing artistic or historical forgery and without erasing every trace of the passage through time.

Brochs are impressive, which is much about the composition of the elements and the buildings' scale and location. Highlighting architectural values in prehistoric monuments require the wholeness of a building and its associated architectural experience.
At present, the wholeness of brochs is compromised in most cases. Since none of them has survived as a complete and original site; Thus, the brochs have become various ruins. The ‘wholeness’ of the original is missing while the later modifications become a new part of the whole. A.M. Oteri (2011) mentioned the ruins as ‘what remains’ (of construction, in our case), so things become more complicated if we consider what is missing from ‘what remains’ and our interest in ruins is not only an aesthetic one. Ruins are usually not appreciated by people as much as restored historic monuments, and if they cannot be visited, they would normally have no other function and become so-called ‘dead monuments’. Commonly, ‘Dead monuments’ have a high possibility to be abandoned due to lack of maintenance. The worst consequences are that the buildings corrode or collapse, which leads to a desperate end to archaeological excavations.

Therefore, a readable ruined site should be a better conservation aim for brochs, and the architectural perspective could improve its conservation as it goes beyond the consolidation. An initial stage is conserving the sites while demonstrating both the ruins and the architectural modifications. Several cases have achieved this goal.

The archaeological museum of the Crypta Balbi in Rome has restored layers and buildings (both ancient and post-ancient) as an information and research center relating to the conservation of the historical city (Conforto, 2015). It aimed at centralizing this vital cultural resource for the visitors, which is spread all across the city.

In this project, the complex reciprocal influence between the analytical phase of the archaeological research and the synthesis of the project have been represented not only by drawings but also by models (Figure 5.11) and written texts about the reasons of the decisions and the descriptions for the executive processes which can be also used for future maintenance (Ibid.).
In the following stages, the ample open space of the ancient portico would open towards the city through the paths of medieval alleys and gardens. Therefore, from street level, the internal space will be articulated below towards the archaeological area or upstairs towards the terraces that conclude the volumes left after the demolitions, dynamically composing ancient and modern architecture from continuously varying points of view (Ibid.).

It can be seen that architectural perspectives can provide an explanation to help the professional archaeological works to be understood. While similarly, keeping both the original and modifications for prehistoric brochs is still possible and also used in many sites, like Jarsholf and Midhowe, where all the sequences of changes are maintained.
Santa Maria della Scala, located in Siena was once an important civic hospital dedicated to caring for abandoned children. After some intense restoration work, it opened as a museum in 1995, including a small archaeological museum. The conservation aimed to deal with the needs of the great art collections and the increasing demands of research and tourism. The old structures are stratified through the fragmentation of complex, contradictory, and distant histories, so conservation would bring interpretations to make coherent action, forming dialogues between the new function and the surviving fabric. The previous restorations, as seen in the complex material patterns in the façade of the entrance in Figure 5.12, were not sewn together. Conservation thus becomes a perceptual and visual path that echoes two past memories (Ibid.), the existing original building and modification, which were shown at the same time. Thus, the different layers of construction in history become readable. The existing parts of the building and those inserted by the intervention of recovery appeared simultaneously and were interpreted by the architecture.

Brochs do have similar and contradictory layers of history. However, their uncertain origin and long-time modifications are hidden in the bland drystone structure, which often makes them look like a whole piece. The layers need to be understood and highlighted clearly before a composition.
The architecture talks with the ruin, and at the same time, it is taking care of the ruin (ibid.), stated Oteri when she commented on architect Salvador Pérez Arroyo and archaeologist Fernando de Miguel's conservation work on Benedictine Monastery of Carracedo in Spain. The conservation took three years long starting in 1988. The architecture has demonstrated ruins together with the surrounding nature. Perez Arroyo (2009) says, 'Restoring is not only interpreting, preserving, rebuilding but also opening a speech towards the future, analyzing the harmony and strength of architectural and constructive elements.' The interventions fit into the surviving architectural remains in a distinctive way (Figure 5.13). A wooden walking path was used to preserve the original floor and connect the new choir. Also, the original walls were protected with warm, pink stucco. The intervention of Perez Arroyo is based on two fundamental principles: on the one hand, pure preservation of the ruins, and on the other hand an operation of architectural 'orthopaedics', necessary to prop up structurally and architecturally the remains and guarantee the preservation and functionality of what is left of the monument (Arroyo & Munoyerro, 2012). The conservation has offered the ruins a rebirth but through reversible changes, which were highlighted using new materials like wood, in contrast to the original masonry. Notably, the original architecture has become readable again after the conservation.
As a consequence, the lack of interpretation in the even more fragmented broch ruins could be dealt with interventions that explain any layers of history on the sites. At a further step, interventions would visually make coherent architectural features that are presently confusing. When visitors go to certain ruins, the surviving part and interpretations on sites should exhibit an image as complete as possible to the original idea. In which case, a ruin containing more information about the monument is more than just a fragment.

The completeness that comes out of the fragments in brochs contains two levels of meaning. Fragments of the building elements represent a whole in themselves, and they do not have to address the unity of architecture. However, as the information of most ruins may not be able to offer clear and precise data of the building's architecture, there is a need of reading the whole collection as part of the complete data.

For example, the dimensions of buildings are mandatory for architecture. The sanctuary of Minerva at Portonaccio is an archaeological site that has its parts of the Temple of Apollo restored. The temple (Figure 5.14) is a typical 6th century BC Etruscan temple, but the remains are less than 2 meters of masonry. The architecture of this temple is mostly gone. However, according to Roman architect Vitruvius's description of the Etruscan style, restoration work can be done, which at the same time has to protect the archaeology.
In this conservation project, the lightweight tubular frames have restored the edge and walls of the temple to reproduce the scenes with the buildings' original height and area. Steel bars have been used, which stands out easily from the original ruins. Also, the conservation added transparency to the newly added parts, which work as the interpretation to visitors. It is wise that restoration work only covers half of four facades, showing awareness not to overwhelm the ruins. Without the new steelworks, the four columns cannot be read with the surviving low masonry on the ground.

In general, the conservation for incomplete building structures can act as an interpretation for the original structures which were complete. The reappearance of missing building features in ruins can offer a better architectural experience with a deeper understanding. Similarly, since broch ruins are quite confusing regarding the vague characters shown, their interpretation as brochs is needed. Nevertheless, what is left to be interpreted? As there are many circular-shaped stone ruins, the brochs have to be first recognized as such. Then their confusing variety in features caused by original typological variants or later modification may be explained.

5.4 The interpretations in conservation

There are different kinds of interpretation methods used in conservation. Commonly, reading materials and architectural interventions have been used as interpretations in conservation projects. English Heritage (2008) defined the interventions in conservation as 'Any action which has a physical effect on the fabric of a place'. Any changes of the fabric in ruins should be interventions.

Minimum intervention is defined (Roca, 2020) as an intervention that optimally combines compliance with structural requirements with the maximum possible protection and enhancement of heritage values and respect to the structure's authenticity. Here for brochs with archaeological potential, the minimum intervention should be applied, which means keeping the most original fabrics for on-site conservation and enough consolidation for the safety and durability with the least harm to heritage values. In situ interpretation has to be changes which are substantially reversible.

There is the risk of interpreting monuments or historical buildings whose origin and transformations over time are not clear and never will be. Thus, the interpretation should be based on scientific research, and over-interpreting should be avoided. The focus is on valid information. For example, the hypothesis of typological models made due to the newfound in broch collections can be used for interpretations on sites. However, pure artworks which are not supported by the findings may lead to wrong understanding and should be prohibited. The site interpretation of the uncertain attributes of brochs should be clear and readable for visitors.
5.4.1 Texts and images as interpretations

Texts and images set on sites are the initial reading materials that work as interpretations. Nevertheless, currently, the exhibition boards on different sites (Figure 5.15) are not satisfying. The images of a broch in its original times are often the same, depicting possible iron age lifestyles. Changes in the building fabric within the history of brochs could make them different from the suggested model PBM.

An even more serious problem is that most images have described the timber structures built in brochs. The board of Dun Telve focused on the timber and different internal levels and fireplaces, while all of these are still controversial without any evidence of existing.

Generally, as the only objects with text and diagrams for reading in a site visit, the boards should interpret situations of the monument with more details. The possible original use of brochs conjectured from the archaeological reports is still uncertain and too academic in the archaeological field, which could more appear in museums or educational places. The basic information of the monument, as the surviving architectural features and proved consolidation in the past, should be readable on site. A better presentation board should depict their distinct features as a more clearly demonstrated presence of this architecture.
Figure 5.15 Presentation boards found on broch sites
On-site interpretation panels guide visitors around the structures in chronological order.

- Farmhouse: about 1300 - 1500 AD
- Norse farm: about 850 - 1275 AD
- Wheelhouse: about 100 AD
- Broch and Courtyard: Around 100 BC
- Later roundhouses: around 500 - 200 BC

Rubber models of buildings showing layers of time on site Jarlshof.
Some sites can showcase a much extensive history, with the broch period being the highlighted among all the prehistoric phases. Jarlshof (Figure 5.16) in Shetland is a good example, which appears as a Bronze Age/Iron Age village.

The chronological order map has shown that there were primarily eight periods, but since the Bronze Age settlements and early Iron Age settlement are also roundhouses, the half-surviving broch cannot be easily differentiated. Besides, the Iron Age wheelhouses are also round and similar in plan compared to brochs. The rubber model in the site shop can help with this problem, as it demonstrated the layers of time highlighted with different colours. The model could be regarded as a reasonable interpretation brought on sites to explain the broch within this prehistoric village. However, due to the limited features that Jarlshof shows, where the features of jutted scaracement are blurred and the stairs are missing, the broch could be mistaken for a Bronze Age roundhouse with thicker walls. The half surviving broch could be better understood if the other brochs near Jarlshof were mentioned and compared. For example, a newly built scaracement with steel or glass on the inner wall-face could be used to explain this feature. Furthermore, the visitor center could tel scaracements have been found in broch nearby, like Mousa.

However, the best material to read is the broch itself rather than boards or models. Being confusing or misleading are the major problems of broch ruins. There are some cases that do need interpretations because they are so unique which were caused by modifications in later times, or they would confuse people’s understanding of brochs.

Since brochs have complexity and extensive data to be read, new technology like AR (Augmented Reality) can offer people a sense of destinations that will take them precisely where they want to travel using their smartphones. Also, AR can effectively enhance people’s travel experience with interactive maps, making them more fitting, and the 3D virtual models can carry the information of different parts where the modifications can be read. AR has been used in Stirling Engine Shed, a building conservation centre run by Historic Environment Scotland, where a virtual map attached with different monument models was displayed.

The reading text, images and even AR works can help understand monuments without transforming or altering the authenticity of the sites. Are those works enough or satisfying to interpret the brochs’ ‘uncertainty’? Here is an example of Thrumster, which shows a mixture of masonry works from different times after consolidation led by archaeologists.
According to the excavations directed by John Barber in 2011, Thrumster (Barber, 2017, p.241) has at least three phases of construction: 300 BC, 200-40 BC, and 200-400 AD highlighted with different colours in Figure 5.17. Possibly, there were abandonment between the phases. After the original entrance failed, the broch was re-used during 200-400 AD with a new entrance. An inner lining wall was erected during 300 to 400 AD, which built up the general wall thickness. 50 years after the first excavation on site in 19 century, the remains were landscaped to form a garden feature, and the southern section of the wall, which included the original broch entrance, was removed to build the summer house.

At present, Thrumster (Figure 5.18) appears as a 3/4 wall circle, lower than 1 meter in height, made up of survived original features and later modifications. However, these modifications hide the original features (like wall thickness and entrances) and confuse the public. Especially, the stair-access-cell was tiny and easy to be ignored, which may confused with duns. The architectural features of works in each period, if known, could be labelled through interpretations on sites for better understanding the brochs.

However, a better solution would be intervention. The fabrics of brochs need a level of integrity to be read. For example, the inner-wall circularity is the arrangements of cells’ entrance, broch entrance and the rest of the inner wall. The salient features of the intervention are the coherence of the fabric (Dutta, 1996). This study would move to intervention which can link the surviving fabric to form a missing feature.
5.4.2 Architectural interventions as interpretations

The conservation can bring back the atmosphere of original architecture to the present ruins. Some conservation cases have rearranged the building features, recreating the atmosphere of the original building scale.

The Old Church of Vilanova de la Barca (Lleida, Spain) is a 13th-century Gothic building that was partially demolished in 1936 due to the bombings of the Spanish Civil War. Since then, the church has been in a general state of roofless ruin. After mandatory repairs and consolidation, the renovation (Figure 5.19), designed by AleaOlea Architecture & Landscape, has recreated the building scale by making up the missing parts of the walls and adding new roofs.
The spatial qualities of the original church were recovered, and new materials were applied for the walls, which were deliberately different from those of the surviving original work. This church is in use now, but not as a place of worship. It has become a valued community hall for social and cultural use, which requires a complete building rather than roofless stone ruins. The conservation has not changed the original plans but recalled urban memory.

Figure 5.19 Santa María de Vilanova de la Barca / AleaOlea architecture & landscape (photo credit: Archidaily)
Another case is the conservation project of the Roman Ruins of Can Tacó designed by Toni Girones (Figure 5.20). The archaeological site of Can Tacó in Turó d'en Roina is located in Turons de les Tres Creus's natural setting, a highly fragmented metropolitan area.

This conservation intervenes in the backfill of Roman traces, improving the content (the space) and highlighting the container (the walls). The main strategy has applied two layers: 1 a steel mesh contains the new stones and aims to reproduce the successive horizontal planes where the Romans transited. 2 a second denser (corten steel frame) and thinner mesh (railings) is arranged like a curtain over a period of time to project various archaeological remains. The conservation has used new materials to highlight the Roman ruins' scale and protect them from collapse and other possible damage on site.

As for broch ruins, the scale of the buildings is missing in most cases, except Mousa. The dimensions of a monument are so important as they demonstrate the inner space where the Iron Age people lived. Parameters like the height of walls, diameters of the plan circles and size of the cells on ground level create the atmosphere, which would much relate to the architectural experience for people's visits on sites. Moreover, unlike the old church Santa María de Vilanova de la Barca where the origin of the building was recorded in text and drawings that people can read, brochs are difficult to read due to lack of evident history and rich material culture.
Therefore, brochs need a basic scale and atmosphere of building to be understood through the visiting experience. These features should be visible and carefully selected as part of architectural design. The conservation should tell stories of the scale, building element, the unique design and the variant features. Clarifying the essential features is important to make brochs recognizable among other similar-shaped stone monuments.

Equally crucially, the classification between modification and variation should be clear. As analysed above, both of them are part of the broch architectural identities. However, modifications should not be confused with an original broch definition that involved regional variations. Since the variations of building features have shown regional distributions, the need of narrating regional characters appears almost on every site of brochs.

Thus, the intervention as interpretation for brochs may ask for two levels of information from architectural perspectives:

1) **The features of broch (definition) compared to other Iron age monuments**

There are other monuments that appear pretty similar to the broch ruins (Figure 5.21). They are much confusing. For educational purpose, the conservation for brochs should highlight the definition of typical broch features/elements and the diversity of the features in different regions. Despite the duns or wheelhouses, which may look similar to broch according to the shapes and stone materials, there has been a semibroch hypothesis that may confuse the victors’ understanding. Mackie (1965, 1971) has studied the structural development of brochs, assuming that such a complex structure could not have sprung into existence from nothing. He (1994) has used two excavation studies (Dun Ardtreck and Dun an Ruigh Ruaidh) to argue that prototypes were probably built slightly earlier than the round towers, like semi-brochs or galleried duns. Those broch prototypes were considered as a distinct class of buildings closely related to the brochs. However, they still can not be regarded as brochs their architectural features have not reached the confirmed broch complexity due to the broch definition.

Mackie’s five points defining a broch are mandatory to be addressed. According to the PWB study in Chapter 4, the broch ruin should support the possibility of being built tall, which differentiates it from most Duns. Therefore, the circularity and dimensions need attention in conservation work.
Except for broch Dun Beag and Fiadhait, all the other galleried structures (Figure 5.21) cannot be regarded as brochs, at least due to their missing of high-level circularity. For example, Dun Liath has thin, long, curved walls that cannot support a structure of a certain height. Chapter 4 has analyzed the failures of achieving circularity that may be caused by geographic conditions (contours) or partial structural failures. However, how can the semibrochs treat through conservation?

The conservation should tell the regional models of brochs based on the definition, which is the image of a ‘perfect’ broch regarding its features. The semibrochs has to be read with the other ‘complete’ broch models. Thus, no matter these buildings were built before or after the time when the origin of broch appeared, ‘broch’ actually represents a period in the development of structure with the building features specified.
So, the conservation of brochs should consider those broch-related structures which may confuse people’s understanding of the brochs they visited. A clear understanding of brochs on sites would help people’s understanding of other broch-related structures as well. At present, the brochs ruins look so similar to the broch-related structures mentioned above. Thus, some actions are needed basically to differentiate them at least.

2) The variations in broch design (regional characteristics).

The variations in broch design will affect how the broch is presented in a professional conservation project and understood by the wider audience. Regional characteristics could be regarded as a style of the broch. For example, the round shape is not a regional character as it classifies whether an Iron Age building is a broch.

However, the guard-cells are regional features that can show trends of a style. The guard cells can show trends or a style. According to Figure 4.64 in chapter 4, guard cells are mostly found in Sutherland (69.23%), which is in the middle of broch distribution, while the Northernmost and Southernmost region (Shetland and central mainland Scotland, which was named the Rest Area in this thesis) have only a few ones. So, these cells are a regional characteristic of the middle area (Sutherland, Caithness and Outer Hebrides). As the transportation was so limited in Iron Age, the spreading of ideas should be slow and difficult. Therefore, a small change of design, creating a variant or style, should have a rather regional concentration only, which could be used to trace and interpret how the features changed.

Also, the thicker walls could be related to the bigger scale of the building for structural stability. There is a regional distribution of PWB: the Northern part (Shetland, Orkney, Caithness, Sutherland) has higher PWB values while lower at the Southern part (Outer Hebrides, Skye&Lochalsh, Argyll and Rest Area). PWB can help to explain the sites that vary in scales but still can be tall brochs in Iron Age.

So, what are the interventions that are suitable for broch conservation? As conservation become architectural projects on the monuments, Gustavo Giovannoni (1946) distinguished five categories of restoration listed as below.

1) Restoration for reinforcement
2) Restoration for recomposition (or anastylosis; reconstruction technique whereby a historic building or monument is restored using the original architectural elements, for instance, those which are discovered during an archaeological excavation, which are assembled without the use of mortar;
3) Restoration for liberation (removal of parts of the building considered of minor value)
4) Restoration for completion (addition of secondary and distinguishable parts)
5) Restoration for innovation (addition of relevant parts which are necessary for reusing the building)
A.M. Oteri (2018) stated that only the first three categories could apply to ruins and doubt whether they are harmless. Restoration can happen after the objects to be restored fully understood. The first two categories need proper guidance from architectural study to clarify the works. The third category would need archaeological reports which tell the origin and modification, so their values could be discussed to decide what to be removed. The reuse of brochs ruins is commonly tourism, which may require a broch as complete as possible for visiting experience. Since there are many ways to interpret the brochs, like putting labels on missing lintels, restoring the scarncement with glass panels and restoring the missing stairs using steel boards, it should be a creative work that needs architects. Then, the interpretive intervention for visitors’ experience can be point five, Restoration for innovation, using different added works to introduce the original features.

A.M. Oteri (ibid.) also criticized the falsely produced ruins, especially the monuments, creating a separate field of archaeological Restoration, which means reconstruction in another site. A falsely produced ruin would confuse people and harm the authenticity of the original buildings. Nevertheless, for brochs, the authenticity is not fully understood. Reconstruction can be considered just for the need for interpretation, not for producing fake ruins.

The integration of the original potential unity is important, and the first category is usually mandatory. However, the second and third categories should be dealt with carefully, exploring the original integrity limits. A.M. Oteri (ibid.) suggested that an archaeological ruin is an intangible object, out of our time and out of use, only for pure contemplation. The broch ruin has many potentials to be better understood in architecture to offer contemplation. In other words, the surviving brochs are intangible objects while the original fabric and interpretive intervention can reform the architectural design, which still can be accessed.

The integrity for brochs involve four main points:

1) The original features of brochs (the idea of a broch design)
2) The influence of later modification. (meaningful changes)
3) The fragmented fabric. (mostly in ruins)
4) The archaeological values (protected for further excavations)
This requires a broch to be considered with both archaeological and architectural perspectives. Also, the sites should be well consolidated (maintaining the fabric safe) and fine interpreted (able to read the fabric). For the experience of the visits on site the features have to be well demonstrated and the atmosphere has to be understood. This requires a good selection of readable features, like dimensions, height, and some vital building elements like guard cells, entrance style, height, staircases etc.

Moreover, architectural interventions can improve the visitor’s experience on monument sites, which are more convenient methods than text or pictures for the audience to get the information. Especially, using architecture interventions to recreate the atmosphere of the original building scale for brochs, as the basic goal can interpret the mystery brochs’ identity to the public.

Torwood (Figure 5.22) is an example of brochs showing vague features as the weeds have almost hidden the architectural features. This broch was excavated in 2014 with vegetation clearance by Archaeology Scotland and RCAHMS. Three years after, the author visited this place and saw a vague ruin. The left side of the 2nd picture in the Figure 5.22 shows the collapse of the wall heads, which affected the circularity. Also, the extensive moss growing on stones has hidden the scarcement at a similar height to the lintels. There is probably vegetation erosion happening between the stones inside the inner wall.
Interior view from North in Torwood (RCAHMS 1955, photo from Canmore database)

Figure 5.22 The photos of Torwood taken in 1955 and 2017
Archaeological excavations in broch do not happen frequently. Like the site of Torwood was left exposed for more than 5 years between the two excavations. However, the conservation for brochs needs basically a long-term plan of maintenance at least vegetation clearance and structural consolidation. This needs enough funding. The maintenance means basic repairs here. If partial collapse has happened, the reconstruction of such part would be seen as intervention.

Camillo Boito (1883) stated that the older the building, the more the ways of life it documents are outdated, the less the intervention of the restorer is required. In this perspective, prehistoric sites should have the least intervention. If there is no confirmed information from excavations, there should be minimal changes of the monument on the sites. The minimal changes would evaluate the effect of the action. If reversible, set an installation of a glass broch entrance which could be removed, the changes can be minimal intervention.

The interpretive process would work better by using a broch, primarily for tourism, which can also include educational programmes. The confusing ruins can harm the public’ understanding of prehistoric monuments and mislead the next generation. Furthermore, in general, the lack of mass tourism and visitors do not produce enough funding for conservation projects, which leaves the ruins abandoned. The monuments need to be well kept or preserved rather than left unchanged to be crippled.

5.4.3 The context of broch conservation

The context of broch conservation means the circumstances that shaped the conservation of brochs in terms of which it can be fully understood. There could be a wide range of topics regarding the context. However, this thesis will mainly discuss three major points closely related to conservation: the rural and remote landscapes where most brochs were located, audience, and tourism.
The rural and remote landscapes

All the brochs were presently known are not located in any city of Scotland. There are a few brochs close to towns or villages like Clickimin in Lerwick, Shetland, Carn Liath outside Golspie or the brochs in Keiss, a fishing village at the northern end of Sinclairs Bay.

The 108 brochs studied in the thesis were analyzed with a map based on Scottish Government Urban Rural Classification, 8-fold version (Figure 5.23). According to the report published by the Scottish Government (Dalglish et al. 2019), in the 8-fold version, accessible areas (number 1 to number 3) are those within a 30 minute drive time from a settlement with a population of 10,000 or more, while remote areas (number 4 to number 7) have a drive time of between 30 and 60 minutes and Very Remote areas (number 8) are more than a 60 minute drive time from a settlement with a population of 10,000 or more. All the 108 brochs studied are located in areas number 6-8, and 99 are in Very Remote areas. The remote means almost ‘not accessible’ where people would have difficulty climbing hills for a long time.
Figure 5.23 The 108 brochs’ locations analyzed with Scottish Government Urban Rural Classification
(Picture Source: www2.gov.scot/Publications/2018/03/6040/downloads)
The remote landscape has made it quite hard to find a broch in the area. For example, even in Caithness, which is relatively flat with small hills compared to the landscape of Sutherland, brochs surviving with less height are almost invisible, hidden in the grass hill. Like the case of Ousdale (Figure 5.24), this broch is near the A9, a major road running from the Falkirk council area in central Scotland to Scrabster Harbour and Thurso. However, this broch lies about 0.3 miles of hill climbing, where there is no guidepost.

It is a well-preserved broch run by the local community, but it definitely needs a walking path, which should be the first step of opening the conserved broch to the public, to at least draw attention.

Figure 5.24 The photo of Ousdale and the surroundings (taken by the author on May 25th, 2018)
Right now, Highland Conservation LTD has been busy creating a walkable path from the A9 down to the broch (Figure 5.25), working in all weathers and across difficult terrain. Since the distance is roughly 500m climbing, it would take around 10 minutes walking. Then some guideposts should be set on the way to the broch. Also, some facilities are needed, like a bench allowing some rest.

Figure 5.26 A timber bench on the way to broch Mousa (photo taken by the author on 30th Apr. 2019)
On the island of Mousa, Shetland, there is a timber poorly-made bench on the way to the broch (Figure 5.26). It is also a reminder of 60°N. The chair can function as an interpretation of the high latitudes where Mousa was built. The journey from the Mousa boat landing to the monument takes roughly 40 minutes walking, where many rest points can be used to interpret the landscape.

‘...One way in which the value of the visitor to rural places can be discerned, is to understand the countryside as protective and productive landscapes...these definitions focus the specific relationship between ecosystems and human activity. Productive landscapes, as a term, can address both cultural and economic forces at play in the countryside, from working the land to digital livelihoods, all of which require an involvement with the built environment. Its counterpoint, protective landscapes, remain places of ecological regeneration...’ (Brennan, 2018,p.244)

Ecological regeneration is about the re-appraisal of landmark monuments that were central to ancient landscapes. Mousa is an uninhabited island where the grass on this island feeds more than 100 sheep. It is a productive landscape. However, it has been an RSPB (Royal Society for the Protection of Birds) island nature reserve since 2000 and is managed via agreements with its agricultural tenants and the landowner, a protective landscape, a haven for wildlife. In 2019, a new walking path (Figure 5.27) was constructed by RSPB and Biosecurity for LIFE staff as an interpretive trail for Mousa highlighting both the island’s special wildlife and the importance of biosecurity precautions. Also, the path can guide visitors to the broch.

This broch lies in a heritage/landscape which serves as crofting/farming places and also a tourist site for the diversity of the wildlife birds. There are complex roles in its landscape indeed. The large scale of the building makes it stand out from the flat seaside. Thus, the Mousa island is mainly known for its architecture broch. However, the conservation of brochs involving the tourism development can not just focus on treatment on the building but inevitably deal with the challenges coming from the surrounding landscape.
In other places of broch sites, the landscape could cause inconvenience of accessibility to the sites and even have difficulty to build a walking path because of the landowners living nearby. For example, in Dunbeath, this might affect their sheep raising and farming as for the local people. Commonly, the landowners would have disagreements with their neighbours about the construction of the walking path of the brochs. Since it is too related to the limited numbers of the landowner family, where the local community, representing more the social understanding and public responsibility, could have a word but cannot change the landowners’ minds directly. The Dunbeath Broch Project began in May 2018, and a new footpath (Figure 5.28), which is around 240 meters long, has been built between the Dunbeath broch and Dunbrae after negotiation with the landowners.
The rural and remote landscape has offered brochs unique environment and at the same time has shaped the audience of brochs. Especially, tourism becomes an important activity of the sites, and the local community has contributed much to the conservation. The following section would look at the related people, like the stakeholders and professionals under ‘Audience’.
In the audience analyzed above (Figure 5.29), musealisation means the placing in the museum, or more generally, transforming a center of life, which may be a center of human activity or a natural site, into a sort of museum (Desvallées & Mairesse 2010). For example, the National Museum of Scotland has exhibited diagrams of brochs under the Iron Age theme to both national and international visitors. Also, brochs have been included in the educational programs, like courses on prehistory and young archaeologists training. Both musealisation and education can offer people information about brochs. The local communities are the main stakeholders as they manage the broch sites while running the business around the sites. Many conservation projects are done by the local community, like the conservation of Ousdale. Community engagement which involves volunteers has made an excellent effort on brochs. The present conservation is giving an increasing role to communities, which often focus more on the constant use or even business of monuments.
The tourism of brochs as a way to reach the general public can make brochs interesting for the wider audience to gain international fame. Scholars mainly include the governmental staffs, architects, and archaeologists, most of whom are based in the UK and have huge concerns about these monuments.

As for the people who work on the conservation of brochs, a triangle structure (Figure 5.30) is suitable to describe the relationships among the public (authority), community (Local), and scholars (or designer). A good conservation framework should explore the context as broadly as possible (the communities and their priorities, for example) and identify as many threats as possible. The system accordingly changes, almost downsizes from a public-dominant to a community-dominant one. It could stimulate the communities' ability with high efficiency working on more brochs, not just the famous ones. As this research stands at the scholar's perspective, the reflection on the conservation of prehistoric monuments, like Scottish Brochs, should establish more balanced relationships among brochs in an area or region.

Council of Europe (2005) stated in Faro Convention that ‘A heritage community consists of people who value specific aspects of cultural heritage which they wish, within the framework of public action, to sustain and transmit to future generations’ (p.2). The rights of the heritage community to contribute towards heritage are guaranteed.

Community drives conservation nowadays, but in most cases, the communities did the conservation mainly for their profits. Their use of the brochs is tourism and educational purpose which benefit and create jobs. There are three typical cases of communities to look at as Dunbeath Broch Project, Caithness broch project, Clachtoll Broch Project and Nybster Broch Project (Figure 5.31).
The new perspectives of interpretive conservation

The Dunbeath Broch Project, which is led by Berriedale and Dunbeath Community Council, is supported by funding from the National Lottery through the Heritage Lottery Fund, by SSE Beatrice Fund, Highland LEADER programme and Historic Environment Scotland. The project working with AOC Archaeology Group aims to create a program of excavation and conservation work at the broch, with opportunities for involvement throughout and training and skills development for participants. The local primary school pupils learned about the Iron Age through archaeology workshops, while the adult participants can get training on drystone dyking techniques at Dunbeath Heritage Centre.

Meanwhile, Caithness Broch Project has a bigger goal to rebuild a full-scale Iron Age Broch, using traditional methods, along with a visitor centre and dry stone workshop. The replica broch will serve as a visitor attraction and support the diversification of the Caithness economy.
The existing site promotion is also involved in this project that works alongside the local community, tourism and archaeological groups to improve access to the brochs and interpretation of existing brochs in the county, further improving the public’s ability to learn about brochs in Caithness. It acquired £180,000 of funding towards the conservation of Ousdale Broch, which promotes the archaeological landscape of Caithness as a heritage tourism destination.

![Figure 5.32 The conservation work at Clachtoll](Photo credit: AOC Archaeology Group)

Clachtoll has been accessible since 2007 due to work by Historic Assynt and the community. The Clachtoll Broch Project (Figure 5.32) worked on the consolidation work of the unsafe area of stone walls in 2013, which offered an opportunity for archaeologists to inspect the complex engineering involved in the building. In 2017, the project conducted a scientific excavation and conservation on this broch. They excavated the garth, reconstructed the staircase, protected the wall heads and made a design proposal for a viewing platform.

The people from the local community of various ages have participated. The project got support from Historic Scotland and a grant from the Heritage Lottery Fund. The conservation has been guided by archaeologists and engaged volunteers from the local community to work. The aim is to solve the engineering problems and make the broch safe while being open to visitors. The conservation and archaeological works in summer 2017, which archaeologists led from AOC Archaeology Group, also aim at tourism which is regarded as the most important part of the economy by the local people.
The Nybster broch project was a community archaeology project. It was funded by Highland LEADER+, Heritage Lottery Fund and Highland Council started in August 2011 was an opportunity for volunteers from the local community and further afield to get involved in archaeological research. A series of training workshops, lectures and guided tours were designed to allow volunteers, visitors and school children to learn archaeological recording techniques. The aim of the project was more about finding archaeological evidence and training programs for the local community.

All the four broch projects made an approach to lead the excitement of amateur conservation workers to real construction work under professional guidance. The regularly updated blogs have attracted people to visit and encourage local people to participate in conservation. Community engagement has offered a broch project higher possibility to get funding, like Lottery Fund. However, due to the limited funding so far, most projects are aimed at short-term benefits, like one-month conservation and excavation. Although the archaeology students volunteering in those projects are reliable for good excavation, the training programme before site work only takes short periods, which cannot guarantee the skill levels of people that participate.

Above all, as most broch projects had limited funding, the local community has taken an important role in both conservation and excavations for brochs. The educational purpose is approved to offer more people with professional skills to work, and the tourism development was mostly aimed for its benefits. However, the guidance became vital regarding the outcome of conservation, which hugely depends on digging and masonry work from community volunteers.

As the local community’s interest in broch conservation was the benefit to itself, the projects only happen from site to site. Since the reading for brochs needs a view of the collection, the links or relationships between two near brochs, one of which may locate in another community range, were not studied or even mentioned.

Here is an example of linking two near brochs in Caithness. Broch Keiss is 150m away from the Whitegate (Figure 5.33). They both have a high circularity level and standard dimensions of walls. However, Keiss broch has one entrance and two staircases; Whitegate broch has two entrances, but no staircases are found. Since Caithness has the most regional models of standard dimensions, perhaps, those two brochs appeared not as standard because of the later modifications. However, those two can be read together when the original features, one staircase and one entrance, could be understood.
An improvement could be achieved if the conservation were based on regions, not just one site. Thus, if more funding could be available for brochs under regional arrangements in the future, the communities can work together to integrate the conservation to interpret the broch features, where the interpretive work can contribute to the visitors' understanding of the monuments. More optimistically, even a systematic conservation and arrangement plan for all the brochs could be achieved to review the whole values of 300 sites and take action.

However, the current conservation was about basic consolidation for structural safety while safe ruins may still be too vague in features. Also, good tourism may require conservation to go beyond it.

Tourism can bring more audience to sites. At least the fame of a broch, like Mousa, could much help to get funding opportunities for conservation purpose. Basically, the breakthrough point would be tourism to help the conservation projects financially.
Tourism

Roberto Sabelli (2017) studied a wider range of values whose coexistence in a single site, named ‘mixed sites’, and emphasized that ‘sustainability should be kept in mind’ with the so-called ‘rule of equilibrium’ – the three dimensions of development, environmental, economic and social, with all their interconnections, so that the resulting effect is liveable, feasible and fair (p.192). Tourism is the common development of prehistoric sites that involves the three dimensions, while the significant contribution that tourism brings is the financial benefit for the monument conservation and surrounding communities.

Since most sites do not have public transportation, the accessibility to brochs, in general, is hard. The risk of overtourism in which a tourism destination exceeds its carrying capacity is relatively low. Also, all the brochs do not have hotels built near the sites, and the trips can only happen in the daytime due to no night lighting facilities on most sites. People visiting brochs, if managed well, would have little impact on such uncontaminated environments. However, good tourism can fanatically help the local communities maintain and conserve the rural heritage landscape.

The brochs in Scotland which are typically ‘mixed sites’, are presently not quite well-known in the scheduled monuments agenda, compared to the famous Skara Brae. Even Mousa, the best-known broch, is being rarely visited for different reasons.

Mousa is located in Shetland, where its population, location and weather mainly lead to the current tourism situation. This archipelago of Shetland has 15 islands in total with a population of 24,000. The only burgh, Lerwick had a population of about 7,000 residents in 2010. Other people live in villages where people commute to the county’s capital, Lerwick, and use the services. Some islands have no people living there, where there is an anonymous broch. Travel between Shetland and Britain is done only by costly flights or overnight ferries. There are also ferry and flight services for travelling among inner islands which should be booked due to the limited numbers. However, both of these transportation modes could become impossible during inclement weather like fog or storm, which regularly happen in winter. Historically, Shetland has been viewed as inaccessible, surrounded by dangerous waters, and offering little interest for tourists (Butler, 1997). With the help of social media and TV programs, Shetland's heritage has contributed a lot in changing this image of tourism.

The Shetland islands boast many exceptional natural and archaeological wonders and a very distinctive culture, from its location at the crossroads between Scotland and Norway. The main form of tourism in Shetland focuses on both natural and cultural heritage. Tourism has been consistently growing over the past 30 years. A survey commissioned by Shetland Islands Council and VisitScotland shows that there was a total of 73,262 visits to the isles in 2017, compared with the numbers for 2013, which amounted to 64,655 visits (Shetland Islands Council and VisitScotland 2018). Seasonality seems to be one of the most significant issues, whereby the islands are only perceived as appropriate for a visit during the summer months (Leask & Rihova, 2010).
In winter, most hotels are closed due to the bad weather, which might affect logistical issues related to ferry and flight connectivity. While the three months tourism for summer is quite competitive compared to other famous prehistoric monuments like Heart of Neolithic Orkney, whose name was adopted by UNESCO when it proclaimed these sites as a World Heritage Site in 1999.

Figure 5.34 Mousa boat (photo taken by the author on Apr. 30th 2019)
Mousa, the best-known broch located on a small island where no one lives, does not have prosperous tourism. The transportation to Mousa is the Mousa boat (Figure 5.34) which runs six days a week from April to the end-September. The Sailings are all dependent on weather, and the season could close early because of weather conditions. The sailor said that there were average of 12 people per trip. Thus, the maximum of visitors per year should be no more than 320, if the stormy weather is not considered.

Besides, the rest of the brochs (Jarlshof, Scatness, Clickimin), which are not as famous as Mousa mainly because of their incompleteness of building structure, are even less visited. Many brochs are located in remote rural places, very hard to be visited.

Based on these situations, the Clickimin, outside Lerwick, may be an ambassador for brochs in the islands, where people can access conveniently. A broch near roads or community can have better tourism if it is well interpreted for the excellent architectural experience.

Regarding this point, the broch ruins where people can visit them easily can have good tourism, even better than the complete Mousa. Thus, the coastal area of Caithness where there are more than 10 brochs near A9 Road can be the next spot to consider.

However, good tourism would require those ruins to offer an excellent visiting experience. A repaired ruins are still dull. More interventions are involved in enriching the visiting experience on sites.
For example, a conservation proposal (Figure 5.35) has been made for reconstituting historical stratigraphy, using the case of Ugarit’s Temple of Dagan (Teba & Theodossopoulos, 2019). The authors of the proposal suggested a lightweight reconstruction approach, an effective tool to present the temple’s analysis and stratigraphy and revitalise its cultural significance with the perspective of the visitors’ experience within the original context.

The proposal consists of two phases of conservation. The first phase is conceptual to highlight the uncertainties in the available archaeological evidence, while the second phase enables the musealisation and protection of the ruins underneath. It focuses on the ritual route and the original experience of the successive phases of the temple. A balance between the ruins’ preservation and the projection of their cultural values is explored, expected to release the embedded intangible aspects of these religious ruins. That is also the balance between original history and contemporary values.
As the massive volume is crucial to this temple, the reflection of this building’s volume would be light and conceptual, using a subtle framed steel structure to show the overall massive volume without specific details. It emphasises the interpretation of ruins, visualises the volume for architectural experience without damaging the objects of archaeological study. The contemporary values would require the ruins to be readable. Thus design interpretations can promote the architectural values of monuments.

Similarly, brochs need to enrich their contemporary architectural experience through conservation. Intervention can happen in recreating specific effects like the transition from light (outside) to darkness (staircases or cell) where the ruins are totally exposed, vertical circulation through the hypothetical platforms where only half of the stairs survived, and the feeling of a solid enclosure etc.

This thesis has studied the brochs through their collective concept as a building typology rather than separate images of different sites. The conservation for brochs in Scotland could argue for modern holistic projects that go beyond consolidation to be interpretive.

5.5 Interpretive conservation for brochs

According to the study above, brochs’ conservation needs to work on interpretation. Frank G. Matero (2000) has stated the interpretation of archaeological ruins as:

‘...From the broadest perspective, archaeology and conservation should be seen as a conjoined enterprise. For both physical evidence has to be studied and interpreted. Such interpretations are founded on a profound and exact knowledge of the various histories of the thing or place and its context, on the materiality of its physical fabric, on its cultural meanings and values over time, and its role and effect on current affiliates and the public in general...’(p.87)
Initially, excavated portions are embedded in the architectural body and are part of the visual image before any intervention. The features of the physical fabric, though, can be vague and need interpretation to make them clear and readable.

The interpreted building features must be architecturally correct, which requires research on the architectural reading and part of a coherent scheme highlighting Frank Matero’s points above. Based on the subtypes and regional models of brochs stated in Chapter 4, the conservation project can be improved.

5.5.1 The use of subtypes and regional models in conservation

This section would demonstrate how the architectural feature study can be linked to conservation. The use of architectural subtypes and regional models in conservation would be majorly about two points:

1) distinguish the original features from modifications
2) identify the brochs' invariant features and variant features.

The first point is essential for conservation. It helps to consider the removal of any less-value modifications that hide or modified the original broch features. The second point would help to interpret the brochs’ features, including basic features and variant features. The variant features include: 1) dimensions 2) positions of entrance and Stairs 3) levels of circularity 4) ground conditions 5) corbelled cells and guard cells. Most variant features are regional, in which case, one feature could be found in another broch nearby.

Thus, people can understand the standard broch models and the subtypes from different sites in different regions. Knowing the modifications, how can conservation treat them? The study will discuss the origins and modifications in the following section.
5.5.2 Origins and modifications

Firstly, there could be a debate on defining modifications regarding the date of conservation or modification. For example, some brochs built as part of a prehistoric village may date from different times. In Shetland, there are Clickimin, Old Scatness and Jarlshof, while in Orkney, there are Midhowe, Howe, Gurness and Lingro. Moreover, Bronze Age monuments surround them (Figure 5.36), so some of the brochs may have started as Bronze Age wall circles. The case of Jarlshof has been conserved as a mixture of prehistoric sites, highlighting each as part of different times. However, prehistoric sites are also mixtures of times, classified as the origin (when it was first built) and modifications (what happened after).

![Figure 5.36 The photo of brochs built in prehistoric villages. (Photos referring to Canmore database)](image)

The identification of ‘origin’ in conservation depends on how the monuments were valued. The most valued time in the building history is normally taken as the origin in conservation. The modifications (Figure 5.37) may have obscured the origins while they have become a part of the monument’s history. If a historic monument has had a long life and needs to be restored, the designs, function, and appearance of the monument have changed many times. The restoration proposal usually considers restoring it to the phase of the most important period of the monument life after the value study comparing different phases. It takes many considerations to decide which phase is more important, or more valuable, analysing different aspects from historic values to contemporary social values. As for all the historic and prehistoric monuments, the debate of conserving the original versus modifications is always valid.
The modification has become history, and understanding history’s values, or prioritising some, would change the conservator’s attitudes. For example, there was a controversial debate on conservation ideas between Viollet-le-Duc and Camillo Boito. Viollet-le-Duc’s stylistic restoration added elements to the building without evidence and rebuilt entire portions, including the walls of the nave, to create a more perfect/complete artistic vision which was called by Boito a lie to posterity (Orthel & Anderson, 2018). The intervention decision made by conservators would express the results of the value analysis.

Regarding the changes (intervention) made on sites, the Barra Charter (ICOMOS Australia, 1987) has stated that ‘If a place includes fabric, uses, associations or meanings of different periods, or different aspects of cultural significance, emphasising or interpreting one period or aspect at the expense of another can only be justified when what is left out, removed or diminished is of slight cultural significance and that which is emphasised or interpreted is of much greater cultural significance.’ (Article 15). At present, the modification in most broch cases is the changes of certain architectural elements (like the scarcement in Carn Liath and the lintels in Gurness) rather than the whole building alteration. The changes were highly related to the reuse of the building fabrics and would not carry the design culture of the later period. It is not necessary to display all the stratifications over time, but the major modification of reuse should matter. Thus, the modifications would have light cultural significance and should not be emphasised. The interpretation of the original broch is important, and it would require the restoration of broch characteristics and classification or removal of the modification part. The in situ retention of archaeological features and in situ interpretation may be the most desirable conservation outcome.

It is vital to figure out authenticity when defining a monument’s history. John Ruskin (1989, p.196) described the origin according to the age, mentioning the restoration as ‘a lie from beginning to end’ while emphasising the authentic characters which cannot be reproduced and stating that an old building should not be made like a new one, but should retain of wear and damage (Pevsner, 1969).
Also, conservation can reinstate the completeness of work which could never have existed at any given time. Viollet-le-Duc addressed the style of the building regarding authenticity.

The restoration was suggested to be based on respect for original materials and authentic documents. However, the term 'Authenticity could change according to different building context. Nara Document on Authenticity (ICOMOS, 1994) required the authenticity of monuments to be considered and regarded authenticity as an essential element in defining, assessing, and monitoring cultural heritage. However, as authenticity varies in different cultures, there would be a need for a broader understanding of the underlying cultural context. For brochs, the modifications and the 'uncertainty' characters of historical values are important parts of the heritage that the authenticity should include.

The reconstruction of a replica should also be carefully treated. Jukka Jokilahto (2019, p.65) criticized the case of the ancient imperial palace area in Nara. He stated the problems of the replica of the imperial palace which has been constructed in the centre of an archaeological area, were the clearly modern construction on the foundations of an ancient palace and the issue that it pretends to replicate a building that was in a different location. A replica should focus on the precise interpretation rather than a misleading message of the wrong locations, wrong architectural styles and any history that is not valid.

The integrity of archaeological sites, which includes all elements necessary to express their outstanding universal value, is essential. Jukka Jokilahto (2016, p.12) explained the example of Bam, which has high archaeological interest and still uses the ancient irrigation system. The proper functioning of the ancient irrigation system has asked for a system of strict social coordination for regular maintenance and care, which includes management of water resources, farming and agricultural production, trading and production of goods, residential and defence functions. The functional integrity of the place can enhance a better understanding and more precise definition of the outstanding universal value of a site. Therefore, the wholeness of archaeological sites should be focused on. Then, the conservation schematics for historical sites and prehistoric monuments with archaeological interest may differ.

For historic monuments, conservation (Figure 5.38) would consider three aspects of information, as surviving building (what need to be restored), the traditional techniques (the capability of construction skills) and the conservation outcome (restore it to origins or the later modified buildings, or even a mixture). Basically, the conservation outcome is based on the debate on a building’s history, mainly derived from documented data, like technical drawings or old photos. The surviving building data is used to compare the present situations and what it was before to know what needs to be restored.
However, for prehistoric monuments, the schematics are different. As the origins, modifications and traditional techniques are all undocumented, these data can only be traced through archaeological surveys on the surviving buildings. Therefore, there is only one kind of data source, the surviving building itself.

As the archaeological findings would keep developing and changing, sometimes later research or findings would challenge the previous archaeological decisions. It is doubtful to make decisions for conservation based on the only source, the archaeological study which justifies oneself. Brochs are the typical cases whose conservation depend on archaeology. Importantly, the usual methods of historic conservation would not work for prehistoric conservation like brochs.

Therefore, the prehistoric conservation for brochs should take more perspectives, bringing in the architectural perspective so that the modifications on the overall design rather than elements can be traced or conjectured.

If there are confirmed phases, should the sites be restored to their origin, or should the sites be kept as found? Anything done now is another modification to the original structure. The conservation should protect the archaeological values while adding architectural elements for interpretive purposes could be made.

So, what is the interpretation method for brochs? A framework of interpretive conservation should be established.
5.5.3 The framework of interpretive conservation

Historically, archaeology has long been preoccupied with finds and facts, which means many times of prove and disprove. Also, the conservation of brochs is a long-time task rather than accomplishing the goal once and for all. The interpretation can help display both hypothesis and evidence but eventually help people understand the brochs’ features.

The conservation frameworks of interpretive conservation would be built on previous conservation principles for brochs. For example, Clachtoll is under conservation and has one of the best quality in conservation research. The building data has to be recorded first. A laser scan and topographic survey of the broch remains was carried out by AOC Archaeology Group in January 2008. Then the conservation listed five points to follow in practice as below.

*CP1:* Maximise the retention in situ of historic fabric. Corollary: only remove loose or endangered masonry and deposits.

*CP2:* Minimise the adaptation of the historic fabric so as only to improve the visitor’s ability to understand the monument, or to address issues of health and safety.

*CP3:* Maximise the use of original fabric in the reconstruction of parts of the monument wherever possible.

*CP4:* Wherever possible, restoration of historic fabric is preferred to reconstruction.

*CP5:* Restoration will only be undertaken where the original configuration is demonstrable based on archaeological evidence derived from the site itself. (AOC Archaeology Group, 2009, p.30)
The conservation of an ancient monument like a broch must protect its architectural, historic, and archaeological values. However, it can go beyond and stress the concept of their ambitious design to make them readable and offer an architectural experience both for the public and researchers. Completing architectural features can offer a precise delimitation of space, like the low and narrow galleries showing there were possibly many people using them at the same time. These features, if existing in a whole broch, could be highlighted to archaeologists to imagine the possible diverse activities and frame the use of the artefact found on sites. The interpretive conservation has two levels of meaning:

1) Correct past conservation errors if later scientific research proved them wrong.

Correcting the errors mainly aims to keep pace with the present archaeology research, which may disprove the previous statements that had influenced the finished conservation project. Highlighting the important features, especially for people’s recognition of the monuments.

2) Clarify features if they are confusing.

Clarifying features are interventions on broch sites that distinguish one feature from the other. It mainly involves restoration methods to save the features from being vague or missing where the collapse happened. Notably, the later modification should be clarified if being proven.

The frameworks may work with brochs but can be challenging for other prehistoric monuments, as the expectations and rules may not be the same. Corinna Rossi (2017) found similar challenges in the multidisciplinary study of the Late Roman archaeological site of Umm al-Dabadib, stating that not everything can be successfully exported from one disciplinary field to another, and from one country to another. Survey methods that represent the optimal solution in one place might be impractical to adopt in another place, whilst restoration techniques that are uncommon in one place might correspond to the best solution in another context (p.24). Thus, the framework of interpretive conservation needs to be carefully applied to other ‘uncertain’ monuments after the local context is studied.

5.6 Conservation practice for brochs

At present, most broch conservation projects are limited to consolidation. However, some consolidation work has restored the features. The consolidation work is definitely needed, but further interpretive work should work on restoring the architectural features, making the orginal broch’s atmosphere appear.

Thus, this section would study the conservation work which has been done or is in progress. It is classified into two kinds: 1) Consolidation of building elements 2) Restoration of architectural features.
5.6.1 Consolidation of building elements

Reconstructions of entire staircases (Clachtoll)

In Clachtoll, the excavation happening in 2017 uncovered the 13 steps of the original stair ascending clockwise. The doorway to the staircase was badly damaged, the inner wall was bulging, and the gallery floor was uneven, so there was an immediate need for reconstruction to avoid a collapse of walls. The entrance was consolidated firstly and after archaeological excavation in 2018. The staircase (Figure 5.39) was dismantled and reassembled, and all rubble at the interior was removed. AOC Archaeology expected more steps to be revealed as the average stairs from ground floor to 1st-floor consist of 17 steps.

Stairs are structurally working as binding elements between the inner and outer walls. Consequently, they could show whether the walls suffer displacement. Keeping them as found or rectifying them is an important, delicate part of a broch’s consolidation. Although there is often a question of whether the original stairs were uneven, this may not affect the architectural space and its spatial sequences. However, the length and width of stairs are critical. Reassembling for consolidation has to be planned carefully using reliable information from typological studies like this thesis to avoid confusion.
Reassembling the walls (Midhowe)

The Western part of the walls in Midhowe (Figure 5.40) has partially collapsed and exposed the staircases. The blocks should be reused for reassembling the inner and outer walls. However, it should follow a clue of the façade pattern. For example, Dun Telve can be referenced (Figure 5.41). The thicker blocks are always used for the lower side of the walls. This feature also can be found in Mousa and Dun Troddan. Typically, the higher part of the building would make it harder to build with thick stones due to the stone weight. This order of laying stones has been found in the other four tall brochs (Dun Troddan, Dun Carloway, Dun Dornaigil and Mousa). For a collapsed broch, the fallen stones can be reused, but they should be placed following this order, from thick slabs at the lower part of the walls too thin slabs at the wall head.

Figure 5.40 The Western side of Midhowe (photo taken by the author in May 2018)

Figure 5.41 The Western façade of Dun Telve
Reconstructions of wall-heads (Dun Telve).

Reconstruction of wall-heads mainly aims to preserve the top face from footfall, animals, and erosion. Small slabs were used to fill the gaps between big slabs. The wall heads often need to be reinforced to form a smooth surface. In Dun Telve, the wall-heads on the first floor were protected (Figure 5.42) by letting moss and grass grow and act as soft cappings.

The grass, moss and soil also built up a thermal and moisture-buffering layer, impeding the decay of masonry structures (Morton et al., 2011). Species growing on the wall-heads have to be in control. The maintenance should be regularly done, removing the vegetation growing, and since moss prefers to grow in acidic soil, some alkaline paint could be used to control the PH of the exposed surfaces.
Steel bars used for the consolidation of stacked voids
(Mousa and Dun Troddan)

Stacked voids are weak structurally as they are kept apart by a few stone slabs that connect the two sides of the voids in the inner wall. Due to weathering and erosion, most of these linking lintels have shown different cracking levels in the two sites. Dun Telve and Mousa have used steel bars for consolidating the stacked voids.

Steel bars (Figure 5.43), with high strength and stiffness, are thin so not intrusive of the architecture, and this can be regarded as minimal interventions. Importantly, Stacked voids need safety checks regularly. Unlike the settlement and bulging of walls, which can be spotted by eyes, the cracking of the stones in stacked voids is subtle. It is like the ‘butterfly effect’ that a small crack could lead to walls falling.

Generally, steel is presently good as a repairing material for brochs, but it is expensive and has to be treated to avoid corrosion. This is reversible conservation, which could be used to interpret the broch missing features as well. For example, it could be used to complete the damaged wall circle or missing scaracement to recreate a broch’s atmosphere.
5.6.2 Restoration of architectural features

Restoring too many features (Clickimin)

Clickimin Broch (Figure 5.44) is situated on the south shore of the Loch of Clickimin, three-quarters of a mile southwest of Lerwick. It is the nearest broch to the town and one of the best-preserved ones. It was excavated between 1953 and 1957 by Hamilton (1968), who recovered a history that shed new light on the Iron Age colonization of the area. He stated this broch was built from 100 BC to 100 AD on an abandoned ringwork, which was a large masonry platform. John and Julia Keay (1994) mentioned that the interior of the building had been originally modified with an inner wall part of a later dwelling constructed in the 2nd or 3rd century AD. After it was abandoned in 800 AD (Hamilton, 1968), the gradual settlement of the structure has led, on more than one occasion, to bulging of the outer wall face and thus to instability. Previous conservation has possibly made the walls much thicker than the original to make them firm. This can be confirmed when compared to the PBM and dimensions of nearby brochs like Levenwick and Clevigarth, which have a similar inner-wall diameter, about 9m, but outer-wall diameter, around 16m, the outer wall diameter of Clickimin, around 20m, seems to have an additional thickness which was built after the broch. With further excavations in the future, the original thickness could be proven to be widened in later times.

The earliest occupation of the site was a small Late Bronze Age farmstead of the 7th or 6th centuries BC, which was superseded by a larger circular farmhouse built by Iron Age immigrants in about the 5th century BC. In the 4th or early 3rd century BC, large and well-organized bands of Celtic settlers arrived, capable of erecting a stone-walled fort consisting of a blockhouse and ringwork, which was in turn superseded by a broch about the 1st century AD. In the 2nd and 3rd centuries AD, the need for such defences passed away, and the subsequent history of the site centers around a large wheelhouse built within the reduced tower and with little outhouses, storage pits, and cattle stalls dug in the debris inside the older defences (ibid.).
Figure 5.44 North-side of Clickimin Broch (taken in May 2019)

Figure 5.45 Level 0-4, viewed from the wall head of Clickimin (diagram credit: Chang Liu)
Due to the confirmed modifications, the inner space of this broch seems to be too complicated in comparison to a normal broch. The outer edge of the broch is not even where the added parts could easily be seen in the North-Eastern direction, as Figure 5.45 displays. The entrance of staircases (from level 1 to level 4) was linked with the timber stairs inside connecting to level 0. The circulation of the broch starts from the South-Western entrance and goes up through the staircases on the 1st floor, which creates a 90 degrees angle to the entrance. However, this relationship is relatively obscure, as the side level 2 formed a slope and level 3, which resulted from partial collapse at the inner wall head, formed another layer of the slope. According to the archaeological report (Ibid.), level 0 and level 1 are on the ground floor while level 2 to level 4 belong to the 1st floor. Also, the scaracement seems to be fluctuating at this broch. Therefore, Clickimin presents a confusing idea of the building, in whatever initial phase it may be regarded.

Frank Matero (2007) stated that all cultural works have a continuing history, that they are used, damaged and repaired, cleaned and restored, and sometimes destroyed. Their present state records not only the moment of creation but also a whole subsequent sequence of events. The removal of the modifications is controversial as the additional stone structures represent the actions of later cultures and their understanding or lack of appreciation of the original broch, which can be seen as historic values. The criteria for changes would be hard to set. However, if the additional wall thickness was confirmed as an attempt for consolidation in the recent hundred years, which has few values to be kept, and the structural technology can make this broch retain its original dimensions, this additional part should be removed.
Nevertheless, this debate needs to be interpreted with the modifications highlighted on other sites in Shetland, or it would confuse visitors and mislead the public’ understanding of what a broch is.

Especially, the collapsed walls, which were poorly consolidated in the 90’s, were made thicker with an additional wall, making the original wall thickness hard to know. Regarding a long period in the future, if there was no highlighting of the dimensional features, the conserved walls could have been slowly enlarged dealing with a collapse.

**Restoring wrong features (lintels and walls in Gurness)**

![Incorrectly placed lintel in Gurness](image)

Figure 5.46 Incorrectly placed lintel in Gurness (Photo by Barber 2017, p.230)
There are some even worse conservation projects which are misleading. Broch of Gurness is a case where dating was mis-interpreted or ignored (phases that never co-existed were presented together) while Midhowe restoration actually brought back features that the earlier clearing of the ruins had cancelled (edge-set slabs applied as external buttresses against the N face of the broch wall). The lintel (Figure 5.46) was falsely placed, which should have been horizontally supported by the stones on two sides.

The inner wall of preserved Gurness has been proved to be leaning outwards (Barber, 2017, p.230). The earthfast (Figure 5.47), standing on the ground on the right side of the highlighted bulge, has shown a curved shape of the masonry pattern because the gaps between earthfast and the inner wall have become wider. A possible settlement may have happened. Thus, preservation has failed, and further consolidation should be done urgently to avoid collapse.
A laser scan image of the broch at Gurness (Barber, 2007, p.223)

The photo of the view point in broch Gurness (picture taken in May 2019)

Figure 5.47 Deformations and past repairs in Gurness (the view taken from the broch center to broch entrance)
Restoring features (lintels and walls in Midhowe)

Aerial View of the broch Midhowe

Photo of the view point in broch Midhowe

Figure 5.48 Deformations and past repairs in Midhowe (the view taken from the broch center to West-North)
In comparison, Midhowe (Figure 5.48) in Orkney is much better preserved. The lintel is horizontal, as standard. The surface of the inner wall appears to be more compact and neater, with relatively uniform masonry thickness. Only parts of wall heads have shown a slight leaning. The big slabs vertically placed are much regular-shaped. Thus, there were few gaps between the earthfast and the inner wall. John Barber (ibid.) suggested the conservation work in Gurness as a failure.

Similarly to the incorrectly placed lintel in Figure 5.46, the masonry pattern in Figure 5.47 indicates a highly possible later intervention rather than the progressive combination of human action and natural decay. Following a large-scale collapse, the monument was repaired as a broch, but its structural failure continued, and eventually, it became subsumed within its decomposition products. Because of that, as a retrospective observation, the conservation should respect the original form, so the structural changes in later times should not have been confused with the original work, or it will be understood as variant features, which falsely change the definition and identity of brochs.

Moreover, the building has some rare features compared to other brochs, especially the entrance part, and the surviving elements indicate that this was a cellular house (Gilmour, 2005; Henderson, 2007). John Barber (2017, p.240) agreed, stating an Early Medieval cellular structure was built over the mound containing the reduced broch near the broch entrance. The cellular can be seen as a modification rather than an original variant feature, which has not been highlighted enough.
Restoring features (circularity in Ousdale)

Figure 5.49 The circularity restored in Ousdale

Ousdale is an unusual broch embedded in the ground that has been heavily damaged (Figure 5.49). The tree growing at the internal debris was removed to clear the entrance and the stones were reused to rebuild a part of the inner wall.

The consolidation work is currently successful, arresting the structural problem caused by the partial collapse of the inner wall circle. More importantly, the architectural features of this broch became clear. The circularity is recovered and the lintels of the cell become visible. Besides, the clearance of the earth and grass in the garth made the foundation readable (about 30cm underneath the level of the broch before consolidation).

This is the only broch found in Scotland with this unique feature, where people can walk down from top to bottom, as from the outside to inside. It is still controversial to answer the question of whether this spatial feature represents space perception in the Iron Age or was caused by the specific geographic conditions.
Interpretation of phases (Thrumster)

Since broch Thrumster has at least three phases confirmed by archaeologists, the three phases need to be interpreted as shown with a restoration proposal example (Figure 5.50) on broch sites. The conservation could make three points as below,

1) Highlight phases with very different masonry. The digram shows that the masonry of red color is used in the stair-access-cell and the passage to highlight the broch period work.
2) Complete the missing ¼ with neutral materials. The restoration has used glass boards, offering a view of the original fabric. It also installed the steel bars for structural safety, which are removable. It aims to make up the missing parts and rebuild the entrance with masonry lintels.
3) Highlight the scarcement. The same new masonry is used to extend the scarcement to make it notable.

Additional text and diagrams should explain the new materials and structures that won't confuse the visitors.
The modification of the scarcement (Carn Liath)

Kindradwell is suggested to have the same regional model as Carn Liath, shown in the typological study diagram (Figure 5.51). However, the scarcement of Kindradwell (Figure 5.52) is constant and horizontal, running around the inner face over 2 meters from the floor. Also, compared to other brochs’ scarcement, the curved ‘possible scarcement’ on the inner wall-circle at Carn Liath (Figure 5.53) is misleading as the shape cannot be used to support an internal platform. Initially, it was suggested as scarcement by Mackie (2007). However, John Barber (2017, p.142-143) found scale errors in drawings that failed to find the proper position of the inner wall face. He proved that the curved scarcement was either caused by the structural failure or by the tower’s reconstruction at and above that level that was returned. Therefore, the origin of scarcement is either lost or covered in the ‘possible scarcement’, which is an inner lining wall face built attached to the original inner wall face. Also, the position of the lintel in the photo of Carn Liath (the lintel of the stair-access- cell) indicates where the original inner wall face should be.
Figure 5.52 The scarcement in Kindtradwell.

Figure 5.53 The view of inner wall in Carn Liath and Dun Troddan
The regional features should offer a template as a reference to the conservation. It helps to understand the most possible origins. For instance, a broch ruin modified or consolidated with stones may become much bigger in area. The later modification may have fixed the problem but not make it the same as the original shape. Like the cases in Carn Liath and Clickimin, some brochs have been modified or repaired in modern times with additional wall thickness, re-using stones from the site but without documentation. It is reasonable that some careless past conservation reused the stones of collapsed parts for repairs or consolidated the walls with additional ones.

If more evidence or findings are needed to confirm the changes in the conserved sites, a mark on the modification parts of brochs should be possible. Removable structures, like steel bars, as seen in Figure 5.54, could be used to make up the collapsed parts and the original wall head of the inner wall, which could offer the impression of the function of the building elements and the sense of building scale without damaging the archaeological site.

However, under the concept of being interpretive, there would be a question about what level of impact this approach should reach. Article 9 of the Venice Charter (ICOMOS, 1994, Article 7, p.1, ) stated that ‘any extra work that is indispensable must be distinct from the architectural composition and must bear a contemporary stamp’, which stressed the importance of respect for original material authentic documents. For brochs here, the authenticity lies in ruins, and the archaeological values should be prioritised. The interpretive conservation for brochs should not repair them with the same sandstones as being confusing or fake. Importantly, the added materials should always be removable to get rid of the damage caused by improper conservation decisions.

Figure 5.54. Steel bars highlight the original inner wall face in Carn Liath
A viewing platform (Clachtoll)

Historic Assynt made a design application for the erection of a viewing platform at broch Clachtoll. The structure was planned to be fabricated from heavily galvanised steel with a dark grey finish to avoid reflection (Figure 5.55).

The platform proposal aimed to control visitor access and circulation so that there was a reduction of visitors walking on the top of the turf-covered drystone walls and reduce erosion. It also seeks to offer a level of protection to the broch from the sea and would incorporate Information and illustrations, which increases the understanding and appreciation of visitors. It is an interpretive structure set on site, which is indeed an intervention. Moreover, it is reversible and could be removed, which could be of contemporary use.

However, the platform would change the appearance and make the circulation of visitors different from that of walking in the first-level gallery. The platform can be an excellent approach to interpreting features but should follow the design of the original building, in which case a ring-shaped platform would be better. Also, since a complete broch has cells and staircases which are in a closed-cobbled space, the atmosphere of a dark space is an architectural feature to be clarified. Thus, the platform can be used to enrich the visiting experience, which gets closer to that of Iron Age people in brochs.
5.6.3 The reconstruction replica of broch

For prehistoric architecture like brochs, authentic documents are missing. The reconstruction of a 'complete' broch that follows the design traced through academic research would not damage the authenticity of monuments.

Considering the matter of brochs which is under the same conservation purpose, the reconstruction replica would first be distinct from any original monument conditions, and make mixtures of brochs and other monument types, and then offering the contemporary site experience with full scale and proper features, which would make the understanding of the building type easier.

Reconstruction replica could face future archaeological findings, which may challenge the previous understanding. It could be keeping pace with updating discussion and archaeological reports. Thus, the pledge for optimizing tourism strategies could be achieved when the sense of reading broch history is offered.

Since the design of the replica is based on broch understanding of this time, it has a temporal role to interpret the 'brochs'. It could be seen as an experiment. A new finding in archaeology or architecture could support a different reconstruction plan of a broch. However, the replica that could develop with the research can have a broader audience, stimulate tourism, and be a part of the interpretive work in conservation.
The replica shown in (Figure 5.56) known as the CBP broch was designed to be built in a place where there are no other broch ruins. The location prevented confusion that the CBP would look like an original work. Furthermore, the replica serves as a tourist attraction and acts as an important project in experimental archaeology. It also serves as an educational place narrating the regional models and regional subtypes rather than one standardizing model.

However, there comes the new controversial question which broch to be imitated for the new replica broch. The CBP broch is designed by incorporating features from various brochs to show the broch designer’s palette while accommodating the modern human frame size, making some concessions to safe access for all and accessibility for those with additional needs, and include modern requirements for a visitor attraction such as emergency lighting and ventilation, fire detection and alarms.
Figure 5.57 CBP Broch Symposium (Stirling Engine Shed) (Photo taken by the author)

Figure 5.58 A section of CBP broch (picture credit: Caithness Broch Project)
CBP hosted a Broch Symposium in January 2018 (Figure 5.57). The scholars doubted the way of making this broch, composing each 'perfect element' including the triangle lintel, but the result is a bigger Mousa with two corbelled cells and one guard cell (Figure 5.58). Archaeologist John barber questioned the project and pointed out the problem that 'no other broch is like Mousa'. He mainly disagreed with the reconstruction model that may represent the collection of brochs which would be wrong.

CBP broch was planned to be built in Caithness and may learn from the brochs in Caithness. The replica could be regionalized rather than a 'perfect' one that never existed. Brochs have quantity and regional subtypes. Thus, a reconstruction replica may need a quantity, where each region has one for demonstration. Thus, at present, a regional replica for the Caithness community would be a better idea.

There is another issue to be discussed as the building methods. CBP broch used steel structure hidden between the inner wall and outer wall for safety. Thus, this work is actually a new building design whose appearance looks similar to broch rather than a strict reconstruction of a monument. Regarding this point, authenticity can be a problem.

The replica can interpret the brochs' concept as dimensions and building elements. However, the story behind this building project needs to be explained as well. The bigger inner space set for the capability of more visitors does not respect the original dimensions regarding authenticity.

The action of reconstruction replica for a broch still follows the conservation principles set by ICOMOS. However, how to build it is a big challenge. It requires a clear identity of this project and its contribution to the subject.
5.7 Chapter epilogue

Brochs are weak in their original design appraisal, as it is not fully understood and need more help from archaeological excavations and the typological analysis of the regional context. Also, brochs are weak in the fabric due to the surviving conditions, which are pure, drystone (not bonded) masonry without graceful decorations. The archaeology-led conservation for brochs has limitations. This study mainly claimed two points of weakness: 1) the missing architectural perspectives; 2) the missing typology used for the regional study.

The architectural features could be seen as the choices the original builders made when they were designing. The brochs could not be appropriately understood if the integrity of the features were not well studied and thus led to a loss of richness in design. The origin of brochs as rich designs and architectural spaces would ask for more interpretive works on ruined sites.

‘Uncertain’ monuments lack documents, which is the essential information to be interpreted. There can be exhibition boards demonstrating how much the present research has gotten to know the brochs. The architectural-supporting typology, which helps restoration and archaeological-finding supporting evidence that narrates the mind of Iron Age builders, can be read by the general audience. The interpretive conservation would focus much on the origin of brochs. Therefore, correcting mistakes in unprofessional excavations or consolidation and clarifying essential features with the help of typological studies (PBM and subtypes) have become necessary. Reconstruction replica interpreting the complete building features has to be clearly differentiated from real sites. The straightforward demonstration of the collection of the brochs and how they can be understood is addressed. The conservation would allow possible misjudgments in archaeology research at present and in the future as the reversible changes on prehistoric sites would mainly eliminate misunderstandings caused by later modifications. The interpretation and conservation of the uncertain monuments should keep renewing with the latest findings and research.
The critical contribution of this thesis is to challenge the conservation of brochs, currently led by archaeology, with typological studies on brochs’ architectural features, which would improve their conservation with stronger interpretation on sites. Conservation of uncertain monuments, especially for ruins, should analyze the need for interpretation. The way of interpretive intervention on-site, which is a creative work needs architectural perspectives.

The broch ruins have secured an understanding of history where the excavations might tell how our ancestors lived. The ruins need essential maintenance and repairs inasmuch as their values in prehistory and architecture. However, most of the brochs are 'dead monuments', in which case they are not in use at present. To make broch ruins meaningful, the use of the sites becomes important, which is also the goal of conservation. Tourism would benefit the sites and the local communities that currently run the business while maintaining the ruins. Tourism in its wider sense should attract a broader audience would require brochs to be readable. Since the broch ruins are conserved by archaeologists (primarily applying consolidation) and still lack wider interpretations and interventions to become readable as architectural structures, typological studies could help the broader architectural readings, especially where features are fragmented.

The interpretive conservation frameworks for these uncertain monuments can correct past conservation errors or prevent new ones while clarifying the features if they are confusing. Especially for ruins, where the features appear vague, the frameworks can improve the conservation with a stronger architectural visiting experience. Ruins can be explored with values to be conserved. The study wishes to challenge the completeness needed for broch, diverting the attention from a broch as 'Mousa' to the ruins like Cairn Liath, Clickimin and Midhowe, which could be more attractive if they are read together.

The uncertain monuments should be studied with broader subjects before the conservation planning. The extrapolation of the experience gained in researching the case study of brochs can suggest interdisciplinary research involving architecture and archaeology to understand the uncertain monuments and deal with the uncertainty through appropriate intervention in conservation.
This thesis has two research questions (Figure 6.1) which were answered with typological methodologies on broch architecture in Chapter 4 and Chapter 5. Chapter 4 has offered a deeper understanding of brochs through features reading. This chapter found the design scheme of the broch, from a location to build it to the architectural features. The outcome of the study in this chapter is the information of subtypes and regional models. Understanding these regional characters would help the conservation study in Chapter 5 that focused on how to use this architectural reading to bring new perspectives to the established conservation, which archaeologists have mainly conducted so far. The points of interpretive conservation can suggest conservation improvement, taking some conservation practices in Chapter 5 as examples.
6.1 Summary of typological reading

The typological study approaches the principle of broch design through reading features in a regional context and eventually seeing brochs as a collection rather than individual monuments. This typological study can make contributions to conservation in four ways:

1) The typology works as information or built context for museological purposes.
2) Typology can interpret the variants of established architectural features.
3) The analysis can help the understanding of the often fragmented features, contributing to defining the identity of the monuments and the regions
4) The studies could provide a set of cognitive, technical, and construction information, linking the surrounding conditions with the buildings in a systematic way.

Generally, this methodology can identify regional subtypes and models that would help classify variations of original designs with later modifications on sites. An understanding of architectural features is necessary for conservation study. Here is the summary of the new understanding of broch architecture derived from the typological studies on architectural features in chapter 4.

Locations

The location preferences studied have shown that a relatively flat ground with near waters and higher elevation (compared to surroundings) was ideal for building brochs. However, the broch builder can still deal with the challenge of a sloping ground for a broch with high circularity. The location preferences regarding ground conditions and the distances to nearest waters have shown some levels of regional characters.

The study of locations has offered a glimpse of regional characters of brochs. Especially the preferred ground conditions are different based on areas. Then, the reading on the design of the brochs has demonstrated regional subtypes and models

Dimensions

The standard brochs are more likely to appear in 6 areas: Shetland, Orkney, Caithness, Sutherland, Outer Hebrides, and Skye&Lochalsh. It could be found in the high concentration areas, as as the South of Shetland, the central area of Orkney, the Eastern side of Caithness, the Central area of Sutherland, the Western coasts of Outer Hebrides and the Western coasts of Skye and Lochalsh. The standard PWB of the Northern area (Shetland, Orkney, Caithness and Sutherland) is 48%-54% which is higher than that of the Southern area (Outer Hebrides, Skye&Lochalsh, Argyll and the rest of Southern mainland), as 39% - 44%.
Circularity

The high concentricity and circularity can be seen as an intentional will of Iron Age builders, presenting the full awareness and understanding of round shapes. Argyll and Outer Hebrides have the least circularity in brochs which may be a local trend or style due to the isles’ geographical conditions.

Sloping ground could cause less circularity, where the broch walls may be built parallel to the contours of the slope. However, the broch entrance has a high possibility of being used as a symmetry axis to achieve circularity of building on a steep slope.

Orientations

Both the orientations of broch entrance and stair-access-cell have not shown a significant trend of any particular direction. The orientations are not crucial for the design and could be less possibly related to prevailing wind directions.

Cells/galleries

Most of the broch cells and galleries were built near or on the right middle between the inner wall and outer wall.

Guard cell could be a stylish and defensive design that appears most in brochs in Sutherland. Shetland and Argyle have a few brochs with guard cells, whose islands and isles are relatively safer regarding fewer populations and fewer wild animals.
Conclusions

Figure 6.2 The PBM applied to Caisteal Grugaig and six pairs of brochs with similar plans.
In terms of the broch’s plans, the PBM (Perpendicular Broch Model) is found in this thesis which should be the standard model for brochs in general (Figure 6.2 top picture). It takes Caisteal Grugaig as an example of how the 90-degree angle between entrance-to-center and stair-access-cell-to-center worked to create a path that supports comfortable climbing on the steep slope. The model offers a profound understanding of how Iron Age builders are wise to build brochs with excellent structural behaviours.

The PBM was applied to the six pairs of brochs (Figure 6.2 bottom picture) with similar design characters except for the orientations. The six pairs of brochs whose locations are near and the ground level plans are similar in a pair proved that there were broch plans (of a regional model) were used to reproduce brochs at different locations. Moreover, the six pairs of brochs have different dimensions based on the different areas.

The summary of broch understanding with new findings in regional characters could be read from Figure 6.3. The subtypes in the different regions have depicted the standard model with unique parameters of architectural features for each region. These have developed the Revised Standard Model for broch (Barber, 2017, p.101) and found regional characters of subtypes. The brochs built on the boundary of two areas may have characters from both of them.
Figure 6.3 The subtypes of standard brochs in different areas shown in the map of Scotland. (‘I’ means inner wall diameter, ‘O’ means outer wall diameter)
6.2 The main points in conservation

The research outcome can be used as guidance for repairs, restoration, or even reconstruction of broch features. The use of the outcome is displayed in Figure 6.4.

![Diagram](image.png)

Figure 6.4 The used of PBM, subtypes and regional models.

1 Consolidation of building elements.

Based on the reading of the features in typological studies, the building elements are relatively fixed with recognized forms. The wrong consolidation should be prevented, like the uneven entrance lintel in Gurness and the curve-shaped scarcement on the ground floor in Carn Liath.

2 Restoration of architectural features.

The restoration has to be carefully done. The PBM can suggest the correct position of the entrance and stairs if a broch has two entrances or the stair-access-cell was missing. The subtypes could tell the style of the brochs in one area. Moreover, the regional models, the 12 brochs in Sutherland, Caithness, and Skye&Lochalsh, can offer references to the conservation of the brochs near them. Future archaeological excavations can tell the modifications and phases of sites (like the case of Thrumster). If the modifications are proved, the restoration under the principles of minimal intervention should use structures with removability to interpret the sites to the general audience. This part would aim to clarify confusion, make regional connections, and eventually improve the architectural experience of sites.
3 The reconstruction replica of brochs.

Through this study, the reconstruction replica is possible. However, only one broch replica, which cannot represent the brochs with all the variants, may lead to misunderstanding. A well-interpreted replica of one regional following the characters of subtypes should be a better choice.

6.3 Limitations and Suggestions for Further Research

The data used in this thesis were based on findings and archaeological reports published so far (2021). Future excavations can then add more cases into the collection, which is analyzed here. More evidence found on sites in the future could optimize the interpretive conservation with new information.

This study would suggest further interdisciplinary research on uncertain monuments where architecture should work closely with archaeology. The way of intervention is also important. The durability, removability, feasibility, and sustainability of intervention on brochs can be the future study.

Above all, the main challenges of conserving uncertain heritage are the lack of valid documents. Thus, discovering more information through research becomes essential. There are two principal points to be considered for generally ‘uncertain’ heritage as below.

1) Treat the type of monuments as a whole.

The uncertain heritage may appear as more than one single monument. The relationships of features among different sites are important and can be read by studying this type's collection.

2) Concentrate on the regional variations.

The standard model or subtypes may be hidden from regional variations. The conservation strategies should interpret the regional variations to demonstrate the heritage for better understanding.

The Scottish brochs have given a different situation from other historic monuments to consider the conservation without knowing the origin. However, the conservation for both known and uncertain monuments can still share some level of identities, in Frank Matero's words (2020) that 'conservation itself is a way of extending and solidifying cultural identities and historical narratives over time, through the valorization and interpretation of cultural heritage' (para. 2).
References


Boito, C. (1883). “Ordine del giorno sul restauro” at the *Convenzione nazionale degli ingegneri e architetti italiani* [National Convention of Italian Engineers and Architects], Rome.


Giovannoni, G. (1946), Il restauro dei monumenti (pp.45-83). Roma.


Appendix

The brochs in Scheduled Monument List (HES, 2019)
(the 87 brochs studied in this research are highlighted in the table)

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