Making Key Pattern in Insular Art: AD 600-1100

2 Volumes
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Abstract

Key pattern is a type of abstract ornament characterised by spiral shapes which are angular rather than curved. It has been used to decorate objects and architecture around the world from prehistory onward, but flourished in a unique form in Insular art (the art of early medieval Britain and Ireland, c. AD 600-1100). Ornament of many kinds was the dominant mode in Insular art, however, key pattern has remained the least studied and most misunderstood. From the 19th century, specialists mainly have relied on simplified, line-drawn reproductions rather than original artworks. These 'correct' hand-made details, isolate patterns from their contexts, and in the case of Insular key pattern, de-emphasise its important physical structures. This resulted in misunderstandings of key pattern's structure and an inability to recognise evidence for medieval artists' working processes. Postwar art historians and archaeologists then largely abandoned study of ornament structure altogether, in critical reaction to this earlier method. For two centuries, academics have overlooked the artists' role in pattern-making, and how their creative agency is reflected in patterns' internal structures.

In response, this thesis presents a new, artist-centred method for the study of Insular key pattern, which adapts Michael Brennan's pioneering approach to Insular interlace (a different pattern), to suit key pattern's distinct structure. Close examination of objects and monuments, rather than idealised 'types', has revealed how Insular artists themselves understood key pattern and handled it *in the moment of creation*. The core of the thesis is an analysis of key pattern's structural properties, i.e. its physical parts and the abstract, often mathematical concepts that Insular makers used to arrange and manipulate these parts, in order to fix mistakes, fulfill specific design goals, or invent anew. Case studies of individual artworks support this analysis and demonstrate how key pattern is a vehicle for accessing Insular artists' thought processes, as they improvised with the pattern's basic structures for maximum creative effect. For the first time, this thesis also places Insular key pattern in its global context, via comparative analyses of key patterns from other world art traditions. This investigation has confirmed key pattern's origin in prehistoric basketry and weaving technologies and explains why Insular key pattern's geometric complexity remains unparalleled. The adaptation and expansion of this new analytical method for key pattern also proves its applicability to any type of ornament from any culture, making it immediately useful to art historians and archaeologists. This thesis therefore represents a larger paradigm shift that brings ornament study into the 21st century.

Table of Contents

Volume 1: Text

*For Table of Contents for Volume 2: Figures, see Volume 2.

Dedication

To my family, loved ones, and friends, whose support means the world to me. And to the pattern-makers, who inspire me.

'I think I am extremely lucky to have gotten to the end of it all without finding myself an inmate of a lunatic asylum or the workhouse.'

> --John Romilly Allen, in a letter of thanks to a positive reviewer of *The Early Christian Monuments of Scotland*, in 1903, as published in Isabel Henderson's introduction to Pinkfoot Press's 1993 reprint of this publication (p. 31).

'What do they do,
the singers, tale-writers, dancers, painters, shapers,
makers?
They go there with empty hands,
into the gap between.
They come back with things in their hands.
They go silent and come back with words, with tunes.
They go into confusion and come back with patterns…

That is where they live,
where they get their breath:
there, in the gap between,
the empty place.

Where do the mysterious artists live?
There, in the gap between.
Their hands are the hinge.
No one else can breathe there.
They are beyond praise.'

> --Excerpts from 'Artists', in Ursula Le Guin, *Always Coming Home*, Hachette UK: 2016

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First, I offer my deepest thanks to my supervisors, Dr Katherine Forsyth and Dr Ewan Campbell of the University of Glasgow. Their unstinting generosity with their time, expertise, guidance, and support (both academic and emotional) made my thesis possible. It was a joy to learn from them. I benefitted not only from their expert supervision in matters related to Insular art, but also from their willingness to go above and beyond the call of duty in so many ways: for example, in kindly providing me rare reading materials from their own collections as well as their photographs of monuments, objects, and museum displays; accompanying me on a research trip to view Pictish stones; supporting me in my first publications, funding applications, and conference presentations; and more. I am so thankful to them for their steadiness and kindness to me as I undertook this great academic challenge. I also extend my gratitude to the University of Glasgow's College of Arts for awarding me a three-year Ph.D. Scholarship, and to the College of Arts, Society of Antiquaries of Scotland, and the Society for Medieval Archaeology for their additional awards that allowed me to travel for conferences and research vital to this thesis. I offer deep thanks to the Marshall Aid Commemoration Commission, for awarding me a two-year Master's scholarship between 2011-2013. This scholarship provided many opportunities, making it possible for me to continue study at the doctoral level afterward.

I owe so much to two intellectual giants who broke new ground in the study of Insular pattern. First, I tip my hat to the late John Romilly Allen. Although this thesis contains detailed criticism of his methodology, Allen deserves great respect as the first antiquarian to 'see' Insular patterns and study them with the detail and care that they deserve. His awe-inspiring research paved the way for all future inquiries. Second, I am very grateful to Dr Michael Brennan, who in his 2011 doctoral thesis invented the methodology that I adapted here for key pattern. Michael met with me at workshops and conferences to discuss Insular ornament. His guidance and encouragement were indispensable. He first helped me visually recognise and grasp the importance of key pattern's spiraliform nature, as well as the internal symmetry and spin direction of those spiral structures – phenomena that became crucial components of my analysis. Michael did not seek to shape my conclusions, but generously brought these issues to my attention and let me extrapolate on my own. He offered suggestions on many other points as well, all of which I carefully footnoted throughout this thesis.

Many more academics also offered me invaluable help. I thank Dr Jo Clements for taking me on wonderful Pictish stone safaris and inviting me to lecture at the Groam House Museum, and I am grateful to Susan Seright for her advice and encouragement in our discussion of the Rosemarkie stones. I thank Dr Susanna Harris for her guidance on prehistoric basketry and textile weaving, Dr Elizabeth Moignard for advising me on ancient Greek key pattern, and Dr Donncha MacGabhann for forwarding many intriguing Insular key patterns, some of which feature in the thesis. Stephen Walker offered detailed information on metalworking, as well as editorial comments for that section of Chapter 3. I also thank Dr Niamh Whitfield and Raghnall Ó Floinn for providing reading material and high-quality photographs of the Ardagh Chalice, respectively. I am grateful to Dr Victoria Thompson for her generous support and advice, and to Perin Westerhof Nyman for alerting me to the fact that certain woven designs could be key pattern – a suggestion that opened a rewarding avenue of research. Ian and Pauline Scott kindly hosted me multiple times at their home to discuss my work. Ian accompanied me on a key visit to the National Museum of Scotland to view Pictish stones, and his expertise there greatly enriched my research. I also am indebted to Dr Natasha Ferguson for inviting me to view those stones. I thank John Borland for calling on me to present my doctoral research to the Pictish Arts Society and for several illuminating discussions of Pictish sculpture. I deeply appreciate Dr Martin Goldberg's generosity in taking me to see the Glenmorangie throne in storage at the National Museum of Scotland and sharing information about the process of its key pattern's reconstruction. I thank Alastair Morton of Groam House Museum for his helpful discussion of the Rosemarkie stone panel, and all the staff of this museum for their hospitality during my visits and my 2018 lecture in Rosemarkie. I extend my gratitude as well to the staff of the Clonmacnoise visitor centre. I also thank Drs Isabel and George Henderson for inviting Katherine Forsyth and me to afternoon tea near the end of my final year, and kindly offering a confidence-boost and valuable guidance.

My family, friends, and loved ones supported me in countless ways over the past four years. I love them all so much. My family buoyed me with their affection, advice, endless encouragement, and the provision of much-needed photographs of artefacts. I am grateful to Anouk and Ann for their close friendship, wisdom, and confidence over many cups of tea, and to Phil for the comfort, emotional support, and provision of delicious, warm meals that sustained me in the final months of work. If I have inadvertently omitted anyone else here, I offer them too my humble thanks.

1. Chapter 1: Prolegomena

1.1. An Overview of Insular Key Pattern: Media, Geographical and Chronological Distribution

Key pattern is an abstract pattern composed of angular spirals, formed by straight rather than curved lines, which intersect successively at angles (Fig. 2.1c). The pattern occurs in art around the world and from a variety of time periods, but it was particularly common and prominent in Insular art, that is, the art of early medieval Britain and Ireland roughly between AD 600 to 1200. It also decorates artefacts made in the Insular style that were brought to or produced on the Continent during this period, such as the Harley Golden Gospels and St Gall Gospels, both of which will be discussed in detail later in this thesis.

Insular makers applied key pattern as decoration to every medium in their artistic repertoire. They carved it on stone cross-slabs, recumbent slabs, high crosses, and other sculpture, typically in large rectangular fields, though occasionally in circular ones (Fig. 1.1). In manuscripts, illuminators filled rectangular, circular, or irregular and curvilinear fields with key pattern in cross-carpet pages, the borders of pages, and canon table and initial decoration (Fig. 1.2). Insular smiths applied key pattern to metalwork objects using a variety of methods: a) casting, as with the gilt-bronze, chip-carved panel below the stem of the 8th- to 9th-century Ardagh Chalice from County Limerick, Ireland (Fig. 1.3), b); directly carving the metal, as may have been done on an 8th-century, gilded silver, Pictish scabbard chape (no. 16) from St Ninian's Isle, Shetland (Fig. 1.4); c) engraving, as on the Cashel Bell from County Tipperary, Ireland, and more (Fig. 1.5).[1] Insular craftspeople also carved key pattern on ivory or bone, as seen around the border of the 8th-century, ivory Genoels-Elderen Diptych from Northumbria (Fig. 1.6), and on wood, like the 10th-century, yew gaming board from Ballinderry 1 crannog in Ireland (Fig. 1.7).[2] The latter two examples are the only survivals in ivory or wood, likely because of the perishable nature of these materials. As we shall see in Chapter 6 of this thesis, Insular artisans may

[1] The Hunt Museum 2018; Laing 1993, pp. 103, 105, no. 237; Walker 2017, 233; Youngs, ed. 1989, pp. 110, 154, no. 103; Dr. Donncha MacGabhann, pers. comm., 1 July 2016; Stephen Walker, pers. comm., 18 July 2016. I also am grateful to Stephen Walker for informing me that the key pattern of the St Ninian's Isle chape was carved into the metal directly, and to Dr. Donncha MacGabhann for alerting me to the key pattern on the Cashel Bell. For a discussion of the debate over whether metal objects such as the chape were carved directly, see Chapter 3 below.
[2] Beckwith 1972, pp. 20, 118, fig. 14; 1974, pp. 3, 21, no. 4; National Museum of Ireland 2018.

have woven key pattern in cloth as well. Although Insular textiles with key pattern have not survived, artistic representations of clothing hems decorated with woven or embroidered key pattern do occur on a few Insular artworks (Chapter 6 and Fig. 6.19).

Key pattern was not specific to any one region of the Insular world. Pattern-makers utilized it across Ireland, Pictland including Orkney and Shetland, Dál Riata, Man, Wales, Cornwall, the British-speaking areas of northern and southwest Britain (Strathclyde and Dumnonia), and Anglo-Saxon regions of Britain. After AD 800, Scandinavian incomers to Britain and Ireland also adopted Insular key pattern (along with other forms of decoration) into their art. However, many scholars have observed that Pictish sculptors favoured it particularly, carving it on their cross-slabs with a frequency, a decorative prominence in large, expansive fields, and sometimes also with great technical achievement and physical complexity, which were infrequently matched elsewhere in Britain or Ireland (Fig. 8.29).[3] We can only speculate why Pictish stone carvers were so interested in key pattern. Dr. Isabel Henderson has suggested that because Pictish sculptors predominantly chose the cross-slab format, as opposed to the narrower free-standing cross common in Ireland and the Anglo-Saxon kingdoms, they faced the dilemma of how to fill the expansive, blank areas of leftover stone around the relief-carved cross and on the entire back side of the slab. In response to this problem, Pictish sculptors developed a unique preference for filling these large fields with a variety patterns, key pattern included.[4]

Pictish or otherwise, makers across Britain and Ireland applied key pattern to monuments and art objects throughout the entire early medieval period. For example, Insular key pattern occurs in the Book of Durrow, which scholars generally date to the later 7th century, and it continued in use until the Romanesque period, as seen on a 10th- or 11th-century cross from St John’s Church, Chester, as well as a cross-slab from Bride Parish Church on Mann (Kermode no. 92), which is decorated with key pattern on one side (alongside interlace) and Viking-Age ring-chain pattern on the other side (Fig. 1.8).[5] The key pattern on the Irish Romanesque chancel arch of the Nuns’ Church at Clonmacnoise, completed in 1167, is a very late chronological outlier of Insular key pattern (Fig. 1.9).[6]

[3] See for example Cramp 1984b, xlvi; Crawford 1926, 36; Edwards 2013, 94.
[4] Dr. Isabel Henderson, pers. comm., 28 July 2012.
[5] Bailey 2010, pp. 62-63, ill. 80; Megaw and Megaw 2001, 252; Kermode 1907, p. 168-70, no. 92, plate xlii. For an up-to-date analysis of Viking-Age ring-chain, see Brennan 2011, vol. 1, pp. 134-57.
[6] See Manning 2010, 36, for the date of the chapel. Without discussing key pattern in detail, Jenifer Ní Grádaigh argued that the Nuns’ Church deliberately was decorated with Insular ornament, including

By this time, Insular key pattern was going the way of all other types of Insular ornament, such as interlace and curvilinear (ultimately La Tène) spirals, soon to disappear as art styles changed in the Anglo-Norman or Romanesque period.

It is important to note that although *Insular* key pattern fell out of use in Britain and Ireland by AD 1200, key pattern itself did not vanish entirely, from Britain at least. When the grave of Walter de Gray, Archbishop of York (died in 1255), was opened during restoration work in York Minster in 1967-78, archaeologists found amongst de Gray's grave goods two cloth bands made of silk and gold thread.[7] The original purpose of these bands is uncertain, but they were identified as having been tablet-woven by local weaver(s) in England, and decorated with 'short sections of different designs' including 'angular, labyrinthine patterns' and 'stripes'.[8] In fact, two sections in each cloth contained two different types of key pattern (Fig. 1.10a-c). However, these later medieval specimens did not evolve from Insular key pattern or have any direct link to it, besides sharing the requisite, basic physical structure necessary for them to *be* key pattern at all. One of the de Gray key patterns (Fig. 1.10b), with lines arranged at diagonals to the edge of the cloth (known in weaving terminology as the 'running dog', existed in art in Continental Europe from at least the Neolithic period (Chapter 6 and Fig. 6.13a). The other also contains a running dog, but this has been altered to contain swastika-shaped spirals; the latter variant is similar to key patterns extremely common in ancient Greek and Roman, as well as Chinese art, but which are virtually non-existent in Insular art (c.f. Figs. 1.10c, 7.11, 7.25). Rather than being a continuation from the Insular period, the de Gray key pattern was part of a much larger global phenomenon, in which different key pattern traditions developed around the world in different time periods, either as unrelated parallel developments or very distant cousins with shared origins in prehistoric basketry and textile production. Key pattern's global context, prehistoric origins, and geographical dissemination will be discussed in Chapters 6 and 7.

'fretwork' (that is, key pattern) as a form of 'ornamental mimicry', in order to express links to the earlier Irish Church. See Ní Grádaigh 2012b, 105, 107; 2015, 234-35.

[7] Ramm et al. 1971, pp. 101-102, 128, plates LVb-LVIa-b. I am grateful to Dr. Katherine Forsyth for alerting me to the existence of this textile, and for providing me with photographs and information from her visit to York Minster. Dr. Katherine Forsyth, pers. comm., 14-19 April 2017.

[8] Ramm et al. 1971, 128-29.

1.2. A New Theoretical Approach to All Key Pattern

Abstract patterns of many kinds were the dominant decorative mode in Insular art, but amongst these, key pattern has remained the least studied – an oft-forgotten child which both modern academics as well as authors of popular drawing manuals have frequently passed over in favour of other patterns, particularly interlace (Chapter 4). From the birth of modern interest in Insular patterns in the mid 19th century and up until the present day, the few attempts that specialists did make to study Insular key pattern were all comparatively limited. In addition, in the later 20th century, mainstream archaeologists and art historians as a whole lost interest in the study of abstract patterns in general, especially in conducting formal, empirical analysis of their structure (Chapter 4). The resultant dearth of modern interest in and knowledge about Insular key pattern is unfortunate, because it flourished as an extremely rich, complex, and visually diverse tradition for at least six centuries in Britain and Ireland. Little is known of the anonymous artists themselves either, or how they conceived of and approached key pattern in their working processes. The previous analyses of key pattern noted above mainly consisted of academic, archaeological classifications of different Insular key pattern compositions, and more popular, artistic publications which presented step-by-step guides for drawing Insular key pattern to a modern public unfamiliar with this genre of ornament. However, significant and numerous methodological flaws in all of these previous studies have limited our understanding of the pattern. For example, they generally focus on a limited set of physical structures within the pattern, and rely on idealised pattern templates or types, i.e. machine-made, printed or vector-graphic reproductions, often in monochrome. These problems have resulted in the elision of the important roles that Insular makers gave to other physical structures within the pattern, as well as the regularization of the patterns' fine details and imperfections. The latter in turn frequently caused scholars to misrepresent the original artworks, which were hand-made and – in sculpture and metalwork, three dimensional – thereby obliterating evidence of how Insular makers conceived of and handled key pattern *in the moment of creation*. As a result, key pattern not only has been the least studied, but also perhaps the most misunderstood type of ornament from the period. All previous studies of key pattern and their inherent methodological problems are discussed in detail in Chapters 4 and 5.

This thesis seeks to correct these problems, by presenting a new, comprehensive, and systematic theoretical approach to the study of key pattern in Insular art (AD 600-1200), in every medium that makers chose to decorate with this pattern. In contrast to previous studies, this approach is artwork- and artist-centred, that is, based on close examination of artworks *in the field* rather than idealised types or templates. For the first time ever, it thereby enables the identification of how Insular makers themselves conceived of key pattern, how they handled it, and what their intentions were for each key pattern while they were working on it. This approach is founded upon structural analysis, or the identification of the pattern's 'structural properties': its physical parts or building blocks (lines and shapes), and the abstract, often mathematical concepts which medieval artists used to manipulate these building blocks, in order to fulfil design goals (such as fitting a key pattern into an irregular shape, like an illuminated letter, or creating a series of unique shapes within an individual pattern), invent anew, and even fix mistakes partway through the creative process. This rigorous identification of key pattern's structural properties builds upon insights from previous studies but also corrects their mistakes, and reveals Insular pattern-makers' own way of seeing and understanding of artistic concepts such as space, line, and symmetry. As a result, this new theoretical approach provides a fuller understanding of Insular key pattern and its significance, access to the thought processes and agency of anonymous Insular pattern-makers, and new information about the manufacture of complex decorated artefacts.

By extension, this approach applies not just to key pattern from early medieval Ireland and Britain, but to all other traditions of key pattern from around the world, in all art-historical and archaeological time periods, because it is based on study of the deep physical structures that make it possible for key pattern to *be* key pattern (rather than some other type of ornament entirely, such as interlace). This new theoretical method of analysis thus has two additional benefits for our knowledge of key pattern as a whole. Firstly, key pattern's structural properties have remained under-researched not just in Insular studies, but also by scholars in other archaeological and art historical fields, such as ancient Greek and Roman art, and even that of the Americas. The following thesis offers significant insights into these other, non-Insular key patterns, which have never before been fully explored in scholarship. Secondly, improved understanding of non-Insular key pattern traditions increases our knowledge of Insular art by placing it in a clearer global context. Through comparative structural analysis of Insular key pattern with its analogues from other eras and cultures, this thesis sheds light – again for the first time – on the uniqueness of Insular key pattern and demonstrates how and why it outstrips key patterns from most other global traditions in its geometric, physical complexity and visual variety (Chapters 6 and 7). As a result, we not only gain a newfound appreciation of the pattern's significance in Insular art, but also a deeper recognition of the complexity and sophistication of Britain and Ireland's early medieval art-historical heritage.

This artwork- and artist-centred method of analysing patterns is new, both in and out of the field of Insular studies.[9] It was invented and first pioneered by Michael Brennan, in his 2011 doctoral thesis from Bangor University, *The Structure of Interlace in Insular Art, c. AD 400-1200*. Brennan outlined similar categories amongst the previous studies of Insular interlace as those noted above for key pattern (archaeological classifications, artists' manuals, and so forth), and identified and corrected similar problems within their approaches.[10] He was first to advocate close examination of individual artworks and focus on the artists' agency, and he coined the terms 'structural analysis' and 'structural properties', the latter defined as the physical components of interlace, as well as the ways that Insular artists intelligently manipulated these components – all while simultaneously controlling the domino effects that one manipulation might have on other components within an individual interlace pattern.[11] Brennan was also first to note that his new approach to the Insular interlace pattern illuminated hitherto unrecognized information about the artworks in his case studies and Insular art as a whole.[12] Brennan's ground-breaking contribution to Insular art studies and his influence on the following analysis of key pattern is discussed in detail in Chapter 5 below.

However, Brennan dedicated his study to Insular interlace, and so his insights are specific to that pattern. Interlace is distinct in its structure, and therefore the components (and artistic manipulations of these components) that Brennan identified are, for the most part, not applicable to key pattern. Nevertheless, Brennan's work has provided for this thesis an indispensable inspiration and a methodological model or framework, which has been developed specifically for key pattern. The following thesis represents the first-ever study of key pattern of this kind.

[9] In her own research, the author has not yet come across this method in other, non-Insular art-historical and archaeological studies of pattern.
[10] Brennan 2011, vol. 1, pp. 1-4, 10.13, 17, 19-20, 29.
[11] Ibid., summary, 1, 5, 29, 33-50.
[12] Ibid., summary, 1, 5.

1.2.1. The Structural Properties of Key Pattern: Elements and Principles

This entire study of key pattern is founded upon analysis of the pattern's 'structural properties': again, its physical parts or building blocks (lines and shapes), and the abstract, often mathematical concepts which Insular makers used to manipulate these building blocks. These structural properties will feature in every chapter, but are outlined, defined, and illustrated in greatest detail in Chapters 2 and 8. While Brennan used the term 'structural properties' to refer to both the physical parts of Insular interlace, as well as the concepts, operations, or strategies that Insular makers used to manipulate these physical parts, this term will be broken down further for key pattern.

The pattern's physical structures (lines, shapes, spiral forms, et cetera) will be referred to as its 'structural elements'. The author is grateful to Dr. Brennan, who did not use this phrase in his own thesis, but suggested 'element' in a conversation about the author's research on key pattern as a more suitable and specific replacement for the vaguer term 'property'.[13] The New Oxford American Dictionary defines 'element' as 'an entity that is a single member of a set', and so this term appropriately captures the physical thing-ness of each physical structure in a key pattern, and how it functions as an individual member within a larger group, distinct from other groups of elements within that same individual pattern. It is important to emphasise that when key pattern is rendered in three-dimensional form, as in metalwork or carved stone, these structural elements are tangible, that is, able to be differentiated not only by sight but also by touch. They are concrete entities. In this thesis, the usage of the term 'element' in reference to key pattern therefore differs from its use in art-historical formal analysis, in which the 'visual elements' of art *do* include physical components such as 'line', 'shape', and 'space', but also other intangible concepts or aspects which are not applicable in this analysis of key pattern, including 'time and motion', 'light', and 'color'.[14]

The abstract, often mathematical concepts that makers used to manipulate the structural elements will be referred to as the 'structural principles' of key pattern. The term 'principles' sometimes has been used in studies of Insular ornament, but only in a quite

[13] Dr. Michael Brennan, pers. comm., 13 May 2015.
[14] Getlein 2008, 121.

general manner, as we shall see in Chapter 5. In this thesis, the term 'structural principles' encompasses far more concrete and specific actions that Insular artists took to manipulate key pattern, many of which are specific to key pattern and which artists of any art-historical era did not employ for other types ornament (such as interlace, spirals, plant-like designs et cetera), and which previous scholars have not fully noted. They include such concepts as the specific application of certain symmetry operations, the inclusion or omission of certain lines, the careful maintenance of specific structures at an even and consistent width, and much more (Chapter 8). The structural principles of key pattern therefore also differ from the 'principles of design' as understood by art historians, in which artists organize the 'visual elements' of a composition according to the principles of 'unity and variety', 'balance', 'emphasis and subordination', 'contrast', and so forth.[15] Art-historical 'principles of design' apply not just to abstract patterns but also to all types of art, representational and non-representational alike. They are rather broad and aesthetic, and not specific to key pattern, and so are not addressed in this thesis.

In this thesis, the structural elements and principles of key pattern are referred to together as the pattern's 'structural properties'. 'Property' was chosen as an overarching term according to its definition in the Oxford Dictionary of English: 'an attribute, quality, or characteristic of something.' Both the elements and principles of key pattern fulfil these roles.

1.2.2. Hand-Drawn Studies versus Mechanical and Vector-Graphic Reproduction

As part of the research for this thesis, the author chose to hand-draw the drafts and test drawing that she used to identify, study, and gain proficiency in the structural properties of key pattern. Tidied, legible versions of some of these sketches are included as figure diagrams in this thesis, alongside scans and photographs of key pattern on art objects and monuments. The choice to hand-draw key pattern as a research tool – rather than study from monochrome, printed key pattern types (like those found in archaeological classifications and popular artists' manuals) or to use vector-graphic computer software to manipulate the pattern – was deliberate and methodological. By hand-drawing, one remains more faithful and receptive to medieval makers' working processes and ways of

[15] Frank 2014, 68-69.

handling abstract patterns. As we shall see in Chapters 4 and 5, previous scholars who used technologies alien to the medieval world (including the authors of artists' manuals, who otherwise advocated hand-drawing as a means of authentic recreation), such as vector-graphic computer software or typographic, printed, monochrome images of pattern types, as a result inadvertently introduced anachronisms and inaccuracies that ultimately undermined their studies of Insular key pattern. The author only used computer software (Apple Preview and Inkscape) in the creation of diagrams in order to annotate drawings, scans, and photographs with arrows, circles, or added coloured lines, which simply serve to highlight areas of interest for the reader.

1.3. Sources

The purpose of this thesis does beg the question: since Insular pattern-makers were largely anonymous and no instruction manuals or treatises of key pattern survive from the Early Middle Ages, how can we theorize and identify all of Insular key pattern's structural properties, as well as how Insular makers themselves conceived of the pattern and managed its properties in their working processes? In answer, it is possible to fully identify Insular key pattern's structural properties and Insular artists' own understanding of the pattern, by conducting close examination of every known surviving key pattern composition in Insular art. The author of this dissertation has viewed hundreds of objects, fragments, manuscripts, and monuments, and thousands of individual key pattern compositions (as many of these artworks contain more than one area of key pattern). Whatever words Insular makers used to describe key pattern, and whether they were directly conscious of all or only some of its structural properties, all of the elements and principles discussed in this thesis appear in key pattern compositions across the Insular world with such repetition and predictability that indicates widely held and authentic conventions.

Whenever possible, the author conducted close, in-person physical examination of artworks in a wide range of media, as this often provided the clearest and most accurate view of tiny and often telling details within the patterns that might otherwise be concealed by shadows, angle, lighting or simple lack of high-definition detail in photographs, especially if the artwork's surface had been damaged in any way. The author has viewed key pattern on metalwork, other portable objects, and monuments in the displays of the National Museum of Scotland (as well as its storage);[16] the National Museum of Ireland;[17] the British Museum (also particularly helpful for key pattern from non-Insular art traditions); the Yorkshire Museum; Dunrobin Castle Museum in Sutherland, Scotland; the Caithness Horizons Museum and Gallery in Caithness, Scotland, and the Groam House Museum in Easter Ross, Scotland. The author has also visited sites containing collections of stone monuments, including St Vigeans, Meigle, Aberlemno, Abercorn, Kilmartin, Inchcolm, Rosemarkie, and Applecross in Scotland, as well as Monasterboice, Kells, and Clonmacnoise in Ireland. Sites with individual stones, such as Nigg, Eassie, and that of the Maiden Stone in Aberdeenshire, Scotland, Duleek in Ireland, and more also are included in this list. Research trips to Clonmacnoise and Groam House Museum were variously funded by the Society of Antiquaries of Scotland, the Society for Medieval Archaeology, and the University of Glasgow College of Arts. For manuscripts from Ireland, Anglo-Saxon England, other parts of Britain, and the Continent, the author viewed both photographic and digitised facsimiles, with digital facsimiles being as – if not more – useful than direct viewing of the manuscripts, given the availability of high quality scans and extreme zoom functions.

For monuments, metalwork, and other portable objects of which personal examination was not possible, the author studied photographic collections, including all volumes of the *Corpus of Anglo-Saxon Stone Sculpture* and *A Corpus of Early Medieval Inscribed Stones and Stone Sculpture in Wales*, Peter Harbison's *The High Crosses of Ireland: An Iconographical and Photographic Survey*, Iain Fraser's *The Pictish Symbol Stones of Scotland* (supplemented by examination of photograph collections in Historic Environment Scotland's web database, *Canmore*), Susan Young's *'The Work of Angels': Masterpieces of Celtic Metalwork, 6th-9th centuries AD*, Lloyd Laing's *A Catalogue of Celtic Ornamental Metalwork in the British Isles c AD 400-1200*, every published Proceedings of the International Insular Art Conference (commencing in 1987), and many more. Frequent close, physical examination of objects and monuments in person has enabled the author to develop the expertise to make highly educated, expert judgments of the structure of key pattern compositions from such photographs. A complete record of published sources that

[16] I am grateful to Martin Goldberg of the National Museum of Scotland for providing me access to its archaeological collections of carved stones and stone casts in storage.

[17] I am also grateful to Raghnall Ó Floinn of the National Museum of Ireland for providing me high-definition images of different sections of the Ardagh Chalice, and to Niamh Whitfield for arranging this.

were consulted for this thesis, from books to photographic and digitised facsimiles, can be found throughout the Bibliography.

1.4. Summary of Thesis Chapters

The following chapter, Chapter 2, contains a further introduction to key pattern and many of the main concepts in this thesis. It begins with an overview of how key pattern differs from the other main types abstract patterns in Insular art, a clarification of terminology for key pattern, and an explanation of how to distinguish it from other patterns (in Insular art or otherwise) that possess straight lines and are often confused for key pattern because of their similar appearance. The chapter continues with a review of technical terms relating to patterns and mathematical symmetry, which will be used throughout the thesis, and closes with a full technical definition of Insular key pattern. These two latter sections contain introductory discussions of some of key pattern's structural properties, particularly the most basic, fundamental properties required for its structural integrity and which distinguish it from other types of ornament.

Chapter 3 introduces the 'creative approach', or the way in which artists – when making any kind of artwork – create positive and negative space, across different media. Insular pattern-makers used a specific creative approach for key pattern, which is crucial for understanding this pattern's structure and the makers' working processes. The creative approach has never before been studied in this way for abstract patterns, including key pattern, and will reveal significant insights not only about Insular pattern-making but also key patterns in other time periods and places.

Chapters 4 and 5 review previous studies of Insular key pattern, beginning with those of J.O. Westwood and John Romilly Allen in the 19th century, up until the present day. These include archaeological classifications, popular drawing manuals published by professional artists, and one mathematical study. The studies' historical and academic contexts and contemporary cultural influences are outlined for this chronology. Allen's study proved to be foundational, impacting all other scholars' explorations of key pattern after him, including the one in this thesis. This thesis in part builds upon some important insights about key pattern from previous scholars. However, Chapters 4 and 5 are mainly dedicated to exploration of the range of methodological flaws that ultimately made these studies of key pattern inadequate, in order to best highlight how this thesis also departs from and corrects them. Chapter 5 then closes with a discussion of two additional previous studies of pattern, by Derek Hull and Michael Brennan respectively, neither of which were dedicated to key pattern, but which represent a ground-breaking paradigm shift in the study of Insular pattern and a significant methodological inspiration for this thesis.

Chapter 6 provides a robust, new theory for key pattern's ultimate origins in prehistoric basketry in central and eastern Europe, the technology for which developed far earlier than scholars have long assumed, during the Neolithic and possibly even Palaeolithic periods, before key pattern's subsequent dissemination into other geographic regions and into textile weaving and other media. Chapter 7 builds upon Chapter 6 with explorations of key pattern traditions from other, non-Insular time periods and places around the world. These discussions reveal new information about non-Insular key pattern traditions, which have never before been investigated at this depth. Comparison with other traditions also illuminates the uniqueness of Insular key pattern, the fact that it is almost completely unrivalled in its geometric complexity and visual variety, and why. As a result, the study of key pattern places Britain and Ireland's early medieval art-historical legacy more firmly in its global context.

At this point, readers are prepared for deeper investigation of Insular key pattern's structural properties. Chapter 8 is a discussion not of the pattern's most basic, fundamental structural properties (which maintain its structural integrity and distinguish it from other types of ornament), but rather of the more complex structural elements and principles with which Insular artists engaged to fulfill higher-order creative goals. Unlike in previous studies, the structural properties of key pattern are not pressed into the service of creating a key pattern classification. Instead, they are identified in order to explore Insular makers' choices and ability to problem-solve and invent in their creation of key pattern. In particular, this chapter focuses on two structural principles that Insular makers frequently utilised and therefore viewed as being of great importance in their making of key pattern: the principles of symmetry and of manipulation of negative space. The analysis also pays specific attention to how medieval artists' use of principles to manipulate one element would affect other elements, in a manner the artists may have intended, or in contrast, had to manage in order to maintain the structural integrity of the pattern – as Brennan similarly focused upon in his study of interlace.

Finally, Chapter 8 includes in-depth case studies of individual Insular artworks that demonstrate the practical benefits of this new theoretical approach to key pattern, by outlining exactly how several individual Insular makers manipulated structural properties in their working processes. The first case study focuses on the Harley Golden Gospels, a Continental manuscript with Insular decoration, and the Kilmartin Cross, a Viking-Age sculpture from western Scotland. Comparative analysis of adjacent key pattern compositions within the manuscript pages, and a key pattern and spiral pattern on opposing sides of the Kilmartin Cross, reveals how pattern-makers used symmetry to communicate to the viewer the deliberate structural connections they had made between two patterns on the same artwork. This comparison also reveals a hitherto unrecognized key pattern composition, which Allen had misunderstood and misrepresented in his own classification, because of his inadequate awareness of symmetry within key patterns as well as of medieval artists' practice of using the surrounding context of individual artworks to highlight structural aspects of specific patterns within those artworks. The second case study is an analysis of how Insular artists cleverly manipulated negative space to create innovative, visual, and physical variety in their key pattern compositions, and highlights a page from the St Gall Gospels as an example. The final case study is dedicated to a Pictish sandstone panel from Rosemarkie, Easter Ross, Scotland, entirely carved with key pattern. This site contains a large collection of virtuoso monuments, whose decoration has been compared to that of the Book of Kells. Close, personal examination of this panel has revealed that the Pictish carver skillfully corrected an initial mistake in the structure of their key pattern by manipulating the negative space. By doing so, this carver successfully managed to salvage the artwork halfway through the working process and create a convincing illusion of perfectly even ornament from one end of the slab to the other. All case studies demonstrate how this new theoretical approach to key pattern can provide a glimpse over the shoulders of anonymous medieval makers, improve our knowledge of their own understanding of and fluency in key pattern, and uncover brand-new information about known art objects and monuments.

1.5. Other Methodologies *Not* Pursued in the Thesis

Insular specialists, both who have studied key pattern or Insular art as a whole, as well as anthropologists and archaeologists from outside the field of Insular studies who discussed patterns more generally, have taken a variety of methodological approaches different to that of this thesis. These include theorizing construction aids and methods (defined below), identifying the overall program of symmetry within an artwork (such as an entire cross-carpet page in a manuscript) or the comparative area ratios of its different sections, and hypothesizing the symbolism of patterns or their role in material culture. All of these subjects are worthy of study, however, for key pattern they should not be pursued first. The structural properties of any pattern *must* be correctly analysed and understood before a scholar can safely develop fully-informed conclusions about which, if any, construction aids or methods a medieval artist used as they created an individual pattern composition, whether its maker imbued it with specific symbolism, and how the pattern may have affected or been used by contemporary viewers. Scholars who first pursue answers to these latter questions risk forcing their analyses of key pattern's structure to fit wider theories. As a result, their knowledge of the pattern's structure would be incomplete or incorrect, a fate that befell all previous studies of key pattern to date. This thesis therefore is intended not only as a pioneering study of key pattern's structural properties and of Insular artists' creative agency in handling these properties, but also as a firm foundation upon which further studies of the pattern may be built.

1.5.1. Construction Aids and Methods

The tools which medieval craftspeople used to create patterns, such as compasses, straight edges, templates,[18] and grids, are referred to in this thesis as 'construction aids'. The order in which an artist inked, carved, hammered, or otherwise created the individual structural elements of a key pattern composition, one after another, is referred to here as the 'construction method.' In previous studies of key pattern, and of Insular ornament in general, modern scholars have commonly assumed that medieval artists always used construction aids whenever they created patterns – especially grids (Fig. 1.11b). Some

[18] For more information about the potential existence of early medieval pattern templates, see Bailey 1978, 179-85; 1980, 252-54; Kitzler Åhfeldt 2012, 189, 191; O'Meadhra 1979, 126-27.

archaeologists and most authors of popular drawing manuals for key pattern also frequently have argued for the existence of a single authentically medieval construction method. That is, these modern specialists have claimed that Insular makers always drew certain lines or other structures within key pattern before others. In previous key pattern studies, such assumptions have led to a long-held but incorrect belief that construction methods and aids, especially grids, were fundamental to key pattern's structure – that their presence and use was structurally necessary to keep key pattern from physically breaking down into another pattern or a random assortment of lines. For example, Allen and other archaeologists classified key pattern compositions into separate groups according to the type of grids they believed underlay those compositions. In turn, these assumptions have resulted in significant flaws in previous discussions of key pattern's structure. Chapters 4 and 5 review theories about construction aids and methods in previous key pattern studies in detail, and the resultant misunderstandings of the pattern's structure.

Insular art history and archaeology are overdue for a much-needed explanation of the difference between a pattern's physical structure and the construction aids or methods which artists may or may not have used to achieve that pattern. As we shall see for key pattern, the construction aids and methods that both medieval and modern pattern-makers have used can vary widely, even for the same or similar pattern compositions. Medieval makers also sometimes chose to create key pattern freehand, without construction aids. Indeed, the same effects could be achieved with key pattern no matter which construction aid (or lack thereof) or construction method the artist chose. Therefore, although construction methods and aids certainly played a part in the working process sometimes, they were not fundamental to or necessary for maintaining key pattern's structure. Instead, they were contingent on the artists' personal preferences, the demands of a specific medium, or speculatively, their local training. Construction aids such as grids were simply optional tools, to help artists desirous of such assistance to create straighter lines, repeated shapes of perfectly equal size, and to perhaps to speed up the creative process. Construction methods were also highly variable, and makers may have developed personal strategies for creating different key pattern structures in different orders, either out of habit or for practical reasons, such as to avoid smudging ink or chipping stone as they proceeded across an artwork.

1.5.1.a. Construction Aids: The Use and Non-Use of Grids

Grids consisted of a series of lozenges, squares, and/or triangles forming a lattice of intersecting guidelines, which were scratched, pricked, chalked, or otherwise mapped on the surface of an artwork before the artist laid a pattern over it (Fig. 1.11b). Art historians and archaeologists often assume that Insular pattern-makers universally used grids. For example, in his discussion of Insular metalworking, Paul Craddock stated that 'intricate designs were often worked out and developed on bone or slate. These were not executed free-hand but on a carefully prepared and quartered grid with extensive use of compasses – evidence of which sometimes survives where the design has been abandoned before completion'.[19] Evidence does survive for the medieval use of grids, the most famous of which R.L.S. Bruce-Mitford discovered in the Lindisfarne Gospels. Pricks and ruling lines survive on the blank rectos of the carpet-page folios 2, 26, 94, 138, and 210, indicating that the illuminator laid out guidelines and grids to aid his creation of the rich decoration on the verso sides.[20] Behind four panels of key pattern on folio 210v, Bruce-Mitford noted prick-marks connected by ruling lines, which formed a 'diagonally-set grid of diamonds' which the artist '[subdivided] into a series of smaller ones' (Fig. 1.11a-b).[21] Uaininn O'Meadhra also observed grids on several partially-finished key pattern compositions on early medieval motif-pieces. For example, on a wooden fragment, squares in a rectangular grid were 'diagonally sub-divided into two triangular units', each one holding an individual spiral shape within the key pattern (Fig. 1.12).[22]

However, just because grids survive on some artworks, it is incorrect to assume that: 1) Insular makers dedicated specific types of grids to specific key pattern compositions, 2) the type of grid used can be conjectured just by looking at a finished (and now gridless) key pattern, and 3) this grid reveals information about how key pattern compositions differ from each other in structure. As we shall see in Chapters 4 and 5, the authors of previous key pattern studies, including John Romilly Allen, George Bain, Iain Bain, and more, each claimed to have identified the authentic, medieval underlying grid for key pattern, but the fact that each of their conjectured grids vary widely in their inclusion and size of squares,

[19] Craddock 1989, 170.
[20] Bruce-Mitford 1960, 221, 224-26.
[21] Ibid., p. 224, fig. 52.
[22] O'Meadhra 1979, pp. 29-30, no. 10A2, plates 1-2. For more unfinished key pattern compositions with grids, see p. 76, no. 80A2, 80B2, fig. 385-86, plates 29, 38.

lozenges, triangles, or in combinations of all three, underlines the subjectivity and suggests that there was – and still is – no single style or type of grid required for key pattern. In fact, medieval artists themselves were inconsistent, using different grids for key pattern compositions that have the exact same structure. Bruce-Mitford noted that for a key pattern composition on folio 138v of the Lindisfarne Gospels, (which has the same basic physical structure as the key pattern on folio 210v, Fig. 1.11b), the illuminator used a grid with large diagonal squares rather than the smaller ones from the grid for folio 210v.[23] Given the unpredictability of grid types chosen by Insular pattern-makers, it is inadvisable to analyse the structure of key pattern compositions based on their supposed grids or to assume they are structurally unrelated to each other if they have surviving grids that differ. Unfortunately, many previous scholars did base their theories on such shifting sands, resulting in a series of misinterpretations of key pattern structure and misunderstandings of Insular artists' strategies for manipulating it, all of which will be outlined in Chapters 4 and 5.

There also is ample evidence that Insular makers sometimes created key patterns without using grids at all, instead drawing or carving them freehand. Brennan likewise observed that for interlace, Insular specialists in general have underestimated evidence that medieval artists created this pattern freehand.[24] In a discussion of Viking-Age art, James Graham-Campbell cogently noted that medieval or modern, 'a skilled craftsman working with geometric motifs does not have to have recourse to a grid to lay out his patterns or to align their elements'.[25] He quoted a modern Irish family of professional stone cross carvers as stating, 'measuring it gets you nowhere…it's all in the eye, a ruler's no use at all'.[26] It should be noted that the author of this thesis, by no means a trained artist, is able to draw respectable Insular key pattern compositions without grids (Fig. 2-55a-b). O'Meadhra photographed and drew diagrams of ten more key pattern compositions on early medieval motif-pieces, both finished and unfinished, none of which show traces of grids.[27] Finally, the author has neither found nor read of evidence of pricked or ruled grids in the St Gall Gospels. The key pattern compositions on page 266 were inked with a casual and confident inexactness indicative of freehand work, its lines mildly crooked and its

[23] Bruce-Mitford 1960, 212.
[24] Brennan 2011, vol.1, pp. 3-4, 13, 20, 27.
[25] Graham-Campbell 1987, 147.
[26] Ibid, 147, quoting Cody 1985, 42.
[27] O'Meadhra 1979, pp. 42-44, 52, 55-56, 81, 83, no. 28A4, 28A5, 28A7, 28B3, 28B4, 30A4, 31B1, 42A1, 49A1, 103A1, fig. 83, 87-89, 91-92, 203, 238-42, plates 9-10, 15-17, 19, 37-38. O'Meadhra noted that the surfaces of some motif pieces, such as no. 28, were scratched. However, the author of this thesis has deemed these scratches unrelated to grids after examination of O'Meadhra's images.

repeating structures differing very slightly in size and shape (Fig. 1.13). Grids were not necessary for the making of key pattern in Insular art, and without fuller and more correct knowledge of key pattern's structural properties, over-focus on grids in modern studies can distract from or obscure Insular makers' conventions for this pattern and their working processes.

1.5.1.b. Construction Methods: The Order of Steps

Authors of popular, modern drawing manuals for key pattern, as well as a few archaeologists such as Allen, have argued that Insular makers drew, carved, or otherwise created certain lines or structures within a key pattern composition first, before creating other lines or structures (referred to here as the construction method). For example, George Bain (d. 1968), a renowned art instructor and professional artist of the Insular style, and his son Iain Bain both wrote manuals for drawing key pattern for modern audiences (Chapter 5).[28] In their manuals, they each instructed readers to draw the individual lines within key pattern compositions in a different order (Fig. 1.14a-b).[29] There are also many online video tutorials available through Facebook and Youtube, posted by enthusiasts and professional artists, all providing varying construction methods.[30]

The construction methods proposed in previous key pattern studies are very useful for teaching a modern public unfamiliar with Insular art how to draw this pattern in a simple, step-by-step manner. Problems arise, however, when scholars and artists claim that their specific, proposed construction method was authentically medieval (Chapters 4 and 5). First, these claims are incorrect. There is no single, 'correct' construction method for key pattern. Instead, methods vary from artist to artist, and from artwork to artwork. As noted with the Bains above, construction methods proposed by modern scholars all differ, but all result in perfectly acceptable key pattern. Ann Lorenc, an American artist who specializes in pen and ink drawing of Insular patterns, prefers to draw each spiral shape within a key pattern in full, with all its internal structures, before moving on to the neighbouring spiral

[28] G. Bain 1951; I. Bain 1994.
[29] G. Bain 1951, p. 75, plate 1; I. Bain 1994, p. 1, fig. 1-4.
[30] For example, Carroll 2016; Bellchamber 2013. Michael Carroll is well-read in John Romilly Allen's theories of construction methods for key pattern (Chapter 4), and well-versed in some of the basic structural elements of key pattern (individual spiral shapes, longer versus shorter intersecting lines or branches, which will be discussed in detail in Chapters 2 and 8).

shape, only altering her preferred order of construction on occasion, in order to ensure evenness of spacing or to help herself feel her way through the pattern.[31] This contrasts with the Bains, who filled their key pattern compositions with the longest lines first, before any other structures, initially creating a hatched visual effect that filled the entire pattern field (c.f. stage 1 of Figs. 1.14b, 1.15). In fact, Lorenc found the Bains' construction methods unhelpful in her own practice, as she felt they created too many opportunities for mistakes.[32] She likewise emphasised that individual medieval artists also would have chosen different construction methods for the same key pattern composition, depending on their personal needs or preferences.[33]

Lorenc's hypothesis about Insular artists' construction methods is correct. No one method was authentically 'medieval', as surviving evidence shows that Insular artists' construction methods were diverse. The unfinished nature of the key pattern on the wooden stave in O'Meadhra's catalogue reveals that the artisan carved the longest lines of the pattern first, as suggested by both Bains (this also gives the impression of a grid). However, like Lorenc, the medieval artist then filled in all the other structures within each spiral shape within the key pattern, one spiral shape at a time – as if he or she was proceeding from one triangular grid cell to the next. This is a method the Bains would not have advised. As a result of this construction method and the unfinished nature of the wood carving, some areas in the key pattern which were reserved for spiral shapes remain empty (Fig. 1.12). The St Gall Gospels illuminator's construction method was entirely different, and contingent upon the challenges presented by the parchment. Gifford Charles-Edwards has noted that the rough texture of Insular parchment, as opposed the smooth parchment used by contemporaries on the Continent, required Insular scribes to create the serifed ascenders of letters in a specific way.[34] An Insular scribe placed the nib down and immediately pulled it to the right to create the serif, then dragged the pen down without lifting it to create the ascender (Fig. 1.16).[35] The St Gall Gospels were made in Ireland in the mid 8th century,[36] and because its key pattern was drawn in ink on rough parchment and contains intersected straight lines, it required a ductus similar to that of serifed ascenders. As a result, the illuminator drew the longest lines of the composition and their shortest intersecting lines in a single stroke (c.f. Figs. 1.16, 1.17a-b), rather than in two separate

31 Ann Lorenc, pers. comm., 4 February 2015.
32 Ibid.
33 Ibid.
34 Charles-Edwards 2007, 79.
35 Ibid., p. 83, fig. 54.
36 St. Gallen [accessed 23 July 2018].

strokes as the Bains suggested (stages '1' and '3' in George Bain's manual, '1' and '4' in Iain Bain's manual, as illustrated in red in Fig. 1.14a-b). Again, both methods in the medieval examples described here resulted in structurally sound key pattern. In fact, the number of possible construction methods for key pattern are so various they are nearly infinite. Unlike the modern public, a skilled medieval maker was so familiar with key pattern that they would have been able to envision the final product in detail at the start of the working process, and so technically they could fill in the pattern's component structures in any order they chose.

Secondly, and most importantly, the modern focus on construction methods is premature. Construction methods were optional, variable, and contingent on a plethora of unpredictable factors, and therefore cannot be used to explain key pattern's deep physical structure, which existed independent of these methods. One must first gain a comprehensive and correct understanding of key pattern's structural properties and how Insular artists arranged and manipulated them, before attempting to identify the particular construction method used in an individual artwork or to use construction methods to build theories about key pattern. Previous scholars who theorized construction methods either made inadequate efforts to understand key pattern's structure or skipped it entirely. This thesis therefore completes this necessary foundational work.

1.5.2. Overall Symmetry and Geometric Ratios of Artworks

Over the past few decades, Robert Stevick has developed a new and mathematically complex way of analysing the construction of Insular artworks, from manuscript carpet pages to brooches to stone crosses. By measuring and comparing the main sections and fields within individual artworks, such as the arms and central circle within a stone cross head, or the hoop and terminal compartments of a brooch, Stevick has identified how Insular artisans used compasses and straight edges to lay out these major sections of artworks, and to manage their relative proportions and shapes using symmetry and geometric ratios (particularly the golden ratio).[37] He refers to these relationships between different sections or compartments of artworks as 'coherent geometry'.[38] Stevick focuses

[37] Stevick 1983, 3-12; 1994; 1998, 5-16; 2004, 5-32; 2013, 13-23.
[38] Stevick 2004, 5.

on how Insular artists laid out the large fields and areas within artworks, which afterward were filled with decorative patterns, but he does not focus on the patterns themselves (Fig. 1.18). Therefore, he does not address key pattern or its structural properties. A few other scholars have conducted studies in a similar vein, examining the overall programs of design in individual manuscript pages. However, they also analysed how these larger programs of symmetry relate to the symmetries found within individual patterns on those pages. For example, Derek Hull observed that on folio 1v of the Book of Durrow, not only do the large rectangular-shaped fields and four-armed cross possess rotational symmetry, but so do the colour schemes and individual patterns within them, including key pattern.[39] In his doctoral thesis, Brennan demonstrated that the Lindisfarne Gospels illuminator created a program of rotational symmetry in the structure of all the patterns (interlace and key pattern) on folios 210v and 138v, while simultaneously deliberately interrupting this symmetry with episodes of asymmetry.[40] Hull and Brennan were correct in their identification of rotational symmetry in these respective key patterns, however, their focus on key pattern otherwise was very limited in comparison to interlace.

Insular makers cleverly manipulated the symmetry, or other structural properties, within individual key pattern compositions to reference the structure of neighbouring patterns, or the structure of the artwork as a whole, as we shall see in the case study of the Harley Golden Gospels in Chapter 8. Like construction aids and methods, such deliberate acts of grand design were part of the working process. However, they will not be the focus of this thesis, nor will Stevick's methodology be adopted. There will be no comparisons of the overall proportions or ratios of fields within an artwork to the proportions or ratios of the key patterns inhabiting those fields. To do such work, the intrinsic structure of key pattern must be properly understood, and again, this thesis completes that crucial first step.

1.5.3. Symbolism, Religious Beliefs, and Material Culture

Insular specialists on occasion have commented on the potential symbolism of abstract patterns in an iconographical sense or identified the ways in which these patterns may have reflected the religious worldviews of the societies that created them. Rosemary Cramp has

[39] Hull 2003, 197.
[40] Brennan 2011, vol. 1, pp. 110-117.

described how Insular artists used plant-like patterns, inhabited with abstract animals feeding upon their fruit, as a visual reference to a passage from St John's Gospel, in which Christ was compared to a life-giving vine.[41] Jenifer Ní Grádaigh has explained that the interlaced filigree animals on the Derrynaflan Paten communicated 'encoded Christological meaning' to elite, literate clerical audiences.[42] The interlaced filigree eagle on the paten, for example, represented 'Christ's divine nature, as elaborated in patristic exegesis'.[43] Stepping away from overt Christian symbolism, Brent R. Doran suggested that the mathematical aspects of curvilinear spiral patterns, such as symmetry and fragmentation, betray the even older religious worldview of Iron-Age Celtic-speaking peoples, and by extension that of early medieval people in Britain and Ireland (who added interlace to this repertoire).[44] According to Doran, the curvilinear, fragmented, and ambiguous nature of spiral and interlace patterns reflect these societies' embrace of 'the subtly cyclical and occasionally chaotic world around them.'[45]

Academics have ventured almost no explanations for what Insular peoples may have intended their key pattern to symbolise, however. Ní Grádaigh has made the only published comment of which the author is aware. Key pattern fills the shaft and arms of the cross on the Tullylease cross slab, from County Cork, Ireland, and Ní Grádaigh has proposed that its highly ornamented surface was intended to reference the adorned cross of the Parousia.[46] However, Ní Grádaigh does not specify why key pattern would have been chosen for this purpose over other types of ornament, such as interlace or spirals. Interlace and spirals filled other crosses in Insular artworks in a variety of media far more often than key pattern did. If the carver simply wanted to convey an adorned cross, any pattern would have suited. James Trilling has suggested that medieval artists applied interlace not only to the Christian cross not only to enhance the inherent apotropaic power, but also to protect the cross itself from evil, though he made no mention of key pattern and warned other academics about the difficulties of identifying meaning or symbolism in ornament.[47] Authors of popular artists' manuals sometimes have offered even more mystical explanations of Insular key pattern's symbolism, which are addressed in Chapter 5. In contrast to Insular key pattern, key patterns from other time periods and cultures

[41] Cramp 1984b, xxiv.
[42] Ní Grádaigh 2012a, 115.
[43] Ibid.
[44] Doran 1995, 258-60, 263, 276-78, 283.
[45] Ibid., 278.
[46] Ní Grádaigh 2012a, 125.
[47] Trilling 1995, 59-60, 71, 73-75.

sometimes do have more identifiable meanings. Nevertheless, even in the same culture, this symbolism was never fixed. As we shall see in Chapter 6, makers from other historical periods and cultures used key pattern to convey a variety of meanings, often specific only to an individual artwork. At other times, non-Insular key patterns simply functioned as decoration, and do not appear to have been imbued with any symbolic meaning at all. This variability may have been similar in Insular art. Finally, the study of Insular key pattern's potential symbolic meanings is a separate topic entirely from that of this thesis, and so is not addressed further here. In fact, scholars should not attempt to extrapolate symbolic meaning from key pattern's structure, until its structural properties are more correctly and thoroughly understood.

On occasion, scholars of Insular art, as well as those of art history, archaeology, and anthropology more generally, have also included abstract patterns in studies of material culture. That is, they have analysed how decorative patterns 'act on people, and are acted upon by people, for the purposes of carrying out social functions'.[48] Only one of these scholars commented on key pattern and its structure directly, however. In his posthumously published book, *Art and Agency: an Anthropological Theory*, the anthropologist Alfred Gell focused his research on how non-western art objects acted as agents in social interactions, with power and influence over the people who used and viewed them.[49] The objects functioned this way because their makers deliberately created them with such agency in mind.[50] In studying this aspect of material culture, Gell endeavoured to develop an 'anthropology of art' that bypassed aesthetics or evaluations of quality, according to either western standards or those of the cultures being studied.[51]

Many of these objects were highly ornamented, and Gell argued that their patterns were not merely decorative, but part of a 'technology of enchantment', in which their makers' intended them to have 'cognitive' and 'psychological' effects on viewers.[52] His comments included a very brief excursus on key pattern. He focused it on ancient Greek and other unspecified, non-western key patterns, none of which included Insular versions. In addition, his statements about key pattern's structure and symmetrical properties were

[48] Woodward 2007, 3-4.
[49] Gell 1998, 5-7, 27.
[50] Ibid., 23.
[51] Ibid., 2-3.
[52] Ibid., 74-75.

short and impressionistic, and so in no way constitute a structural analysis of the pattern. Nevertheless, Gell offered intriguing insights into how key pattern – or more specifically, the eye boggling effects of its complex physical structure and inherent symmetries – may have given it the power to influence viewers in social situations.

First, Gell noted that patterns of all kinds give viewers an impression of movement, even though they are abstract and therefore not representative of any living (and thus motile) thing.[53] He explained that makers imbued key pattern with this illusion of animation by iterating its 'root' or basic motif using various symmetry operations, singly or in combination (symmetry operations in key pattern will be discussed in Chapters 2 and 8).[54] Gell used a single key pattern composition from ancient Greek art, arranged in a narrow band or row, to demonstrate how artists created this effect.[55] He correctly identified the fundamental unit or motif in key pattern (the individual spiral shape), and observed how the artist built up the composition by repeatedly translating the spiral unit along the horizontal axis, as though sliding it successively to the left or right along the row of pattern.[56] The pattern-maker therefore created for viewers a sensation of sideways movement, because the viewers' eyes themselves would move as they 'read' the pattern, landing on each successive spiral unit from left to right.[57] Gell also argued that artists used the spatial relationship between 'ground' (that is, negative space) and 'figure' (positive space) in patterns to create a sense of movement or visual confusion in viewers.[58] He used a larger, all-over composition of key pattern (of a kind not existing in the Insular corpus) to illustrate this dazzling interplay between black and white forms.[59] Such a pattern functioned as a 'mind-trap' by confusing viewers, who are 'drawn into the pattern and held inside it' while they attempt unsuccessfully to understand its complex structure.[60] Gell was one of few modern scholars, Insular or otherwise, to engage with the very important structures of symmetry, and positive and negative space in key pattern. However, his fleeting observations on structure lacked the depth necessary for fully understanding key pattern structure, because he was less focused on these structures themselves than on their intellectual and emotional impact. It is possible, though ultimately speculative, that Insular makers intended their key patterns to similarly entrap the minds of viewers.

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[53] Ibid., 76.
[54] Ibid., 76-77.
[55] Ibid., p. 77-80.
[56] Ibid., p. 77-80.
[57] Ibid.
[58] Ibid., 80.
[59] Ibid.
[60] Ibid.

Second, Gell proposed that abstract ornament – key pattern or otherwise – not only boggles the minds of human viewers, but defends against malevolent, spiritual entities, as Trilling also suggested for interlace.[61] Complex abstract patterns shield their human owners from otherworldly assault by visually distracting demons or spirits, thereby diverting them from their harmful activities, or even by physically entangling them within the structure of the pattern.[62] Again, it is possible, though speculative, that Insular craftspeople created key pattern for the same reason. If this were the case, the key pattern on the Tullylease cross may have been intended to function as a protective agent against Satan, in its own right or by increasing the inherent apotropaic power of the cross itself.

In Insular art-historical and archaeological studies, there have been few analogous material-culture analyses of abstract ornament. Two illustrative examples are listed here. Emmanuelle Pirotte used Gestalt theory to analyse how the complexity of the abstract ornament in manuscripts excited a meditative, contemplative mental and spiritual state in medieval illuminators and viewers.[63] Jenifer Ní Grádaigh has suggested that filigree interlace ornament on metalwork objects required medieval viewers to retrace each patterns' lines from start to finish with their eyes, 'in a mimicry of the original act' of drawing, in order to decipher the forms within and their Christian symbolism.[64] Ní Grádaigh then proposed that in the elite, educated Insular mind, the 'somatic response' required for viewing interlace – tracing with the eye – was linked to the act of religious gesturing with the hand, such as signing the cross, as well as to the act of writing of script in ink.[65] She included the key pattern on the Tullylease cross in her discussion, because it also required the viewer's eye to '[scurry] around the labyrinthine pattern'.[66] The author of this thesis has found no Insular material-culture study specific to key pattern, however, and with exception of Michael Brennan's research on interlace, the scholarly focus primarily is limited to the reception and/or function of finished ornament, rather than the process of its production.

[61] Ibid., 83-84.
[62] Ibid., 83-84, 88-90.
[63] Pirotte 2001a.
[64] Ní Grádaigh 2012a, 114-16, 120-21.
[65] Ibid., 115-119, 121-23, 129-30.
[66] Ibid., 125.

1.6. Conclusion

This thesis ultimately is a study of material culture, as well as of art history and archaeology. However, unlike most material culture studies, it does not focus on the social impact and function of art. Like Gell, this study also avoids discussion of Insular aesthetics and what early medieval artists may have thought about 'good' versus 'bad' key pattern, because in the absence of written record this information is unrecoverable. Nor is it solely a means of deepening our understanding of key pattern for its own sake. Instead, this thesis utilizes key pattern as a vehicle for glimpsing over the shoulders of Insular makers in the workshop or scriptorium, for uncovering their intellectual activity, intentions, and creative agency in the middle of their working processes. It identifies Insular makers' shared conceptions of and minimum structural requirements for key pattern, and how they understood and approached line, shape, space, and symmetry. It then illuminates how Insular artists proceeded to push against, break, and transcend these minimum structural parameters for the purpose of maximum invention – much like jazz musicians improvise with chord structure today.

Key pattern's structure and the ways in which Insular artists manipulated it *must* be understood comprehensively before modern scholars can safely theorize about construction aids and methods, the pattern's meaning, or viewer reception. Otherwise, they will base their conclusions about these latter topics on unstable ground, just as previous archaeologists and art instructors did in earlier technical studies and classifications of key pattern. Furthermore, this structural analysis of key pattern is not simply a prelude to studies of grids, symbolism, or social impact. By following in the footsteps of Michael Brennan and re-adapting his approach to Insular interlace, this thesis presents to academia a new methodology that has caused a paradigm shift in the study of ornament. It revamps Morellian formal analysis for new purposes beyond connoisseurship and comparisons of style, the latter have been criticised as having 'a distressing tendency to eliminate the anonymous artists or craftsman altogether by substituting artistic choice with vague "influences"…leaving art objects stranded in a depersonalised vacuum'.[67] This new approach to key pattern corrects this tendency and re-centres the study of its structure on individual artists and artworks. By identifying Insular makers' conceptions for key pattern, this new methodology also prevents the imposition of modern aesthetic values on

[67] Ní Grádaigh 2015, 216.

medieval artworks, which otherwise result in insensitive judgments of ‘irregularity’ and inferior quality in objects that do not harmonize with 21st-century expectations. Structural analysis of key pattern also reveals that it is impossible to classify typologically, because medieval artistic license always causes individual compositions to wriggle out of modern organizational schemes. Instead, key pattern is revealed as being reflective of a set of mental procedures in which Insular makers intelligently engaged, from the planning process to completion.

Finally, this thesis presents the first theory for key pattern that is applicable not only to Insular compositions, but to key pattern around the world and throughout history. This new approach uncovers new information about key pattern from other cultures, and which features made Insular key pattern unique in this global context. It allows us to access brand-new information about known artworks and their manufacture, improving our knowledge of Britain and Ireland’s archaeological and art-historical legacy. Therefore, this new analysis of key pattern fills a significant, longstanding gap in Insular art history and archaeology, and in the study of ornament more broadly.

2. Chapter 2: Key Pattern: Terms and Definitions

2.1. Pattern in Insular Art

Art historians and archaeologists from the nineteenth through the 21st centuries have regularly identified three basic groups of pattern in Insular art across a variety of media (Fig. 2.1a-e).[68] In art historical formal analysis (i.e. 'the visual analysis of artistic form', rather than content or meaning), a pattern is understood as any visual effect in an artwork in which smaller attributes, such as colours, lines, and shapes, are repeated in a regular way to create a larger decoration.[69] In Insular art, patterns are fundamentally geometric, that is, they contain components art historians and designers refer to as 'geometric shapes', elements, or motifs, such as 'precise and regular' squares, rectangles, circles, and triangles, with generally straight lines or perfect curves.[70] Though Insular pattern-makers sometimes did insert animal, plant, or human shapes into these patterns, such alterations did not change their basic structure, and the patterns remained fundamentally geometric.[71] Therefore, they contrast with patterns formed from 'organic' or 'freeform' shapes that are 'irregular' and 'do not conform to explicit or even implicit rules', such as splotches or splatters of paint.[72] Geometric patterns include both rectilinear and curvilinear patterns. Curvilinear patterns are geometric patterns composed entirely of curved lines. Rectilinear patterns are geometric patterns consisting predominantly of straight lines arranged at angles.[73]

The basic groups of Insular patterns that scholars typically identify are:

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[68] C.f. Allen and Anderson 1903, vol. 1, part 2, pp. 140-403; Crawford 1926; Nordenfalk 1977, 17; Edwards 1987; G. Bain 1951, 23-81.
[69] Kleiner and Mamiya 2006, 6; Sayre 2010, 128.
[70] Frank 2014, 40, 66; Lewis and Darley 1986, 139; Trilling 2001, 36.
[71] For differing views on the insertion of zoomorphic, human, or plant forms in Insular patterns and the patterns' subsequent categorization, compare for example Allen 1904, 242 or G. Bain 1951, 23-81, 101-126 to Nordenfalk 1977, 17 and Trilling 1995, 63. The author of this thesis follows and expands Nordenfalk's and Trilling's view on interlace, that zoomorphic embellishments (or other lifelike forms, such as plant or humans shapes, one should add) do not require us to re-categorize the resultant pattern as separate from those without such additions, because the basic structure of the pattern remains unaltered.
[72] Frank 2014, 40, 66; Trilling 2001, 36.
[73] Megaw and Megaw 2001, 251-52.

A) interlace, a pattern whose lines alternate, or weave together in an over-under sequence (sometimes with added organic features such as zoomorphic, human, or plant-like additions) (Fig. 2.1a);

B) spirals, originating in Iron Age Celtic, or 'La Tène' art style,[74] formed by lines that travel outward in ever-widening curves from a central point (Fig. 2.1b); and

C) various rectilinear patterns. These patterns are visually similar to each other because of their rectilinear nature, but are otherwise distinct in structure. These include: key pattern, simple step pattern, and complex step pattern (Fig. 2.1c-e).

2.2. Rectilinear Patterns in Insular Art

2.2.1. Key Pattern

As noted in Chapter 1, key pattern is composed of straight lines that form angular spirals (Fig. 2.1c). More specifically, these straight lines are arranged parallel and perpendicular to each other, with some intersecting at angles (Fig. 2.2). Certain lines are always discontinuous, that is they ultimately terminate, even after a series of intersections occur (Fig. 2.3). In Insular art, these discontinuous lines are the negative space of the pattern (hereafter negative lines). Also known in formal analysis as the 'ground', negative space represents the surface upon which artists situate their subjects, decoration, or areas of focus.[75] Negative space therefore should be understood as the background of the image, and it often appears to recede from the viewer's eye. The negative lines of Insular key pattern can be minimal or very wide, and even expand into geometric shapes (Fig. 2.4). Key patterns also contain negative lines that only intersect one, and not more, sides of the border or edge of the pattern (Fig. 2.5). These negative lines themselves are one of the physical building blocks, or structural elements, of key pattern. The concept or convention

[74] Allen 1904, 242-43.
[75] Frank 2014, 40; Lewis and Lewis 2009, 479.

that these negative lines must be discontinuous, and can fluctuate in width and shape, are two important structural principles attached to them.

The negative lines create a path of positive space between them (Fig. 2.6). In formal analysis, positive space or shapes represent the subject or forms that the artist places upon or that otherwise appear to be located on top of the negative space.[76] Positive space therefore should be understood as the foreground of the artwork, because it either is physically closer to the viewer, or gives the illusion of being so. In key pattern, the positive space or path is generally continuous, i.e. never terminating, and it never intersects or crosses out of the border around the pattern field (though around the edges of the key pattern composition, the path or positive space will run parallel to that border at intervals). It also remains a consistent width throughout the composition (Fig. 2.6). The positive space is another structural element. The concept that the positive space must remain continuous and of a consistently even width throughout a given key pattern composition, and never intersect with or cul-de-sac at the outer border of that composition are three important structural principles related to this structural element.

Together, the intersecting negative lines and the positive path form single individual rectilinear spiral shapes that turn at angles (Fig. 2.7). These spiral shapes too are structural elements. Artists multiplied them to form key pattern, keeping the spirals in the same pattern at generally the same size, avoiding very large or very small outliers, the latter treatment typical of Insular spiral patterns in contrast (Fig. 2.8a-b). Key pattern is therefore spiraliform, or having the structure of the spiral, and is a repeating pattern (a type of pattern built from the regular repetition of a single entity).[77] The spiraliform structure is fundamental to key pattern,[78] and the convention of keeping each spiral unit within a key pattern composition at the same size as all the others is a structural principle related to this element.

[76] Frank 2014, 40; Lewis and Lewis 2009, 479.
[77] Trilling 2001, 36; Henderson and Henderson 2004, 206. For repeating patterns, see Trilling. Isabel and George Henderson are the first to the author's knowledge to use the term 'spiraliform' to refer to key pattern. However, they used this adjective to refer to a particular artwork with a key pattern composition containing curved embellishments, rather than to the structure of all key patterns worldwide, as a whole.
[78] While some scholars interested in key pattern from both within and without Insular studies, such as John Romilly Allen in the early 20th century (Chapter 4) or Eva Wilson more recently (see below, section 2.4.2.), have identified the equivalency between spiral pattern and key patterns, I thank Dr. Michael Brennan specifically for helping me to visually locate these spiral shapes in key pattern, alerting me to their structural importance, and encouraging me to pursue analysis of them independently and more deeply than has been done in previous studies. Dr. Michael Brennan, pers. comm., 13 May 2015.

Finally, Insular key pattern is a 'non-representational' pattern. In formal analysis, non-representational art or patterns consist of 'visual forms with no specific references to anything outside themselves,' such as lines or geometric or freeform shapes.[79] Non-representational patterns contrast with abstract patterns that represent recognizable, 'natural objects in simplified, distorted, or exaggerated ways', as well as representational patterns that contain depictions of the 'everyday world' without significant alteration or distortion.[80] Interlace and spirals with zoomorphic, human, and plant forms are abstract.

NB: This overview of key pattern both overlaps with and departs from the ways that other scholars have described the pattern. For example, most Insular specialists have previously noted key pattern's spiral structure, the parallel and perpendicular nature of the pattern's straight lines, and that some of those lines are discontinuous while others are continuous. However, some of the above descriptions of key pattern's structure are new to the author or are drawn from previous studies but also are greatly expanded upon, refined, and corrected throughout this thesis. A few examples are listed here. No previous specialist has clearly noted that the repeating spirals within a key pattern composition must all be the same size, and while some scholars have noted the presence of two types of 'lines' in key pattern (one being discontinuous and the other continuous), few have clearly identified which represent positive versus negative space (i.e. foreground or background) or how to distinguish them. Few previous scholars have commented on the fact that the positive space must remain an even width throughout a key pattern composition, and none have fully explored the implications and crucial importance of this principle. In addition, none have commented on a significant structural aspect of negative space that sets key pattern apart from other abstract patterns: that series of intersected negative line segments were only permitted to intersect *one* side of the outer border in a key pattern. All these earlier studies, their positive insights adopted in this thesis, as well as their omissions and problems feature in depth in Chapters 4 and 5 .

[79] Frank 2014, 11.
[80] Ibid., 9-11. Frank notes that the term 'abstract' is also used to describe art that does not represent anything recognizable, however, the term non-representational more adequately covers this.

2.2.2. Simple Step Patterns

In the past, previous scholars have confused key pattern with two other types of rectilinear pattern common in Insular art (see below, section 2.4.1.), each of which possess their own, distinct structure: simple and complex step patterns. Simple step pattern and complex step pattern share structural aspects unique to each other, but also have fundamental structural differences from key pattern, as well as from each other. Therefore, while they are both referred to as 'step', they must be understood as two distinct patterns – separate from each other as well as from key pattern. It improves our knowledge of key pattern to fully identify how it differs in structure from simple and complex step pattern.

Like key pattern, simple step pattern is repeating and non-representational. However, in simple step pattern, the basic fundamental structure (or unit) is a negative line, bent twice at an angle, each time in the opposite direction (or in more mathematical terms, three line segments that intersect at two alternate angles). This negative line therefore never doubles back on itself, but is angled like a flight of steps (Fig. 2.9a-b). Pattern-makers repeated this angled line to form the pattern, either by iterating it in rows (so that the step-like lines appear to move successively forward across the surface of the artwork), or radially to form a tile shape that some modern scholars refer to as a 'swastika' (Fig. 2.9c).[81] In simple step pattern, these negative lines always intersect two sides of the border or edge of the pattern (and when the lines are arranged in a 'swastika', a single negative line will intersect the border on one side, and another negative line at its other end, which in turn intersects the border) (Fig. 2.10a-c). Between them, these negative lines create enclosed areas of positive space that take shapes coincidentally similar to the Latin letters 'T' or 'S'/'Z' (Fig. 2.11a-c). When the negative lines are repeated in a row, archaeologists have observed simple step pattern's similarity to an interlace pattern of two twisted paths or cords, the former being rectilinear and the latter curvilinear (Fig. 2.12a-b).[82] Step pattern occurs across a wide variety of media in Insular art, from metalwork to sculpture to manuscripts (Fig. 2.13a-c).[83]

[81] For example, see Crawford 1926, pp. 42-44, no. B-C, fig. 9b-c.
[82] Kermode 1907, 50; Brennan 2011, vol. 1, pp. 52-53; Preston-Jones and Okasha 2013, 73.
[83] Crawford 1926, p. 36 no. 66, plate xxvii no. 66. I am indebted to Niamh Whitfield for alerting me to the step pattern on the Ardagh chalice.

2.2.3. Complex Step Patterns

Complex step pattern looks similar to simple step pattern and scholars often refer to it by the same name, because one of the basic structures of complex step pattern also is an angled line reminiscent of flights of stairs or steps (Fig. 2.14a-d).[84] However, the two patterns are in fact qualitatively different in structure, and so the author has coined the new term, 'complex step pattern', to reflect this distinction from simple step pattern. The basic component of complex step pattern is a square or sub-rectangular field containing one or more discrete lines bent successively at right angles in alternate directions (e.g. up-along-up-along). They run in a roughly diagonal manner across the field (and they do not travel sideways in rows, nor are they radially arranged, as in simple step pattern) (Fig. 2.15). These lines appear similar to the angled lines of simple step pattern, but in complex step pattern each line often contains three or more angles, whereas their analogues in simple step pattern typically contain only two angles (c.f. Figs. 2.9a, 2.15). In complex step pattern, these angled lines are the positive space. They remain at a constant width. Insular pattern-makers sometimes placed single square or sub-rectangular fields containing these lines in an isolated manner within an artwork (Fig. 2.14a), but more often they repeated a field four times (or more, in multiples of two) to form a full block of complex step pattern that covers a wider area (Figs. 2.16, 2.14b-d).

When the fields are multiplied thus, their positive, angled lines join to leave enclosed areas of negative space between them. Artisans filled these enclosed areas of negative space with brightly coloured enamel, glass pieces, or precious stone in metalwork and coloured ink in manuscript illumination (evidence for potential colouring on sculpture does not survive) (Fig. 2.14a-d). Depending on how an artist arranged multiple fields, the positive angled lines within those fields meet either to form concentric squares of negative space (Fig. 2.14b-c) or a cruciform shape (when in a cruciform shape, the artists sometimes chose to cut each of the four rectangular fields diagonally in half after joining them together, while making the cut edges of the composition curvilinear so as to form a complex step pattern that fills a circular space) (Fig. 2.14d). Once the fields were joined, each area of colourful negative space is of consistent width throughout the pattern (Fig. 2.16). When four fields are arranged with their positive lines in a concentric manner, both

[84] For example, see Allen 1904, 278-79; Crawford 1926, pp. 36-37, no. 67-69, plate xxix, no. 67-69; Edwards 1983, 19-20; 1987, 114; 1998, 112-13.

the positive lines and areas of negative space are mainly continuous and of consistent width, though some may intersect with the outer border of the pattern, and therefore terminate at that point of intersection (Fig. 2.16). If four fields are arranged in a cruciform manner, both positive lines and areas of negative space are still of consistent width, but are all discontinuous throughout the pattern (Fig. 2.17).

No previous scholar has so fully explained the structure of complex step pattern (which they typically referred to just as ‘step pattern’). However, in 1904 John Romilly Allen correctly described the lines within the pattern as ‘bent backwards and forwards at right angles’.[85] Henry Crawford later observed the repeating nature of the pattern’s square fields and that artists placed angled lines across them, as well as the presence of cruciform shapes in some patterns.[86] Nancy Edwards first noticed that the pattern’s square fields could feature singly in an artwork as well as in multiples, and she demonstrated awareness of concentric versions in her diagrams.[87] Finally, in his popular guide to drawing Insular patterns, *Celtic Design: A Beginner’s Manual*, Aidan Meehan correctly noted that medieval makers built the pattern by arranging ‘the quarters’ or fields in different ways, supplying illustrations of both concentric and cruciform versions, and that they applied this pattern to a variety of media including manuscripts, carved stone, and metalwork.[88] However, he had nothing to say about positive and negative space, and how these two structural components were affected by such rearrangement into concentric or cruciform compositions.

Though Allen noted that such patterns can be found across different media, he suggested that in using them in manuscript illumination and sculpture, such as the Lindisfarne Gospels or the Dysert O’Dea high cross, Insular artisans imitated ‘enamelled bosses’ in metalwork (c.f. Fig. 2.14a-d), because the illuminated and carved versions look so similar to these bosses.[89] Edwards suggested that the pattern developed specifically from the techniques of champlevé, in which variously shaped, recessed cells were cast in metal in high relief, and then filled with enamel (Fig. 2.14d).[90] Eva Wilson, a craftswoman and archaeological illustrator working outside of Insular studies, referred to the patterns as

[85] Allen 1904, 278-79.
[86] Crawford 1926, pp. 36-37, no. 67-69, plate xxix, no. 67-69.
[87] Edwards 1987, pp. 114, 116, fig. 5.
[88] A. Meehan 1991, pp. 7-22, esp. 8-9.
[89] Allen 1904, 248, 278-79.
[90] Edwards 1983, 19-20.

‘cloisonné designs’, pointing to the similar technique of cloisonné, where each cloison (or cell that held the enamel, glass, or a precious stone) was first made by soldering angled wire or metal strips onto a metal backing (Fig. 2.18a-b).[91] When complex step pattern occurs in sculpture or manuscripts, raised angled lines in relief-carving and drawn black lines in illumination do imitate these champlevé cells or cloisonné wires. The pattern might as well be called champlevé or cloisonné pattern.

At this point, readers may have noticed that when comparing key pattern and simple step pattern with complex step pattern, the angled or intersected lines within all three patterns are visually similar but represent opposite types of space, positive or negative. In key pattern and simple step pattern, these angled or intersected lines are the negative space, while in complex step pattern they are the positive space. Conversely, the enclosed ‘T’- or ‘S/Z’-shaped areas in simple step pattern are positive space, while the enclosed concentric or cruciform cells of complex step pattern are negative space. In short, the positive and negative space of an enamel pattern is reversed from what the viewer might expect after learning about key and simple step patterns.

These differences result from the fact that key pattern, simple step and complex step pattern not only have fundamentally different structures, but also that Insular pattern-makers took a different approach to handling positive and negative space in key pattern and simple step pattern than they did in complex step pattern. We will explore these differences in approach further, as well as their crucial influence on key pattern structure in Insular art, later in Chapter 3.

2.2.4. Miscellaneous Rectilinear Patterns

Insular artists also created a miscellaneous variety of simpler rectilinear patterns that were structurally distinct from key, simple step, and complex step patterns. For example, metalworkers also used the cloisonné technique to create checkerboard-like designs, as seen in garnet and blue glass on the Sutton Hoo shoulder clasps. The individual squares or checkers in these compositions are not bisected internally by diagonally-oriented, stepped

[91] E. Wilson 1994, p. 188, fig. 9:33; Kleiner and Mamiya 2006, 534.

lines as would occur in complex step pattern. Anglo-Saxon carvers applied chevrons to stone sculptures, as Rosemary Cramp illustrated in her introductory discussion of ornament for the *Corpus of Anglo-Saxon Stone Sculpture*.[92] The authors of the first volume of *A Corpus of Early Medieval Inscribed Stones and Stone Sculpture in Wales* illustrated a pattern formed of a narrow row of straight, vertical lines, each intersecting both sides of the border.[93] These rectilinear patterns are not spiraliform, extremely various, often very simple in their geometry, and do not conform structurally to any of the groups listed above (key, simple step, and complex step pattern), and therefore will not be analysed further in this thesis.

2.3. Comparison between Insular Patterns

Because all Insular patterns are geometric, key pattern shares the following structural similarities with spirals, interlace, and simple and complex step patterns:

- All five patterns possess negative and positive space;
- All five patterns are or can be repeating patterns;
- All five patterns are or can be non-representational;
- Both key pattern and spiral pattern proper are spiraliform in their positive and negative space (Fig. 2.19);
- Other rectilinear patterns share with key pattern a structure composed of straight lines and angular shapes. In all rectilinear Insular patterns, straight lines are typically parallel and perpendicular to each other. They are also sometimes discontinuous, as are the negative lines in Insular key pattern (Fig. 2.1c-e).
- In interlace, negative lines and space likewise are always discontinuous (Fig. 2.20).

However, major structural differences distinguish key pattern from other Insular patterns.

[92] Cramp 1984b, pp. xlv-xlvi, fig. 27.
[93] Redknap and Lewis 2007, p. 101, fig. 74.

Key pattern differs from simple step pattern in the following ways:

- In simple step pattern, the T or S/Z-shaped positive spaces or enclosed paths are spiraliform in relationship to each other, but depending on their arrangement, the negative lines may or may not be spiraliform as well (Fig. 2.21a-b). This differs from key pattern, where both sets of lines always must be spiraliform.
- In simple step pattern, the path is only of a single, consistent width when in an 'S'/'Z'-like shape (Fig. 2.22a). It is of inconsistent width when in a 'T'-like shape (Fig. 2.22b), whereas in key pattern the path must be of a consistent width everywhere within the composition.
- A simple step pattern's path is always discontinuous (unless the pattern-maker inserts additional lines that are not fundamental to the pattern, and then the path is continuous in a series of individual, closed loops (Fig. 2.23)), whereas in key pattern the path is generally continuous.
- The negative lines of a simple step pattern touch two sides of the border or edge of the pattern. In key pattern, a negative line or set of intersected negative lines can only ultimately intersect one side of the border or edge of the pattern.

Key pattern differs from complex step pattern in the following ways:

- Complex step pattern is never spiraliform.
- Negative space is only discontinuous in key pattern, whereas in complex step pattern the negative space (coloured in ink or enamel, or carved out of a stone surface) can be both continuous and discontinuous in the same composition (c.f. Fig. 2.3, 2.16).
- In complex step pattern, an area of negative space may touch more than one side of the border, whereas Insular makers of key pattern allowed one negative line or series of intersected negative lines to touch one side of the border only (c.f. Fig. 2.5, 2.15).
- The different enclosed areas or sets of negative space in complex step pattern each remain a consistent width within themselves, whereas in key pattern any negative line can change from being very narrow or very wide along its length (c.f. Fig. 2.4, 2.16).

- The positive space (angled lines enclosing the cells) in a complex step pattern can be abruptly discontinuous, typically when one intersects with the pattern border, whereas in Insular key pattern the positive space never intersects with the border and is generally continuous (c.f. Figs. 2.6, 2.15).

Key pattern differs from interlace in the following ways:

- Unlike all other Insular patterns of any kind, interlace possesses a positive path that alternates (weaves over and under itself). This alternating path is uniquely characteristic of and fundamental to interlace.
- Interlace is not fundamentally spiraliform in structure, even though it can contain cords that coil in a spiraliform manner in places along their length (Fig. 2.24).
- The lines comprising an interlace pattern can be either rectilinear and curvilinear – neither option is fundamental to interlace. In contrast, rectilinearity is fundamental to key pattern and any curvilinear additions serve the sole purpose of minor embellishment (c.f. Figs. 2.24, 2.25, 8.29)
- The positive space, or path, of an interlace pattern can vary significantly in width, unlike key pattern (c.f. Figs. 2.6, 2.26).
- In interlace, the positive space or path can be abruptly discontinuous at any point (Fig. 2.27).
- Interlace can be a repeating pattern, but also can contain motifs of vastly different size and shape juxtaposed within a single field, the latter which key pattern cannot contain (Fig. 2.28).
- Insular artists could make interlace either non-representational or abstract. They created the latter by adding plant, animal, or human forms to interlace (Fig. 2.27). These forms are virtually unknown in Insular key pattern, with only one surviving exception on the St John’s Cross at Iona, where the ends of some of the negative lines are embellished with plant-like forms.

Key pattern differs from spiral pattern in the following ways:

- Spiral patterns are always curvilinear, never rectilinear.

- In spiral patterns the positive space or path can widen as it travels from the centre of the spiral, whereas in key pattern the path has a constant width (Fig. 2.19).
- The spiral path can be made abruptly discontinuous at any point in the composition, unlike in key pattern (Fig. 2.29).
- Spiral patterns can be repeating, but may also juxtapose differently sized and shaped motifs (Fig. 2.8b).
- Insular artists could make spiral patterns either non-representational or abstract, the latter typically by adding animal or human forms (Fig. 2.30).

In Insular art, key pattern, simple step pattern, complex step pattern, interlace, and spirals are separate and distinct in structure. However, because of coincidence in some cases, or the pattern makers' deliberate intervention in others, the structural differences between these patterns can occasionally blur in surviving artworks. For example, in simple step pattern, the enclosed 'S/Z' or 'T'-like areas of positive space look superficially similar to the enclosed negative shapes of complex step pattern, though the latter are far more varied in shape. When a simple step pattern's angled, negative lines are arranged in 'swastika'-like manner, both positive and negative space can be thought of as spiraliform. Because the spiraliformity of both positive and negative space is fundamental to key pattern, such 'swastika'-like instances of simple step pattern close the gap between the two patterns slightly, though not completely. As noted above, Insular makers occasionally also incorporated curvilinear spirals into key pattern, though these additions were solely optional embellishments (Fig. 8.29). Finally, Insular makers sometimes included stylized, leafy plant forms to both interlace and spiral patterns. Modern specialists have cited the distinctly Mediterranean origin of these plant-like patterns and their scrolling structure in ancient contexts (as a continuous series of running spirals), and therefore traditionally classified them as a separate group, variously named vine-scroll, plant-scroll, foliageous, phyllomorphic, or vegetal ornament.[94] Ancient Mediterranean vegetal ornament also sometimes took an interlacing form, as seen on early Coptic architectural carvings.[95] Terms like plant-scroll or vegetal ornament remain convenient labels for these patterns, however, in a structural sense they are simply variants of interlace or spiral patterns both in their original Mediterranean forms as well as in later adaptations in Insular art, because artists either interlaced the plant-like strands or gave them a curvilinear, spiraliform

[94] See for example Kitzinger 1936; Allen 1904, 242, 295; Cramp 1984b, xxiv-xxviii; Edwards 2013, 99. For a definition of the scroll in decorative arts and design, see Lewis and Darley 1986, 272.
[95] Badawy 1978, pp. 138, 141, fig. 3.47.

structure (Fig. 2.31a-b). In an Insular context specifically, this structural cross-pollination between patterns highlights Insular pattern-makers' inventiveness and is typical of the complex fluidity of Insular art that defies rigid or total categorization. Nevertheless, in spite of such creative flights, Insular makers largely viewed key, simple step, complex step, interlace, and spiral patterns as distinct from each other. These distinctions are readily apparent and consistent across Ireland and Britain, because objects and monuments typically are decorated with bounded fields of ornament that clearly divide these different patterns from each other, indicating that Insular artists understood them as structurally separate.

Readers can consult Fig. 2.32a-b for diagrammatic charts outlining the structural differences between key pattern and other Insular patterns.

2.4. Terminology

Now that we have concluded a basic overview of key pattern's structure and its similarities to and differences from other Insular patterns, the chapter will turn next to modern terminology for the pattern. First, we will address the problematic inconsistencies in the terminology that scholars have used to refer to Insular key pattern, and correct this confusion by adopting clearer vocabulary that researchers outwith Insular studies, from the field of decorative arts and design, have developed for patterns from all time periods and places. The chapter then includes a glossary of other assorted technical terms necessary for analysis of key pattern. Some of these terms were introduced above already, but all will feature repeatedly throughout this thesis. These assorted terms are drawn in a multi-disciplinary fashion from mathematics, art historical formal analysis, decorative arts and design, and architecture. The chapter will conclude with a comprehensive, technical definition of key pattern more detailed than the introductory description from section 2.2.1. above, as well as a brief description of a few additional structural aspects that are characteristic of Insular key pattern.

2.4.1. Problems with Terminology in Previous Scholarship

Modern Insular art historians and archaeologists have never established a unified terminology for key pattern itself. The lack of consensus does not reflect any ongoing academic debate, but rather a casual diversity in their choice of descriptive vocabulary, a lack of universal awareness of the structural distinctions between different rectilinear patterns, and a lack of engagement with broader theories of pattern. The resulting confusion inhibits comprehensive, comparative study of key pattern and a full understanding of how it differs from other patterns. In fact, there is no agreed umbrella-term for the pattern itself. In his classification of Insular patterns in the *Early Christian Monuments of Scotland* (hereafter *ECMS*), Allen chose the term 'key pattern' because the pattern looked to him like 'the L and T shaped slots' of skeleton keys.[96] Allen did not invent the term 'key pattern', for it was already in use amongst classicists in the late 19th and early 20th centuries,[97] though his attempt to explain the meaning of the term is novel. Later in the 20th century, the artist Aidan Meehan alternately argued for 'Celtic maze patterns' because he found Allen's likening of the pattern to skeleton keys was 'arbitrary' and visually did not fit all varieties of key pattern.[98] Meehan felt that the dictionary definition for 'maze' better reflected the appearance of the pattern, ('An intricate network of paths or passages').[99] In her introductory volume to the *Corpus of Anglo-Saxon Stone* Sculpture, Rosemary Cramp preferred the term 'meander' for a select group of key patterns common in Anglo-Saxon sculpture, reserving 'key patterns' and 'fret patterns' collectively for all other key patterns in Insular art and particularly those from Allen's *ECMS*.[100] This inconsistency in Insular scholarship may result from the fact that in the fields of decorative art and architecture, as well as art history, key patterns from all parts of the world have long been ascribed various synonyms, ('fret pattern', 'key pattern', and 'meander'), a variance of which Allen was already explicitly aware in the early 20th century, when he selected 'key pattern' as his favoured term.[101]

[96] Allen and Anderson 1903, vol. 1, part 2, p. 308.
[97] See for example Walters 1905, vol. 2, pp. iii, 211-13. Walter based his own book on the research of Samuel Birch, a British antiquary who died in 1885 (see p. iii).
[98] A. Meehan 1993b, 9-12.
[99] Ibid.
[100] Cramp 1984b, xlvi.
[101] C.f. Osborne, ed. 1975, 346; E. Wilson 1994, 29-30, 44; Allen and Anderson 1903, vol. 1, part 2, p. 308.

The array of labels previously used for key pattern is confusing and inhibits readers' understanding of the material. First, it prevents readers from associating familiar terms to different visual varieties of key pattern, with the result that they cannot easily imagine the pattern compositions directly from published texts without first accessing photographs of the artworks in question. This problem is clear when two scholars give different names for similar key pattern compositions found on separate objects or monuments. For example, the same key pattern that Cramp identified in her classification of Anglo-Saxon patterns as 'meander' also is referred to as 'T-fret' in The Royal Commission on the Ancient and Historical Monuments of Scotland's (RCAHMS) archaeological inventory of monuments in Argyll, Scotland (Fig. 2.33).[102]

Second, some Insular specialists used the term 'step pattern' in reference either to actual simple and complex step patterns, or to key pattern, or various combinations of these. Still others incorrectly identified step pattern as a key pattern itself. Their interchangeable application of these terms demonstrates a common misunderstanding of the structural distinctions between these three rectilinear patterns, especially of key pattern's fundamentally spiraliform structure, which the other two patterns lack. Even Insular scholars aware of the presence of spiral shapes in key pattern, such as Allen, mistook step pattern for actual key pattern. In the *ECMS*, Allen not only included step patterns in his classification of key pattern, but also then applied the term 'step pattern' to a particular variety of key pattern within which he envisioned step- or stair-like shapes (Fig. 2.34).[103] In a mathematical study of symmetry in patterns, Mark A.M. Lynch referred to both key and complex step patterns as 'step pattern' and treated them as one group.[104]

In other cases, some Insular archaeologists aware of key pattern's difference from both simple and complex patterns – including even Allen in his later work after *ECMS* – either mistook simple and complex step patterns for a single type pattern, or in Edwards' case, examined only one of them (complex step).[105] Likewise, Crawford correctly recognized that simple step pattern differed from key pattern because it contained lines 'bent…alternately in opposite directions', while key pattern contained lines 'bent several times in the same direction' (that is, lines that are spiraliform), but he referred to both

[102] Cramp 1984b, xlv; RCAHMS 1971, 145-46.
[103] Allen and Anderson 1903, vol. 1, part 2, p. 321-22, 331-32, no. 887-890, 965-971.
[104] Lynch 2000.
[105] Allen 1904, 242, 278-79; Edwards 1987, pp. 114, 116, fig. 5; Hull 2003, pp. 44, 97-98, figs. 2.6a, 4.5.

simple and complex step pattern as ‘step pattern’ and treated them as the same.[106] Ultimately, no Insular scholar has successfully attempted to ameliorate this terminological chaos.

2.4.2. Revised Terminology: Fret, Meander, and Key Pattern

Specialists of pattern outside of Insular art, namely from the field of decorative arts and architecture, have made more concerted efforts to streamline their vocabulary. Though there remains some terminological fluidity even in their approaches, some have attempted to clarify the relationships between geometric patterns, identify where key, fret, and meander patterns lie in this network, and as a result, how key pattern should be named. For example, Eva Wilson worked to establish more specific applications for key pattern and meander as part of her exploration of patterns on a wide variety of British Museum artefacts in her publication, *8000 Years of Ornament: An illustrated handbook of motifs*.[107] However, this thesis will specifically follow vocabulary from Philippa Lewis’ and Gillian Darley’s *Dictionary of Ornament* (1985) that provides thorough and technically rigorous definitions of patterns, and thus the clearest sense of key pattern’s relationships with fret, meander, and other pattern designations in both physical structure and visual appearance.[108] It is hoped that the terminology set out below will resolve the confusion that currently proliferates in Insular studies.

In their glossary, Lewis and Darley demonstrate that ‘fret pattern’ is simply an umbrella-term for any geometric pattern that contains arrangements of lines that intersect at angles, most frequently at right angles (of 90 degrees), but also sometimes oblique angles (greater or less than 90 degrees) (Fig. 2.35).[109] They note that fret patterns are used in architecture and three-dimensional media, in long bands (friezes) or over wider areas, and historically have occurred not only around the ancient Mediterranean, but also in Chinese and Japanese art.[110] The additional term, ‘fretwork’, specifically refers to such patterns when cut into wood by a fret-saw.[111] While Lewis and Darley state that fret patterns are used in three-

[106] Crawford 1926, pp. 34-41, esp. pp. 35-37, no. 57, 67-69, 72, plates xxvii, xxix, no. 57, 67-69, 72.
[107] E. Wilson 1994, 11, 29, 44.
[108] Lewis and Darley 1986, 5.
[109] Ibid., 137.
[110] Ibid.
[111] Ibid.

dimensional media ('incised, relief or pierced decoration'),[112] they can be found in painted form, in manuscript illumination or on pottery. One also should add to Lewis and Darley's assessment that fret patterns are rectilinear and non-alternating (no structures in the pattern weave over and under as is the case in interlace), and that in both two- and three-dimensional media, the pattern's intersecting lines leave characteristic cell-like or labyrinthine, open areas of space. These voids are positive or negative space depending on the specific artwork and choice of the artist. Because these cells or labyrinthine shapes recur throughout the composition, fret pattern also is a repeating pattern. The lattice, or an 'openwork decoration in wood, stone or metal' – such as the grid-like lead wiring around the panes of early modern windows – is therefore an extremely simple fret pattern.[113] Indeed according to the Oxford English Dictionary, the term fret originates from the Old French *frete*, or 'trellis-work', and Lewis and Darley indicate that 'trellis' and 'fret' are synonymous (Fig. 2.36).[114]

Next, Lewis and Darley define 'key pattern' as 'one of many variations on the fret', specifically possessing 'interlocking right-angles and vertical lines, sometimes intermittently broken but more often applied as a continuous pattern', and note that it is best known from classical art.[115] What makes key pattern distinct from other fret patterns is its 'interlocking' lines, or more clearly put, lines that form rectilinear spiral shapes. Key pattern is therefore a rectilinear fret pattern with a spiralling structure. All individual key patterns are fret pattern, but not all individual fret patterns possess the structural requirements to be key pattern.

Finally Lewis and Darley define 'meander' as any 'progressive ornament' (that is, a frieze or 'uninterrupted strip or band of ornament') formed from 'winding lines' (i.e. spiralling) that are either curvilinear or rectilinear.[116] According to Lewis and Darley, curvilinear meanders include the running spiral or 'wavescroll', a spiral pattern that Eva Wilson correctly notes as having an otherwise identical structure to rectilinear meander, i.e. a single row or frieze of key pattern (Fig. 2.37a-b).[117] This important detail, however – that the term meander can include curvilinear as well as rectilinear patterns – has not stopped

[112] Ibid.
[113] Ibid., 184.
[114] Ibid., 11, 299.
[115] Ibid., 178.
[116] Ibid., 200, 247.
[117] Ibid., 200; E. Wilson 1994, 29-30, fig. 1:6, 1:8-9.

even scholars of decorative arts and design from using it as an exact synonym for 'key pattern'. Wilson herself attempts to 'avoid confusion' by assigning 'meander' to friezes of key pattern, while applying term 'key pattern' to larger, 'area-filling versions'.[118]

Nevertheless, 'meander' does not adequately reflect key pattern's specifically rectilinear nature. It also is inappropriate for key pattern on several more counts, no matter the size of the composition, whether in a frieze or a larger field. First, though Wilson largely is correct in her assessment that all spiral patterns and key patterns are close structural cousins, not all Insular spiral and key patterns map to each other so perfectly as do rectilinear 'meander' and running spirals. Running spirals are very simple and were common in ancient Mediterranean art, while in contrast, Insular craftspeople created spiral patterns that were often far more complex in structure, with unique conventions and details distinct from key pattern, such as vesica and trumpet shapes inherited from Iron-Age Celtic art (Fig. 2.38).[119] Therefore, Wilson's retention of 'meander' for key pattern rows and her assignment of 'key pattern' only to 'area-filling versions' is not only redundant, but cannot communicate the nuances that differentiate Insular spiral pattern and key pattern, despite their close structural relationship. Furthermore, Lewis and Darley note that the term 'meander' technically only can include patterns that repeat in a single row, thereby excluding the larger-sized fields of key pattern common in Insular art. As a term, 'meander' therefore is at once too specific (including only single rows) and too broad (in its inclusion of curvilinear spirals or other progressive, non-key patterns) to be a suitable replacement for 'key pattern.'

We are left to contend with 'step pattern' as the final term that Insular art historians and archaeologists frequently use to refer to key pattern. Lewis and Darley do not discuss step pattern (in either a simple or complex type) in their *Dictionary*. However, both simple step pattern and complex step pattern are sub-sets of fret pattern according to the structural requirements of Lewis and Darley's definition, as they possess non-alternating lines intersecting at predominantly 90-degree angles and characteristic repeating, open cells of space. In this vein, Wilson cogently observed that late Roman cloisonné was in fact a fret pattern, and her observation also would apply to the Insular context.[120]

[118] E. Wilson 1994, 29, 44.
[119] Allen and Anderson 1903, vol. 1, part 2, pp. 374-75.
[120] E. Wilson 1994, 187.

These relationships between repeating, rectilinear geometric patterns have not been fully identified in previous studies of Insular art. For example, in his classification of patterns on early medieval Irish sculpture, Crawford included both key and simple step patterns (as well as complex step patterns, though he confused them with simple step) in a chapter entitled 'Fret patterns.'[121] Though he proceeded to use the terms 'fret' and 'key pattern' interchangeably, his chapter title could reflect a tacit, early recognition that 'fret pattern' represents a larger category or umbrella-term.[122] Cramp utilized 'fret pattern', 'key pattern', and 'meander' all to refer to key pattern, rather than identifying 'fret pattern' as an over-arching category, but she correctly distinguished key pattern from simple step pattern and recognized that both were sub-sets of a larger group in Anglo-Saxon art (which she termed 'line patterns').[123]

To summarize the new terminological standards set out in this thesis for analysing rectilinear Insular pattern, key pattern, simple step pattern, and complex step pattern are all sub-sets of a larger group known as 'fret pattern'. Key pattern is the only sub-set of fret pattern with a spiraliform structure. The term meander is superfluous, carries confusing scholarly baggage, and therefore has been discarded hereafter except in necessary reference to its use in previous scholarship.

2.5. Glossary of Technical Terms

In the interest of precision and clarity, this section includes definitions of further technical terms that will appear in the thesis. Definitions are drawn from a variety of disciplines and fields, including art historical formal analysis, mathematics, and decorative arts and design.

[121] Crawford 1926, 34-41.
[122] Ibid., p. 35, no. 58-60.
[123] Cramp 1984b, pp. xlv-xlvi, fig. 27.

2.5.1. General Terms for Pattern and Design

Line: In this thesis, the term 'line' is shorthand for a line segment, as understood in plane geometry: the 'shortest connection between two points.'[124] In formal analysis, line refers to 'linear forms in which length dominates over width', often found at the edges of shapes or figures.[125] This thesis follows the mathematical definition more closely. Here the term specifically designates a single negative line element occurring within a key pattern, which in all cases intersects with either the border or another negative line element, or both (Fig. 2.39). This term does not refer to the positive space of Insular key pattern (which instead is called the path).

Motif: 'Motif' is often used as a synonym for pattern. In formal analysis, however, this term describes any smaller entity that is repeated to form a pattern, such as a line or a larger concept like a flower or geometric shape.[126] It is therefore a component of a pattern. A single motif may or may not make visual sense if viewed in isolation from the whole pattern. In key pattern, the motif is the individual spiral shape formed by negative lines and the positive space, or path, that repeats to create the pattern (Fig. 2.7). Insular artists seem never to have rendered these individual key pattern spirals in isolation in an artwork.

Design: 'Design' is also often used as a synonym for both pattern and motif. However, in formal analysis, this term has three specific meanings: 1) the physical act of arranging visual elements (in art historical scholarship, these are understood as entities such as line, shape, colour, et cetera) to make an artwork, i.e. to design something; 2) the design itself, or the final product or artwork after the artist arranges the visual elements; or 3) the field of design, which includes graphic design, interior design, textile design, industrial design, and more.[127] Patterns belong to the second definition.

Ornament: 'Ornament' also is used as a synonym for pattern. According to James Trilling, an art historian and former instructor at the Rhode Island School of Design,

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124 Bronshtein, et al. 2015, 129.
125 Frank 2014, 37.
126 Getlein 2008, 102; Sayre 2010, 128.
127 Frank 2014, 68; Sayre 2010, 141.

ornament more specifically implies abstract and non-representational patterns that artists apply to portable objects, tools, cloth, architecture, or even their skin, for the purpose of decoration.[128] Ornament therefore carries a three-dimensional connotation. Nevertheless, Insular specialists refer to abstract and non-representational patterns as ornament even in the two-dimensional context of manuscript illumination.

Composition: A synonym for a design, particularly in two-dimensional art such as painting, drawing, or illumination.[129] Composition therefore means not only the maker's act of arranging a pattern or artwork, but also the pattern or artwork once finished.[130] In this thesis, composition refers to a maker's act of arranging of negative lines, spirals, and other components within a key pattern (i.e. 'to compose a key pattern') as well as the finished key pattern as an entity itself.

2.5.2. Terms for Spiral Shapes

The following terms apply to both rectilinear and curvilinear spirals.

Strand: A 'strand' is a spiraliform path of positive space that is formed between two facing negative lines in any pattern, whether interlace or spirals or key pattern. In key pattern, these negative lines are parallel to each other. Readers will encounter the term frequently in publications on Insular art, where it typically is used to describe each weaving, ribbon-like path in interlace. However, it is also appropriate for discussion of spiraliform patterns. In key pattern, a strand is the path which occurs between the parallel negative line segments forming a rectilinear spiral, and in curvilinear spirals it occurs between two curved negative lines (Fig. 2.19). Together, all the strands of a key pattern comprise the positive space, or path.

Single-stranded spiral: Insular specialists frequently use this term to describe a spiral containing a single strand. This single strand forms as a by-product of a single negative

[128] Trilling 2001, 12-13.
[129] Frank 2014, 68.
[130] Ibid.

curvilinear line in spiral pattern or, in key pattern, a series of intersected line segments travelling outward at angles from a central point (Fig. 2.40). As noted above, in key pattern the positive space or path is generally continuous. However, single-stranded spirals are the most common exception; here the path always terminates in a cul-de-sac, at the centre of each spiral (though in such a pattern, these are the only points of discontinuity).

Multiple-stranded spiral: A spiral containing two or more strands, designated respectively as two-, three-, or four-stranded spirals, et cetera (Fig. 2.41). These terms also are used frequently in Insular scholarship. Because strands are formed between negative lines that are parallel to each other (in key pattern) or opposing (in spiral pattern), the number of negative lines and strands in a multiple-stranded spiral are always equal.

Closed spiral: A multiple-stranded spiral is 'closed' if the negative lines intersect at the centre of the spiral, thereby causing the strands (the path) to terminate, or form cul-de-sacs, between them (Fig. 2.42).

Open spiral: A multiple-stranded spiral is open if its negative lines do not meet at the centre of the spiral, keeping the path continuous through the spiral (Fig. 2.41). Negative line elements in open multiple-stranded spirals therefore have the interlocked appearance which Lewis and Darley referred to in their glossary entry on key pattern. Open, rather than closed, multiple-stranded spirals are most common in Insular key pattern.

Spin direction: The direction that both the strands and negative lines of a spiral turn or spin. In mathematics, this is known as the 'sense class' or 'orientation' of a figure, or the direction that one must read a series of points on any figure from start to finish (Fig. 2.43).[131] In this thesis, the sense class or orientation of a spiral will be referred to as its 'spin direction.' For spiraliform patterns, we define the spin direction starting from the centre point of the spiral, moving outward (Fig. 2.44).[132] The orientation, or spin direction, of a spiral or any mathematical figure may be clockwise or counter-clockwise.[133]

[131] Bronshtein, et al. 2015, 133-34; Kinsey, et al. 2011, 278.
[132] Dr. Michael Brennan, pers. comm., 13 May 2015.
[133] Bronshtein, et al. 2015, 133-34; Kinsey, et al. 2011, 278.

C-spiral: Two individual spirals joined so that they spin in opposite directions (Fig. 2.45a).[134] C-spirals can be either single- or multiple-stranded. Art historians and archaeologists of La Tène and Insular art use the terms C-spiral or C-scroll as standard.

S-spiral: Two individual spirals joined so that they spin in the same direction (Fig. 2.45b).[135] S spirals can be either single- or multiple-stranded. Art historians and archaeologists of La Tène and Insular art use the terms S-spiral or S-scroll as standard.

Ligature: The line that connects the two individual spirals in a C- or S-spiral (Fig. 2.46).[136] In key pattern, the ligature is also present in the adjacent path.

2.5.3. Terms for Symmetry

So far this chapter has omitted reference to symmetry in key pattern, though it is was one of the most important structural principles in Insular key pattern and pattern-makers treated it with significant priority when designing compositions. This thesis will draw repeatedly on this mathematical concept and therefore basic definitions are appropriate here.

It is unknown how Insular pattern-makers conceptualized, taught, or described symmetry in patterns and their art amongst themselves. Nevertheless, in key pattern they deliberately exploited this geometric phenomenon for artistic effect. As a repeating pattern, key pattern is composed of combinations of individual rectilinear spirals that form larger designs (such as C- or S-spiral shapes). Artists then repeated these designs again and again into bigger and more complex entities to create key pattern compositions. For evidence of Insular artists' awareness of symmetry, we need search no further than these iterations. A survey of key patterns across early medieval Britain and Ireland reveals such consistency and universality in craftspeople's application of different symmetries in key pattern

134 Allen and Anderson 1903, vol. 1, part 2, p. 313.
135 Ibid.
136 Dr. Michael Brennan, pers. comm., 13 May 2015. Dr. Brennan alerted me to the fact that Robert Stevick coined the term 'ligature' for this structure in C- and S-spirals in his studies of the geometry of Insular art compositions. However, the author was unable to find this term in Stevick's texts. See Stevick 1983; 1994; 1998; 2004.

compositions, as to indicate their shared knowledge of this mathematical concept and development of a common set of conventions for its use (Chapter 8). Michael Brennan, the leading expert of Insular interlace, cited longstanding scholarly discussions of the 'informal' and non-theoretical, yet still inherently mathematical nature of art in both historical and modern 'non-mathematically-literate' cultures – a field of study known by the racially-weighted moniker 'ethnomathematics'.[137] Setting the uncomfortable terminology of 'ethnomathematics' aside, Brennan was first to comprehensively analyse the overwhelming importance of symmetry in Insular interlace, which Insular artists regularly used alongside key pattern and to which they consciously applied symmetry.[138] He therefore noted that although Insular artists never 'formalized' the types of symmetry they used to create interlace patterns (or their theories were never committed to writing and so did not survive beyond the early medieval period), they were clearly able to conceptualize different types of symmetry, and thereby 'exploit' them.[139]

However anachronistic, we must employ modern theoretical terms to define symmetry and to identify and analyse the different types that Insular artists used in key pattern. Mathematicians define a 'symmetry operation' as an action or relationship through which an original object, known as the 'domain', is 'mapped to' another object known as the 'range', so that each internal feature of the range (often described as the distance between two points or a line segment within that range) is identical to each internal feature of the domain, so that 'the object goes into a covering position to itself'.[140] In layman's terms, this means that once an object (for example, any line, shape, motif, or pattern field) undergoes a symmetry operation, it:

A) appears to have been physically moved in such a way that the object looks unchanged, or,

[137] Brennan 2011, vol. 1, pp. 5-6, discussing Ascher and Ascher 1981, 159; D'Ambrosio 1985; Gerdes 1988, 138-39. Brent R. Doran also discussed 'ethnomathematics' and the knowledge of what is now theorized in the modern world as mathematics amongst Iron-Age and medieval Celtic-speaking peoples. Doran 1995, 258-61.
[138] Brennan 2011, vol. 1, pp. 4-7, 32, 40-43, 59-64. Doran also analysed artists' active use of symmetry in Insular interlace, but not as comprehensively, for in the same work he mainly focused on earlier Iron-Age, Celtic spiral patterns. Doran 1995.
[139] Brennan 2015, 'Interlace in the Early Art of Scotland', paper presented at the Centre for Scottish and Celtic Studies Seminar Series, 12 May, University of Glasgow.
[140] Brennan 2011, vol. 1, p. 59; Stewart 2013, 20; Bronshtein et al. 2015, 346.

B) appears as though a copy were created that has a symmetrical relationship to the original (domain), so that if the same symmetry operation were applied to the copy (or range) in reverse, it would simply become the domain again (Fig. 2.47a-b).

What mathematicians refer to as the domain and its range are here termed the 'original' and its 'multiple', respectively. Brennan noted that while symmetry operations in mathematics do not involve the actual movement of an object, Insular artisans had the option to turn or flip their artworks or templates as desired, or even move physically around their artworks in order to use symmetry in their compositions.[141] He also noted that the symmetry operations identified in art historical patterns should be understood as only one- or two-dimensional (that is, repeating in one or two directions), rather than three-dimensional, even though Insular art includes three-dimensional media such as sculpture or metalwork objects and craftspeople might have handled their artworks or models in a three-dimensional manner, turning and flipping them to compose a pattern.[142]

Insular artists used all four symmetry operations, sometimes singly, but most often in combination. For more detailed information about these symmetry operations, as well as how they relate to patterns, readers may consult the footnoted list of mathematical, archaeological, and design texts from where the following definitions and information were drawn and adapted.[143]

Mirror Symmetry: When an artist applied mirror symmetry to a motif or section of a pattern composition, all features of the original motif or section within that composition (or object, in mathematical terms) map to its multiple, that is, they are the same distance from a dividing line or axis of symmetry (Fig. 2.48a). A single object (a motif within a pattern or the pattern field itself) may also be bisected by an axis of symmetry, making one half the 'original' and the other half its 'multiple' (Fig. 2.48b). In a practical – if technically incorrect sense – a single object or a pair of objects possess mirror symmetry if, when folded along a line down the middle, both halves of that single object or each object within the pair overlay each other as a mirror image.

[141] Brennan 2011, vol. 1, pp. 40-41, 59.
[142] Ibid., 40-41.
[143] Ibid., 40-43, 59-64; Bronshtein et al. 2015, 133-34, 346; Farmer 1996; Gallian 2013, 31-41, 461-468; Hann and Lin 1995; Horne 2000, 8-11; Hull 2003, 94-95; Kinsey et al. 2011, 267-365; Stewart 2013, esp. 42.

An object undergoes ‘horizontal reflection’ or possesses mirror symmetry ‘in a horizontal axis’ when it is mirrored side to side (that is, along the horizontal or x-axis, and across the vertical or y-axis) or is bisected by the vertical axis (Fig. 2.49a). An object undergoes ‘vertical reflection’ or possesses mirror symmetry ‘in a vertical axis’ when it is mirrored up and down (that is, along the vertical or y-axis, and across the horizontal or x-axis) or is bisected by the horizontal axis (Fig. 2.49b).[144]

Mirror symmetry reverses the orientation or sense class of an object.[145] Therefore, if an individual spiral is reflected, the resulting multiple has the opposite spin direction as the original spiral. C-spirals contain two mirror-symmetric spirals that therefore have opposite spin directions (one clockwise and the other counter-clockwise) (Fig. 2.45a).[146]

Mirror symmetry also is called ‘reflectional symmetry’, ‘bilateral symmetry’, ‘reflection in a line’, or ‘axial symmetry’.[147] Outside of the field of mathematics, mirror symmetry is often the only recognised or discussed symmetry operation.[148] This is readily apparent upon surveying general art history textbooks.[149]

Rotational symmetry: An object (here a motif within a pattern or a pattern field itself) has rotational symmetry when it is rotated about a fixed point, through an angle that is a divisor of 360 degrees (360°/n), so that the result looks the same as its original position (Fig. 2.47a). This object is rotationally symmetric *to itself*. Two objects (or an original and multiple) are rotationally symmetric *to each other* if, when one is rotated through a specific angle that is a divisor of 360 degrees (360°/n), it overlays the other (Fig. 2.50a). The fixed point of rotation can be anywhere within the object or outside of it. Rotation can be in clockwise or anti-clockwise direction. In art history, rotational symmetry is sometimes referred to as ‘radial balance’.[150]

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[144] For the difference between horizontal and vertical reflection, see Brennan 2011, vol. 1, p. 63; Abdul-Aziz 2018.
[145] Bronshtein et al. 2015, 134.
[146] Dr. Michael Brennan, pers. comm., 13 May 2015. I am grateful to Dr. Michael Brennan for alerting me to the effect of symmetry operations on the spin direction of spirals.
[147] Brennan 2011, vol. 1, p. 60; Horne 2000, 8; Sayre 2010, 143.
[148] Dr. Michael Brennan, pers. comm. 13 May 2015.
[149] Frank 2014, 72, 494; Kleiner and Mamiya 2006, 542; Sayre 2010, 143.
[150] Lewis and Lewis 2009, 59.

The phrase ‘n-fold rotationally symmetry’ refers to the number of times (n) that an object is rotated through an angle of 90°.

a) 90° rotation or one-fold rotational symmetry: The object is rotated once about a fixed point through 90° (Fig. 2.50a).

b) 180° rotation or two-fold rotational symmetry: The object is rotated once about a fixed point through 180° (or twice 90°) (Fig. 2.50b). Two-fold rotational symmetry is also called ‘central symmetry’, and when this symmetry operation is applied to an object, the result is the same as successive horizontal and then vertical reflection.

c) 270° rotation or three-fold rotational symmetry: The object is rotated once about a fixed point through 270° (or thrice 90°) (Fig. 2.50c).

d) 360° rotation or four-fold rotational symmetry: The object is rotated once about a fixed point through 360° (or four times at 90°). When rotated at 360°, all objects are identical to their original position, and therefore 360° rotation is the same as no rotation.

Unlike mirror symmetry, rotational symmetry does not change the orientation or sense class of the object.[151] Therefore, if an individual spiral undergoes rotation, the resulting multiple has the same spin direction as the original spiral. S-spirals contain two spirals that are rotationally symmetric to each other, and thus have the same spin direction (Fig. 2.45b).[152]

Translational symmetry: Translational symmetry occurs when an object (again, a motif or a wider area of a pattern) appears to be shifted a fixed distance from the original in one direction, as though a copy of the original were slid up, down, right, or left (Fig. 2.51).

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[151] Bronshtein et al. 2015, 133-34.
[152] Dr. Michael Brennan, pers. comm., 13 May 2015. I am grateful to Dr. Brennan for alerting me to the effect of symmetry operations on the spin direction of spirals.

When an object is translated, its orientation or sense class does not change. Therefore, the spin direction of a spiral does not change when it is translated.

2.6. New Technical Definition of Insular Key Pattern

Now that we have reviewed many of the technical terms useful for analysis of patterns, we may now outline a full, technical definition of Insular key pattern. The following definition reiterates details given already in the informal, introductory description of the pattern at the beginning of this chapter, but contains additional information in greater depth. This new technical definition also is more detailed than any other for key pattern found in previous scholarship (Chapters 4 and 5), and though it overlaps with these previous definitions, it also expands and corrects them. Namely, the definition comprehensively identifies the structural elements and principles that appear repeatedly and regularly throughout all individual key pattern compositions across Insular art. Therefore, it reflects the expectations and conceptions that Insular artists likely had, in their own historical context, for what was fundamental to key pattern's structure.

This new technical definition of Insular key pattern contains three parts:

Part 1:

- An Insular key pattern is formed by different sets of straight line elements that repeat throughout the composition.

- When viewed in total, these sets of line elements are arranged so that each is parallel to one half of all other sets of lines, and perpendicular to the other half. In some cases, it is possible for the lines of one set to lie at an oblique angle (at a slant) in relationship to other sets (Fig. 2.52).

- In each individual key pattern composition, the lines of a single set generally share a specific length that differs from other sets (Fig. 2.52). In this thesis, these different sets of line elements will be referred to as 'trunks,' 'branches', and 'embellishments'. The trunks are typically the longest set of lines and are the most basic and fundamental set within a key pattern (in fact, key pattern can exist entirely made of trunks, without any other sets of lines). The trunks located along the edge of the key pattern composition always intersect with the outer border (red in Fig. 2.52). In fact, the trunks are the only set of negative lines allowed to intersect with the outer border at all. Next, branches (orange and green) may be added to the ends of the trunks at right or acute angles. Finally, embellishments (left in black in Fig. 2.52) may be added to the branches and in rare cases to the trunks, again at right or acute angles. These embellishments can appear in a wide variety of forms.

- These straight lines are the negative space of the pattern, or the background (hereafter 'negative lines').

- These negative lines can vary in thickness throughout a key pattern composition, becoming very narrow or wide, and in some cases taking geometric shapes such as triangles (Figs. 2.4, 2.52).

- Each individual negative line must intersect the border of the composition, or another negative line, or both (Fig. 2.5). Therefore, Insular pattern-makers did not permit negative lines to float completely freely within the pattern (Fig. 2.53).

- Insular artists did not permit a negative line, or a series of intersected negative lines, to intersect more than one side of the border of the composition (Fig. 2.5).

- The negative lines are always discontinuous, that is, eventually they terminate either within the pattern composition or at the outer border, instead of intersecting with another negative line (Fig. 2.3).

- Artists caused these negative lines to intersect so that they formed rectilinear spirals (Fig. 2.8a).

Part 2:

- The positive space, foreground – or as it is referred to in this thesis, the path – of a key pattern composition is formed between parallel negative lines (Fig. 2.6).

- In contrast to the negative lines, artists kept all the positive space within a key pattern composition at an approximately even width (Fig. 2.6).

- Because it is formed between parallel negative lines, the path also takes rectilinear spiral shapes (Fig. 2.8a).

- The positive space or path is generally continuous (never terminating) and artists avoided letting it intersect with the border of the key pattern composition (otherwise it would terminate at that point of intersection) (Fig. 2.6). However, artists sometimes chose to terminate it for specific, limited creative purposes. This occurred most often when the artist chose to create a key pattern composition with single-stranded spirals, and here the path would discontinue at the centre of each spiral (Fig. 2.40). A pattern-maker also could make the path discontinue at the centre of a closed, multiple-stranded spiral, though this choice rarely appears in the surviving Insular corpus of key pattern (Fig. 2.42).

Part 3:

- Together, the intersecting negative lines and the path create individual spirals that then repeat to form a key pattern composition (Fig. 2.8a).

- These individual spirals are the base unit, or motif, of key pattern and are fundamental to the pattern's structure.

- In a key pattern composition, these base spiral units are all the same size, with no large or small outliers (Fig. 2.8a).

- In general, Insular artists did not permit a base spiral unit to stand on its own. Instead they multiplied each spiral unit using symmetry to make larger structures, beginning with C- or S-spirals, and then further into larger and larger units that in total comprised a key pattern composition.

2.7. Additional Structural Aspects of Insular Key Pattern

The technical definition above includes both structural elements and structural principles that occur across individual examples of Insular key pattern with a repetition and regularity that reveals what Insular artists prioritized as physically fundamental to their key pattern. However, early medieval pattern-makers in Britain and Ireland consistently handled two other structural principles in key pattern in ways not addressed in the technical definition above (as they are not fundamental to the pattern, i.e. they are not necessary for its structural integrity). In his *ECMS* in 1903, John Romilly Allen was first to identify these two characteristically Insular treatments of key pattern.[153]

First, as they did with all other abstract and non-representational patterns, Insular artists fitted each key pattern composition completely inside a bounded field in an artwork. These fields could be rectangular or circular in shape. They often occurred within cross shapes on sculptures and manuscript illuminations, in the background around the cross shape, or as frames or segments of letters in manuscripts, and as compartments in metalwork. A field may or may not have had a raised or otherwise delineated outer border or frame, but an Insular maker never truncated their key pattern at the edge (Fig. 2.54b). Instead, they ensured that the key pattern fitted within this field in its entirety, even if they had to alter the pattern's structures to do so (Fig. 2.54a). This artistic choice helped them maintain the structural principle requiring the continuity of the path, so that it would not intersect (i.e. run into) the outer border.

Second, Insular artists arranged the negative lines of key pattern in two different orientations in relationship to the *edge* of the pattern field. In art history, 'orientation' refers to the arrangement of lines in an artwork either in a horizontal and vertical, or diagonal manner.[154] The orientation of a key pattern composition is a structural principle in itself, and we will refer to the two variants of orientation as 'orthogonal' and 'diagonal'. In orthogonal orientation, the negative lines of the key pattern are arranged parallel and perpendicular to the outer edge of the field (in mathematics, 'orthogonal' describes two

[153] Allen and Anderson 1903, vol. 1, part 2, p. 309, 324-25.
[154] Sayre 2010, 70-72.

lines that are perpendicular) (Fig. 2.55a).[155] In diagonal orientation, the same negative lines largely remain in orthogonal relationships *to each other*, as in all Insular key pattern, but are arranged so that they lie diagonally to *the edge of the pattern field* (Fig. 2.55b).[156] Individual key patterns in both orientations are otherwise identical in their most basic structure. [157]

2.8. Conclusion:

In this chapter we have defined key pattern, distinguished it from other patterns, established a working vocabulary for its analysis, and explored how Insular craftspeople used it in a general sense. The new technical definition introduced readers to key pattern's most basic structural properties, which are required for the maintenance of its physical integrity (i.e. to prevent it from becoming an unrecognisable jumble of lines) and to distinguish it from other types of ornament. The following chapter is focused on how Insular pattern-makers handled positive and negative space in key pattern, which will be referred to by a term coined for this thesis: the *creative approach.* Their unique creative approach has never been studied or discussed before, despite the fact that it permeated these artists' entire working processes and allowed them to create key pattern compositions characterised by a visual variety and geometric complexity rarely rivalled elsewhere in art of other places and time periods.

[155] Allen and Anderson 1903, vol. 1, part 2, p. 325; Bronshtein, et al. 2015, 129. Allen referred to orthogonal key patterns as 'square' key patterns.
[156] Allen and Anderson 1903, vol. 1, part 2, pp. 309, 325
[157] Allen and Anderson 1903, vol. 1, part 2, pp. 325-28; Allen 1904, 281, 283.

3. Chapter 3: Key Pattern in Insular Art: The Creative Approach

3.1. Positive and Negative Space in Key Pattern

As outlined in the new technical definition of key pattern in Chapter 2, the pattern's individual spiraliform units – and thus the whole pattern itself – are composed of two complementary structural elements: 1) negative lines, which form the background of the composition, and which are governed by structural principles that require them to be arranged parallel and perpendicular to each other, intersect the outer border and each other, be discontinuous, and vary in width and shape, and; 2) the path, which is the foreground or positive space, and which is formed between parallel negative lines, is governed by the structural principles that require it to be generally continuous, not intersect the outer border, and remain a consistent width throughout a given composition.

In art historical formal analysis, negative space is generally described as the surface or background upon which artists arrange the subjects of their artworks. Therefore, negative space is or gives the illusion of being farther away from the viewer. Following this logic, the positive space is commonly understood as the subject, shape(s), or other object(s) of focus that the artist actively lays or otherwise creates on top of the ground or negative space. The positive space thus is physically closer to the viewer, or gives the illusion of being so. In this process, once the artist has created the positive space, the negative space takes on a shape of its own as a passive by-product, around and between the added positive forms.[158] An appliqué is an excellent example: the base cloth is the negative space, and the additional pieces of cloth and ornament sewn atop it are the positive space. This understanding of positive and negative space is often found in art history textbooks.[159]

However, when Insular makers created key pattern, they actually reversed the process described above. The negative space in a finished Insular key pattern composition is still physically located farther away from the viewer or has the illusion of being so, and the positive space also remains or appears to be closer to the viewer. Nonetheless, to achieve

[158] Frank 2014, 40; Lewis and Lewis 2009, 479.
[159] Frank 2014, 40; Lewis and Lewis 2009, 479.

this result, Insular artists actively created the pattern's *negative* space rather than its positive space, laying down the negative lines physically on top of or into the surface of the artwork (and therefore on top of or into the positive space). In three-dimensional media such as metalwork or carved stone, Insular artisans recessed these negative lines. For example, in a relief sculpture, they removed stone to create the negative lines, cutting them out of the surface (Fig. 3.1a). In manuscripts, Insular illuminators drew the negative lines on the vellum or parchment in black or dark-coloured ink (Fig. 3.1b).

Because Insular pattern-makers actively drew or recessed the negative space in key pattern, they simultaneously created the positive space or path as a passive, resultant by-product, formed automatically between the negative lines. In three-dimensional media, the path was the relief – or area left raised – after the negative lines were carved away or otherwise depressed (Fig. 3.2a). In manuscripts, the path was the untouched area of vellum or parchment that remained after the artist illuminated the negative lines in black or dark ink (Fig. 3.2b).

3.2. The Creative Approach: Additive Versus Reductive

Insular makers' treatment of key pattern therefore reflects a second, yet equally valid, way of handling negative and positive space in pattern and artwork more generally – one that contradicts the more common understanding of space typically presented in introductory art historical textbooks. In this thesis, we will refer to a pattern-maker's handling of positive and negative space as their 'creative approach'. There are therefore two possible creative approaches when producing any work of art: 1) the maker actively, physical creates and manipulates the positive space (as typically discussed in art historical overview texts), or conversely, 2) the maker actively, physically creates and manipulates the negative space. For key pattern specifically, Insular artists took the second route.

Examination of this alternative route is crucial for improving our understanding of key pattern as a whole. Insular pattern-makers' creative approach significantly impacted the structure of their key pattern, as well as the ways in which they conceived of the pattern physically and used structural principles to manipulate it in their working processes. Their creative approach to positive and negative space therefore delineated contingent possibilities and limits for creative invention, and further separated Insular key pattern from other rectilinear patterns in the Insular corpus that required active creation of positive – rather than negative – space. Despite this fact, so far no modern Insular scholar has discussed these two contrasting creative approaches to positive and negative space, or how these approaches affected Insular artists' treatment of patterns.

In stone-carving, these contrasting creative approaches are known respectively as the 'additive' and 'reductive' processes. Without reference to Insular art itself, these two processes have been discussed by the investigators and researchers of the STONE Project at the Edinburgh College of Art, a project dedicated from 2007-2011 to collecting information from practitioners and academics worldwide about the 'physical processes' and concomitant 'thinking approaches' to, or understandings of, stone-working.[160] According to the STONE Project collaborators, stone carvers and sculptors may choose to create a sculpture by either modelling (an additive process) or carving (a reductive process).[161] Modelling, or the additive process, involves the successive addition or building of parts onto an artwork in order to create a whole, as in a collage or assemblage.[162] In the additive process, the artist actively creates the positive space, laying it successively over the ground or negative space – as in the appliqué example given earlier in this section. By contrast, carving is the reductive process, and involves the successive 'removal' or 'stripping' to create a work of art in stone.[163] In a sculpture created in the reductive process, the negative space therefore is the void formerly occupied by the material that the artist has carved away.[164]

As described in the STONE Project, the reductive process (and one should add, the additive process) do not solely concern the mechanical aspects of handling stone, but also betray the sculptor's 'way of thinking' or mental approach to their chosen medium and thus to the entire process of making an artwork.[165] In this thesis, we therefore will extend the terms 'reductive' and 'additive' to describe how *all* pattern-makers (and not just stone-carvers in general) handled – and therefore thought about – positive and negative space not

[160] Harvey, et al. 2007-2011.
[161] Ibid.
[162] Ibid.
[163] Ibid.
[164] Sayre 2010, p. 76-77, fig. 93.
[165] Harvey, et al. 2007-2011.

only in stone, but also other media, three- and two-dimensional alike. In any medium, an artist's creative approach is additive when they actively create the positive space by adding material to the background or initial surface, leaving the negative space as a passive by-product. In contrast, the artist's creative approach is reductive when they actively create the negative space, leaving the positive space as a passive by-product.

The members of the STONE project were not concerned with Insular art, but their discovery that 'way[s] of thinking' underlie the physical reductive process is applicable to key pattern. Whatever media they used, Insular makers *always* created key pattern in a physically reductive manner, by carving away material to create the pattern's negative line elements, or in a reductive logic, by otherwise actively creating the negative line elements and leaving the positive path behind as a passive by-product. As noted above, Insular manuscript illuminators drew the negative lines of key pattern in ink, leaving the positive path behind in untouched vellum or parchment (Fig. 3.1b). In incised or relief-carved stone, wood, and ivory, Insular craftspeople carved away the negative lines of key pattern in order to leave behind the path, or positive space (Fig. 3.1a). Metalworkers used a wide variety of techniques, but here too they acted directly upon the pattern's negative lines. For example, on two 8th-century Pictish silver bowls from the St Ninian's Isle hoard in Shetland, the artist(s) created key pattern through 'punched dot stippling', that is, by hammering the patterns' negative lines into the metal surface in a series of dots (Fig. 3.3).[166] On the upper foot-girdle of the Ardagh chalice, the metalworker cut away the negative space of the key pattern in openwork (Fig. 3.4).[167]

Insular smiths also created key pattern in metalwork in style known today as chip-carving or 'kerbschnitt', through a variety of techniques.[168] Almost all the chip-carving techniques attested by Insular archaeological evidence were reductive. Chip-carving originated in woodworking, when wood-workers carve grooves into wood in order to leave a 'pattern of ridges', but as a style this technique can be imitated in metal, as seen on the St Ninian's Isle scabbard chape 16, which sports key pattern around the necks of the beasts and on their back-ridge (Fig. 1.4).[169] To create chip-carved metalwork, Insular craftspeople could

[166] Laing 1993, pp. 103-104, no. 223, 227, plates 16, 20, no. 223, 227; D.M. Wilson 1973, 103; Youngs, ed. 1989, pp. 108-109, no. 97-98.
[167] Organ 1973, p. 254, fig. 32.
[168] Walker 2017, 234-37.
[169] Ibid. 234; Walker 2013, 26; Laing 1993, p. 105, no. 237.

reductively carve a model from wax, lead, wood or bone, which they then would use in the lost wax casting process, or to push an impression into a clay mould (after which they would pour molten metal into this impressed mould).[170] Lead models and the remains of fired clay moulds have survived (Fig. 3.5a-b).[171] Metalworkers could also create decorative patterns by carving the metal object directly after it was cast.[172] Stephen Walker, a modern metal-smith who creates historically-informed 'Celtic' style jewellery and researches and tests early medieval production methods, has argued that there is evidence for direct carving on a scabbard chape from the St Ninian's Isle hoard from Shetland (object no. 16), because it gave the piece a 'choppy texture with burrs and scratches'.[173] In all of these techniques for creating chip-carved metalwork, Insular metalworkers used the reductive approach, and so would have carved the negative lines of key pattern either directly into the metal or into a model.

Walker also argued that Insular metalworkers employed a third technique for the chip-carved style: carving the mould (rather than the model or cast metal) directly.[174] If medieval metalworkers did use this method, in this *sole* case they would have been forced to actively create the positive space of the key pattern, rather than the negative space. Walker found that carving the fine detail of patterns into soft clay models for impression was impractical because the clay would break off after he made several incisions.[175] While reconstructing the chip-carved St Ninian's Isle hoard brooches and stem of the Ardagh Chalice, Walker experimented with carving patterns directly into gypsum plaster moulds for the objects, and he found this far more effective, as well as reflective of the original final objects' appearance (Fig. 3.6).[176] Gypsum plaster does not survive in the archaeological record, however, Walker notes that because the material is so perishable, lack of evidence does not disprove this historicity of the method.[177] If metalworkers did

170 Walker 2017, 234-37; Walker 2013, 26; Craddock 1989, 170-71.
171 Alcock 1963, fig. 23; Walker 2017, 234-36; Youngs, ed. 1989, pp. 191, 193, fig. 181, 185.
172 Walker 2013, 26.
173 Ibid., 24, 32-33, fig. 3.6. Penannular brooches also were found with this chape in the St Ninian's Isle hoard. Ewan Campbell noted that scholars have debated whether Insular metalworkers carved patterns into the moulds of the St Ninian's brooches, into the cast metal. While the technique used on the St Ninian's brooches is uncertain, Campbell argued after close physical analysis that on an 8th- to 9th-century, copper-alloy penannular brooch from Loch Glashan, Argyll, Scotland, which was similar in form to those from St Ninian's Isle, the decorative patterns were carved into a lead model, rather than the cast metal itself. Effie Photos-Jones, however, suggested that some 'engraving' was indeed done on the Loch Glashan brooch metal, after it was cast, as Walker also suggested for the St Ninian's Isle brooches. Whatever method ultimately was used for the key pattern on the scabbard chape described above, both were still reductive. See Campbell 2005, 65-68; Photos-Jones 2005, pp. 139, 141, pl. 35d.
174 Walker 2013, 26-28.
175 Ibid., 28; Stephen Walker, pers. comm., 18 July 2016.
176 Walker 2013, 28; Walker 2017, 237-41.
177 Walker 2013, 28.

indeed add this technique to their repertoire, they would have carved the raised path or positive space of the key pattern directly into the mould. Only one surviving Insular mould indicates that Walker's hypothesis might reflect original Insular practices in certain cases. At Armagh, Ireland, in 1968, archaeologists uncovered a clay (rather than gypsum) mould, possibly for a metalwork panel intended to decorate a crozier, which is carved with key pattern.[178] This key pattern composition is additive, with the positive path carved into the clay, just as Walker would carve it into gypsum. However, the authors of the excavation publication suggest that this particular mould may itself have been formed from earlier models and moulds in wax and clay which are now lost,[179] so it is possible that the Armagh smith rendered this key pattern in a reductive manner in the very first step of the production process. In addition, despite the technically additive nature of Walker's carving of gypsum moulds or the Armagh metalworker's carving of the clay mould, the logic behind this physical action still is not additive, because it was an optional means of producing a final object that was chip-carved and therefore possessed the illusion of having had its negative lines physically carved out of the metal itself.

All other surviving evidence demonstrates that artists across the Insular world produced key pattern by consistently using the reductive approach, no matter the medium, from manuscript illumination to carved stone to metalwork.

3.2.1. The Creative Approach: Key Pattern versus Complex Step Pattern

As a result, Insular key pattern differed from simple step pattern and complex step pattern not only in its structural properties, but also because artists handled positive and negative space differently in the latter two patterns, and therefore conceived of each pattern in fundamentally different ways. For complex step pattern, Insular makers almost always used the opposite creative approach: the additive approach that required active creation and manipulation of the positive, rather than negative space. A smith could create complex step pattern in metalwork using two techniques, and the logic of both then translated into other media. In cloisonné, the smith soldered bent wires on top of a metal backing, leaving open cells of negative space to hold the enamel. Those bent wires are the successively

[178] Gaskell Brown, et al. 1984, 136-38, 140, plate 6.
[179] Ibid., 138.

angled lines of a complex step pattern, laid down atop the surface in three-dimensional media so that they are raised up above the background, and are therefore positive space (Fig. 2.14d). In champlevé, the smith cast the metal object with raised, angled positive lines and depressed, negative cells (Fig. 2.14d). If Insular metalworkers carved their moulds directly, as Walker suggests, they would have used the additive approach for champlevé, and cut the positive lines of complex step pattern directly into the mould material, leaving the negative spaces as a by-product. In manuscripts, Insular illuminators first drew in black or dark ink the angled, positive lines of complex step pattern in order to imitate cloisonné metal strips or the raised metal lines of champlevé, thereby creating the negative, cell-like, coloured shapes as a by-product (Fig. 2.14b). Even on the Emly shrine from County Limerick, Ireland, a rare example of mixed-media dating to the late 7th to early 8th century, the artist actively created the positive space by hammering angled lines of lead-tin alloy into the wooden face of the shrine (Fig. 3.7).[180]

Three other methods for creating complex step pattern did require Insular pattern-makers to depart from their usual additive, positive-space-focused approach, but only in an immediately practical, technical sense. First, in champlevé, if the metalworker chose to carve a lead, clay, wood, or wax model rather than the mould itself, they would have had to carve away the recessed, negative cells of their complex step pattern, in order to leave behind the raised positive lines. These raised, positive lines in the model would then depress the clay mould. Second, craftspeople also carved out the negative cells of complex step pattern from clay moulds in order to cast glass studs, so that the raised positive lines in the mould then depressed the pattern into glass (these depressed areas of positive space in the glass could then be inlaid with silver wire) (Fig. 2.14a).[181] Finally, in carved stone sculpture, the additive approach is physically impossible, and so here sculptors also resorted to carving away the negative spaces or cells from the pattern. However, in all three cases, the logic - if not the physical process - of the additive approach remained. The resulting complex step pattern, if created by carving a metalworking model, a mould for glass studs, or a stone surface, still imitated the appearance of a cloisonné equivalent that was produced in a wholly additive manner. This is particularly clear for cast glass studs, because once the positive lines (created by carving out the negative cells from the clay mould) were impressed into the glass stud, craftspeople then inlaid metal or enamel into

[180] Swarzenski 1954, 60-61; Edwards 1983, 19-20; 1998, 112-13; Museum of Fine Arts Boston 2018.
[181] Youngs, ed. 1989, pp. 205-206, fig. 209.

them, in direct imitation of the cloisonné technique (Fig. 2.18b).[182] Likewise in sculpture, the positive, angled lines of complex step pattern were left raised in relief in order to mimic the bent wires or metal strips of metalwork versions. The creative effort still focused on the formation of these positive, raised, angled lines.

3.2.2. The Creative Approach: Key Pattern versus Simple Step Pattern

In Insular art, simple step pattern straddled the reductive and additive creative approaches more so than key pattern or complex step pattern. In many cases, makers focused directly on the negative space of simple step pattern rather than the positive: by carving its angled, negative lines away in relief sculpture (Fig. 2.13a), punching them into a metal surface as on the lower foot ring of the Ardagh Chalice (Fig. 2.13c),[183] or drawing the negative lines in manuscript illumination (Fig. 2.13b). Here, the 'S'-, 'Z'-, or 'T'-shaped enclosed spaces were left behind as the positive, passive by-product, either in raised stone or metal, or bare vellum or parchment. However, in some media or techniques, pattern-makers reversed the raised and recessed spaces of simple step pattern not just in the production process (as sometimes occurred for complex step pattern), but also in the final product. For example, on the Emly Shrine, the artist used the cloisonné technique to create the simple step pattern within the decorative medallions on the front of the reliquary.[184] To make cloisons, it was necessary to use the raised cloisonné wires to represent the angled (and otherwise normally recessed and negative) lines of the pattern (Fig. 3.7). The 8th-century Copenhagen shrine, of unknown origin but taken to Norway in the Middle Ages, also exhibits a similar reversal though here the craftsperson laid copper-alloy plates over the wooden box that had raised negative lines (Fig. 3.8).[185] These two examples, in which not only the process but also the final product was additive, demonstrate that Insular pattern-makers were less committed to a single creative approach for simple step pattern than they were for either key pattern (wholly reductive) or complex step pattern (mostly additive).

182 Ibid., pp. 131, 205-206, no. 125a, b, 209, fig. 125a, b, 209; Campbell 2016, pp. D100-101, 220, ill. 5.7.10b-c.
183 Organ 1973, 251.
184 Swarzenski 1954, 60-61; Museum of Fine Arts Boston 2018.
185 Swarzenski 1954, 60; Youngs, ed. 1989, p. 138, fig. 131.

3.3. Rarity of Key Pattern in Metalwork

There is one final point to discuss about Insular artists' use of media and their reductive creative approach to key pattern. Key pattern is common in carved stone and manuscript illumination, but relatively rare in metalwork when compared to other patterns such as spirals or interlace, though metalwork objects survive in significant numbers in general. The rarity of key pattern in metalwork was noted as early as the late 19th century by Joseph Anderson, Keeper of the National Museum of Antiquities of Scotland, in his Rhind Lectures for 1892.[186] Insular specialists also have long remarked on the general visual similarities between stone sculpture and manuscript carpet pages, which were both produced in an ecclesiastical milieu. This helps to explain the shared frequency of key pattern in these two media, but it does not explain its comparative scarcity on metal artefacts.

Extremely highly-skilled examples of key pattern on metalwork do survive, dispelling any notion that metalworkers as a whole could not be equal masters of the pattern as specialists in other media. For example, Walker explained that the gilded bronze chip-carving on the Ardagh Chalice was so well-wrought, particularly around the seamless cylindrical stem of the cup, that modern metalsmiths struggle not only to replicate its flawless workmanship but also to identify the actual methods that the medieval Irish maker used.[187] Walker researched the chalice by making a reconstruction and discovered a potential technique for casting the complex interlace-decorated, chip-carved stem.[188] Walker did not discuss the fields of chip-carved key pattern on the ring panel located directly below the chalice's stem, but here as well the metalworker demonstrated complete control (Fig. 1.3).

The question of key pattern's rarity in metalwork therefore must address not only the makers' overall ability, but also their choices. There are two potential reasons for Insular metalworkers' avoidance of key pattern. First, in his own projects, Walker found that when carving patterns into clay moulds, the details sometimes sloughed or broke from the surface.[189] Dr. Ewan Campbell also noted that the same difficulty might have arisen when

[186] Allen and Anderson, vol. 1, part 1, p. lx, note 3.
[187] Walker 2017, 233-37.
[188] Ibid.
[189] Walker 2013, 28; Stephen Walker, pers. comm., 18 July 2016.

carving rectilinear rather curvilinear patterns into wax models.[190] If Insular metalworkers relied predominantly on clay moulds or wax models to create the chip-carved style, their commitment to the reductive approach could have dampened some artists' interest in carving key pattern's intricate negative lines and shapes. However, if this were the case, smiths would have struggled with all patterns, yet simple and complex step patterns, interlace, and spirals were widely used. Furthermore, other methods for creating models for chip-carved pieces and other techniques entirely were available. Metalsmiths could have carved key pattern onto lead or wooden models[191] or directly into a metal object itself, or chosen openwork or stippling as on the Ardagh Chalice and St Ninian's Isle bowls. Furthermore, beeswax models do not survive, but Walker suggests it is possible that original recipes yielded a product that was easier to manage.[192] If smiths used plaster moulds for chip-carving, as Walker also suggested, this too would have rendered the problem moot.[193] The issue of breakage when carving delicate patterns into moulds or models therefore was an unlikely deterrent.

Walker posited a second, more likely reason for why Insular metalworkers often chose against key pattern.[194] According to Walker, it was 'not techniques that might have caused some Insular metalworkers to avoid key pattern, but the physical constraint of the typical designs'. Square or rectangular fields of pattern were common in Insular sculpture and manuscripts, and so once carvers and illuminators 'mastered' key pattern in this mode, it then was easier to adapt it to 'more unusual shapes and surfaces', such as circular fields, illuminated letters, or raised stone bosses. Walker pointed out that metalwork objects instead were characterized by pattern fields with curved borders (and which also were sometimes curved in three dimensions). The Ardagh Chalice and the St Ninian's Isle scabbard chape are excellent examples of the latter (Figs. 1.3, 1.4). With fewer opportunities to gain fluency with key pattern in rectangular-shaped fields first, some metalworkers may not have felt confident in manipulating the pattern to fit small, curved spaces. Walker further observed that interlace and spirals do not present the same spatial challenge because they are curvilinear patterns, and so metalworkers appear to have developed a stronger tradition of working with these. Walker conceded that metalworkers as a whole certainly were not ignorant or incapable of creating key pattern, for technically

[190] Dr. Ewan Campbell, pers. comm., 11 February 2016. I am grateful to Dr. Campbell for pointing out the potential difficulties of carving wax models, specifically with rectilinear designs.
[191] Stephen Walker, pers. comm., 18 July 2016.
[192] Ibid.
[193] Ibid., 19 July 2016.
[194] Ibid., 18-19 July 2016.

astute examples occur on masterpieces like the Ardagh Chalice (and one should add, smaller pieces with more modest key pattern, like the St Ninian's Isle chape), nor were manuscript illuminators and sculptors strangers to creating key pattern in oddly-shaped, curved, or even three-dimensional spaces. Bosses on the Pictish cross-slab at Nigg in Ross and Cromarty, Scotland, are virtuoso examples (Fig. 3.9). Nevertheless, a significant number of metalsmiths may not have 'accumulated and mastered the skills' needed to comfortably attempt key pattern in the small and challengingly-shaped spaces typical of Insular metalwork.

3.4. Conclusion

The creative approach is not so fundamental to key pattern as its structural properties. It is possible to create key pattern using either approach, while in contrast, the structural elements (the path, trunks, branches, embellishments, individual spirals, et cetera), as well as the structural principles of their arrangement, distinguish Insular key pattern most clearly from other rectilinear patterns, such as simple and complex step patterns, and ultimately Insular interlace and spirals. Nevertheless, a pattern maker's chosen creative approach betrays their 'way of thinking' about key pattern. This 'way of thinking' in turn defines the makers' intellectual conception of and ability to physically manipulate its structural elements, either limiting or expanding opportunities for invention, alteration, and even problem-solving when the creative process goes awry.

It is possible to make key pattern using the additive approach, by actively creating the path rather than the negative lines, as we will see in art from other time periods and parts of the world in Chapter 7. However, Insular artists never chose to deviate from the reductive approach to key pattern. Potentially, only one metalworking technique might have required them to physically create the positive space first (carving the mould rather than a model or the metal object itself, as Walker suggested), which might be seen on the Armagh mould discussed above. And while technically additive, this method also is still reductive in its logic, for metalsmiths would have used it to create the illusion that their key pattern had been chip-carved directly out of a metal surface in a reductive fashion. Surviving evidence therefore shows that Insular artists used the reductive approach far more strictly and consistently for key pattern than for other rectilinear patterns. Their choice to actively create key pattern's many interlocking, discontinuous negative line elements permitted them to unlock myriad opportunities to arrange these lines with different symmetry operations and in different orientations to the border (diagonal or orthogonal), while simultaneously tweaking, removing, adding, and expanding them into shapes (Chapter 8). As a result, Insular artists invented a corpus of different key pattern compositions across multiple media that is bewildering in its visual variety (c.f. Figs. 1.12, 2.1c, 2.3, 2.55a-b). As we shall explore in Chapter 7 in comparisons of Insular key pattern with traditions from other art historical eras or places, this flexibility was physically impossible for artists who chose the additive approach to key pattern. In these non-Insular contexts, pattern-makers who took the additive approach never produced an equally wide variety of structural arrangements within their key pattern compositions, in negative lines and shapes and/or the imposition of the principle of symmetry, because they instead focused their creative energy on the pattern's positive space, which had to plod steadily throughout their compositions in order to remain continuous and of a consistently even width.

We also must clarify that two key pattern compositions created in the additive and reductive approaches respectively, but of otherwise identical structure, should never be understood as simply being 'reciprocals' of one another. In art historical analysis, a reciprocal is defined as an instance of 'figure-ground reversal', or a 'visual effect in which what was seen as a positive shape becomes a negative shape, and vice versa'.[195] In his structural analysis and classification of Insular key pattern in 1903, Allen himself incorrectly stated that 'each key-pattern has a reciprocal…so what was before black on a white ground becomes white on a black ground.'[196] Allen's concept of 'reciprocals' prevented him from recognizing the much deeper, more fundamental importance and impact of the creative approaches in their own right. First, Allen did not note that Insular artists in fact never created physical reciprocals to which he referred (because they maintained a reductive approach). Second, this indicates that he also was unaware that all key patterns' discontinuous, intersected negative lines *always* remain the ground or negative space, no matter their colour or whether the artists actively created them in a reductive manner or passively in an additive manner. Likewise, the path *always* remains the foreground or positive space, whatever its colour or whether artists actively created it in the additive approach or as a reductive by-product between the negative lines. Third, the additive and reductive approaches to key pattern are far more than a 'visual effect' or

[195] Frank 2014, 66.
[196] Allen and Anderson 1903, vol. 1, part 2, p. 310.

simple 'figure-ground reversal', because they underpin pattern-makers' entire intellectual and physical understanding of key pattern, thereby impacting how they handled its structural properties, and their subsequent opportunities for creating geometric variety.

In addition, it is important to distinguish an artist's creative approach to key pattern from their chosen construction method (i.e., the order in which they drew, carved, or otherwise formed the individual structures within a key pattern composition). A pattern maker's creative approach does dictate whether they draw or carve the negative lines or positive path (leaving the other as a passive by-product), but once on their chosen route, the maker is then free to create the different sections of the path or negative line segments in any order they prefer. For example, a craftsperson using the additive approach can choose to create the path's individual spiral shapes within each base unit first, or the sections of the path that connect these spirals. Conversely, with the reductive approach, an artist can form the pattern's trunks, branches, or embellishments in any order they wish. They may even re-order their construction method in the middle of their work, according to personal preference, need, or requirements of the medium. In contrast, the pattern maker's creative approach fundamentally expands or limits their ability to manipulate or alter their key pattern's structure from the moment of mental conception, through the planning process, up to the physical completion of the composition.

It is unclear whence Insular pattern-makers' reductive impulse originated. Modern scholars commonly remark that curvilinear spiral patterns in Insular art survived as a direct tradition from earlier, La Tène art. It is likely that Insular pattern-makers simultaneously inherited their interest in the interplay between positive and negative space from La Tène artistic traditions, in which manipulation of the relationship between positive and negative space was already a fundamental aspect. In his doctoral thesis, Jody Joy analysed the artistic practice in Iron Age Britain of balancing positive and negative space in decoration on metal hand mirrors, particularly to highlight the importance of negative space in the interplay between background on foreground and vice versa.[197] Insular artists' reductive approach may have been their method for achieving similar eye-boggling effects in key pattern, but ultimately the origins of this practice are speculative.

[197] Joy 2010, esp. 1, 24-40, esp. 27, 34.

In the following chapter, we will examine how modern specialists have studied Insular key pattern in the past. None have ever addressed the creative approach to positive and negative space, either additive or reductive, for any pattern whatsoever. This led to an incomplete understanding of key pattern. Each scholar did discuss some, though not all, of the structural properties of key pattern featured in the new technical definition given in Chapter 2. This thesis therefore necessarily builds on many of their findings. Nevertheless, all earlier studies contain conceptual flaws, limitations, and methodological problems that make them inadequate for study of key pattern, particularly for correctly understanding its structure and the artistic agency that underpinned every individual composition.

4. Chapter 4: The History of Studies of Insular Key Pattern, Part I

4.1. Introduction to Previous Studies of Insular Key Pattern

From the mid-19th to the 21st century, key pattern has been the subject of research and publication in largely two arenas: classificatory studies in the discipline of archaeology, and popular publications that provide instructions for drawing the pattern to modern-day artists. In addition to these two main areas, only one theoretical mathematical study of Insular key pattern has been published thus far. Finally, two further studies, independent of the other categories, have made initial – and limited – forays into evidence for Insular artists' working processes in their creation of patterns in general. The next two chapters provide an account of all these previous studies, placing each in their scholarly and historical context, in order to trace how ideas about key pattern developed from publication to publication over the past two centuries. Some details drawn from across these previous studies have already featured in the technical definition of key pattern in Chapter 2.

Although previous publications on Insular key pattern contain many useful insights, the methodologies underpinning archaeological classifications and popular, artistic manuals for key pattern are ultimately unsatisfactory, as they are neither comprehensive nor conducive to significant understanding of medieval pattern-makers' working processes. There is a general tendency amongst both archaeologists and art instructors to (a) 'correct' or regularise uneven lines or supposed 'mistakes' in the original patterns, (b) to isolate the patterns from their surrounding artworks, (c) to confuse construction aids and methods with key pattern structure, and (d) to over-focus on only a limited range of the pattern's structural properties at the expense of others. Few have addressed positive and negative space in key pattern, and never comprehensively. Furthermore, authors of previous Insular key pattern studies either were unaware or omitted mention of the creative approach to pattern, whether additive or reductive. All of these problems have obscured evidence for the artists' working methods and resulted in a disinterest in or inability to recognize two structural principles that possessed particular, driving importance for medieval makers of key pattern: the use of symmetry and the manipulation of negative lines.

Knowledge of Insular key pattern has remained underdeveloped for four additional reasons. First, as the 20th century progressed, mainstream scholars of archaeology (i.e. not Insular specialists) no longer focused on pattern for its own sake. Earlier, in the 19th century, archaeologists did treat decorative patterns on objects either as a significant component of their analysis or as their sole focus of research. This trend began with the work of Swedish archaeologists Gustaf Oscar Montelius and Hans Hildebrand, in their respective development of methods of typology and classification, and peaked in Insular studies with Allen's classification of Insular patterns in *ECMS* in 1903.[198] However, this focus evaporated in the following century. It is telling that throughout Bruce G. Trigger's sweeping historiography for the discipline, *A History of Archaeology Thought*, no 20th-century researchers from Western and Eastern Europe or North America developed specific theories for the study of decorative pattern.[199] If they addressed pattern at all, it was in service of a broader methodology not focused on pattern for its own sake.[200] Archaeologists of Iron Age Britain may now be shifting their attention back to pattern, for at the 2016 Prehistoric Society Europe Conference: 'Dynamics of Art, Design, and Vision in Iron Age Europe', the majority of papers addressed ornament on La Tène or other northern European artefacts.[201] However, even here researchers took a thematic approach to patterns, focusing on their symbolism or impact on ancient audiences, rather than their physical structure.[202] Therefore, outside of early medieval, Insular studies, 20th-century archaeologists paid no significant attention to key pattern.

Second, the neglect of patterns in mainstream art history in the later 20th century was more extreme. Largely rejecting formalism and style as methods and subjects unworthy of

198 For a general discussion of Montelius and Hildebrand, see Trigger 2006, 224-27.
199 Trigger 2006.
200 Ibid., 314-528. For example, Trigger discusses Scott Ortman's research of pottery designs during the Great Pueblo period in the American Southwest (AD 1060-1280). Ortman studied patterns in order to identify continuity in cosmological beliefs of local communities up to the present day. See Trigger 2001, 475-76 and Ortman 2000, 613-45.
201 Examples of such papers from the 2016 Prehistoric Society Europe Conference (3-4 June, University of Edinburgh) include T. Romankiewicz, 'Balancing Acts: Iron Age Creativity from a Design Theory Perspective'; H. Chittock, 'What Did Pattern Do in Iron Age East Yorkshire?'; L. Hedeagar, 'Art and Myth – Politics and Power in Post-Roman Europe'; and J. Joy 'What Did Celtic Art Do and Why Decorate?'. Romankiewicz later published a paper in which she discussed how the 'principles of design' or the 'design matrix' (i.e. the underlying structure) of patterns in La Tène art reveals information about the 'creative process' of the makers, viewers, and users of those objects. However, Romankiewicz did not analyse pattern structure in great detail or the artists' working processes. Instead she focused more on how symmetry and asymmetry, generally defined, reveal ancient cosmology or what the objects were intended to 'do'. Romankiewitz 2018.
202 Jody Joy's conference paper on Iron Age mirrors (cited above), which ultimately drew upon his doctoral research, did address pattern structure and positive and negative space in spiral patterns used to adorn these mirrors. However, Joy predominantly focused on how these and other objects and their decoration functioned in a social context. See also Joy 2010.

pursuit, art historians relegated patterns to the periphery of study and only recently have begun to reconsider them. This contrasts starkly with the state-of-play in the discipline during the 19th century, when formal or stylistic analysis of patterns, and their use in design and decorative arts, were in vogue (see section 4.2. below). This empirical approach reigned across 19th-century art history in general, influenced by contemporary scientific approaches from archaeology, such as classification and typology.[203] Perhaps the most important contributor in this era of enthusiasm for pattern was Aloïs Riegl, who in 1893 published his theory of the *Kunstwollen*, or the abstract 'creative force' that he believed drove the formal, stylistic evolution of plant-like patterns from Egypt through the Mediterranean from the Ancient through the Late Antique periods.[204] However, as the 20th century progressed, interest in pattern was quashed by what James Trilling has referred to as 'cosmophobia,' or the fear or disdain of ornament.[205] In his recent and magisterial publication on ornament, Trilling noted that with the advent of Modernism, decorative artists, architects, and designers viewed ornament (and therefore pattern) as frivolous, unnecessary, and undesirable.[206] According to Trilling, Modernist cosmophobia was born of a variety of factors and philosophical ideas, such as a longstanding moral discomfort with the supposed excess associated with ornament (a discomfort originating in the classical world), a rebellion against the social values of preceding historical periods that favoured ornament (especially the Victorian period), and the rise of aesthetic values concomitant with mass-production that prioritised 'simplicity and efficiency'.[207] Cosmophobia was not limited to decorative arts and design. Catherine Karkov observed that amongst art historians 'words such as "decoration" and "ornament"' also 'carried a negative meaning', connoting 'mere pattern…devoid of meaning, and thus not really serious art'.[208] At first, from the mid-20th century onward art historians did continue to pursue stylistic analysis, but here their attention turned away from patterns and their physical structure, with intellectual giants such as Erwin Panofsky and E.H. Gombrich focusing respectively on iconography and cultural history as reflected in High Art (i.e. painting) rather than the decorative arts.[209] As the 20th century progressed, art historians began to criticise stylistic analysis itself as too limiting and 'shifted the centre of gravity

[203] Fernie 1995b, 13-15. See Fernie for an overview of the development of empirical approaches and stylistic analysis in 19th-century art history as a whole.
[204] Riegl 1893, 48-305, esp. 30-33, 50-52, 65, 96-102, 162-63; Castriota 1992, xxv; Iverson 1993, 5, 52; Lorda 2001, 120.
[205] Trilling 2003, xv.
[206] Ibid., 3-17, 115-225.
[207] Ibid., 5, 117, 119, 124 137-67. For the Modernist rejection of ornament, see also Brett 2005, 8-9; Picon 2013, 10, 15, 20, 23-24, 52.
[208] Karkov 2011, 181-82.
[209] Fernie 1995b, 17-18; Panofsky 1940, cited in Fernie 1995a, 184-195; Gombrich 1967, cited in Fernie 1995a, 227-236.

away from objects and towards social context and ideology…the structures of social power, and from there to politics, feminism, psychoanalysis and theory' as well as audience interaction and reception.[210] While the 'New Art History' diversified the discipline, the dominance of such thematic concerns resulted in continuing neglect of patterns and their physical structure.

Thankfully, in the 21st century, cosmophobia is just beginning to decline. In the fields of design and architecture, Trilling and Antoine Picon have ascribed this change to a range of factors, from the development of computer software that makes it easier to manipulate abstract patterns, to multiculturalism, globalism, and the increased social value of individual expression.[211] Art historical scholars also recently have become more open to pattern and call for its renewed study, as reflected at a recent multi-disciplinary conferences at the University of York and University College London ('Patterning Pattern/Figuring the Decorative' in 2015, and the Northern/Early Medieval Interdisciplinary Conference Series (N/EMICS): 'Ornament and Pattern' in 2017, respectively). Like archaeologists, however, most of the art historical papers presented at the conferences focused on links between function and symbolism, meaning, audience perception, psychology, and even iconography, rather than the physical structures of patterns or artists' working processes.[212] Art historical re-evaluation of pattern is still in its infancy and Trilling lamented the fact that 'no modern tradition of ornament studies' is yet established.[213] Twentieth-century mainstream art historical scholarship therefore has not advanced knowledge of Insular key pattern.

Insular specialists have continued to engage with patterns at a rate not seen in other areas of art history and archaeology because abstract and non-representational patterns dominated Insular art as a major decorative component. The regular published proceedings of the International Insular Art Conference (beginning in 1985) provide a

[210] Fernie 1995b, 18-21.
[211] Picon 2013, 9-10, 17, 25-27, 30; Trilling 2003, 201-225, esp. 202-203, 212-223.
[212] Such papers from the 'Patterning Pattern/Figuring the Decorative' conference (6 May 2015) include M.A. Aristova, 'Locating the Decorative – Architecture and Beyond'; H. Hills, 'Introduction'; and M. Nixon, 'Pattern and Coherence in the Palazzo Biscari, Catania'. The majority of art-historical papers in the N/EMICS conference focused instead on iconography rather than abstract pattern. Michael Brennan's paper on Insular interlace from the 'Patterning Pattern/Figuring the Decorative' conference ('Disturbing Behaviour: Inside the Mind of the Pattern-Breakers'), as well as the author's paper from the 'Ornament and Pattern' conference (3 June 2017), 'Key Pattern in Insular Art: Seeing Space, Line, and Symmetry in Early Medieval Britain and Ireland', were exceptions to the contributors' overall omission of pattern structure at both conferences. For more about Brennan's research, see Chapter 5.
[213] Trilling 2003, xiv.

barometer for tracking how Insular specialists have approached pattern in more recent decades.[214] Archaeologists have discussed patterns – most often spirals and interlace – directly and frequently. However, their discussions did not focus on pattern structure, but instead either remained descriptive and secondary to the artefacts possessing the decoration, or were centred on style and identification of forms (often animal body parts in zoomorphic patterns) in order to compare, classify, and typologise them, and to explore their origins and influences.[215]

Like their archaeologist colleagues, Insular art historians from the mid-20th century onward generally have not chosen to engage deeply with physical structures of patterns or what these structures reveal about the pattern-makers' working processes. While many Insular art historians kept patterns at the forefront of their analyses, their studies have instead followed wider methodological trends from mainstream 20th- and early 21st-century art history. Jane Geddes' recent examination of the development of Pictish art studies from the post-war era to the present day is applicable to Insular art as a whole, and thus illustrative here.[216] According to Geddes, historians of Pictish (and we should add, all Insular) art 'followed the same basic development as art history in general', beginning in the 1950s with stylistic analysis.[217] Françoise Henry's three-volume *L'art irlandais* (1963-64, translated to English in 1965-70) is a foundational contribution to the discipline, in which she examined predominantly spiral and interlace patterns across Insular manuscripts and artefacts in order to describe, compare, and date them on the basis of style.[218] Insular art historians never rejected stylistic analysis as a method and have continued to apply it to pattern into the 21st century, as demonstrated for example by Leslie Webster's contribution on Anglo-Saxon pattern and ornament in Karkov and Brown's edited collection of essays, *Anglo-Saxon Styles* (2003),[219] or in articles from the published International Insular Art Conference proceedings, the latter similar in approach to archaeological contributions in

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[214] Ryan 1987a; Spearman and Higgitt 1993; Bourke 1995; Redknap et al. 2001; Moss 2007; Hawkes 2013; Newman et al. 2017.
[215] See for example Haseloff 1987; Roth 1987; Ryan 1987b; 1993; 1995; Whitfield 1987; 1995; Wamers 1987; Graham-Campbell 2001; Thomas 2001; Youngs 2013. For a discussion of some of the more problematic, nationalist or ethnocentric interpretations that other Insular specialists have applied to Insular patterns, see Netzer 2001.
[216] Geddes 2011.
[217] Ibid., 121-23. See also Karkov and Brown 2003b, 1-2.
[218] Henry 1963-64; 1965; 1967; 1970. See especially Henry 1967, 114-21. In her 1965 volume, Henry briefly delved into the structure of spiral patterns, including mathematical concepts such as symmetry, but even here mainly focused on construction aids and methods such as the use of compasses and grids (Henry 1965, 212-224). NB: Henry first wrote the initial volume, *Irish Art in the Early Christian Period (to 800 A.D.)*, in 1940, which she then expanded in the later publications. For a biography and summary of Henry's publications, see L. Sorensen [accessed 28 November 2016].
[219] Webster 2003.

the same collections.[220] Geddes also observed that from the 1980s, art historians also took up mainstream methodologies from the 'New Art History' and examined more thematic, social, and psychological issues relating to 'patronage, reception, function, setting and gender'.[221] Emmanuelle Pirotte's application of Gestalt theory to abstract patterns from manuscript carpet pages, in order to explore their potential psychological, contemplative impact on medieval viewers, as well as her examination of the tension and 'interplay between script and ornament', are excellent examples of this approach in a wider Insular context.[222] At the recent 'Patterning Pattern' conference at York, Jane Hawkes also examined medieval audiences' psychological and sensory experience of pattern, and though she did not elaborate on these patterns' physical structures and their arrangement, she called for analysis of medieval artisans' working processes in their manipulation of pattern textures, colours, foreground, and void in order to influence and astound their viewers.[223] Nevertheless, despite their many contributions, 20th- and 21st-century Insular art historians, like archaeologists, have generally left the deep physical structures of Insular patterns – particularly key pattern – unexamined.

Fourth and finally, key pattern also has been under-studied because the few Insular specialists from the nineteenth through the early 21st century who *did* examine pattern structure in depth generally paid key pattern less attention than they did to interlace. There are more published studies of interlace than of key pattern, and the former tend to be longer and more involved.[224] For example, in *ECMS*, Allen's section on interlace consumes 167 pages, whereas he dedicated only 54 pages to key pattern. (Allen also gave similarly short shrift to curvilinear spiral pattern, with only 40 pages).[225] It is unclear why key pattern has been treated as a poor relation to interlace. It may be that during the Celtic Revival of the 19th century, early emphasis and fascination was awarded to interlace as a quintessentially 'Celtic' design, despite its actual Mediterranean origin, an attitude that had long-lasting impact through the 20th century, as evidenced by the high number of popular

220 See for example I. Henderson 1987; Marx 1995.
221 Geddes 2011, 125-26. See also Farr 2011, 303, 313.
222 Pirotte 2001a; 2001b. For further discussion of recent studies of the relationship between text and images or ornament in manuscripts, see Farr 2011, 313.
223 Hawkes 2015, 'Order Out of Chaos: The Art of Pattern in Anglo-Saxon England', paper presented at the Patterning Pattern/Figuring the Decorative Conference, 6 May, University of York.
224 See for example Adcock 1974; G. Bain 1951, 25-56, 101-118; I. Bain 1986; Brennan 2011; Budny 2001, 183-210; Cramp 1984b, xxviii-xlv; Edwards 1987, 111-13; 2007, 72-77; 2013, 90-94; Garrett 2007; 2009; Guilmain 1993; A. Meehan 1999; 2003a; 2003b; 2007, 165-322; Preston-Jones and Okasha 2013, 70-72; Redknap and Lewis 2007, 94-99; Tetlow 2013, 32-45, 56-57.
225 Allen and Anderson 1903, vol. 1, part 2, pp. 140-307, 308-362, 363-403.

artists' manuals dedicated to 'Celtic knotwork'.[226] Key pattern may also have been unusual in Celtic Revivalist art and art-historical/archaeological studies in the 19th century because, unlike interlace, it was not in keeping with the sinuous, curvilinear aesthetic of the time in Arts and Crafts medievalism and Art Nouveau movement.[227] If the Celtic Revival had occurred in the era of Art Deco, when rectilinearity was favoured, key pattern may well have enjoyed greater popularity. Finally, it also may be the case that Allen, as the first scholar to conduct detailed technical analyses of Insular patterns, steered the focus of future studies toward interlace and away from key pattern because of his personal interest and expertise in interlace, spanning multiple publications over the course of his career.[228]

4.2. The Historical Context of Insular Key Pattern Studies

In the 19th century, approaches to abstract pattern across art history, archaeology, and decorative arts and design were deeply influenced by contemporary scientific, industrial, and political concerns in Western Europe. Nineteenth-century approaches in turn impacted the ways that archaeologists as well as art instructors have treated Insular patterns ever since. In her historiography of stylistic analysis in Insular art studies, Nancy Netzer observed parallels in the 19th century between the rise of 'rigorous analytical study' amongst archaeologists and antiquarians, including 'systematic organization' of patterns, and new scientific theories such as zoological classification.[229] The same intellectual zeitgeist that underpinned new typological methods in biology and earth science therefore impacted Insular pattern studies, leading archaeologists to classify Insular patterns into basic types (i.e. key pattern, interlace, spirals, et cetera), and subgroups within each type. Darwinian theory may also have encouraged art historians and archaeologists to examine patterns in order to theorize their evolution and structural relationships, as Riegl did in his

[226] For a 19th-century view of interlace as quintessentially Celtic, see D. Wilson 1851, 504-505. For an overview of debates about the Mediterranean origin of interlace, with a new technical and structural perspective, see Brennan 2011, 68-75, 79-80. For a sample of modern artists' manuals for drawing knotwork, see I. Bain 1986; A. Meehan 2003; Garrett 2007; 2009.

[227] The work of John Duncan, a late 19th-century artist from Dundee, Scotland, is an exception. Duncan included key pattern in at least one of his imaginative paintings and drawings of medieval Irish and Scottish literary characters, as featured in the background of *Deirdre of the Sorrows*. As a native of eastern Scotland, Duncan would have frequently viewed Pictish sculpture, on which large and prominent fields of key pattern are common, and this local corpus may have inspired him to include the pattern in his art. For a biography of Duncan and information on *Deirdre of the Sorrows*, see Kemplay 2009, esp. 11-25, 91.

[228] Allen 1878, 352-59; 1883, 211-71; 1904, 238-253, 257-279; Allen and Anderson 1903, vol. 1, part 2, pp. 140-307.

[229] Netzer 2001, 169-71, 173.

exploration of the stylistic evolution of Mediterranean plant ornament. Netzer identified similar trends in Insular archaeology, such as Joseph Anderson's theory that the Insular style evolved as a conglomeration of pagan, Iron Age Celtic spiral motifs and early Christian, Mediterranean interlace and key pattern.[230] Art instructors also have followed this classificatory tradition by dividing basic Insular patterns for teaching purposes and attempting to explain the patterns' origins in their popular manuals. As a result, these ultimately 19th-century typological and evolutionary approaches deeply affected how archaeologists and art instructors have explained key pattern's structure and its relationship to other Insular patterns.

Both industrial mass-production and the backlash against it from the field of decorative arts and design – the latter typified by the late 19th-century Art Nouveau and Arts and Crafts movements – also influenced the format of archaeological classifications and later artists' manuals of Insular patterns. Trilling suggests that in the 19th century, increased availability of foreign patterns in design and industry, and, somewhat ironically, the concomitant backlash against such industrial mass production, led to a demand for pattern 'compendia' or books containing pattern samples from historical and international art styles.[231] Historians, designers, and the public used these pattern compendia for their own, different purposes.[232] David Brett has suggested that at its height in the 19th century, this interest in pattern was not just fashion but became an important part of Western 'intellectual life' as a 'forum for modernity'.[233] Owen Jones' *The Grammar of Ornament* (1856) is a seminal example.[234] In this publication he organized a vast array of patterns or 'ornamental art' from different historical eras and the contemporary, non-Western world into separate chapters, each accompanied by a collection of colour plates.[235] Jones intended his readers, from the general public to professional craftspeople, to learn and innovate them.[236] In a manner typical to pattern compendia, Jones arranged multiple snippet images of different types of ornament from a single culture on each plate, providing little to no contextual information about the objects or architecture they adorned, their original locations, or comparative scales (Fig. 4.1a).[237]

230 Ibid., 173, citing Joseph Anderson 1903, vol. 1, pp. lxix-lxxviii, lxxxn4.
231 Trilling 2001, 58, 60.
232 Ibid., 58.
233 Brett 2005, 1.
234 Jones 1856b.
235 Jones 1856b, 1, 6-7.
236 Ibid., 1.
237 See for example Jones 1856b, plate 2.

Following this trend, archaeological classifications of Insular patterns, from Allen's *ECMS* in 1903 onward, echoed the format of such 19th-century compendia by presenting and arranging sample images of patterns in a similar fashion (Fig. 4.1b). As a result, they too can serve both academics and designers. Popular artists' manuals for Insular patterns also have continued this format into the 21st century. For example, in his 1951 manual, *Celtic Art: The Methods of Construction*, George Bain presented sample images of patterns not only for the education of art students and the general public, but also to aid professional designers.[238] While this format increases our knowledge of Insular key pattern because it preserves and presents a multitude of examples, it also can be detrimental, for reasons explored later in this chapter.

Nineteenth-century political ideologies also influenced archaeological classifications and artists' manuals of key pattern through the 20th century. In the first half of the 19th century, renewed awareness of and interest in ancient Celtic and Insular art amongst academics, fashion designers, and the Victorian public – a phenomenon known as the Celtic Revival – followed archaeological discoveries of Insular treasures such as the Tara brooch.[239] Murdo Macdonald and Martin Goldberg have independently identified the antiquarian Daniel Wilson as one of the first to identify a 'distinct' ancient and medieval 'Celtic' style of art.[240] The rise of nationalism in historically Celtic-speaking countries also drove archaeological study of Insular art and patterns, in reaction to racist, hegemonic British views, such as that of the 'savage' Highlander, and the concomitant denigration of ancient and medieval Celtic art as inferior.[241] Justification for study of Insular art and classification of its patterns ranged from the rejection of the Classical, Mediterranean heritage of Western art and culture, to the preservation of local historical art as a source of national pride.[242] Netzer also proposed that artists' manuals for Insular patterns, today a

[238] G. Bain 1951, 18, 21.
[239] Groam House Museum 2013a, 6, 20. For more on the Celtic Revival, see Macdonald 2012, 'Crossing the Highland Line in the 19th Century: Cross-Currents in Scottish Writing', paper presented at The Association of Scottish Literary Studies, Annual Conference, 8-10 June, Sabhal Mòr Ostaig, University of The Highlands and Islands; and Macdonald 2016,'Celtic Revivals and Reappropriations in Art and Books 1760 – 1955', paper presented at The Celtic Revival: Authenticity and Cultural Identities, 16-17 January, London, British Museum.
[240] Wilson 1851, esp. 220-21, 504-505; Goldberg 2015, 'A Monumental Difference in Early Medieval Insular Art', paper presented at the International Congress of Celtic Studies, 14 July, University of Glasgow; Macdonald 2012, 'Crossing the Highland Line in the 19th Century: Cross-Currents in Scottish Writing', paper presented at The Association of Scottish Literary Studies, Annual Conference, 8-10 June, Sabhal Mòr Ostaig, University of The Highlands and Islands, 6-7, 9; Macdonald 2016, 'Celtic Revivals and Reappropriations in Art and Books 1760 – 1955', paper presented at The Celtic Revival: Authenticity and Cultural Identities, 16-17 January, London, British Museum, 3-4.
[241] Groam House 2013a, 6; Campbell (Forthcoming).
[242] Netzer 2001, 170-72; I. Henderson 1993, 13, 19-21.

‘cottage industry’, have their origins in the Celtic Revival of the 19th century.[243] Even in recent decades, authors of these manuals have cited the uniqueness and even magical qualities of Celtic art as their reason for promoting it to the public (Chapter 5). These ideological undertones have had a positive effect by encouraging interest in key pattern, however, nationalism also has had a negative impact on study of key pattern, especially when certain varieties of the pattern were rejected as unworthy for analysis solely for political reasons (section 4.3.1. below; Chapter 5).

The remainder of this chapter will now turn to 19th- and early 20th-century scholarship specifically dedicated to key pattern, up to and including Allen’s pivotal structural analysis and classification of the pattern in *ECMS* in 1903. As noted above, Allen’s scholarship in turn influenced all subsequent archaeological classifications and artists’ manuals of key pattern in the 20th and 21st centuries, which will be addressed in the following chapter (Chapter 5).

4.3. Nineteenth- and Early 20th-Century Pattern Classifications

4.3.1. The Publications of John Obadiah Westwood, 1845-1868

The first attempt to classify Insular patterns dates to the mid-19th century, in the publications of the English entomologist John Obadiah Westwood, who applied his training in scientific classification to identify basic differences between the main Insular pattern groups: interlace, spirals, key pattern, and so on.[244] He published a series of early works between 1845 and 1853, the ideas from which he developed further in two later publications.[245] In 1856, Westwood contributed to Owen Jones’ *Grammar of Ornament* by writing the chapter dedicated to ‘Celtic Ornament’ (i.e. Insular patterns).[246] Jones does not state whether or not Westwood also produced the colour plates for the chapter. Here Westwood provided general descriptions of different Insular patterns, and made a few crucial first observations about key pattern’s structural properties as well as about complex

[243] Netzer 2011, 176, 177n5.
[244] Ibid., 170-71. For examples of Westwood’s entomological work, see Westwood 1836; 1847.
[245] Westwood 1843-45; 1850; 1853.
[246] Westwood 1856, ch. 15, pp. 1-7, plates lxiii-lxv.

step pattern.[247] Referring to key pattern as 'Chinese-like pattern', he observed that it was built from a series of non-interlacing, intersected lines that were 'arranged at equal intervals apart'.[248] Though Westwood made no identification of positive and negative space within key pattern, here he touched upon the important structural aspect of path evenness, i.e. that Insular makers arranged negative lines so that the positive space, or path, left over between them remained an even width throughout. Insular specialists would not fully recognize either the path or the structural importance of its evenness again for over a century. Westwood also correctly distinguished between key pattern and complex step pattern (while omitting mention of simple step pattern), describing complex step pattern as a 'series of angulated lines, placed at equal distances apart, forming a series of steps'.[249]

Next, Westwood's *Fac-similes of the Miniatures & Ornaments of Anglo-Saxon & Irish Manuscripts* (1868) contained full-colour facsimile reproductions and descriptions of entire decorated pages from early medieval British and Irish illuminated manuscripts, rather than just snippet images of patterns.[250] Like Jones did for the *Grammar of Ornament*, Westwood intended his collection of facsimiles as an educational resource for art students and the public,[251] therefore this art historical resource also served as a sort of pattern compendium, but with full-page reproductions of manuscript folios rather than limited extracts of individual patterns. Westwood's purpose was also nationalistic, as he used his publication as a platform for showcasing the historical 'perfection' of early medieval British and Irish art as 'absolutely distinct from that of any other part of the civilized world' and in competition with ancient Mediterranean art, the latter which art historians and society still held in higher esteem.[252]

Westwood's most important contribution in *Fac-similes* was his classification of basic categories of Insular patterns, which Netzer has noted as the very first in Insular studies.[253] Westwood's classification also was more pointed and streamlined here than his discussion of pattern in Jones' *Grammar of Ornament*. He identified seven groups, including dotted decoration, 'simple lines', 'step-like angulated pattern' (here simple step pattern, rather

[247] Ibid., ch. 15, pp. 3-5.
[248] Ibid., ch. 15, p. 4.
[249] Ibid., ch. 15, p. 5, plate lxiv, no. 28.
[250] Westwood 1868, pp. iv-v, 1-155, plates 1-54.
[251] Ibid., iii.
[252] Ibid., iii-iv; Netzer 2001, 171-72.
[253] Netzer 2001, 171.

than complex step pattern as in the *Grammar*), zoomorphic and non-representational interlace, spiral patterns, and finally 'the Chinese-like Z pattern' – i.e. key pattern.[254] In this classification, Westwood included no discussion of key pattern structure itself.

Nevertheless, Westwood's nationalist agenda limited his contribution. It is unclear why he chose to refer to Insular key pattern as 'Chinese-like Z pattern', but his choice may have been political. While he recognized the coincidental similarity between Insular and Chinese key pattern, he actively disavowed potential links with other patterns closer to home, especially from Roman art.[255] For example, he argued that no 'Chinese-like Z patterns' occurred in the mosaics of Roman Britain, and therefore, Insular artists invented it without reliance on classical models.[256] His claim for the absence of key pattern in Roman art is untrue. Roman craftspeople did use key pattern, though it contained significant physical differences from much of the key pattern typically found in later Insular art (Chapter 7), (and so Westwood is partly right, only in that Roman key pattern was not a fundamental influence on Insular key pattern in terms of structure). However, Westwood's inability or unwillingness to recognize similarities as well as differences between Insular and Roman key pattern indicates that his knowledge of the structural properties of key pattern and the artistic processes involved in its creation was incomplete. The underdeveloped state of his knowledge also is indicated by his lack of awareness of the structural similarities between key pattern – Roman and Insular alike – with curvilinear spiral patterns, the latter which he classed separately.

Westwood's chosen medium of the facsimile collection, almost like a pattern compendium in form, also led him to technically misrepresent some artworks, misunderstand key pattern's structure, and overlook medieval artists' working processes. Although Westwood studied pages from the manuscripts directly and produced the facsimiles himself, Netzer observed that Westwood's 'drawings introduce small inaccuracies that are alien to the originals'.[257] At first glance, comparison of Westwood's facsimile plate of folio 290v of the Book of Kells to the original page reveals no glaring differences (Fig. 4.2a-b).[258] Closer inspection however reveals that Westwood altered the key pattern in the

[254] Westwood 1868, iv-v.
[255] Ibid., v-viii.
[256] Ibid., v-viii.
[257] Ibid., iv, ix; Netzer 2001, 171.
[258] Westwood 1868, plate 9.

corner finials. Westwood's top left finial accurately matches the original in the gospel book, with only minor colour alterations (Fig. 4.3a-b). However, in his facsimile he then took this top left finial and mirror-reflected it across the horizontal axis to create the bottom left finial, and then mirror-reflected this again across the vertical axis to create the bottom right corner finial (Fig. 4.3c, e). The Book of Kells illuminator does not appear to have used the top left final as a template in this way and instead constructed all four finials independently, introducing slight variations to each (Fig. 4.3b, d, f). Because the Book of Kells illuminator drew the key pattern in each corner independently from the other corners, from scratch so to speak, rather than using one corner as a template and successively mirroring it to create all the others (as Westwood did in his facsimile), the reader will observe that some key pattern compositions in Westwood's finial corners actually point in different directions than did the key pattern in the original (Fig. 4.3f-h). Finally, Westwood's key pattern in the top right corner of his facsimile does not structurally match any key pattern composition in any of the finials from the original manuscript page. Derek Hull suggested that Westwood altered patterns within his facsimiles in order to correct what he believed were 'mistakes' in the originals.[259] However, the Book of Kells illuminator did not make 'mistakes' in the key pattern on folio 290v. Instead, Westwood likely used a mechanical aid, such as a mirror, to speed up the reproduction process of the key pattern from one corner finial to another, and assumed that a medieval maker would have done the same, when instead the artist drew each key pattern composition individually. Westwood's work illustrates what Aurélie Beatley has described as the 'very early tension between artistic representation and accurate delineation' that began with such early antiquarian reproductions.[260]

By altering the original patterns, Westwood introduced to key pattern studies a problem that would continue to haunt both archaeological classifications and artists' construction manuals into the 21st century. Because the key pattern compositions in the finials in his facsimile version are all technically correct in their physical structure, it is clear that he did not introduce inadvertent changes by merely copying from the manuscript, but possessed a functional understanding of at least the most basic structures within key pattern. Nevertheless, he never communicated this to his readers, most of whom likely lack specialist knowledge and must trust his reproductions. Therefore, any academic theories and classifications of key pattern built upon such inaccurate reproductions would be

[259] Hull 2003, 88-89.
[260] Beatley 2010, 2, 19.

rendered invalid. Long after Westwood's work and the pattern compendium itself had fallen out of fashion, archaeologists and art instructors have continued this tradition of 'correcting' and regularising reproductions of key pattern. As a result, they have continued to erase evidence of the medieval artist's original working processes and intentions for key pattern.

4.3.2. John Romilly Allen

The next significant Insular pattern classifications were published in the late 19th and early 20th century by John Romilly Allen, culminating in his seminal two-volume publication of 1903, *The Early Christian Monuments of Scotland* (*ECMS*). Allen, who in the 1870s worked as chief engineer for the construction of the Leith docks near Edinburgh, was originally from Wales and had a personal interest in archaeology.[261] He was an active member of the Cambrian Archaeological Association and published papers for that organization, after which in 1878 he became a Fellow of the Society of Antiquaries of Scotland and began to write articles on Insular patterns, becoming a self-made expert on early medieval sculpture and its ornament.[262] In 1890, the Society of Antiquaries of Scotland awarded Allen funding to conduct research and photography in order to publish a survey of Scotland's early medieval stone monuments, a project that led to *ECMS* in 1903.[263] The use of photography was pioneering at the time.[264] *ECMS* includes an introduction comprising the 1892 Rhind Lectures of Joseph Anderson, Keeper of the National Museum of Antiquities of Scotland; Allen's photographic and descriptive corpus of early medieval sculpture from Scotland; his discussion and classification of Pictish symbols; and his detailed structural studies and classifications of Insular patterns, in which he classified and illustrated innumerable sub-varieties within each pattern group. In *ECMS*, Allen hoped to preserve weathered sculptures as national, historical monuments for the public, and he used photographs, rubbings, and drawings to record them.[265] Allen also used tracings of his own photographs and rubbings of the stones to create reproduction images of pattern fields. These two-dimensional line drawings were overdrawn in black ink and then reproduced typographically in *ECMS*.[266]

[261] Henderson 1993, 15-16.
[262] Ibid.
[263] Ibid., 19-20.
[264] Ibid., 17.
[265] Ibid., 17, 25-26.
[266] Ibid., 18, 25-27.

Aurélie Beatley and Lisbeth Thoms both observed that Allen's contribution with *ECMS* was far more scientific in its empirical and systematic approach than previous publications on Insular stone monuments, making it 'the first modern survey' of Insular sculpture and a model for all corpora published thereafter.[267] Knowledge of key pattern and the genre of archaeological classification in Insular studies also leapt forward with Allen's work, and his structural analyses and classifications of patterns defined the course of scholarship on Insular patterns ever after. Allen's classifications reflected the same 19th-century scientific zeitgeist that influenced Westwood, however, this impulse was far more fully realized in Allen's surgically detailed approach, perhaps heightened as well by his training as a civil engineer.[268] In detail and sophistication, Allen's structural study and classification of key pattern far surpassed Westwood's initial effort, and his work contained many crucial and correct observations about key pattern that scholars have included in their own analyses of the pattern ever since. One of Allen's most important insights about key pattern was its spiral structure, and thus close relationship to curvilinear spiral patterns, a fundamental structural truth that Westwood did not mention.

Despite this, Allen's approach was hampered by significant methodological problems and technical misconceptions. Throughout his career, Allen promoted three contradictory theories regarding key pattern's internal structures and their arrangement, two of them founded on the incorrect assumption that construction methods (grids) were essential pattern's structure. In addition to a range of other serious issues, these irreconcilable tensions weakened his classification of key pattern in *ECMS*, ultimately rendering his work unsatisfactory.

Before *ECMS*, Allen produced a series of shorter articles that provided a testing ground for ideas presented in that later work.[269] In 1885 Allen published 'Notes on Celtic Ornament - The Key and Spiral Patterns'. He later recycled most of its details in *ECMS*, though several aspects of Allen's analysis of key pattern made this early publication unique.[270] He first gave a definition of the pattern and gave a unique explanation for his choice of the common term, *key pattern* (presumably in opposition to other terms also in use in the 19th century, such as fret or meander). Allen preferred the term because of key pattern's

[267] Beatley 2010, 22; Thoms 2005, ix.
[268] Henderson 1993, 15-16, 18; Netzer 2001, 173.
[269] See for example Allen 1878, 352-59; 1883, 211-71; 1885, 253-308.
[270] Allen 1885, 263-92.

similarity to the bent shape of a skeleton key that he had seen in the hand of an angel depicted opening the gate to heaven, in an 11th-century Anglo-Saxon manuscript (Bodleian Library, MS Junius 11).[271] The 1885 article also made clear that in manuscript illumination, artists created the negative background space, or 'groundwork' as Allen called it, by adding lines in black or coloured ink.[272] He observed briefly that the removal or addition of a line (i.e. a negative line element) could change the number of strands within a spiral in the key pattern composition.[273] Both of these basic observations are correct, making Allen the first to demonstrate awareness – albeit partial – of the crucial structural importance of negative line elements in Insular key pattern and its spiral units.

One further aspect of the 1885 article differs from *ECMS*: the classification of Insular key pattern. Allen's 1885 classification (his first attempt) is based on how he believed the patterns were constructed and on his identification of certain structures within them (negative line elements and spiral units). Allen argued that all geometric patterns of any kind are based on one of three types of grids, being square, triangular, or hexagonal, and that Insular artists used square grids to create all of their patterns, whatever the type (Fig. 4.4).[274] Allen then separated groups of key pattern according to whether he believed Insular artists drew them upon grids made of squares placed parallel, diagonally, or subdivided into triangles (Fig. 4.5).[275] These two arguments would reappear later in *ECMS*. However, Allen then argued that Insular artists filled the square or triangular cells of these grids with unconnected spiral shapes (the latter actually comprised of the patterns' branches and embellishments, as defined in Chapter 2), as though the artists were laying down a series of tiles.[276] He classified these forms according to shape and number of spiral strands (Fig. 4.6).[277] Finally, Allen stated that Insular artists then made 'the whole into one design by [adding] a series of connecting lines' between the spiral shapes, and he further classified key pattern by the shape of these 'connecting lines' (these 'connecting lines' are in fact key pattern trunks and, once again, branches (Fig. 4.7).[278] According to his classificatory parameters, Allen presented key pattern compositions that were supposedly constructed upon different square grids (Fig. 4.5) and contained differently-shaped spirals

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[271] Ibid., 263-64, 264n1; Bodleian Library [accessed 12 April 2016].
[272] Allen 1885, 260.
[273] Ibid., p. 279, 279n1, fig. 19.
[274] Ibid., 265.
[275] Ibid., 265-92, esp. p. 265-66, plate 1.
[276] Ibid., pp. 265-69, plates 2-3.
[277] Ibid.
[278] Ibid., pp. 265, 269-70, 272, plates 4-5.

and ‘connecting lines’ (Figs. 4.6, 4.7) as having belonged to fundamentally different groups.

This methodology resulted in multiple technical misconceptions and gaps of understanding that limited the benefits of Allen’s early research. Again, most of these problems were repeated in *ECMS* and so will be discussed in relation to that publication. However, his 1885 classification of key pattern best showcases the negative aspects of the 19th-century scientific mindset and eagerness to apply modern – and therefore anachronistic – tools to the study of medieval pattern, and so sheds light on the problems associated with the classification approach, which have continued to trouble all subsequent studies of key pattern.

First, Allen’s classification system highlights the pitfalls of confusing key pattern’s essential structure with the various construction aids or methods that artists sometimes used to create individual patterns, according to their personal preference. As demonstrated in Chapter 1, construction aids and methods appear to have varied between medieval artists, even when they sought to achieve the same effect. Allen’s intuitive certainty that all Insular artists used grids therefore reveals more about 19th-century approaches to design than it does about early medieval artists’ own conceptions of key pattern and their working processes. In fact, in *ECMS*, Allen reiterated his theory of grids from his 1885 key pattern study, this time citing Lewis Foreman Day, a contemporary British designer and decorative artist in the Arts and Crafts movement.[279] Day argued that all patterns, modern and historical alike, were constructed of motifs repeated in the cells of a ‘lattice’ or ‘constructional scaffolding’ in the shape of squares, triangles, or hexagons, exactly as Allen did in his own publications (Fig. 4.4).[280] Day drew his grid theory not from archaeological evidence but from practical production methods in modern industry, such as wallpaper printmaking and mechanical weaving, which required the use of such grids to multiply individual motifs into patterns over larger surfaces.[281] Day claimed scientific authority for his theory of underlying grids, in keeping with the 19th-century intellectual worldview: “Just as the physiologist divides the animal world, according to anatomy, into families and classes, so the ornamentist is able to classify all pattern-work according to its

[279] Allen and Anderson 1903, vol. 1, part 2, p. 131-33; Day 1887.
[280] Allen and Anderson 1903, vol. 1, part 2, p. 131-33; Day 1887, pp. 8-15, plates 1-10.
[281] Day 1887, 21-22, 25-28, 36-37.

structure.'[282] Day used this scientific authority to argue that the use of grids originated not with modern industry but 'primitive handicraft' such as netting and plaiting of textiles, and therefore was universal and timeless.[283] Allen's 1885 publication on key pattern pre-dated Day's by two years, but it is clear that Allen adopted grid theory from the field of modern decorative arts and design because of its industrial usefulness and contemporary theoretical weight. In contrast, Insular makers created key pattern in a variety of media, and physical evidence demonstrates that they did not always use grids as construction aids (Chapter 1). Allen's application of grids specific to modern, industrial-era textile production therefore was an inappropriate means of classifying and studying medieval key pattern structure.

The practicality of Allen's proposed construction method in his 1885 article (i.e. the order in which individual negative lines were drawn) is also doubtful in many cases. He did not distinguish between two separate structural elements, the branch and embellishment, as evidenced by the fact that he included the same branch structures both in the spiral shapes he believed were created first, and in the 'connecting line' structures he argued were added last (c.f. Figs. 4.6, 4.7). He appears to have been unaware that in his model, Insular pattern-makers would have had to draw or carve the same negative line structure (the branches) twice, a point of confusion that calls into question his overall theories as a whole. In addition, in some key pattern compositions, if an artist chose to draw the spirals (i.e. branches and embellishments) first as Allen suggested, they would be forced to create many free-floating lines and shapes before adding 'connecting lines' (trunks), increasing the possibility for mistakes (Fig. 4.8a-b). Allen's theory about construction methods was a problematic means of classifying the patterns or analyzing their underlying physical structure.

Second, all pattern classification systems are aims sufficient within themselves, and therefore tend to prevent rather than permit further analysis. Namely, once a structural phenomenon is observed or a pattern has been assigned to a group, further investigation ends. For example, Allen wrote that in manuscript illumination, artists created the 'groundwork' or negative space by drawing black lines in ink, which in scholarship was the first-ever correct observation of this phenomenon, but he did not expand on his comment and explore the physical ways in which Insular artisans created negative space in

[282] Ibid., 3-4.
[283] Ibid., 21-22.

key pattern in metalwork or carved stone and ivory. As a result, he was unable to recognize Insular artists' reductive approach across media and its impact on the pattern's physical structure. Allen also noted that the addition or removal of negative line elements (here, branches) could change the number of strands in each spiral unit within a key pattern, but this knowledge only served his purpose of classifying key patterns into different groups. It left him no reason to explore *why* medieval artists chose to make such additions or removals, what affect such choices had on the rest of the pattern, and how artists managed the structural fallout. As we shall see throughout this thesis, in Insular key pattern, the reductive approach, the structural principle of the manipulation of negative space, and resultant knock-on effects on the rest of the pattern's structure together were a major concern for artists, but Allen either left these fundamental medieval conceptions about key pattern unexplored or was unaware of their implications.

Eighteen years later in *ECMS*, Allen developed his ideas from 1885 more fully and altered some of them. He reiterated his definition of key pattern as a geometric design made of straight lines and similar in appearance to the angled teeth of a skeleton key, but elaborated further, defining the pattern as:

> 'a surface covered with black lines on a white ground…drawn in such a way that between each black line there is a white line separating it from the one next to it; one set of lines…being generally continuous [unending]…whereas the other set, which forms the ground, is discontinuous or broken'.[284]

Allen continued with an overview of his theory of construction and key pattern structure in greater detail than in 1885. He reiterated his argument that the patterns were constructed upon various types of underlying square grids.[285] However, Allen then reversed his argument regarding which lines Insular artists supposedly drew first in key pattern. He now stated that 'isolated straight lines' (the 'connecting lines' of 1885, or trunks) formed the structural basis or 'skeleton' of all key pattern (implying that these were the lines drawn first, rather than the individual spirals, or branches and embellishments), and that these 'isolated lines' could be placed in various arrangements on a square grid in an all-

284 Allen and Anderson 1903, vol. 1, part 2, pp. 308-10.
285 Ibid., 131-32, 325, 327-328, 355.

over fashion, either parallel to each other, or simultaneously parallel and perpendicular (Fig. 4.9).[286] Allen again was echoing Day, who had written in 1887 that all patterns were based on 'the simplest arrangement of straight lines bound on the square system' or grid.[287] Once placed on the grid, these 'isolated lines' could be further offset from each other as the pattern-maker desired (Fig. 4.9).[288]

In Allen's view, the leftover grid spaces, or 'the spaces between' these isolated lines (trunks), were then 'filled in' with 'straight-line spirals'.[289] These spiral shapes (referred to in this thesis as units) first consisted of an added line (i.e. a branch), added at an angle to both ends of each 'isolated straight line' (trunk) (Fig. 4.10).[290] Allen then classified and illustrated possible all-over arrangements of these combined structures (trunks and branches), a theoretical scheme that he used in part to organize Insular key pattern into a classification (Fig. 4.11).[291] Here Allen also identified the presence of 'C'-shaped or 'S'-shaped rectilinear spiral structures in key pattern, depending on the placement and number of branches added to each individual trunk, with the connected spirals in an S-shape spinning in the same direction, and connected spirals in a C-shape spinning in opposite directions (Fig. 4.12).[292] Finally, Allen noted that these added lines (branches) could be extended (i.e. with embellishments) to further elaborate a key pattern composition's spiral shapes, in various shapes such as triangles, successively angled lines, or perpendicular branching lines (Fig. 4.13).[293]

The order in which Allen stated that these individual structural elements were constructed, with 'isolated straight lines' (i.e. trunks) preceding the spiral shapes (i.e. branches and embellishments together forming the spiral units), may or may not reflect the preferred construction method of every medieval (or even modern) pattern-maker, but this new method in *ECMS* is far easier to accomplish in practice than his construction theory from 1885. By drawing trunks first in the example given above from the St Gall Gospels noted above (Fig. 4.8a-b), the artist could more easily anchor the pattern before drawing the rest of the negative line elements within the composition.

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286 Ibid., 131, 310-12.
287 Day 1887, 8-9.
288 Allen and Anderson 1903, vol. 1, part 2, 311-12.
289 Ibid., 312.
290 Ibid., 312-14.
291 Ibid., 314-22, 328-30.
292 Ibid., 313-14.
293 Ibid., 312, 323-24, 326-27.

Allen made other useful observations about Insular key pattern structure. He was the first scholar to note that Insular makers fitted their key pattern within a circumscribed field, often square or rectangular in shape, rather than simply cutting the pattern short when it reached the outer border (Fig. 2.54).[294] He also was first to identify that Insular key pattern possessed two possible orientations in relationship to the outer edge of the field, one with lines oriented parallel and perpendicular to the border ('square' key patterns, i.e. orthogonal), and another 'diagonal' to the border (Fig. 4.14), and that diagonal orientation was more common in Insular contexts than it was in key pattern from other time periods and places.[295]

Allen followed this introductory analysis of structure and construction methods with a classification of Insular key pattern's many varieties.[296] Here he illustrated each pattern with a black-and-white typographic reproduction of an original composition from an early medieval artwork. He divided patterns according to his theory of underlying grids, separating 'square' key patterns, (with square grids and orthogonal orientation to the border), from 'diagonal' key patterns and 'diaper' patterns (both again created, he thought, on several different types of square underlying grids) (Fig. 4.15). Within each of these divisions, he distinguished patterns filling narrow strips or rows from those filling larger fields (Fig. 4.16a-b), and created further sub-groups according to the shapes and all-over arrangements of the patterns' 'bars' (a new term he introduced in the classification section only, to refer to trunks and their branches as one) (Fig. 4.17). Allen also cross-referenced otherwise identical patterns that contained different embellishments (Fig. 4.18). Finally, he listed examples of the early medieval artworks where each individual key pattern composition occurred, mainly from Scotland but also across Britain and Ireland. Appended to his classification was a brief selection of patterns from the groups listed above, arranged in curved rather than rectangular fields (Fig. 4.1b).

Lastly, as an aside within his classification section, Allen introduced yet another theory for how Insular artists both constructed and conceived key patterns. Somewhat confusingly, he explained that the all-over arrangements of lines (trunks and branches) that he had presented at length in his introductory section, and upon which he had partly based his classification system, were merely byproducts of single rows of key pattern that were then

[294] Ibid., 324-25.
[295] Ibid., 325-26, 328.
[296] Ibid., 331-63.

multiplied into larger blocks by 'doubling, trebling, or quadrupling', as if they had been stacked (Fig. 4.16a-b).[297] It seems that Allen intended this new theory to supersede the old one, though he spent a significant portion of the chapter outlining the latter, while barely exploring the implications of this new one.

Allen's analysis and classification of key pattern in *ECMS* was unprecedented in its detail and value. He was the first to develop a terminology for key pattern by clearly identifying some of its important structural elements (though he did not use this term) and distinguishing between visually different key pattern compositions. His insights that Insular makers fitted whole key pattern within bounded fields, and that the lines of the patterns could be oriented to that border either in a 'square' (orthogonal) or diagonal fashion, also are both crucial contributions. Although Allen gave insufficient attention to the interplay of positive and negative space in the patterns, as he focused so intently on 'bars' (the negative line elements comprising just the trunks and branches) and did not discuss Insular makers' reductive approach to key pattern, his description of 'black lines' separated by 'white' lines was a step in the right direction toward recognition of the relationship between two types of space. So too was his brief mention that one set of lines was 'continuous' (the positive path) while the other (the 'black', or negative, lines) was 'discontinuous' – both important structural principles that artists consciously maintained in their key patterns. Allen also recognized that the 'isolated straight lines' (trunks) and the angled lines added to them (branches and embellishments) are different structural elements that could be mixed and matched to a certain extent, added and removed: 'the number of possible key patterns depends on the number of ways that a surface can be covered with [intersecting line segments]' and 'on the variations capable of being produced in the arrangement of isolated straight lines'.[298] Allen also rightly observed the overall parallelism and perpendicularity of negative line elements within key pattern, and briefly that 'black' (negative) lines could vary in thickness, as when artists expanded them into triangular shaped embellishments. His focus in all these areas was a significant, foundational step toward acknowledging the important role that Insular artists gave to negative space, though he did not specifically identify the 'black' lines as being negative.

[297] Ibid., 347.
[298] Ibid., 313.

Allen also was first to notice other crucial structures in key pattern, such as narrow fields or rows that could be multiplied into larger patterns. Perhaps most importantly, he was the first to discuss the pattern's spiraliform nature and its structural relationship with curvilinear spiral patterns. In both key pattern and curvilinear spirals he identified shared 'C'- and 'S'- spiral structures, as two spirals combined to have respectively opposite or identical directions of spin, by the addition or omission of branches to trunks, in curvilinear form for spiral patterns and rectilinear form for key pattern (Fig. 4.12).[299] Allen's insights in these many areas have continued to shape all subsequent studies of key pattern, from classifications to popular artists' manuals, all of which – including this thesis – owe him a deep debt.

Nevertheless, Allen's approach also introduced misconceptions and led to underdeveloped analyses and even gaps in our understanding of key pattern. This is because he did not clarify the distinction between construction methods/aids, which pattern-makers used only according to their personal preference, and the pattern's essential structural properties. Problems also arose because he analyzed key pattern for the sole purpose of making a classification system, thereby introducing to his work the pitfalls that plague that methodology.

First, like Westwood he often 'regularised' the original patterns, thereby misrepresenting them. In particular, for each variety of key pattern, Allen presented what Trilling would later refer to as a 'pattern-type', or an abstracted, representational visual concept or ideal, in this case via black-and-white typographic reproductions, rather than an accurate likeness of an original pattern.[300] In these snippet images, Allen regularized mistakes or idiosyncrasies from the original patterns by straightening negative lines and sometimes even rearranging structures. Allen's regularization of the unique pattern found in the St Gall Gospel Book is especially striking (Fig. 4.19a-b).[301] The St Gall illuminator worked in a casual, freestyle manner and even allowed some of the negative line elements in the pattern to stray into each other, but Allen's pattern template betrays none of this valuable detail. In his historiography of studies of Scotland's early medieval sculpture, Graham Ritchie observed that a reproducer's own historical, cultural moment dictates what details in a historical artwork they find interesting or are even able to see, and therefore how they

[299] Ibid.
[300] Trilling 2001, 58.
[301] Allen and Anderson 1903, vol. 1, part 2, p. 342, no. 934.

reproduce it.[302] Here Allen inappropriately imposed a modern, machine-age preference for straight lines and perfected shapes onto a corpus of patterns produced in a historical era when machine perfection was impossible and likely less valued. Allen's use of photography may also have resulted in this tendency to regularise patterns. Photography allowed Allen to reproduce patterns quickly for publication, by using them to ink out pattern templates, but this efficiency also collapsed the patterns' three-dimensional details and prevented him lingering in order to conduct deeper, artist-focused studies of individual artworks. Because of his regularisation and 'correction' of patterns, Allen repeatedly erased evidence of medieval artists' individual approaches to the working process.

The typical format of the classification itself also limited Allen's ability to gain full understanding of Insular key pattern and the artists' working processes. Nineteenth- and early 20th-century approaches in science and design led Allen to format his pattern templates like a pattern compendium or a catalogue of specimens, with the key pattern artificially isolated from their surrounding artworks. As Trilling also noted, this aspect of 19th-century pattern compendia is ultimately 'very misleading', causing differences of individual artistic style and detail to 'evaporate' in a 'decontextualized and unnaturally homogenous' setting.[303] Archaeological typologies in general likewise 'isolate' objects from their 'contexts of production' in the same way,[304] with Jane Hawkes likening pattern classifications to an entomologist's drawer, filled with rows of butterflies removed from their habitats and pinned in an externally-imposed order.[305] In reality, Insular makers often showcased structural relationships between different patterns within a single artwork through physical juxtaposition (Chapter 8), thereby conveying valuable information about their own understanding of the patterns. This information is then lost when the patterns are reproduced out of context. Because of his method, Allen either overlooked or chose to disregard this evidence left behind by early medieval artists while composing *ECMS* for publication, causing him to badly misrepresent the structure of certain key pattern compositions and their relationship to other patterns.

302 Ritchie 1998, 1-2.
303 Trilling 2001, 60.
304 M.L.S. Sorensen 2015, 91.
305 Hawkes 2015, 'Order Out of Chaos: The Art of Pattern in Anglo-Saxon England', paper presented at the Patterning Pattern/Figuring the Decorative Conference, 6 May, University of York.

Namely, classifications require the imposition of strict divisions that force different visual varieties of key pattern into predetermined groups. These divisions are based on a narrow set of parameters chosen by the classifier, not the original artists. Marie Louise Stig Sorensen raised the same concern about archaeological typologies more generally, that they are ‘arbitrary’ and external and therefore have ‘no relationship’ to how earlier societies originally understood and organized with their own objects.[306] Therefore, by privileging certain parameters over others (or indeed overlooking or failing to recognise other important aspects of the patterns), pattern classifiers risk artificially separating patterns with structural similarities of which medieval artists were aware. For example, Allen assigned two key patterns that look diverse, but which actually share deep structural connections, to two entirely separate structural schemes according to the visual appearance of their ‘bars’ (trunks and branches).[307] Allen’s classifications numbered 906 and 963 ultimately differ only in their diagonal or orthogonal orientation (with the differences in number of spiral strands resulting directly from the need to manipulate and maintain other structural elements while in their respective orientations) (Fig. 4.20a-b). Allen’s focus on the superficial appearance of ‘bars’ therefore caused him to artificially separate patterns that had deep structural links that medieval pattern-makers exploited for design purposes.

In addition, the weaknesses of pattern classification systems are exposed by the difficulties classifiers have in addressing patterns that do not fit their schemes, yet another problem Sorensen also observed in archaeological typologies.[308] Allen’s parameters – the type of grid upon which a pattern was supposedly constructed, and the shape and arrangement of ‘bars’ (trunks and branches) – prevented him from analyzing a pattern with unusually shaped and arranged negative lines, other than labeling it ‘irregular’ (Fig. 4.21).[309] Allen therefore was unable to analyse and appreciate works of artistry that did not fit his predetermined groups, which are not actually ‘irregular’ but the products of inventive, deliberate, and intelligent artistic decisions. He imposed limits on key pattern that do not reflect the Insular reality – a methodological problem that would continue in later studies of key patterns as well.

[306] M.L.S. Sorensen 2015, 86-87.
[307] Allen and Anderson 1903, vol. 1, part 2, pp. 317, 337, 349-50, nos. 831-31a, 832-32a, 836-37, 913, 963, 965.
[308] M.L.S. Sorensen 2015, 91.
[309] Allen and Anderson 1903, vol. 1, part 2, p. 340, no. 923.

Finally, because Allen identified key pattern's physical structures, or elements, to serve a finite, classificatory purpose, he did not explore what these structural elements themselves and their arrangements tell us about medieval makers' own understanding of key pattern. Allen's focus on grids and a limited range of structural elements caused him to overlook two important structural principles that medieval artists commonly used to manipulate key pattern, leading him to misunderstand some pattern compositions altogether. These two structural principles are symmetry and the manipulation of negative lines through the reductive approach, the latter which artists engaged with for both creative and strategic purposes.

First, Allen did not explore the role of symmetry in key pattern and he made no acknowledgement that medieval makers prioritized this structural principle (Chapter 8). In his general introduction to his classification sections for all Insular patterns, Allen did define two types of symmetry that occurred in Insular patterns, rotation and mirror reflection, and correctly observed that 'the principles of symmetry…underlie all ornamental design produced by the repetition of the same figure over and over again' and that the symmetrical placement of repeating 'figures…upwards or downwards, right or left' resulted in different pattern varieties or visual effects.[310] However, Allen did not continue this discussion into his classifications sufficiently, especially for key pattern.[311] He did not analyse how pattern-makers' actually used these symmetry operations to multiply the pattern's spiral units, which resulted in the larger C- and S-spiral structures he did address. He also did not discuss the fact that multiples of the same *row* of key pattern spiral units, by 'doubling, trebling or quadrupling,' could possess different symmetrical relationships that resulted in wildly different visual results. He made a rare recognition of symmetry in his classification of a 'square' (orthogonal) key pattern formed of two rows that were a 'symmetrical opposite' (mirror reflected), but did not explore the same concept in diagonal patterns (Fig. 4.22).[312] This caused him to misunderstand the structural relationship of diagonal key patterns with mirror-reflected rows to diagonal patterns containing other kinds of symmetry. He not only misidentified the 'bar' structures (trunks and branches) in patterns with mirrored diagonal rows (Fig. 4.23), but also classed them separately as being the only key pattern supposedly constructed on a hexagonal rather than

[310] Ibid., 135-39, esp. 135-36.
[311] I am grateful to Dr. Michael Brennan, who also observed Allen's silence here, including in his interlace classification as well. Brennan, pers. comm., 13 May 2015.
[312] Allen and Anderson 1903, vol. 1, part 2, pp. 335, 342, nos. 906, 932, 935.

a square grid.[313] Allen's misunderstanding likely stemmed from the irreconcilability of the contrasting theories of key pattern that he presented in *ECMS* (all-over arrangements of 'bars' in different grids, versus the multiplication of single rows of key pattern).

Second, Allen's focus on the shapes and arrangements of 'bars' (the trunks and their branches) as a tool for classifying 'the number of possible key patterns' prevented him from asking a more fundamental question.[314] *Why* did Insular artists arrange their negative line elements in certain ways in the first place (resulting in Allen's 'bars'), and what knock-on effects did their choices have on the other structural elements within the pattern? Namely, because of their reductive approach to key pattern, Insular artists had to manipulate the negative line elements in order to create compositions, while still taking care to maintain the principle of the path's continuity and evenness. Allen's lack of engagement with this phenomenon caused numerous problems. First, in *ECMS*, he reversed his original understanding of positive and negative space from his 1885 article, where he correctly noted that manuscript illuminators created the 'groundwork' (i.e. negative lines) of key pattern by drawing lines in black ink. In *ECMS* he instead wrote that key pattern was made from 'black lines on a white ground,' now confusing the 'white' positive space as the negative background.[315] Second, though Allen did explain that different C- or S-spiral shapes could be created by adding or removing portions of the 'bars' (i.e. by manipulating negative line elements, in the addition or omission of branches from their trunks), thereby 'altering the direction of the twist' or the number of strands within a key pattern's interlocked spiral units (Fig. 4.12),[316] he only made this observation in order to classify pattern compositions into different groups. As already noted above, this caused him to artificially separate patterns with close structural relationships into different parts of his classification (Fig. 4.20). In addition, he could not explore how pattern-makers' purposeful alterations of negative line elements would impact both nearby areas of positive space *and* other negative lines in ways that the artist had to actively anticipate and manage. For example, if an artist expanded or otherwise altered one negative line, they would then have to remove or alter an adjacent negative line in order to maintain a continuous and even path. Failure to do so would cause the pattern to break down. Such careful adjustments are visible in the key pattern from the St Gall Gospels (Fig. 4.24a-b). Allen's recognition of this complex artistic process was limited, for though

313 Ibid., p. 342, nos. 932, 935.
314 Ibid., 313.
315 Ibid., 309.
316 Ibid., 313-14, 323.

he did note that artists sometimes widened intersections of negative lines into triangle shapes in order to '[equalise] the width of the lines of the white background throughout' (Fig. 4.25a-b), he argued simultaneously and incorrectly that 'the breadth of the black and white lines should be nearly equal'.[317]

Allen also did not realize that Insular artists ensured that *both* the negative line elements and positive space in key pattern were spiraliform. Because of this, he incorrectly included simple step patterns in his classification, even though their negative and positive space were not always both spiraliform (Fig. 2.21).[318] Allen also did not discuss the fact that in every individual key pattern composition, the artist would assign each set of negative line elements within it (here trunks, branches, and embellishments) a different length from the two other sets (without which they could not have maintained the integrity of the positive space or path) (Fig. 2.52). Finally, he did not mention that Insular makers rigorously prevented negative line elements from floating within their key pattern compositions (that is, negative line elements that did not intersect another negative line segment and/or the outer border) (Fig. 2.53), and never, ever allowed negative line elements to intersect more than one side of that border (Fig. 2.5).

Allen returned to Insular key pattern one more time a year later in *Celtic Art in Pagan and Christian Times* (1904), but this publication reiterated details from *ECMS*.[319] However, here Allen did separate 'cruciform' or 'swastika' shaped simple step patterns from key pattern, but only because of their resemblance to cloisonné patterns in metalwork. He did not analyze them for their spiral structure.[320]

Allen's structural study and classification of key pattern in *ECMS* was groundbreaking because he was the first to conduct sustained analysis of key pattern's internal physical structures and to distinguish between different key pattern compositions. Without his work, no subsequent key pattern study, including this thesis, would be possible in their current form. At the same time, his method was problematic and his recognition of key pattern's structural elements and principles was incomplete. As a result, some of the

[317] Ibid., pp. 310, 326-27, nos. 863a-64a.
[318] Ibid., pp. 331-32, 338-39, nos. 887-890, 916-17, 920-22.
[319] Allen 1904, 279-84.
[320] Ibid., 278-79.

theories he built upon this partial foundation were fundamentally flawed or underdeveloped. For better and for worse, his authoritative contribution influenced all key pattern studies thereafter, steering scholars to return to the same structural aspects of key pattern, mimic his methodology, and perpetuate many of the same misconceptions.

5. Chapter 5: The History of Studies of Key Pattern, Part II

5.1. Following Allen: Other 19th- and Early 20th-Century Archaeological Classifications

5.1.1. Johan Adolf Bruun: *An Enquiry into the Art of the Illuminated Manuscripts of the Middle Ages: Part I. Celtic Illuminated Manuscripts*, 1897

After Westwood and Allen, the next scholar to address Insular key pattern was Johan Adolf Bruun. Born in Sweden, Bruun studied at Edinburgh and Oxford in the 1890s, after which he returned to Sweden and eventually became a lecturer in the Swedish and German languages in 1901.[321] In 1897, Bruun discussed key pattern (referring to it as 'fret' throughout) very briefly in a larger publication about early medieval manuscript illumination, and for the most part, his summary follows Allen's ideas from 1885 very closely.[322] It is unknown whether he developed the same ideas independently or drew from Allen directly. Bruun's book was published in Edinburgh, and he and Allen were present in the city at the same time, so it is possible that he was familiar with Allen's early work. However, Bruun explicitly noted – which Allen did not – that lines in key pattern never 'overlap' or alternate, thus differentiating it from interlace.[323] As Allen did in 1885, Bruun noted that Insular manuscript illuminators created the pattern's 'groundwork' (i.e. negative line elements) by drawing them in black ink, but he also correctly explained that in doing so, illuminators were echoing relief-carved key pattern from sculpture.[324] This was an insightful, though underdeveloped, step toward recognition of Insular artists' reductive approach to key pattern. However, Bruun's study does not appear to have been influential, as no future scholars quoted him.

321 Geni: A MyHeritage Company, 2017.
322 Bruun 1897, 14-17. I am grateful to Dr. Donncha MacGabhann for alerting me to Bruun's publication.
323 Bruun 1897, 14.
324 Ibid. 16-17.

5.1.2. Henry Crawford: *Handbook of Carved Ornament*, 1926

In 1926 Henry Saxton Crawford, archaeologist and administrator for the Royal Society of Antiquaries of Ireland,[325] published an archaeological classification of patterns on early medieval Irish sculpture. Crawford added to Allen's knowledge with an identification of a previously unremarked structural element of key pattern, as well as the first-ever nod to medieval pattern-makers' choice and agency in their creation of key pattern. In this monograph, *Handbook of Carved Ornament from Irish Monuments of the Christian Period*, Crawford presented a collection of photographs of abstract patterns from early medieval Irish sculpture in order to address a lack of publications in this arena, to record and preserve their increasingly damaged decoration, and to allow the general public to more easily compare patterns from geographically disparate sites.[326] Because inconsistent lighting, weathered stone, and other difficulties made the details of some patterns hard to see, Crawford partnered each photograph with a 'restored' version, which he touched up after consulting casts, rubbings, or making informed guesswork (Fig. 5.1a-b).[327] Crawford organized these photographs into a classification of basic Insular pattern types (non-representational interlace, zoomorphic interlace, spirals, and so on), with a collection of photographic plates and corresponding descriptions accompanying each pattern type. He addressed key pattern across two chapters, one dedicated to 'fret patterns' and another to 'geometrical symbols' where he included key pattern varieties that resemble swastikas.[328]

Crawford's classification differed from Allen's in purpose and method. He intended solely to preserve a record of the patterns in photographs, and so within each chapter, he did not further classify the subject pattern into smaller sub-groups. He also conducted his analyses directly from the photographs rather than black-and-white, typographic diagrams, and his collection of patterns was far less comprehensive than Allen's, because he used only Irish material and left out sculptures he believed too weathered to discuss accurately.[329] Crawford also included brief descriptions of the patterns in each photograph, but did not intend a thorough overview of the patterns' structures because he felt that Allen had 'clearly set out' this information to his satisfaction.[330]

[325] Anon 1928, 77-78.
[326] Crawford 1926, 1-2.
[327] Ibid., 2-3.
[328] Ibid., 34-45.
[329] Ibid., 2-3.
[330] Ibid., 2.

Nevertheless, in his introduction to each pattern type and in his descriptions of photographed patterns, Crawford made some limited but valuable references to the pattern's structural aspects. Most of these closely followed Allen's work. While Crawford did not refer to positive or negative space, he identified the presence of a 'continuous line or band' (the path) as well as discontinuous lines (negative line elements), and he noted that all lines in key pattern were fundamentally straight and angled.[331] He followed Allen in distinguishing patterns with different orientations to the border (diagonal or orthogonal) and in recognizing that curvilinear spiral patterns and key pattern shared close structural affinities.[332] Like Allen, he also observed that C- and S-spiral shapes could be created by altering lines within a pattern (i.e. adding and removing branches from trunks).[333]

Crawford also made several unique and important contributions. Unlike many of the archaeologists and authors of artists' manuals who would succeed him, Crawford used the terms 'fret', 'step', and 'key pattern' correctly. He labeled his classification chapter 'fret patterns', using this properly as an umbrella term in order to include both step and key patterns within it. He was also the first since Westwood to attempt to distinguish the structural differences between key and step patterns, noting that key pattern contains lines 'bent several times in the same direction' (i.e. in a spiral), and while the lines of step patterns instead were bent 'alternately in opposite directions'.[334]

Crawford was also the first scholar to show awareness, albeit limited, that medieval makers' deliberate choices affected the structures within key pattern compositions and lay behind some of the more unusual patterns in his corpus. He observed that on sculptures, the 'design can be altered in many ways' and that carvers could choose to make the 'incised portions' continuous (i.e. by joining reductive negative line segments to create closed spirals (Chapter 2)), and the 'raised lines' (the path) discontinuous or 'detached' as a result, and vice versa (Fig. 5.2).[335] He also noted that a pattern on the Termonfechin Cross had been 'altered' to create spirals with three instead of four strands.[336] While Crawford did not identify positive and negative space specifically and so was unable to explain the creative approach by which the carvers created such effects, he clearly sensed

[331] Ibid., 34, 38.
[332] Ibid., 13, 34-36, 38.
[333] Ibid., pp. 38b, 39, fig. 7b.
[334] Ibid., 35.
[335] Ibid., pp. 38a, 39, fig. 7a.
[336] Ibid., p. 37 no. 73, plate xxix, no. 73.

their agency and deliberate manipulation of structural properties. In contrast to Allen, who lost connection with his Insular material because he used idealised monochrome diagrams, Crawford relied on photographs and therefore worked more directly with the original key patterns. Therefore, in these few examples, Crawford did not separate patterns from their makers or regularise their idiosyncrasies by transforming them into printed, Platonic types, nor did he limit his focus to a limited range of structural elements within key pattern. Instead he simply described what he saw in the original patterns through his photographs, and this more direct focus on the artworks permitted him to make such insights.

However, Crawford's method – the classification – still prevented him from gaining deeper, more consistent insights into key pattern's structural properties and the artistic process, nor was it his purpose to conduct such a study. By creating a photographic pattern compendium, Crawford, like Allen, divorced the key pattern from the rest of the sculptures by reproducing sections rather than complete images of the monuments, again erasing potential evidence for key pattern's relationship with other patterns within the overall artwork. His observations about artists' use of structural principles to manipulate structural elements were few and simply observational. For example, like Allen he noted that rows of key pattern could occur in multiples, but he was not interested in exploring their symmetrical relationships and only recognised one type of symmetry - mirror reflection - in two patterns.[337] Overshadowed by Allen's lengthier and more technical approach, and with his own insights scattered intermittently throughout paragraphs of text, Crawford's classification unfortunately does not seem to have made significant impact on later studies.

5.2. Late 20th- and Early 21st-Century Archaeological Classifications

5.2.1. Rosemary Cramp, *Grammar of Anglo-Saxon Ornament*, 1984 & 1991

Archaeologists did not return to key pattern again until the 1980s, in a series of small studies mainly included in publications of new, comprehensive corpora of Anglo-Saxon and Welsh early medieval sculpture. These corpora were similar in format to the second

[337] Ibid., pp. 35 no. 60, 36 no. 64, plates xxvii, no. 60, 64.

volume of *ECMS*, containing detailed discussions and photographs of individual sculptures, divided by geographical region,[338] but for various reasons their authors found Allen's pattern classifications in need of adjustment. In 1984 Rosemary Cramp wrote a general introduction to the British Academy *Corpus of Anglos-Saxon Stone Sculpture* and, with the help of her collaborators, established 'a common vocabulary and system of description' for the monuments' forms, functions, and patterns for use throughout the multi-authored volumes of this series.[339] In 1991 it was reprinted in facsimile as a separate volume, and given the new title *Grammar of Anglo-Saxon Ornament*.[340] With the aid of black-and-white printed diagrams similar to Allen's, she covered the monuments' forms, carving techniques, dating methods, epigraphy, and provided a classification of patterns.[341] She focused her pattern classification predominantly on interlace, by far the most dominant type of pattern on Anglo-Saxon sculpture.[342] Here she adopted a detailed theory of interlace classification that had been developed 10 years earlier by a Durham University MPhil student, Gwenda Adcock.[343] In contrast, Cramp's key pattern classification was extremely brief. Cramp placed key pattern within a larger group of other 'straight line patterns' that also included simple step patterns (which she correctly separated from key pattern) and chevrons (one of the many more miscellaneous rectilinear patterns found in Insular art).[344] Cramp concluded that in Anglo-Saxon art, 'more elaborate straight line, key or fret patterns are few' and so for these types, Allen's classification system was suitable, leaving her to add just three diagrams of key pattern ('Meander' 1-3), which in fact closely followed examples already illustrated in Allen's classification (Fig. 5.3).[345] Cramp intended her regularized black-and-white diagrams to represent basic types rather than actual patterns from real artworks. In addition, besides observing that key patterns were characterized by straight lines in a general sense, it was not her purpose to analyse the pattern's structure or medieval makers' working processes or creative approach, and so she neither detracted from nor added to previous studies in this regard.

[338] Allen and Anderson 1903, vol. 2; Cramp, et al. 1984a-2015, vols. 1-11; Edwards 1987, 111-17; Redknap, Lewis, and Edwards 2007-2013, vols. 1-3.
[339] Cramp 1984b, viii, viiin3.
[340] Cramp 1991.
[341] Cramp 1984b., xiv-xlix.
[342] Ibid., xxviii-xlv.
[343] Adcock 1974.
[344] Cramp 1984b, xlv-xlvi.
[345] Ibid., p. xlvi, fig. 27; Allen and Anderson 1903, vol. 1, part 2, p. 334, nos. 899-900.

5.2.2. Nancy Edwards, 'Abstract Ornament on Early Medieval Irish Crosses: A Preliminary Catalogue', 1987

Three years later Nancy Edwards published the next significant archaeological classification of Insular key pattern after Allen. Edwards intended her pattern classification to accompany an Irish corpus echoing the British Academy *Corpus of Anglos-Saxon Stone Sculpture*, however to date no comprehensive Irish sculpture corpus has been published.[346] In her classification, she referred to key pattern as 'fret' and examined it alongside interlace, curvilinear spiral patterns, and 'step' patterns (complex step patterns).[347] Edwards' discussions of pattern structure therefore paralleled those in Cramp's *Grammar of Ornament*, but Edwards analysed key pattern in more detail because of its greater use on Irish crosses, focusing on specific structural elements rather than classifying whole pattern compositions as Cramp did.

Edwards' overall study developed out of an earlier article she wrote on the high crosses of the medieval Irish kingdom of Ossory, and from her PhD thesis at Durham University under the supervision of Rosemary Cramp, on the high crosses and sculpture of Offaly, Kilkenny and Tipperary.[348] In addition, in her classification of key pattern Edwards also specifically acknowledged the input of John M. Lewis, who at that time was developing a new Wales-specific key pattern classification for a new edition of V.E. Nash-Williams' *Early Christian Monuments of Wales* (*ECMW*), in collaboration with Gwyn Thomas.[349]

Edwards developed her classification for Irish patterns because she found Allen's system impractical, both for recording patterns in the field and in analysis, as it required inclusion and consultation of hundreds of pattern diagrams.[350] She also noted that Crawford's study of ornament on Irish high crosses, while valuable, was brief.[351] In order to replace Allen's system, and citing a gap in scholarly attention to early medieval Irish sculptures which were endangered by increasing environmental degradation, Edwards sought to develop a new, 'reasonably simple vocabulary' for quickly recording and describing patterns, one

346 Edwards 1987, 114, 116.
347 Ibid., 111-17.
348 Edwards 1987, 111; 1983; 1982.
349 Edwards 1987, 114, 116.
350 Edwards 1987 111, 114.
351 Ibid.

that was not over-complicated to print and which could quickly 'give the reader an adequate idea of the pattern'.[352]

Nevertheless, Edwards also acknowledged Allen's inescapable influence.[353] To form the basis of her classification system, she identified structures similar to Allen's 'bars' (that is, the trunks and the branches intersected with them), referring to them as 'fret elements'.[354] (Her use of the term 'elements' differs from that in this thesis, because in the latter, it refers not to just a select group of negative line segments but to every physical structure within key pattern). She also adopted Allen's theory that groups of key pattern that looked visually different were constructed on different types of grids (that is, on square grids in 'horizontal/vertical' form or rotated diagonally, or grids made from a 'combination of the two').[355] Edwards identified different fret elements in an illustrated chart, labelling element groups in a shorthand system from A to E, depending on their orientation to the outer border of the pattern and the angles of their lines (i.e. the degree of the angles between trunks and branches).[356] She further assigned ascending numbers to each group (e.g. A1 through A7) to indicate 'abbreviated forms of these elements' (or trunks with branches increasingly omitted) (Fig. 5.4a).[357] Edwards also discussed and separately illustrated key pattern 'terminals' (embellishments) but stopped short of fully classifying these.[358] Her illustrations of 'terminals' show that she recognized Insular pattern-makers' practice of widening or creating shapes such as triangles from this particular set of negative line elements (Fig. 5.4b).

Edwards also re-emphasised some of Allen's insights. For example, in her 'fret elements', she identified the same sets of line structures as Allen's 'bars' (i.e. trunks with attached branches). She too correctly noted that branches could be added, omitted, or rearranged. Like Allen she noted the physical equivalency between patterns arranged in 'square' (orthogonal) versus diagonal orientation to the border.[359] To explain this equivalency, Edwards adopted Allen's theory of grids, as well as his observations about the differing degree angles of 'bars' (between trunks and their branches) in orthogonal versus diagonal

[352] Ibid., 111, 115-16.
[353] Ibid., 111.
[354] Ibid., 114.
[355] Ibid., 114.
[356] Ibid., p. 114, fig. 3.
[357] Ibid., p. 114, fig. 3.
[358] Ibid., pp. 114-15, fig. 4h.
[359] Ibid., 114.

patterns.[360] For example, she stated that chart group B occurred on both 'horizontal/vertical' (orthogonal) or diagonal grids, and that groups C, D, and E were all diagonal equivalents of B, but that their 'fret elements' and 'terminals' (trunks and branches in relationship to embellishments) intersected at acute instead of right angles (Fig. 5.4a).[361] In her earlier 1983 article on the crosses of Ossory, Edwards also made an important insight independent from Allen. On the Ahenny north cross, she observed that the sculptor had carved 'fret elements' in such a way that they were 'outlined' with stone raised in relief.[362] While she did not refer to negative or positive space, nor discussed Insular artists' reductive approach to key pattern, she correctly identified how stone carvers created trunks and branches in relationship to the positive path.

Because Edwards strove to create a simpler classification system as a more convenient tool for field work and reference, she did not discuss or illustrate other key pattern structures besides the 'fret elements' and 'terminals' – such as the pattern's rectilinear spiral units or the path. Besides her important insight that branches could be added or omitted to trunks, and embellishments could be expanded into shapes, she did not note other structural principles that Insular makers used to manipulate the pattern, such as symmetry, the principle that required the path to remain at an even width in spite of negative line element manipulation, as well as artists' strict avoidance both of floating negative lines and negative lines that intersect more than one side of the border.

Though it was not Edwards' purpose to explore these other aspects of key pattern, her focus on 'fret elements' unfortunately did result in some misunderstandings of key pattern structure. Like Allen, she studied the key pattern types in isolation from other patterns that occurred on the same monument. Because she did not analyse symmetry, Edwards repeated Allen's mistaken conclusion that the border dividing two mirror-reflected rows of diagonal key pattern was part of a 'bar' or 'fret element'. As a result, Group D on her chart does not actually illustrate trunks and branches, but instead a non-essential border between two mirror-reflected rows of key pattern, and the trunks that intersect with it (c.f. Figs. 4.23, 5.4a). Finally, because Edwards also adapted Allen's grid theory to organise her classification system, instead of examining key pattern's spiral structure or medieval makers' manipulation of the relationship between negative lines and the positive path, she

360 Ibid.
361 Ibid.
362 Edwards 1983, pp. 18-19, fig. 6a.

did not clarify that two 'fret elements' (A1 and B4), which she stated were constructed on two different types of grids, in fact are identical (A1 just has embellishments added to the branches, and is rotated at 90 degrees from A1).[363] While Edwards' classification serves her intended purpose as a means of quickly recording a swift, visual impression of key pattern compositions encountered in the field, it does not facilitate deeper analysis of their structure and how artists manipulated it.

5.2.3. *A Corpus of Early Medieval Inscribed Stones and Stone Sculpture in Wales*, 2007-13

Lewis and Thomas' project to create a revised edition of Nash-Williams' *ECMW* was in preparation for many years,[364] and came to fruition in 2007, when Lewis and Mark Redknap published the first volume of the *Corpus of Early Medieval Inscribed Stones and Stone Sculpture in Wales* in its stead. The second and third volumes followed, again in 2007 and then in 2013, both by Nancy Edwards. The Welsh corpus is modelled after the *Corpus of Anglo-Saxon Stone Sculpture*, divided by geographical region and then into smaller entries that record individual stones, accompanied by detailed discussion and photographs of each monument.[365] All three volumes introduce a shared classification of Insular patterns in their front matter, covering interlace, spirals, vegetal patterns, and figural imagery, in addition to key pattern.[366] John Lewis had developed this particular key pattern classification during his earlier work on the new edition of Nash-Williams, and his influence on Edwards' 1987 classification of Irish patterns is apparent in their shared terminology, focus on the same key pattern structures, and similar method for organising them.[367] Allen is also cited as an influence, though the corpus authors note that they also found Allen's system inconvenient and that they desired an easier 'means of identifying and comparing designs'.[368] Lewis' key pattern classification is shared consistently across all three volumes and therefore these volumes will be discussed together here as a unit, though the different corpus authors sometimes included additional, smaller insights unique to their volume.

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[363] Edwards 1987, pp. 114-15, fig. 3a, 4a.
[364] Edwards 2013, xvii-xviii.
[365] Redknap and Lewis 2007, vol. 1; Edwards 2007, vol. 2; Edwards 2013, vol. 3.
[366] Redknap and Lewis 2007, vol. 1, pp. 94-109; Edwards 2007, vol. 2, pp. 72-83; Edwards 2013, vol. 3, pp. 90-100.
[367] Edwards 2007, vol. 2, p. 77; Edwards 2013, vol. 3, p. 93. Edwards' 1987 pattern classification is not listed in the bibiliographies of any of the Wales corpus volumes, however.
[368] Redknap and Lewis 2007, vol. 1, p. 99; Edwards 2007, vol. 2, p. 77.

The Wales corpus authors used the term 'fret' to refer to key pattern and described it as 'rectilinear' and 'a system of straight-line pattern.'[369] Like Edwards, Lewis based the classification on key pattern's 'straight line elements', i.e. the pattern's trunks and the branches attached to them. Treating the trunks and branches as single unified structures, he classified them by shape into charts, labelled with Latin letters to indicate basic groups.[370] His influence on Edwards' 1987 charts of 'fret elements' is clear here. However, in contrast to Edwards' Irish classification, his charts included sub-numbers that indicated increasingly complex 'elaborations' within each group, rather than successive abbreviations (or omissions of branches) (Fig. 5.5).[371] Lewis treated these 'elaborations' as integral parts of each 'element.'[372] However, they are in fact the embellishments, another set of negative lines distinct from the trunks and branches.

Lewis followed Allen's classificatory division of patterns in orthogonal versus diagonal orientation, by splitting his charts into three main groups: 'rectangular frets' (G1-M1, covering orthogonally oriented patterns), 'diagonal and triangular frets' (N1-S1, covering diagonally oriented patterns), and 'diaper patterns' (T1-Y1, using Allen's term for square fields containing diagonal patterns) (Fig. 5.5).[373] In the second corpus volume, Edwards explained these differences in orientation by adopting Allen's theory that they were based on different underlying grids, as she did in her 1987 article.[374] In the first volume, Lewis and Redknap echoed Allen by noting correctly that single 'bands' – or rows – of key pattern could be stacked atop the other to create larger composition.[375] Here Lewis and Redknap also made an important and hitherto unmentioned observation that within such rows of diagonal key pattern, the 'straight line elements' were arranged 'to produce an effect of alternating triangles'.[376] This is the first-ever clear observation of the repeating nature of key pattern's most fundamental, spiraliform units. Allen had previously recognized such triangular shapes in diagonal key pattern, but only viewed them as cells or spaces in the underlying grid.[377]

[369] Redknap and Lewis 2007, vol. 1, pp. 94, 99.
[370] Ibid., pp. 99-100, fig. 71-73; Edwards 2007, vol. 2, pp. 73, 77-78, fig. 7.14; Edwards 2013, vol. 3, pp. 93-95, fig. 7.9.
[371] Redknap and Lewis 2007, vol. 1, p. 99, fig. 71-73.
[372] Edwards 2007, vol. 2, p. 73.
[373] Redknap and Lewis 2007, vol. 1, pp. 99-100, fig. 71-73.
[374] Edwards 2007, vol. 2, p. 77.
[375] Redknap and Lewis 2007, vol. 1, pp. 101-102, fig. 75.
[376] Redknap and Lewis 2007, vol. 1, p. 101, fig. 75.
[377] Allen and Anderson 1903, vol. 1, part 2, pp. 325-26, no. 860-61.

As an archaeological classification, the Wales corpus key pattern study possesses the problems that accompany this methodology. The charts and templates included in the study necessarily divorced the key patterns from their surrounding context (Fig. 5.5). Like Allen, the Wales study incorrectly viewed construction aids (grids) as being equally fundamental as structural properties, and so used grid theory to divide the patterns into groups. Finally, because of his focus on 'straight line elements', Lewis did not discuss the creative approach to positive and negative space, and had to exclude other important structural elements from the classification system, as well as the principles that Insular artists used to manipulate them: symmetry, the path, spiral units, and the reductive interrelationships between negative lines and positive space. These issues again led to some misunderstandings of key pattern structure. For example, though Lewis and Redknap rightly recognized that a single row of key pattern could be doubled to make a larger composition, they classified a diagonally oriented 'straight line element' (type N) and type P as two distinct patterns, when P is in fact the product of stacking N, with each row of N being two-fold rotationally symmetric to the other (i.e. at 180 degrees) (Fig. 5.5).[378] Finally, none of the corpus authors explored Insular pattern-makers' strict avoidance of floating negative lines or negative lines that intersected more than one side of a composition's border. This omission may have led the Welsh corpus authors to classify simple step pattern and key pattern as belonging to the same group.[379] The classification chart does help provide a quick visual shorthand for describing individual key pattern compositions, as intended, but one that is impressionistic and therefore unfortunately liable to misinterpretation.

5.2.4. The *Corpus of Anglo-Saxon Stone Sculpture*, Volume 11: *Early Cornish Sculpture*, 2013

In 2013, Ann Preston-Jones and Elisabeth Okasha published the latest archaeological classification of key pattern to date, in the 11th volume of the *Corpus of Anglo-Saxon Stone Sculpture*. In their introductory chapters and analyses, Preston-Jones and Okasha included a classification and discussion of abstract patterns, as typical for volumes from both the Anglo-Saxon and Welsh corpora.[380] Here, however, they departed from the system that

[378] Redknap and Lewis 2007, vol. 1, pp. 100, fig. 72.
[379] Edwards 2007, vol. 2, pp. 78-79, fig. 7.14-7.15.
[380] Preston-Jones and Okasha 2013, vol. 11, pp. 70-81.

Cramp set out for Anglo-Saxon key pattern in her introductory volume, *The Grammar of Anglo-Saxon Ornament*, and instead adopted Lewis' classification because of the strong similarities between Cornish and Welsh sculpture.[381] Preston-Jones and Okasha follow Lewis' classification system so closely that no additional discussion of their work is needed here.

5.3. Artists' Manuals

Another vein of interest in Insular patterns has run in tandem with the academic, archaeological studies discussed above. Beginning with John G. Merne's *A Handbook of Celtic Ornament* in 1931, art instructors have published guidebooks with step-by-step instructions for drawing Insular patterns, for the benefit of students, designers, and hobbyists. Carrying forward a worldview born in the 19th century, these manuals often are imbued with a nationalist or Celtic Revivalist sensibility that had since faded from later archaeological classifications. In some cases, this amounts to no more than the perpetuation of popular stereotypes about the Celts' free spirit or mysticism, as exemplified in Aidan Meehan's description of key pattern as a descendant of ancient maze symbols 'rich in myth and history, full of meaning and magic'.[382] While artists' manuals typically do not contain detailed classifications beyond practical divisions of basic Insular pattern types (interlace, spirals, key pattern, et cetera), Allen's legacy is still very strong. These manuals emphasise the same key pattern structures and theories about construction aids and methods that Allen focused on in *ECMS*, and therefore their contributions are limited in similar ways. However, because the authors of artists' manuals are more concerned with the practicalities of creating art – albeit in a modern rather than medieval context – they sometimes offer more insight into the medieval approach to key pattern than archaeologists have done.

381 Ibid., p. 72.
382 A. Meehan 1993b, 8.

5.3.1. John G. Merne, *A Handbook of Celtic Ornament*, 1931

In 1931, an artist named John G. Merne published the earliest artists' manual for Insular patterns. His book was not a pattern compendia or classification, but a step-by-step, illustrated guide to drawing interlace, spirals and key pattern. Merne explained that he intended to provide a basic set of steps and ideas, or 'first principles' that students, art teachers, designers, architects, and the general public could use to create patterns on their own.[383] By 'first principles', Merne was not referring either to the deep physical structures in individual patterns or the concepts that makers use to manipulate them, unique to specific places and time periods. Rather, he believed that all forms of 'Celtic Decoration', whether interlace, spirals, or key pattern, originated from a handful of ancient, pan-human 'Symbols or Ideographs' that evolved into the Early Middle Ages in increasingly complex form.[384] First, he illustrated and described these basic, 'primitive' ideographs, including such motifs as swastikas, triskeles, spirals, and stars.[385] He claimed that these motifs originally had nature symbolism and he labeled them with names such as the 'sun sign', 'wheel symbol', or 'whirlwind' (Fig. 5.6).[386] He focused the majority of his manual on Insular interlace and developed a theory that it evolved first from an initial superimposition of two wave scrolls (horizontal lines of S-spirals) (Fig. 5.7).[387] In another plate, he identified the swastika as the common ancestor both of 'step pattern' (complex step pattern), the 'Tau cross' (simple step pattern), as well as some varieties of key pattern because of their similar angled, intersecting lines and general square outline.[388]

Merne's manual for the prehistoric, pan-cultural origins and long-term development of Insular patterns is imaginative, imbued with a lingering 19th-century interest in typology and the evolution of species, and almost Rieglian in its logic. However, it is also severely flawed. As a result, he misunderstood Insular key pattern and was unable to correctly draw it in his diagrams. Referring to diagonally-oriented, Insular key pattern as 'Celtic fret,' he first stated that it originated from 'Primitive Line Ornament' (prehistoric) from urns and burials, including chevrons and cross-hatching, presumably because the visual similarity of

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383 Merne 1931, 3, 6-7.
384 Ibid., 7.
385 Ibid., pp. 10-11, plate 1.
386 Ibid.
387 Ibid., pp. 20-21, plate 6.
388 Ibid., pp. 54-55, plate 23, no. 1, 2, 7.

their angled lines and triangular shapes with those in Insular diagonal key pattern (Fig. 5.8a).[389] Not only is it academically unsound to project Insular patterns backward through millennia to the art of previous epochs wholly unconnected to them, simply because of chance visual similarities between their lines and shapes, but also Merne did not consider the fact that in different regions of the world and time periods, artists could have developed similar patterns by coincidence. He then correctly identified and rendered the individual spiral units in these key patterns (Fig. 5.8b), but once he joined the spirals together to create rows of Insular key pattern, he utterly misunderstood the pattern's physical structure.[390] His patterns lack crucial negative line elements (trunks) and contain other negative lines that are angled or continuous in an unusual manner not found in any known key pattern, Insular or otherwise (Fig. 5.8c). In addition, Merne's evolutionary, symbolic paradigm led him to argue that the common triangular widenings in the negative line elements of Insular key pattern (the embellishments) had religious significance and originated with motifs from ancient art that he called 'Sacred Triangles', an argument that is wholly without basis.[391] Though Merne's manual for Insular key pattern was the first of its kind, his effort was unsuccessful because his own theory caused him to search Insular key pattern for older, prehistoric pattern structures where there were none. Therefore, he was unable to identify and correctly reproduce Insular key patterns' actual physical structures and understand their purposes.

5.3.2. George Bain, *Celtic Art: The Methods of Construction,* 1951

The first-ever artist's manual to correctly render Insular key pattern was published by George Bain in 1951. Born in Caithness, Scotland, Bain later trained in Edinburgh as an artist and became Principle Art Teacher at Kirkcaldy High School in Fife.[392] His manual, *Celtic Art: The Methods of Construction*, was the culmination of his career as an art instructor.[393] He intended it as a textbook for art classes in elementary and secondary schools, as well as a resource for craftspeople and designers.[394] Bain described his methods as mathematical and geometric, and this is true insofar as they require the arrangement of lines and geometric shapes through careful measurements and the use of

389 Ibid., pp. 68-69, plate 30.
390 Ibid., pp. 70-73, plates 31-32.
391 Ibid., pp. 11, 70, plates 1, 31.
392 S.E. Seright 2007, 4-6.
393 G. Bain 1951, 15.
394 Ibid., 15, 18, 21.

compasses, straight edges, and other tools.[395] Bain's book made its greatest impact in its 1973 reprint, which inspired a 'renaissance of interest' in the early medieval art of Ireland and Britain,[396] kick-starting the 'cottage industry' for artists' manuals that would flourish in the later 20th century. Influenced by the Celtic Revival movement himself,[397] Bain's purpose was in part ideological. He likely wanted to promote the modern use of Celtic patterns to stimulate industry in the Highlands,[398] but he also hoped that by spreading awareness about the complexity of Celtic art, he could combat stereotypical views of the historical Celt which were still taught in education system – of 'the hairy savage, smeared in woad' indebted to the Classical world for both civilization and government – and instead elevate early medieval British art in the popular mind as equal to that of 'the very highest civilized nations of all times.'[399] Viewing the Romans as unjust aggressors, Bain protested against theories that Insular key pattern originated from classical key pattern, arguing instead that its roots lay in pan-European prehistoric sources.[400] He therefore disagreed with Allen, who noted parallels between Insular and ancient Mediterranean key pattern.[401] However, he still acknowledged Allen as 'the original pioneer of this form of research' on patterns and his debt to Allen's theories can be seen throughout his section on key pattern.[402]

George Bain did not classify patterns, except to group the broadest categories into separate chapters (interlace, spirals, key pattern, et cetera). Within his key pattern chapter, he placed sample patterns together in a number of plates for instructional purposes, in some cases to illustrate his preferred construction methods and aids, while in others to showcase variations inspired from a single pattern composition, or patterns from a specific historic region of northern Britain (mainly Pictland) or from a single medium.[403] In his first plate, Bain set out the 'stages' of his construction method for key pattern, or the order he thought that students should draw the pattern's individual lines (i.e. the negative line elements, from trunks to branches to embellishments) (Fig. 5.9).[404] Bain placed the patterns on a tight, diagonal grid unlike those seen in any archaeological classification study, and

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395 Ibid., 18.
396 Groam House Museum [accessed 11 December 2016]; Dr. Katherine Forsyth, pers. comm., 17 November 2017; S.E. Seright 2007, 3.
397 Groam House Museum 2013a, 20.
398 Dr. Katherine Forsyth, pers. comm., 17 November 2017.
399 G. Bain 1951, 18-19.
400 Ibid., 19, 71-73.
401 Ibid., 71; Allen and Anderson 1903, vol. 1, part 2, pp. 308-309.
402 G. Bain 1951, 22.
403 Ibid., pp. 75-81, plates 1-14.
404 Ibid., p. 75, plate 1.

demonstrated how to measure different components of the pattern and the size of the overall field by counting grid spaces (Fig. 5.10).[405] His debt to Allen shows in his emphasis on certain key pattern structures. He identified intersected negative line elements (trunks and some branches) that were similar to Allen's 'bars', by bolding them in dark ink in his diagrams and presenting a method for counting their measurements by grid spaces: 'Order 1.8.1' (Fig. 5.10).[406] Like Allen he recognized key pattern's similarity to curvilinear spiral patterns.[407] Also following Allen, he noted that 'multiples' of 'bands' (single rows) could be 'joined together to make all-over patterns'.[408]

Bain made other valuable observations which are not found in archaeological scholarship. It is often difficult to know exactly how much he understood about key pattern structure and its role in the medieval artistic process, because he purposefully offered little written instruction with his diagrams, perhaps in part because the textbook was meant to be accompanied by a teacher's guidance in a classroom setting, but also because he believed it beneficial for students to be forced to observe the patterns closely on their own and develop self-sufficiency in drawing.[409] However, his awareness of certain structural phenomena can be inferred from his illustrative plates. Bain was the first to explicitly name the basic 'unit' that Insular makers repeated to create a key pattern composition, though he did not explain specifically that these units were repeated spirals of identical size. He simply stated instead that 'panels are made by variations of the unit' (Fig. 5.9).[410]

Unlike archaeological classifications, Bain's method also encouraged him (and by proxy his readers) to contemplate and explore the artistic process more directly. In her study of modern reproductions of Pictish stones, Beatley noted that in contrast to photography or printing, direct illustration as a method brings the modern artist closest to the medieval process because it '[allows] the human element to guide its production'.[411] Bain demonstrated the same with Insular key pattern. He rightly emphasized the necessity of observing medieval artworks firsthand in order to learn how to draw the patterns, and by his own example, he encouraged his readers to create experimental designs (Fig. 5.11).[412]

405 Ibid.
406 Ibid.
407 Ibid., 59.
408 Ibid., p. 75, plate 1.
409 Ibid., 21.
410 Ibid., p. 75, plate 1.
411 Beatley 2010, 34-36.
412 G. Bain 1951, pp. 16, 21, 81, plate 13.

Bain's experiments are not found in the medieval corpus, but this spirit for invention is faithful itself to the medieval approach and thus demonstrates his deep understanding of the pattern, because surviving medieval artworks suggest that Insular pattern-makers also valued the ability to push key pattern structurally beyond the existing corpus (as discussed in Chapter 8).[413] His personal 'maxim', 'Theory may inform but Practice convinces' is reflective of his understanding and approach to Insular pattern.[414]

Nevertheless, Bain's debt to Allen ultimately limited his contribution. Firstly, Bain further cemented the mistaken orthodoxy of grids. Unlike Allen, he did not use the concept to classify patterns, but instead claimed to transmit a '[method] of construction used by the ancient Celtic Artists'.[415] Furthermore, Bain's reliance on grids led him to regularise the lines and shapes of his key patterns, again in the *modern* preference for straightness or perfection, which prevented him from exploring original artworks for mistakes or evidence of more relaxed or freehand approaches. Bain's anachronistic sensibility is doubly apparent in his claim that mistakes or even deliberate introductions of irregularity to patterns were 'an impossibility to a designer conversant with the methods'.[416] This claim makes medieval craftspeople seem like automatons and denies the diversity and even irreverent inventiveness of actual medieval work.

Like Allen, Bain also isolated his key pattern diagrams from their original contexts, obscuring their potential structural relationships with the larger art compositions to which they belonged. Finally, he focused most of his instruction on the negative lines of the pattern, either for practical reasons (because in their reductive approach, medieval artists directly drew or carved these lines when creating key pattern), or because Allen emphasized them in order to create his classification system. As a result, like Allen, Bain did not analyse or provide instruction about other physical structures in key pattern or the principles that medieval makers used to arrange them. For example, Bain juxtaposed two diagrams containing the same pattern with rows arranged with different types of symmetry (mirror and rotational symmetry respectively), but it is unclear if he was aware of their relationship because he made no explicit mention of these mathematical operations (Fig.

[413] Dr. Michael Brennan also suggested that George Bain created Insular pattern compositions not known in the surviving medieval corpus. Dr. Michael Brennan, pers. comm., 13 May 2015.
[414] S.E. Seright, 2007, 3.
[415] G. Bain 1951,, 15.
[416] Ibid., 21.

5.12).[417] He also made no mention of the path and negative space, their interrelationship, the reductive creative approach, or of Insular artists' avoidance of floating negative lines and negative lines that intersected more than one side of the border.

Problems specific to his ideological agenda and the artists' manual genre itself also hindered Bain's study of key pattern. His rejection of links between Insular key pattern to earlier, classical key pattern, either historical or simply coincidental and structural, led him to ignore 'square' (orthogonal) key pattern entirely because he felt that it was a non-native, 'Greek fret type seldom used' in Britain or Ireland.[418] This is not true, as orthogonal key pattern was in fact common across Insular art, and as we shall see in Chapters 6 and 7, by no means a classical invention. By purposefully rejecting it, Bain was unable to explore its structural relationship with diagonal key pattern. Bain also claimed to have uncovered medieval makers' exact methods of construction, including the 'rules' for which 'stages' were drawn first (that is, the order in which different sets of negative line elements were drawn).[419] Bain's claim of medieval authenticity is problematic, for reasons already explored in Chapter 1. Bain's promotion of a single, 'medieval' method of construction therefore made his contribution as rule-based and rigid as archaeological classification systems, albeit in a different manner. His instructions certainly are useful for modern readers unfamiliar with Insular patterns, but by promoting a supposedly correct and authentic order for constructing negative lines elements within key pattern, he diverted attention away from evidence for medieval artists' experiences.

5.3.3. Aidan Meehan, 1991, 1993

Aidan Meehan was next to publish a number of artists' manuals for Insular patterns.[420] A professional artist who specialises in the Celtic Revival style, Meehan has stated that his purpose is to continue 'the early Irish tradition' in the present day.[421] He provides more written instructions in his manuals than did George Bain, as Bain intended his publication

[417] Ibid., p. 80, plate 12.
[418] Ibid., 71.
[419] Ibid., pp. 15, 21, 75, plate 1.
[420] A. Meehan 1993a; 1993b; 1999; 2003; 2007.
[421] A. Meehan [accessed 14 December 2016].

to function as a teaching aid in the art classroom, while Meehan intends his books to be used for self-study.

Meehan first discussed key pattern, along with other patterns, in his 1991 publication, *Celtic Design: A Beginner's Manual*.[422] Here Meehan's exploration of key pattern was brief and mostly occupied with a step-by-step method for drawing the pattern. Much of his accompanying commentary overlaps with Allen's introductory structural analysis of key pattern in *ECMS*. For example, Meehan identified various line structures (the negative line elements), referring to the trunks as 'diagonals' (these are Allen's 'isolated straight lines'), to the branches as 'arrowheads' (which together with the trunks Allen referred to as 'bars'), and finally to the embellishments as 'branches' or the 'arms of the spiral'.[423] Meehan also sometimes referred to embellishments as 'locks', perhaps taking inspiration from Allen's comparison of key pattern to skeleton keys.[424] Meehan was also aware of the presence of spirals within key pattern, though he neither consistently identified them, nor specifically named them as the basic units of the pattern.[425]

Meehan also made a new and important advance in the study of key pattern. He was the first Insular specialist to give the positive space a specific name – the 'path' – and he observed that it was created as a by-product between the 'lines' (negative line elements) of the pattern.[426] He did not discuss the creative approach or positive and negative space directly, nor did he analyse their relationship in key pattern, though in a separate chapter devoted to spiral patterns proper, he did explore the interplay between the path and the 'background' (negative space) and the need to adjust their various areas in order to keep these two types of space visually balanced.[427]

In 1993, Meehan followed the *Beginner's Manual* with *Maze Patterns*. He focused this publication predominantly on a summary of Bronze Age patterns such as chevrons, lozenges, and saltires, a discussion of the earliest known prehistoric key patterns from non-Insular parts of Europe, and his speculation about their original symbolic and religious

[422] A. Meehan 1991, 23-38.
[423] Ibid., pp. 25-27, 33, 36, figs. 2a-j, 3n, 6b.
[424] Ibid., 33.
[425] Ibid., 33, 36.
[426] Ibid., 24, 32.
[427] Ibid., 43-45.

meanings and functions.[428] He then followed this discussion with a collection of hand-drawn Insular key pattern diagrams, implicitly projecting his theories of prehistoric origin and pagan symbolism onto them.[429] His key pattern diagrams are arranged in no strict order, except that he drew his examples from Allen's 'repertory'.[430] Unlike the *Beginner's Manual*, he offered very little written instruction for the patterns.

In these diagrams, Meehan incorporated additional information from previous classifications and artists' manuals. He emphasized similar groups of negative line elements as Allen's 'bars' (trunks and branches) by bolding them in black ink, as Bain did (Fig. 5.13a-b).[431] He also included sample patterns of both the 'square' and diagonal orientations.[432] Without explicitly stating so, he correctly implied to his readers that larger diagonal patterns were built up as multiples of single rows, and likely inspired by Bain, he highlighted the pattern's basic spiral units by drawing them separately alongside a full pattern (Fig. 5.13a-b).[433]

In *Maze Patterns*, Meehan extended his observations about the path. While he was not the first author to note the presence of various continuous *and* discontinuous lines within key pattern, he was the first author to identify the path specifically as being continuous. Although he did this solely in discussion of a prehistoric maze incised on a rock face in Italy, and did not carry this insight into his chapters on Insular key pattern, he observed that the maze was carved in such a way that one line was continuous and could be 'traced with your finger' like a 'path' (Fig. 5.14).[434] He also observed that the maze carver could theoretically alter structures within the design in order to make the formerly continuous path discontinuous, by reversing it in the carving with the discontinuous 'line' that bounded it.[435] Though Meehan did not identify whether this 'path' was positive or negative space, the act of identifying its typically continuous nature, as well as artists' ability to switch between actively creating one of two types of space (positive and negative), was a major contribution.

[428] A. Meehan 1993b, 13-32, 33-52, 53-96; Allen 1904, 27-37.
[429] Ibid., 97-152.
[430] Ibid., 113.
[431] A. Meehan 1993b, pp. 7, 111, fig. 61.
[432] Ibid., pp. 114, 122, fig. 63, 70.
[433] C.f. ibid, p. 110-11, fig. 60-61; A. Meehan 1991, pp. 28-35, fig. 3-5.
[434] A. Meehan 1993b, p. 78, fig. 38.
[435] Ibid., p. 78, fig. 38.

Despite these gains, both of Meehan's key pattern manuals inherited problems from previous studies. First, in his *Beginner's Manual*, he instructed readers to construct the patterns on a grid of orthogonally arranged dots that he claimed as authentic to the early medieval period (Fig. 5.15).[436] He also advised readers to draw individual lines within the key pattern according to a 'stroke order', similar to Bain's 'stages'.[437] In *Maze Patterns*, he intermittently included grids, but also demonstrated awareness that they are non-fundamental aids and encouraged his readers to draw the patterns 'freehand' and 'as rough' as they liked, as 'long as their construction is sound.'[438] This latter approach is more faithful to that of medieval pattern-makers, however it contradicts his earlier, fraught assertion that his particular grids and 'stroke order' were medievally authentic, a claim that distracts the reader from deeper, more fundamental structural aspects of the pattern. Second, though Meehan drew his diagrams by hand and so did not regularise them as extremely as Allen or Bain did, he still misrepresented some patterns by neatening them, including the St Gall Gospel key pattern (Fig. 5.16a-b).[439] Third, like all authors before him, he separated the key patterns from their surrounding artworks. Fourth, he conducted no analysis of symmetry in the patterns, and though he was first to identify the 'path' and artists' ability to manipulate it in order to make it continuous or discontinuous, he did not explore the relationship between positive space and negative lines further.[440] Because his purpose was to teach his readers the minimum skills necessary to draw key pattern, he did not delve deeper into key pattern structure or medieval makers' working processes.

5.3.4. Iain Bain, *Celtic Key Pattern*, 1994

George Bain's son, Iain Bain, published the last significant artists' manual for Insular key pattern in 1994. An engineer like Allen, Iain Bain intended to improve upon his father's work by providing the general public with a manual containing clearer and fuller instructions than his father had originally provided, and to promote interest in the

[436] A. Meehan 1991, 6, 24-27, fig. 2.
[437] Ibid., 25-27.
[438] A. Meehan 1993b, 8, 97.
[439] Ibid., p. 124, fig. 72.
[440] A. Meehan did occasionally address internal symmetry in curvilinear spiral patterns and interlace, however, he never carried these observations into his publications on key pattern. See A. Meehan 1993a, pp. 63-64, fig. 28a-b; 1999, pp. 40, 79, fig. 71; 2003, 22-23, 35-37, 44, 140. In his publications on spiral patterns and interlace, Meehan also made rare references to artists' 'thought processes' or intentions, as revealed by the structure of a pattern in a given composition, however once again he did not include such discussions or observations in his key pattern publications. See A. Meehan 1993a, 9; 2003, 117.

patterns.[441] George Bain had passed away by this time.[442] Because he provided detailed written explanations with his key pattern diagrams, Iain Bain's manual is the most user-friendly of all the artists' manuals published to date. He also acknowledged his general debt to Allen and grouped patterns into chapters according to Allen's classification groups, concluding with an extract of Allen's classification of diagonal patterns at the end of his book.[443]

Iain Bain drew from both Allen's and his father's work. For example, like Allen he noted that Insular artists adjusted their key pattern to fit inside a 'panel space' and that key patterns are characterized by arrangements of straight lines and spirals.[444] In his diagrams he emphasized Allen's 'bars', or the trunks and branches (calling them 'diagonals' instead), and like Allen he demonstrated that the embellishments to these lines were variable depending on artistic preference.[445] He also demonstrated that single rows of key pattern could be multiplied.[446] Like his father, he encouraged readers to draw their key pattern on a grid (though Iain Bain preferred a rectangular rather than diagonal grid, unlike Allen and George Bain), and to use this grid in order to measure sections of the pattern.[447] He also instructed his readers on the order in which they should draw each negative line element of the pattern, like his father exhorting them to 'complete each stage before starting the next.'[448] Finally, as the creator of an artists' manual, he also was more alive to the artistic process than the authors of archaeological classifications, encouraging his readers to invent new patterns 'once the construction methods are understood.'[449]

Iain Bain was also the first-ever author – of both artists' manuals and archaeological classifications – to clearly recognise *both* positive and negative space, how Insular pattern-makers physically rendered them in two different media, and how a maker might alter one type of space by manipulating the other. He made these crucial insights briefly, in passing and as part of his instructions to modern readers, but with a clarity not seen in earlier

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[441] I. Bain 1994, viii, x. Iain Bain makes his motivation to clarify his father's work even clearer in an earlier publication on interlace, in which he notes that even modern craftspeople struggled with George Bain's teaching style in his published manual. See Iain Bain 1986, 8-9, 16-17.
[442] Groam House Museum [accessed 11 December 2016].
[443] I. Bain 1994, ix-x, 63-85.
[444] Ibid., ix, 1, 52.
[445] Ibid., pp. 1, 8-9, fig. 5a-c.
[446] Ibid., 1, 26.
[447] Ibid., p. 1, fig. 1-4.
[448] Ibid.
[449] Ibid., x.

studies of key pattern in any genre. He explained that in both interlace and key pattern, Insular artists created the background (negative lines) by carving it away from stone in relief or by painting it in onto the vellum in manuscripts, leaving the positive space, or what he referred to as the 'path', raised in relief or as untouched vellum.[450] He further noted that in key pattern, the paths are continuous.[451] It is unknown if he adopted the word 'path' from Meehan, as he does not acknowledge Meehan's publications, and so the two may have landed on the same idea independently. Iain Bain then correctly instructed readers to maintain the path at a constant width by thickening the lines (i.e. negative line elements) that they drew upon the paper as necessary.[452] Though almost buried in his commentary, Bain's instruction here is critical, for Insular makers treated the maintenance of a consistently even path as a top priority. He also observed just once, where Allen and other scholars did not, that if an artist adjusted one negative line element in a pattern composition, they had the opportunity to adjust neighbouring negative line elements by shortening or lengthening them or altering their shape (Fig. 5.17).[453] As we shall see in Chapter 8, this was one of Insular artisans' most important and frequently used strategies for manipulating key pattern, and one necessitated by their reductive approach.

He also made a small but perceptive observation of an individual Insular illuminator's use of symmetry in their working process. In his illustrations, Iain Bain mainly used idealised diagrams not associated with any particular artwork, but he also included a line-drawn facsimile of a key pattern field from folio 138b of the Lindisfarne Gospels, where he highlighted a few details in the pattern and tersely explained them as areas 'where the scribe had to overcome difficulties caused by the rotation of the branches' (Fig. 5.18).[454] Bain explained nothing more (nor did he use the term 'branch' anywhere else in his publication), and this brief aside is so unusual in comparison to the overall format of the manual that readers might easily overlook or fail to understand it. Bain is not quite right either, because in reality the illuminator casually inserted an S-spiral (using rotation) in a pattern predominantly composed of branches forming mirror-symmetric C-spirals, most likely as a careless or casual variation. This variation did not undermine the integrity of any of this key pattern's structural properties and in fact does not need to be there, so therefore it is unlikely that the illuminator included it because they found the pattern

[450] Ibid., ix.
[451] Ibid., ix, 2.
[452] Ibid., 3.
[453] Ibid., 2.
[454] Ibid, 38.

challenging. However, in its depth, Iain Bain's comment on symmetry still departs from all preceding studies of the pattern.

Unfortunately, Iain Bain's contributions are limited by the fact that he also included many of the same misconceptions about key pattern as previous publications. His pattern diagrams are decontextualized and extremely regularized. Like Meehan he rightly recommended that his readers abandon grids once they had sufficient mastery of the pattern, but he still advocated that they draw each 'stage' of the key pattern in a specific order.[455] Iain Bain fared better than other authors in recognizing the presence of symmetry in key pattern, as he was the first to note not simply mirror reflection, but also rotation: "Like all key pattern, hook patterns can be rotated or mirrored.'[456] However, he did not carry this awareness of rotational symmetry consistently through his manual and so did not identify other notable instances of it, for example in multiplied diagonal key pattern rows, which he simply described as 'widened' (Fig. 5.19).[457] While he made strides in recognising *both* positive and negative space, how Insular artists created them in manuscripts and sculpture, and how one type of space might impact the other, he did not extend his analysis far enough to recognise that Insular artists' uniquely and universally reductive approach to key pattern across all media underpinned the phenomena he described. Because his insights were intermittent, brief, and specific to his instructions for modern artists, his incomplete awareness of how Insular makers used symmetry and manipulated negative line elements led him to overlook structural relationships between key pattern compositions. As a result, he followed Allen by classing key pattern compositions with the same deep structure as unrelated, because they look so visually different.[458] Iain Bain also did not mention Insular artists' avoidance of free-floating negative line segments or negative lines that intersected more than one side of the border. Lastly, like his father, he did not include orthogonally-oriented key pattern in his manual.

Iain Bain expressed a series of extremely perceptive and correct insights into key pattern structure, but these are isolated in his manual because it was not his purpose to linger on medieval pattern-makers' approach, but rather to provide practical and easily digestible instructions to a modern audience unfamiliar with key pattern. Only two subsequent

[455] Ibid., 1. Also compare I. Bain 1994, p. 3, fig. 1-4 and G. Bain 1951, p. 75, plate 1.
[456] I. Bain 1994, 33.
[457] Ibid., 3.
[458] Ibid., 3, 41-47.

authors of key pattern studies may have adopted his awareness of symmetry or the creation of and interrelationship between positive and negative space, but their contributions were also brief and limited and they made no reference to him. So, while admirable, his manual did not elicit a sea-change in modern scholars' approach to study of Insular key pattern or the medieval artistic process.

5.3.5. Sheila Sturrock and Adam Tetlow, 2003, 2013

The two most-recently published artists' manuals for key pattern, Sheila Sturrock's *Celtic Spirals Handbook* (2003) and Adam Tetlow's *Celtic Pattern: Visual Rhythms of the Ancient Mind* (2013), are brief and so are discussed together here. Sturrock, a craftswoman, toymaker, paper engineer, and author of Insular art manuals, recognised the spiraliform structure of key pattern like other Insular specialists before her, and so included it in her larger manual for spiral patterns.[459] Also like many specialists before her, she isolated patterns from their artwork contexts, viewed grids as 'essential' for drawing key pattern, and presented her recommended order for drawing their lines (identical to Allen's 1885 theory, with individual spirals first and trunks later).[460] Sturrock then provided a series of diagrammatic instructions for drawing pattern compositions. In these diagrams, she did not recognize the individual spiral base unit of key pattern (viewing C- or S-spirals as the smallest units instead).[461] While creative and instructive, most of the key patterns in her diagrams ultimately are not found in the Insular tradition, indicating that unlike George Bain (who invented new key patterns that are structurally appropriate for an Insular context), Sturrock like Merne did not have a full understanding of the pattern's properties (Fig. 5.20). She also did not discuss symmetry, artistic approaches to manipulating structures, or other aspects of the medieval working process.

Finally, Tetlow's book is the most recent artists' manual published to date. It addresses Iron Age Celtic and Insular patterns, with a marked New Age bent in its interest in Celtic spirituality and the symbolism of motifs.[462] In his chapter on key pattern, Tetlow directly reiterated many of the original insights of Allen, George Bain, and Meehan, even going so

[459] Sturrock 2003, 1, 4, 88-112, 137.
[460] Ibid., pp. 10, 88-90, fig. 2.1, 7.1, 7.4.
[461] Ibid., pp. 93, 112, no. 72, 90.
[462] Tetlow 2013, 1-2.

far to copy George Bain's style of grids and the exact aesthetic of his diagrams.[463] However, like Iain Bain he was one of the few to address symmetry and the relationship between positive space and negative lines directly (though because he did not use citations, it is unknown whether he drew this directly from Iain Bain himself). Tetlow made the first-ever identification of the symmetry of the individual spiraliform base units in the diagonally oriented row of key pattern (vertical mirror reflection), and he also demonstrated awareness that other, different symmetric arrangements of the same base unit resulted in other key pattern compositions (he did not name the symmetry operations of the latter, however) (Fig. 5.21).[464] Like Crawford, he identified mirror symmetry in a pair of juxtaposed diagonal rows, and like Iain Bain, he mentioned the presence of rotational symmetry in compositions (though occasionally and not consistently).[465] Like Iain Bain, Tetlow also had a more developed, though sometimes incorrect, awareness of the relationship between the path and negative line element (which he referred to simply as 'lines' or 'bars') in key pattern. For example, he noted that if the negative lines of the pattern were made to curve, the path would be curved as well in response.[466] Furthermore, he attempted to explain why Insular pattern-makers expanded the embellishments of negative lines into such a variety of shapes and sizes, from triangles to different spiral forms. He argued that any increase in the size of the base units then required artists to change the embellishments by adding additional line segments or triangular shapes (Fig. 5.22).[467] While Tetlow was in fact incorrect (if an artist enlarged a base unit of key pattern, they could simply enlarge whatever embellishments they had originally planned along with it), but Tetlow's underlying assumption that artists deliberately expanded or contracted negative space in the pattern is correct. Nevertheless, his manual for key pattern was very brief and his images were abstracted from their original artwork contexts, and so he was unable to explore the creative approach or fully explain how medieval makers engaged with symmetry and the manipulation of negative space, and handled other design concerns.

[463] Ibid., pp. 22-31, esp. 22-24, 26-27.
[464] Ibid., 26-27.
[465] Ibid., 26-27, 55.
[466] Ibid., 28.
[467] Ibid., 27.

5.4. Mathematical Studies of Key Pattern

Archaeologists, art historians, and artists have not been the only groups interested in Insular patterns. Mathematicians also developed an interest in their geometric complexities. Mathematical studies generally gravitate to the interlace pattern, however.[468] Only one mathematical study of key pattern has been published thus far.

In 2000, Mark A.M. Lynch published a short article on Insular key pattern for the journal, *Teaching Mathematics and Its Applications*. He intended this article both as an exploratory mathematical exercise and a miniature artists' manual, for he encouraged students of mathematics to use his findings to create their own patterns.[469] Lynch's article also overlapped with previous studies of key pattern because he classified key pattern compositions, in this case according to their mathematical properties, and he provided instructions for their construction.[470]

Lynch only addressed key pattern compositions found in square fields, and also included complex step patterns in his analysis, referring to both of these distinct patterns as 'step pattern' (Fig. 5.23).[471] It is unclear why he chose to refer to key pattern as 'step pattern'. However, he also cited Meehan's 1991 *Beginner's Manual* as a source.[472] Meehan's work greatly affected his analysis. As noted in Chapter 2, Meehan correctly described that Insular artists built square fields of complex step pattern by combining four smaller units together in different ways (Figs. 2.15, 2.16).[473] Lynch, however, mistakenly applied Meehan's observation, specific to complex step pattern, to key pattern as well. He first divided each 'tile' or square field of key pattern into four 'units' or smaller squares, or 'generating units' (Fig. 5.24).[474] He then identified the various symmetries and their combinations which he believed were used to multiply one of these single, smaller squares in order to construct or 'generate' the entire pattern. Lynch described three 'generating procedure[s]' for multiplying this starting unit that included either rotation, reflection, or

[468] For a summary of mathematical studies of interlace, see Brennan 2011, vol. 1, pp. 21-29.
[469] Lynch 2000, 13-14.
[470] Ibid., 13.
[471] Ibid., p. 13, fig. 1.
[472] Ibid., 13.
[473] A. Meehan 1991, 8-11.
[474] Lynch 2000, pp. 13-14, fig. 3.

translation (Fig. 5.25).[475] He then classified the 'tiles', or finished patterns, according to their resultant *symmetry group*, or the symmetries the tiles possessed as a result of both the symmetry within the generating unit and its generating procedure.[476]

Lynch's article stands alone as the only dedicated examination of symmetry in key pattern. However, Lynch imposed both modern mathematical theory, and Meehan's specific analysis of an unrelated pattern, without concomitant knowledge of key pattern's basic physical structures. As a result, Lynch did not consider that the actual basic unit of key pattern was not a single quadrant of the composition, as it is in complex step pattern, but the individual spiral. Therefore, when bisecting one 'tile' composition into quadrants, he inadvertently sliced two spiral units in half (Fig. 5.26).[477] His bisection of these base units resulted in a 'unit' made of partial structures and floating negative lines that would not be difficult to 'generate' into a full pattern for a graphic artist with access to a light box or a computer, but which would be unnecessarily difficult for a medieval pattern-maker to multiply accurately by hand. He also mistook a fully developed key pattern, with four spiral base units of its own, as a quadrant or generating unit of a larger tile (Fig. 5.26).[478] Medieval pattern-makers did manipulate spiral base units by using symmetry, but Lynch applied modern mathematical theories that are unrealistic to the historical setting and do not match the way that medieval makers conceived of and approached the patterns.

5.5. Derek Hull and Michael Brennan: A New Artist-Centered Paradigm

Two other recent studies have heralded a paradigm shift in Insular archaeology and art history. They are neither classifications nor artists' manuals, and though the authors explore mathematical theory, they do not belong in the field of mathematics. Instead, these two studies take an artwork- rather than diagram-centred approach to pattern structure and focus directly on the medieval working process. Key pattern is not their main subject, but their approach provided significant inspiration for this thesis.

[475] Ibid., 13, 16.
[476] Ibid., 14.
[477] Ibid.
[478] Ibid., pp. 13-14, fig. 1, 3.

5.5.1. Derek Hull, *Celtic and Anglo-Saxon Art, Geometric Aspects*, 2003

Derek Hull, an engineer and Insular art enthusiast, set about to identify the 'first principles' or 'geometric factors' that governed Insular art, in order to achieve two main goals: to understand medieval artists' working methods and thus their creative processes and intentions for their artworks, and upon gaining this understanding, to more faithfully reproduce the art without either altering or simply copying the original.[479] He examined individual artworks containing a variety of Insular patterns, including key pattern, though his focus was weighted toward interlace. He never defined what he meant exactly by 'geometric factors' or 'first principles', but he used interlace as an example to clarify this somewhat nebulous concept. To Hull, these 'geometric factors' or 'rules' included both pattern structure, such as the alternation of 'cords' (the positive path) in interlace, as well as methods for the pattern's construction.[480] He argued that the grid as the universal construction method for Insular patterns and spent a significant part of his book presenting and explaining his theory of the types of grids that underlay individual patterns and whole works of art.[481]

Hull carried forward a number of earlier scholarly insights about key pattern, but he also explored what its 'first principles' or 'geometric factors' can reveal about medieval makers' approach to the pattern. He identified the spiral as 'the basic unit for the pattern' and that key pattern could have orthogonal or diagonal orientation to the border.[482] He also recognized rotational, reflective, and translational symmetry in key pattern, between the individual spiraliform base units that formed rows of key pattern and in larger fields.[483]

But Hull did more than simply observe the presence of symmetry in key pattern; he understood that artists used it deliberately as 'a powerful tool in design'.[484] Hull was also first to analyse patterns as part of larger artistic compositions, rather than as isolated diagrams, and in doing so he was able to uncover evidence of medieval artists' goals for their designs. For example, Hull discovered that the Book of Durrow illuminator had

479 Hull 2003, 30, 33, 239.
480 Ibid., 31-32.
481 Ibid., 31-32, 37-91.
482 Ibid., 71, 102-104, 200.
483 Ibid., 94-96, 102-103.
484 Ibid., 99.

designed folio 1v entirely on the principle of rotational symmetry, from the larger shapes of the composition to the individual patterns (Fig. 5.27).[485] Hull also made an effort to break free from the rule-based, rigid approaches to pattern that affected previous classification studies and artists' manuals. He reminded the reader that although Insular makers appear to have laboured under certain 'principles' or 'rules', these rules merely provided 'an underlying framework', and that the 'degree of randomness in the designs' indicated that the artists also aimed to transcend their own guidelines in order to satisfy creative 'personal whims' and even to indulge in artistic 'mischief.'[486]

Hull's dedicated interest in medieval pattern-makers' working processes and artistic agency was new to Insular pattern studies, but ultimately the gains he was able to make for key pattern were limited. As other authors before him, his own method sometimes negatively impacted his conclusions. He incorrectly assumed that the construction aid of the grid as being equally essential as pattern structure, and he used a vector-based computer programme to recreate the patterns (Fig. 5.27).[487] As a result, his pattern reconstructions were very regularized and he was unable to shed his modern preference for straight lines and regular shapes in his analyses of key pattern. Hull warned readers that irregularities or 'errors' were not necessarily a sign of artistic incompetency, but he then denigrated the illumination of St Gall Gospel book as being 'relatively poor' and 'inferior' because some of the key patterns were 'irregular'.[488] In one case he attributed this supposed 'absence of real quality in the artistic work' to the illuminators' failure to fit the key pattern's grid into curvilinear fields.[489] In fact it will be argued later in Chapter 8 that the St Gall illuminator was a master of key pattern who deliberately altered these 'irregular' patterns in unusual ways not seen elsewhere in order to fulfill specific design purposes.

Hull's focus on grids and use of vector-based software also led him to incorrect conclusions about key pattern symmetry. Hull used the modern theory of crystallographic lattices to explain how medieval artists constructed key pattern, applying the concept that crystalline structures (and by extension two-dimensional art patterns) have an underlying

485 Ibid., p. 197, 199, fig. 6.25.
486 Ibid., 42, 203.
487 Ibid., 33.
488 Ibid., 86, 89, 203-204.
489 Ibid., 89.

grid made from a rectangular 'unit cell' that had been translated over and over again in one or two directions (Fig. 5.28).[490] Here, Hull's conflation of patterns' physical structure and a construction aid (the grid) caused him to misidentify the symmetry of common diagonal key pattern in Insular art. According to Hull, Insular artists created a lattice grid and then repeatedly translated the portion of the key pattern located within a single grid cell 'to produce a continuous array' throughout the composition.[491] Hull did not identify the individual spiral units of this key pattern, and instead included more than one spiral unit within his lattice cell. Thus, the borders of each cell bisected the pattern's negative lines (branches) in the same way that Lynch's quadrants bisected fundamental spiral units within square-shaped key pattern compositions (Fig. 5.29). As a result, Hull also did not consider that, in fact, this diagonal key pattern actually contained a series of rotationally symmetric rows of spiral base units. As a construction method, Hull's approach is appropriate for artists with access to a computer, with which they could easily fill a pattern field by instantly generating these arbitrary 'unit cells', but for a medieval craftsperson working by hand, Hull's method would have been difficult to execute because his crystallographic cells bisect spiral base units, and thus cut across individual negative line segments that in the Middle Ages would have been painted in single strokes of ink and carved into stone or some other three-dimensional medium.

Hull's use of modern technology also caused him to misunderstand the structural relationship of positive and negative space, and the realities of creating them without the aid of a computer. In a brief analysis of key pattern on a Pictish cross-slab at Rosemarkie, Hull stated that the artist first created the 'line' of the pattern – and by this he meant the positive path – and then 'broadened [it] to produce the desired effect' (Fig. 5.30).[492] However, in a medieval setting this approach would have been impossible. Given Insular artists' reductive approach to key pattern, once they had removed or depressed the negative line elements from a three-dimensional medium, or inked them onto a manuscript page, the width of the positive space could not be increased. Artists' sole option was to make it narrower, by widening the negative line elements by adding more ink, or by chiselling or hammering them, and so forth.

490 Ibid., pp. 94, 96-97, fig. 4.3.
491 Ibid., pp. 74-75, 83, 99-102, fig. 3.7-3.8.
492 Ibid., p. 79, fig. 3.14.

Hull's book represented a sea change in scholarly approaches to Insular pattern that had prevailed through the 19th and 20th centuries. Rather than entering this field of study by pursuing pattern as an abstract concept, he turned to individual artworks first and built his theories about patterns directly from the source. His conclusions about key pattern structure and artists' working processes were problematic because of his methods of reproduction and study, but his artwork-centred approach and interest medieval makers' thought processes was revolutionary and has been adopted and adapted to suit the study of key pattern in this thesis.

5.5.2. Michael Brennan, 'The Structure of Interlace in Insular Art'

In his 2011 doctoral thesis in History from Bangor University, Michael Brennan developed the artwork- and artist-centred approach to Insular pattern more deeply, though only for interlace and not key pattern. His study was pioneering because it departed from previous paradigms (including Hull's) in his identification of deep physical structures of interlace and the mathematical concepts that Insular makers applied to the pattern in order to manipulate it for artistic purposes, solve design problems, and even to experiment with and transcend artistic conventions. Though Brennan did not focus on key pattern, his groundbreaking contribution to Insular studies has directly inspired the approach to key pattern taken in this thesis. Brennan only addressed key pattern once, to argue that the Lindisfarne Gospel illuminator sequentially rotated a vellum template as a tracing tool or 'shortcut' to create spiral shapes within the four key pattern fields on folio 210v, as part of a larger program of symmetry in the interlace on that page.[493] Brennan's theory about the use of templates as well as the structural principle of symmetry within these fields of key pattern will be discussed in Chapter 8.

Brennan found previous studies of Insular interlace unsatisfactory for similar reasons as those discussed in this chapter for key pattern. Identifying the same major fields (archaeological classifications and artists' manuals) in previous interlace studies,[494] he found that, beginning with Allen, both types were too rigid in their methodological approaches and over-reliant on the theory of grids, and therefore inadequate.[495] Because of

[493] Brennan 2011, vol. 1, pp. 110-12.
[494] Ibid., 10.
[495] Ibid., 1-4, 11-14, 17, 27.

the focus of earlier scholars on 'regular, grid-based interlace', Brennan found that classification systems could not cope with the irregular, 'free-style', or open-stranded and often zoomorphic interlace patterns common in Insular art, which the artists created without the aid of grids.[496] In addition, he noted that previous scholars, including Hull, incorrectly assumed that alternation was an ironclad rule for all interlace and did not explore other aspects of the pattern, such as symmetry.[497] He also found previous scholars' understanding of the physical structures within interlace incomplete.[498] Brennan was also critical of mathematicians' studies of interlace because their interest was theoretical rather than historical, causing them to create and study interlace patterns with structures that are not found in Insular artworks.[499]

Brennan then composed a new theory for interlace, based not on classification or construction methods and aids, but on his identification of the pattern's 'underlying structural properties' – a phrase he coined for both its physical structures and the concepts or ideas that makers used to manipulate these.[500] The interlace properties that Brennan identified could describe and explain all examples of Insular interlace, including varieties unaddressed in previous studies.[501] Brennan identified and described a large number of properties, but noted that alternation (or the weaving over and under of the path) and the manipulation of the pattern using symmetry were particularly important 'objectives' for Insular makers.[502] His mathematical definitions of different symmetry operations are useful and were adapted in Chapter 2 of this thesis.[503] Brennan identified interlace properties not just for themselves, but so that he could use them to analyse individual artworks in order to uncover – for the first time – the artists' agency, intentions, and working processes in how and why they chose certain properties, exploited the interplay between them, or addressed challenges in their designs.[504] For example, Brennan noted that in interlace patterns containing certain types of symmetry, consistent alternation was impossible, and throughout his thesis he explored how makers navigated this tension by prioritising one of these properties over the other.[505] Brennan included a series of case

[496] Ibid., 3-4, 13, 20, 27.
[497] Ibid., 12. Dr. Michael Brennan also noted that if modern specialists referred to symmetry, they usually discussed only mirror symmetry. Dr. Michael Brennan, pers. comm., 13 May 2015.
[498] Brennan 2011, vol. 1, p. 12.
[499] Ibid., 25-26.
[500] Ibid., summary, 33-49.
[501] Ibid., 1, 29.
[502] Ibid., 7, 32.
[503] Ibid., 40-43.
[504] Ibid., summary 1, 50.
[505] Ibid. 4, 40-43.

studies of individual Insular artworks to demonstrate the benefits of his theory in practical application. In these case studies, Brennan maintained an artwork- and artist-centred approach to interlace by examining the pattern in the context of the larger object or monument to which it belonged, rather than isolating the pattern as other Insular specialists typically did previously.

Brennan's groundbreaking approach to interlace has been embraced and adapted to key pattern in this thesis. While the structures and concepts he identified in Insular interlace are specific to that pattern, the following analysis of key pattern will adopt and adapt some of his terminology ('structural properties'), his method of direct study of the objects and monuments (rather than of isolated diagrams), as well as his open-minded approach to the artworks. This permits us to uncover, for the first time ever, medieval artists' conventions and expectations for key pattern in their own historical context, without external imposition of modern values or judgement.

5.6. Conclusion

Both the scholarly and popular publications dedicated to Insular key pattern over the past two centuries, beginning with Westwood's first identification of 'Chinese Z-patterns' and Allen's foundational classification, have introduced many positive insights about the key pattern's structure and significance in early medieval British and Irish art. These insights ranged from recognition that the patterns were always fitted whole into bounded fields, could be oriented to this border in either an orthogonal or diagonal manner, and were composed of series of intersected, angled lines (i.e. trunks and branches), which in turn created spiral structures such as C- and S-spiral shapes, and which could be embellished with branching lines and triangle- or square-shaped extensions. There was widespread, if not total, awareness that the negative lines and the path in the pattern could occur in a continuous or discontinuous form, and that the patterns contained repeating spiraliform base units, which could be grouped into larger and larger compositions (such as single rows or multiple rows). Iain Bain, and to a lesser extent Meehan, were first to discuss the path as positive space outright and its relationship to negative space. Though his analysis was limited, Iain Bain also first realized the particular *importance* of positive space and its dependence on artistic manipulation of negative space, by urging his readers to maintain the evenness of the ‘path’ by thickening or otherwise altering the lines they drew on paper. Crawford, Iain Bain, and Tetlow in particular made early observations about how maker’s choices resulted in visual and structural alterations in the patterns. Iain Bain and Tetlow made several correct observations about the role of symmetry in the arrangement of units or larger sections in key pattern compositions. Hull and Brennan then made the greatest contribution in this arena, with their direct focus on specific artworks rather than isolated diagrams, and their fuller awareness that medieval makers used conventions or structural/geometric principles of some kind when creating patterns, and that a holistic scholarly study of both the patterns’ structures and these concepts or principles - including symmetry – can reveal those artists’ intentions, inventions, and corrections of mistakes during the working process.

Readers may consult Fig. 5.31 for a table that demonstrates the similarities and differences in the terminology for key pattern’s structural elements found in this thesis, in comparison to equivalent terms from earlier key pattern studies.

Nonetheless, all previous studies of key pattern had methodological limitations. These ran the gamut from the isolation of key pattern compositions from their surrounding artistic context, the use of regularised diagrams (or in Hull’s case computer-generated vector-based reproductions) that are unfaithful to medieval reality, the conflation of construction methods or aids with key pattern’s underlying and essential physical structure, the rigidness of classifications methods and the nationalist exclusion of orthogonal key pattern compositions, and an over-focus on a limited range of structural elements (mainly the shapes and arrangements of trunks and branches). These problems resulted in inaccurate reproductions, technical misunderstandings, and gaps in knowledge about key pattern structure – especially the creative approach, positive and negative space, and the principle of symmetry – which minimized the benefits of these studies. In particular, previous paradigms of study resulted in a lack of attention or difficulty in accessing evidence for medieval artists’ working processes: their deliberate manipulation of structures or even transcendence of their own structural conventions, in order to create and alter key pattern compositions for a variety of design purposes, fix mistakes, and even achieve unique flights of invention – all while maintaining a minimum set of concepts that kept the key pattern from losing its structural integrity.

The next chapter departs from the historiography of key pattern studies, and explores the pattern's likeliest origin in prehistoric central and eastern European basketry and possibly even textile weaving technologies, and its dissemination thence to other parts of the Old World. These early textile technologies and their resultant key patterns have survived to the present day in craftworking traditions. Analysis of prehistoric survivals of the pattern and their modern descendants in the next chapter not only corroborates recent archaeological discoveries in Europe indicating that simple basketry and textile weaving technologies developed far earlier than archaeologists previously have assumed, but also improves our understanding of Insular key pattern's structural properties by placing it in a much longer temporal context than has ever been attempted before. Recognition of Insular key pattern's deep link to early European basketry and textile patterns also helps show how these prehistoric designs in question are definitively key pattern in their structure, an aspect which art historians and archaeologists hitherto have never fully examined.

6. Chapter 6: The Origin of Key Pattern: Prehistoric Basketry and Textile Weaving

As noted in Chapter 1, key pattern itself is not unique to early medieval Britain and Ireland. Artists and craftspeople have applied it to art and/or architecture around the world for millennia, with the earliest surviving example dating to the Upper Palaeolithic period (c. 22,000-20,000 BC), from what is now Ukraine. This chapter begins with an examination of the potential origin of key pattern and presents an argument that the pattern likely developed from prehistoric basket- and then textile-weaving techniques in central and eastern Europe, after which it spread through these technologies to other geographical regions and was transferred to other media. This explains the pattern's frequent appearance in disparate parts of the world, even in the art of civilisations that historically had no contact with one another, because after encountering the pattern, each art historical culture then developed its own key pattern tradition distinct from, yet simultaneously parallel to other key pattern traditions elsewhere. This chapter surveys all surviving key pattern examples on both textiles and other media from pre-Iron-Age Europe that are known to the author. In addition to the earliest key pattern from Palaeolithic Ukraine noted above, three Neolithic key pattern compositions survive from central Europe, at least one from Bronze-Age Egypt, and another from Bronze-Age western China. This scattering of rare, early key patterns does not necessarily mean that the pattern was used rarely in the Stone and Bronze Ages, but instead may indicate poor survival rates. Whatever the case, the number of surviving key pattern compositions in a variety of media then markedly increases from the Iron Age onward, particularly in the Mediterranean. In some areas, such as ancient Greece, this creative explosion is so great that it likely reflects not only improved survival of artefacts, but also increased use of the pattern overall. However, key pattern traditions from the Iron Age onward are mainly addressed in Chapter 7, except as they relate to earlier basket- and textile-weaving.

This chapter then presents the first-ever study of the structural properties of woven key patterns invented at least as early as the Neolithic period, which still remain in use today in craft weaving, with their original, prehistoric, physical structure intact. Although scholars of both ornament and textile art have briefly noted the possible link between basket- and/or textile-weaving techniques and key pattern in general, none have previously explored this subject in detail nor confirmed that these early textile patterns are indeed key pattern by comparing their structural properties with analogues in other media. Next, the structural properties of woven key patterns are compared to that of Insular key patterns. This new analysis has a number of benefits: it provides additional evidence in support of new archaeological finds indicating that basketry and weaving technologies developed far earlier than scholars previously have assumed, it deepens our knowledge of Insular key pattern by situating it as one of multiple, parallel strains that developed out of a shared, prehistoric, Eurasian tradition, and further overturns some incorrect assumptions asserted in earlier Insular key pattern scholarship, particularly from Allen.

6.1. Previous Theories

Modern scholars have offered multiple theories to explain how and why humans first invented key pattern. Many of these are limited to a single object or region, or even to an individual key pattern composition, and so cannot explain the development of the pattern as a whole. Many also rely on symbolic explanations, rather than technological ones. The earliest known surviving key pattern is incised in a large field in diagonal orientation alongside chevron pattern on a mammoth-ivory armband found at an Upper Palaeolithic site near Mezin, Ukraine, and dates to approximately 22,000 to 20,000 BC (Fig. 6.1).[506] Ukrainian scholars have suggested that the number and arrangement of lines on the piece, together with the neighbouring chevrons, may have functioned as an early lunar calendar, though this remains speculative.[507] Classical scholars often refer to orthogonal key pattern that forms a single row as ‘meander’ or ‘maeander’, a term directly referring to the twists and turns of the River Meander in Turkey.[508] Eva Wilson noted that this riverine association may have originated in the Classical world, because ancient coins minted in towns located along this river are decorated with single rows of orthogonal key pattern.[509] However, the same orthogonal, single row of key pattern gained another association in Greek vase paintings that featured Peleus and the sea nymph Thetis. Here, the spiral unit of the key pattern was repeated outside the main pattern field, in the grip between Peleus’ and Thetis’ hands (Fig. 6.2).[510] Dr. Elizabeth Moignard suggests that in this context, the painter used key pattern to highlight the precise moment of Peleus’ victory over and

[506] Vavilova and Artemenko 2009, 4; E. Wilson 1994, 27-28, fig. 1:1.
[507] Vavilova and Artemenko 2009, 4-5.
[508] E. Wilson 1994, 44.
[509] Ibid.
[510] Moignard 2006, p. 15, plate 22; Boardman 1975, repr. 1997, pp. 132, 140-141, fig. 214.1.

possession of Thetis.[511] At least one other Classical key pattern, albeit with a different structure, was associated with water. Wilson described a limestone libation table from Egypt from the 2nd or 3rd century AD, carved with a common Classical key pattern composition possessing four-stranded, swastika-shaped spiral units, through which the liquid offering would have flowed.[512] It is notable that due to functional necessity, the artisan took an additive approach to the pattern, carving the positive space into the limestone so that the continuous path could carry the liquid (Fig. 6.3). However, the same key pattern with four-stranded, swastika-shaped spiral units also was used to represent the maze in depictions of Theseus and the Minotaur (Fig. 6.4).[513] In *ECMS*, John Romilly Allen posited that the labyrinths depicted on ancient coins from Crete might have been the spark for Greek key pattern.[514] Nevertheless, it seems unlikely that any of these symbolic associations explain the origin of key pattern. Instead they were simply flexible meanings that key pattern accreted once it was in use, and so cannot not explain why and how early artists first invented it.

Scholars also have posited numerous theories for *Insular* key pattern's specific origin, in part because some varieties in Insular art are visually dissimilar to Mediterranean antecedents such as those described above, because of Insular key pattern's inclusion of a unique set of negative shapes, as well as diagonal and sometimes even curvilinear lines. Most of these theories cannot satisfy, and they still do not explain the origin of the earliest key patterns, like that on the Palaeolithic armband from Mezin. Joseph Anderson, citing the work of Sophus Müller, contemplated the pattern's widespread application as simply a phenomenon of unexplained, unrelated multigenesis.[515] Other explanations rest on the assumption that different patterns across Europe inhabited different points along an unbroken line of evolution from the prehistoric to the medieval period. For example, Allen suggested that diagonal key pattern in Insular art had evolved from Bronze Age rectilinear patterns, such as rows of chevrons, which also contained diagonal lines or shapes suggestive of triangles.[516] Aidan Meehan back-projected Allen's theory into the Palaeolithic to argue that the carver of the Mezin armband created their key pattern by offsetting, nesting, and reconnecting rows of chevrons.[517] It is potentially possible that

[511] Dr. Elizabeth Moignard, pers. comm., 17 May 2016.
[512] Ibid., p. 44, fig. 1:41.
[513] Ibid., 44, 63, fig. 2:27.
[514] Allen and Anderson 1903, vol. 1, part 2, p. 309.
[515] Anderson 1903, lxxx-lxxxi, n.4.
[516] Allen 1904, 27-37.
[517] A. Meehan 1993b, pp. 41, 44-49, fig. 22.

prehistoric artists developed even earlier key patterns, pre-dating the Mezin armband, by manipulating chevrons in this manner on objects which are now lost. However, Allen and Meehan's arguments ultimately are questionable because they are based on coincidental visual similarities between chevrons and key pattern, and for Meehan, the suggestive physical proximity of these two patterns on the Mezin armband. The author knows of no surviving pattern from Stone and/or Bronze Age art whose structure clearly reflects some intermediate, developmental stage between chevrons or other simple rectilinear patterns and fully-developed key pattern, which would otherwise support Allen and Meehan's theory if it had existed.[518] Instead, from its earliest known appearance on the Mezin armband, key pattern was already a fully-fledged type of ornament in its own right, which strongly indicates that its origins lay in a different creative process. Similarly, Sheila Sturrock used key pattern's spiraliform structure to argue that Insular key pattern developed out of later, curvilinear, Iron Age La Tène spiral ornament.[519] However, this too is unsupportable, for as explained in Chapter 2, La Tène, curvilinear spiral patterns differ so much from key pattern in their deep structure as to cast doubt on this theory (for example, curvilinear spiral patterns possess spiral units of vastly different sizes and paths of uneven width, neither of which ever occurred in key pattern anywhere in the world, Insular or otherwise).

Allen also offered another origin theory, that key pattern entered Insular Britain and Ireland as an influence from ancient Greek and Roman art,[520] in which key pattern already existed as an established tradition. George Bain later took issue with this argument, and asserted that key patterns first entered Britain instead with ancient trans-European mass migrations of early Celtic peoples, who brought not only their languages but also artistic ideas (Chapter 5), after which this transplanted key pattern developed in Britain into its uniquely Insular form.[521] However, Bain's argument is problematic not only because archaeological theories of pan-European mass-migrations are outdated, but also because he did not address the comparative dearth of key pattern in La Tène art across Europe (as we shall see in Chapter 7), nor explain in what physical medium ancient Celtic peoples brought key pattern to Britain had they done so. As we shall see, Bain was partly right in suspecting that Insular key pattern's roots lay in a very early, Continental key pattern

[518] The author has reviewed such prehistoric patterns in Allen and A. Meehan's illustrations (as cited in footnote 12 above), as well as in the displays of the National Museum of Scotland and the National Museum of Ireland.
[519] Sturrock 2003, 1.
[520] Allen 1904, 253.
[521] Bain 1951, 71-73.

tradition, rather than ancient Greece or Rome, however, he was incorrect in pinpointing ancient Celtic art or migrating Celtic-speakers as the specific source.

6.2. The Development of Key Pattern, from Basketry to Woven Textiles

It is likely that the earliest key patterns, both orthogonal and diagonal, were invented in prehistoric basket-weaving and textile weaving processes in central and eastern Europe – the products of which are referred to by scholars as 'interlaced fabrics' (there is no relation between this terminology and the Insular interlace pattern).[522] Other scholars have already suggested these origins for geometric patterns, but only in general terms and without any significant, extended discussion of key pattern, its structural properties, or in which medium (basketry or textiles) it was developed first.

The idea that decorative patterns were first invented in basketry and textile weaving, and thence transferred to other media was asserted by the 19th-century German art and architectural historian, Gottfried Semper.[523] Semper argued that all art forms borrowed 'types and symbols' from textile weaving, and he promoted a 'constructional-technical conception of the origin of basic architectural forms', that is, he theorised that decorative patterns on architecture were fossilized or first transferred into paint, stone, or plaster in imitation of textiles or specific woven patterns.[524] Semper's approach was later criticized,[525] his discussions of other cultures were steeped in 19th-century racism,[526] and he had nothing to say on key pattern structure itself. Nevertheless, comparative structural analysis of key patterns from ancient textiles and current weaving traditions with analogues in other media, clearly demonstrates that in the case of key pattern, Semper was right.

[522] I am grateful to Dr. Susanna Harris for her suggestion on the early importance of basketry before woven textiles, and for her explanation of the term 'interlaced fabrics'. Dr. Susanna Harris, pers. comm., 4 September 2017.
[523] For a biography of Semper, see L. Sorensen [accessed 6 March 2017].
[524] Semper 1860, 1863, repr. 2004, 106-107, 109-165; Swift 2009, 4-5. See Swift for a concise summary of Semper's theories, which was very useful here.
[525] Swift 2009, 4-5.
[526] Semper 1860, 1863, repr. 2004, 103-107.

Over a century later, Eva Wilson noted that even though the physical proof – ancient textiles – rarely survives, the scholarly 'assumption that textiles have always played a major role in the creation and dissemination of patterns' is based on common sense and on the real, timeless importance of patterned cloth in decorative arts and design.[527] Bernhard Schweitzer has pointed to the fact that early Greek, Geometric-period painters applied rectilinear patterns, including 'meander…checkerboard, saw-tooth and lozenge' to their pottery in such a way that the abstract decoration took the appearance of 'clinging…to the tectonic structure of the vessel, like a garment', leading him to suggest that a 'lost textile art' may have been the origin for the patterns before they first appeared on Greek pottery after 900 BC.[528] John Boardman posited that ancient geometric patterns arose not just from textile production, but from the technology of basket weaving, 'where the material does much to determine the pattern'.[529] He cited the painted patterns (including orthogonal key pattern) on a late 8th-century (BC) Attic bowl as an example.[530] Allen briefly made the same suggestion in *ECMS* for certain key patterns, and included in his classification system a line-drawn diagram of a Native American basket from Arizona,[531] the orthogonal key patterns from which are identical in structure to that painted on Boardman's Attic bowl (Fig. 6.5a-b).

The earliest indirect evidence for the transfer of key pattern from woven baskets or textiles to other media comes from central Europe. A Neolithic pot from Moravia, dating to the fifth or fourth millennium BC, sports two wide, double-stranded key pattern compositions around its neck and body (Fig. 6.8).[532] Its shape and the hatched lines in the patterns both suggest that the pot was created as a clay analogue of a basket, reinforcing Boardman's observations about the Attic bowl with key pattern illustrated in Fig. 6.5a. Wilson argued that key patterns impressed on a fragment of a Neolithic plaster model house (Fig. 6.6a) and a clay, human-shaped pot, both from what is now Hungary (both fourth millennium BC), as well as key pattern painted on Egyptian tomb walls and ceilings from the Middle Kingdom ('c. 1842-1797 B.C.') (Fig. 6.6b), were intended to evoke woven patterns in clothing and hanging textiles.[533] (Wilson intended her drawing of Egyptian key pattern to

[527] E. Wilson 1994, 16-21.
[528] Schweitzer 1969, 30.
[529] Boardman 1998, 24; Boardman 2006, 17.
[530] Boardman 2006, pp. 17, 255, fig. 281.2.
[531] Allen and Anderson 1903, vol. 1, part 2, p. 309, 362, 362n1, no. 1022a. Allen unfortunately did not provide a date for this basket or state whether it is ancient or modern, nor did he give the name of the artist if known, or that of their nation.
[532] For an illustration and note of dating and location, see E. Wilson 1994, p. 34, fig. 1:17.
[533] Ibid., pp. 33-34, 39-40, fig. 1:15-16, 1:33.

represent how the pattern was used in Egyptian tombs a general sense, rather than to reproduce an individual wall or ceiling. To date, the author has been unable to identify key pattern in available photographs of tomb painting, but has no reason to doubt Wilson's identification of painted key pattern in ancient Egypt). In fact, Wilson's Egyptian key pattern painting instead may have been imitative of woven matting rather than hanging textiles: functional as well as decorative mats (rather than hanging cloth) were used to create walls in early houses and tombs from the Naqada 1 (5,000-4,500 BC) and First-Dynasty periods, after which imitative, patterned wall paintings came into use.[534] While these earliest surviving key patterns (after the Mezin armband) from the Neolithic period and Bronze Age do not occur on baskets or textiles themselves, their physical placement is imitative of these materials. The Moravian pot and Egyptian painting are also completely identical in structure to individual woven key patterns on actual textiles that survive from later historical periods (Chapter 7), and which still continue in craft weaving today (Fig. 6.13a-b). Because the earliest key pattern from this group, on the Neolithic Moravian pot, imitates a basket, it is also possible that key patterns were invented through the technology of basket-weaving first and then transferred to textiles at a later point.

All of the specimens of imitative woven key pattern listed above are diagonal. Orthogonal key pattern also occurs in ancient depictions of textiles: another painting from the Egyptian Middle Kingdom shows a figure with a single, vertical row of orthogonal, branchless key pattern on their clothing (Fig 6.7).[535] This pattern may have been applied (painted or dyed) on the original cloth instead of woven into it,[536] however, like diagonal key patterns, woven orthogonal key patterns also survive in later textiles.

Although the evidence that prehistoric weavers (most likely of baskets) were the inventors of the very first key patterns appears strong, the traditional dating for the beginnings of basketry and textile weaving constituted a serious obstacle to this theory. According to longstanding wisdom, the diagonal key pattern incised on the Palaeolithic mammoth ivory armband from Mezin, Ukraine (c. 20,000 BC) would have pre-dated the earliest secure, dateable evidence for basketry or textile weaving of any kind by as much as 14,000 years.

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[534] Wendrich 2000, repr. 2001, 256-57, 263. Wendrich makes no mention of key pattern specifically. I am grateful to Dr. Susanna Harris for encouraging me to investigate the use of woven mats rather than hanging textiles in ancient Egyptian settings. Dr. Susanna Harris, pers. comm., 4 September 2017.
[535] Schoeser 2003, p. 35, fig. 27.
[536] Ibid.

The traditional chronology saw Palaeolithic peoples creating beaded cords as early as 38,000 BC and using needles to sew skins together as early as 26,000 BC, while netting did not appear until 18,000 BC at the earliest and the oldest woven textiles themselves in 6,000 BC.[537] However, recent new work has identified material evidence of basketry and even simple weaving in Europe as early as 28,000 BC, including 79 fired clay fragments imprinted with marks from woven baskets and textiles from Moravia (c. 26,000 BC), as well as 'bone, ivory, and antler tools' used both for the creation of baskets and for weaving.[538] This new evidence has prompted the same scholars to argue that the spiraling, ribbed decoration on the heads of 'Venus' figures, such as the famous 'Venus' of Willendorf (c. 23,000 BC), represented not hair but woven and 'stitched' 'basket hats'.[539] Still, very little is known about Palaeolithic basket weaving, and there is no mention of pattern decoration in the new analyses summarized above, but this may well provide a context for the remarkably early presence of key pattern on the Mezin armband.[540]

It is unclear exactly when key pattern was transferred from baskets and mats to textiles. The oldest surviving key pattern in cloth known to the author was woven into a pair of remarkably well-preserved trousers recently discovered in a tomb in western China, dating to approximately 1000 BC.[541] They belonged to a nomadic horseman and are also the oldest surviving trousers in existence.[542] Each leg and the crotch were sewn together from a separate woven cloth.[543] A field of diagonal key pattern with single-stranded spiral units decorates each leg around the knee. This means that the pattern was woven with the rest of each solid-coloured leg as part of a single process (Fig. 6.9), presumably on a loom.

From at least the early Iron Age onward, both orthogonal and diagonal key patterns also were used to decorate thin bands along the edges of clothing.[544] With or without key pattern, such bands could be created using a method known as tablet weaving, a type of

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[537] Schoeser 2003, 10, 12; Wild 2003b, 40.
[538] Soffer et al. 2001, 233-35, 237, 242.
[539] Ibid., 233-34, 238-39. See also Soffer et al. 2000.
[540] Again, I am grateful to Dr. Susanna Harris for her suggestion that prehistoric basket-weaving might explain the Mezin key pattern, and for directing me to the publications of Soffer et al. Dr. Susanna Harris, pers. comm., 4 September 2017.
[541] For the age and findspot of the trousers, see Bower 2014.
[542] Ibid.
[543] Ibid.
[544] I thank Perin Westerhof Nyman from the University of St Andrews, who first suggested to me that the 'ram's horn' pattern in tablet-woven cloth bands might be a form of key pattern. Without her suggestion and her introduction to me of tablet weaving, this chapter could not have been written. Perin Westerhof Nyman, pers. comm., 3 and 5 December 2016.

textile production that is first archaeologically attested in the later Bronze Age between c. 1,500-1,200 BC.[545] The earliest surviving tablet-woven band with key pattern, in orthogonal orientation, was found at Hallstatt, Austria, and dates to the early Iron Age (800-400 BC) (Fig. 6.10).[546] The method was used to weave sturdy, narrow bands of highly decorated cloth, which were often sewn onto the hems of clothing.[547] The technique requires a set of square cards or tablets, historically made of bone or wood, with holes in all four corners that allow the passage of the warp threads and create a shed (or opening) between them.[548] As the weft thread is then passed through this shed, the weaver turns different groups of cards forward and/or back in the direction of the warp in order to create their chosen pattern (Fig. 6.11a-c).[549]

While key pattern found on tablet-woven bands was sometimes orthogonal like the Hallstatt example, this weaving method is particularly well suited for *diagonal* key pattern, for as Niamh Whitfield noted, it is characterized by the creation of lines that run in diagonal orientation to the edges of the cloth.[550] In fact, diagonal key patterns identical in structure to those on Wilson's Egyptian wall painting reproduction and the Neolithic pot from Moravia (Figs. 6.6b, 6.8) are found in tablet-weaving. Using tablet-woven examples from 20th-century Anatolia, Peter Collingwood in *The Techniques of Tablet Weaving* has demonstrated methods for creating such diagonal key patterns in this medium, both with single-stranded spiral units and double-stranded spiral units.[551] Collingwood refers to tablet-woven versions of these key pattern compositions by a variety of names, including 'spiral' (for single-stranded key patterns similar to those on the Chinese trousers) (Fig. 6.12), and 'meander', 'kivrim', 'running dog', and 'ram's horn' as synonyms for key patterns with double-stranded spirals.[552] Collingwood used the terms 'kivrim' or 'running dog' specifically when the tablet-woven band contained a key pattern composition with double-stranded spirals in a single row, and 'ram's horn' when the tablet-woven band contained two 'opposed sets' of this pattern composition (that is, two double-stranded key pattern rows that are mirror symmetric to each other across the length of the band) (Fig.

[545] Grömer 2016, 102-103. I thank Dr. Susanna Harris for alerting me to Grömer's work on textiles from Hallstatt and evidence there of tablet-weaving pre-dating the later Iron Age. Dr. Susanna Harris, pers. comm., 4 September 2017.
[546] Grömer 2016, 15-16; Grömer and Rösel-Mautendorfer 2013, 451-52.
[547] Schoeser 2003, 63.
[548] Whitfield 2016, 170-171; Wild 2003a, 19.
[549] Whitfield 2016, 170-171; Wild 2003a, 19; Collingwood 1982, 8-9, 21-22.
[550] Whitfield 2016, 170-171.
[551] Collingwood 1982, pp. 149-150, fig. 72, 97.
[552] Ibid., pp. 138-140, 147, 149-150, fig. 89.

6.13a-b).[553] Collingwood's terminology is specific to tablet weaving, but in this thesis, the term 'running dog' will be applied to key pattern compositions with the same structure found in all media, including non-textile materials. For example, the 'running dog' key pattern on the Neolithic pot from Moravia is identical in structure to that in Collingwood's illustration (c.f. Figs. 6.8, 6.13a). The Egyptian Middle Kingdom tomb painting discussed above is a key pattern field containing multiple 'running dog' compositions, themselves mirror symmetric with each other (becoming a 'ram's horn' pattern) (c.f. Figs. 6.13b, 6.14). The Neolithic pot and Egyptian wall painting therefore further cement the theory that key patterns were first invented in prehistoric basket- and textile-weaving and then transferred to non-textile media.

6.2.1. The Structure of 'Running Dog' Key Pattern

No previous scholar has ever explored the structural properties of the 'running dog' pattern to confirm first that it is indeed key pattern. The woven compositions with single-stranded spirals and double-stranded spirals described above (Collingwood's 'spirals' and 'running dog') can be confirmed as key pattern in their fundamental physical structure. Both have recognizable sets of negative line elements. Trunks intersect with the outer border on one end of their length, and with branches at the other end (Fig. 6.15a). In double-stranded tablet-woven key pattern, each trunk, its intersected branch, and embellishments have a two-fold rotationally symmetric relationship with the trunk, branch, and embellishments emerging from the other side of the band (Fig. 6.15b). The branches of these two rotationally symmetric trunks are extended with embellishments, that interlock to form a spiral base unit (Fig. 6.15b). At the point where each trunk intersects the outer border is a triangular shape of negative space, which may be understood in one of two ways: 1) either each trunk only has one branch (which interlocks with its rotationally symmetric partner to form a double-stranded spiral in the centre of the band as described above), while at its other end where it meets the outer border, that trunk is expanded into a triangular shape; or 2) the trunk has two branches, one of which interlocks with its partner in the centre of the tablet-woven band to form the double-stranded spiral as described above, while the other runs into the outer border, leaving a triangular field in between it, the trunk, and the outer border, which is then filled with colour (Fig. 6.16a-b). This triangular field of negative space is also itself a base unit within the key pattern, as it could potentially be occupied by

[553] Ibid., pp. 140, 147, 149-150, plate 72, fig. 97.

a single-stranded spiral (Fig. 6.16b). Single-stranded woven key patterns (Collingwood's 'spirals' and the Chinese trousers) behave slightly differently, but are also governed by rotational symmetry. First, an embellishment is added to the opposite side of the branch belonging to the outermost trunk. This branch is then extended with an embellishment, which is then multiplied in a parallel and perpendicular fashion, so that each successive embellishment is one-fold rotationally symmetric (i.e. at 90 degrees) to the one before it (Fig. 6.17). It can be confusing at first to understand the structure of running dog key patterns (those with double-stranded spirals especially), because weavers often use two colours for the negative line elements within a single composition: one colour for the trunks (and their connected branches and embellishments) at one side of the outer border, a second colour for those trunks (along with their branches, etc.) located at the opposite side of the outer border, and third colour altogether for the continuous path between them (Fig. 6.18). The path, however, still remains at a consistent width throughout the pattern, as in all key patterns.

These diagonal patterns that originated in basketry and/or weaving meet the structural qualifications for key pattern. However, when they occur in a woven medium specifically, it is impossible to state whether they – or any other woven key pattern, including orthogonal ones – are created with an additive or reductive creative approach. In fact, key patterns on baskets or cloth technically are neither, as the threads representing both positive and negative space are woven together simultaneously, and the weaver can choose any colour for each, dark or light. Nevertheless, it is always possible to identify the positive versus negative space within such compositions. Viewers can always spot the negative line elements by searching for where they intersect with the outer border of the field. In contrast, the positive path intermittently runs briefly parallel alongside the outer border, before angling back into the centre of the pattern – as it does in every key pattern.

6.2.2. From Diagonal Woven Key Pattern to Diagonal Insular Key Pattern

Diagonal key patterns in Insular art look very similar both to the 'running dog' (double-stranded) and 'spiral' (single-stranded) key patterns that originated in basketry and weaving. It is therefore possible that Insular artists developed their distinctive key pattern repertoire from woven antecedents already present in Britain and Ireland, though none of the latter survive in the archaeological record. Previous scholars have neither commented on this similarity nor compared diagonal Insular key patterns with woven key patterns from other time periods and parts of Europe in order to confirm their structural link. Though no woven key patterns survive in the Insular corpus, there is indirect archaeological evidence for their existence. Tablet-woven bands without key pattern do survive from Insular contexts. A cloth hood (covering the head and shoulders) from Orkney, dating to the Late Antique to early Pictish period (c. AD 240-650), contains two tablet-woven bands, one of which was striped, and early medieval bone tablets were also discovered during excavation in Orkney.[554] In addition, remnants of gold-brocaded tablet-woven bands have been found in Anglo-Saxon graves dating from the 5th to 8th centuries AD, and archaeological evidence from Ireland – including two bands from the Lagore crannog (neither of which have key pattern) – survives from the 7th century AD onwards.[555] Tablet-woven bands with key pattern in turn may be depicted in iconography. For example, a single row of diagonal key pattern with double-stranded spirals decorates the hems of a cleric's tunic on a Pictish carved stone fragment from Rosemarkie, in Easter Ross, Scotland (NMS X.IB.119), as well as the sides of Christ's tunic and the hem of the figure to the left (presumably Longinus) on the crucifixion plaque from St John's in Rinnagan, Co. Roscommon, Ireland (Fig. 6.19a-b).[556]

In addition, diagonal Insular key patterns with single-stranded spirals are very similar and in some cases identical in structure to diagonal, single-stranded key patterns in woven cloth, including those on the ancient trousers from western China (c.f. Figs. 6.12, 6.20). Folio 85r of the 9th-century MacRegol Gospels from Ireland contains a diagonal key pattern composition with single-stranded spirals that is extremely unusual in Insular art – the sole example with this exact structure that the author has found in the entire corpus – which itself is identical in its fundamental structure to a modern, instructional tablet-weaving pattern diagram posted by an enthusiast on Pinterest (Fig. 6.21a-b).[557] (This modern weaving enthusiast made no mention of the link to Insular art or the MacRegol Gospels). The only difference between the medieval and modern examples is that the

[554] Ritchie 2005, 33, 37.
[555] Crowfoot and Chadwick Hawkes 1967; Whitfield 2016, 171-172.
[556] Groam House Museum 2013b, 10; Youngs 1989, pp. 140-141, no. 133. Anna Ritchie also identified orthogonal key pattern on a tunic hem on another Pictish sculpture, Meigle 14, and noted that both stones depict tablet weaving. Ritchie 2005, 27.
[557] Bodleian Library [accessed 15 December 2017]; Dominguez [accessed 15 December 2017]. I am grateful to Dr. Donncha MacGabhann for spotting this unusual key pattern composition in the manuscript and referring it to me for analysis. Dr. Donncha MacGabhann, pers. comm., 13 November 2017.

MacRegol Gospels example is wider and its medieval illuminator chose to alternate the colour of both the positive path and negative lines between red and gold, itself a novel approach specific to the manuscript. Both the use of such single-stranded spiral patterns, as well as iconography depicting tablet-woven clothing hems, provide strong evidence that some kind of woven key pattern existed on textiles in the Insular world, which simply have not survived in archaeological contexts.

However, though Insular diagonal key patterns with single-stranded spirals have direct woven equivalents, the running dog (the two-stranded diagonal, woven key pattern) has notable structural disparities when compared to two- (or even three- or four-) stranded diagonal key patterns in Insular art. In fact, the running dog never appeared at all in its exact form in Insular art, even on the hems of the Rosemarkie cleric or the crucifix figures from St John's in Rinnagan. The closest analogue in Insular art has a similar visual appearance to the running dog, with triangular-shaped spiraliform base units nearest the edges of the pattern and a very obvious row of spirals down the centre (Fig. 6.22). In Insular key pattern, that distinctive central line of spiral units can be created by the interlocking of the embellishments of the longer branches of the trunks that intersect the outer border, as occurs in the running dog (Fig. 6.23a-b). Nevertheless, in all cases in Insular art, the second branches of these trunks did *not* intersect the outer border of the pattern, unlike in the running dog (Fig. 6.24a-b). All Insular versions without exception also contain a two-fold rotated pair of inner trunks within the pattern, which do not intersect with the border. These inner trunks do not exist in the running dog (Fig. 6.24b). The branches of these inner trunks in Insular key pattern interlock with the second branches of the trunks that intersect the outer border, creating spiral base units along the edge of the pattern – the same area in running dog which is filled instead with a solid, triangular block of coloured negative space (Fig. 6.25a-b). Finally, Insular makers could also choose to create the spiral units at the centre of the composition by interlocking the embellishments of the second branches of these inner trunks, and omitting altogether the longer branches of the outer trunks (the trunks that intersect the border), a variation impossible in running dog (Fig. 6.26).

These simultaneous, significant structural similarities and differences between the running dog and Insular diagonal key patterns indicate that although Insular makers did apply multiple-stranded diagonal key pattern compositions from basketry and/or textiles to other media, they did not follow the structure of the running dog slavishly, but transformed it according to a new set of conventions. Indeed, in manuscripts, sculpture, metalwork, ivory and wood carving, Insular artists developed even more ways of manipulating key pattern's structure – and they did so not only with multiple-stranded diagonal key pattern, but also diagonal key pattern with single-stranded spirals and orthogonal key pattern. Namely, Insular makers conceived of key pattern in a new way that is not possible for woven media; they conceptualized it not as a band or swathe of interwoven threads, but as a series of individual spiral base units, which could be disarticulated, multiplied, rearranged, and rejoined using a wide variety of symmetry operations in order to build larger and larger compositions. This conceptualization is not born from weaving (as a woven pattern instead is built up gradually via the continuous threading of a single weft strand through the warp). For example, Insular makers created single rows of diagonal key pattern by arranging the spiral base units so that they were successively mirror-symmetric across the horizontal axis, and translated in the direction of that axis (Fig. 6.27a). In tablet weaving, this would have been alien; 'rows' in tablet weaving are understood instead as running in the opposite direction (across the narrow waist or y-axis of the composition), following the sequence of warp strands (Fig. 6.28).[558] Insular pattern-makers then multiplied these single rows of spirals using either two-fold rotation or mirror symmetry (Fig. 6.27b-c). They arranged spiral base units in other ways, for example, with one-fold (90-degree) rotation, which resulted in fields of square rather than rectangular shape (Fig. 6.27d). Insular makers also exploited the structural links between diagonal and orthogonal key patterns, treating orthogonal patterns as structural equivalents by multiplying their base units and/or rows in the same ways (Fig. 6.29). No concrete evidence survives that such square compositions and mirror- and two-fold rotationally-symmetric pairs of rows existed in their exact structure in textile form in the Insular world, and many of them (such as diagonal mirror-symmetric rows) (Fig. 6.27b) are wholly unique to early medieval Britain and Ireland. The ways in which Insular artists used symmetry in key pattern will be examined in more detail in Chapter 8.

In diagonal key patterns with both single- and multiple-stranded spirals, Insular makers also altered the negative line elements in ways not seen in any woven key pattern, by widening them, contracting them, or expanding them into rectangular, triangular or even curvilinear shapes (Fig. 6.30b). Here the pattern-makers were exploiting the creative possibilities of diagonal orientation and the reductive approach. When the trunks of a key

[558] Niles 2009.

pattern are oriented diagonally, large voids are left between them (i.e. the areas to be occupied by the spiral units) that must be filled in order to maintain the path at a constant width, providing opportunities to creatively expand the negative line elements into an endless variety of shapes (Fig. 6.30a). In her criticism of Semper's theories about the technical origins of architectural patterns, Ellen Swift rightly observed that while forms transferred to new media might initially have been intended to reference the original medium and its function, that association would change over time or be lost.[559] (For example, the key pattern on wall paintings in Egyptian Middle Kingdom tombs might originally have been intended to represent real woven mats, but over time became purely decorative, or may have been given a new association altogether). The same is true for Insular key pattern. Insular pattern-makers liberated it from the structural conventions of its original woven medium, in order to suit other materials and their reductive, symmetry-focused approach.

Insular artists' habit of conceptualizing key pattern as the sum of its individual spiral units, and their concomitant interest in symmetry and in the manipulation of negative space may represent the survival of an artistic worldview that was also characteristic of ancient Celtic art across northern Europe. Brent Doran described how the Iron-Age Celts 'decomposed, reflected, rotated, magnified, and rejoined' the 'fundamental units' of curvilinear spiral patterns.[560] Paul Jacobsthal, a founding scholar of 20th-century Iron Age Celtic archaeology, used the term 'Cheshire Style' in homage to Lewis Carroll, to describe how La Tène artisans would abstract human faces into their component parts: they 'often are not even complete faces, only bits of a face…one might call this the Cheshire Style: the cat appears in the tree, and often just the grin of the cat'.[561] Jacobsthal's pupil, the British archaeologist Edward Martyn Jope, went on to describe La Tène artists' preference for arranging patterns and motifs through the use of symmetry, as well as their interest in using positive and negative space to create designs that 'are liable to ambiguities through the alternatives of positive and negative patterning', so that 'both interpretations…often yield rewards when we look at their work'.[562] The distinction between positive and negative space in Insular key pattern is far less ambiguous than in ancient Celtic art, but

[559] Swift 2009, 4-5.
[560] Doran 1995, 263.
[561] Jacobsthal 1944, vol. 1, p. 19. For background information on Jacobsthal's life and work, see Megaw and Megaw 2001, 15.
[562] Jope 2000, 200-203.

Insular makers' treatment of key pattern may reflect a continuing tradition of fracturing or geometricizing patterns that began in the later Iron Age.[563]

This new analysis – of the key pattern's prehistoric origin in basket and textile weaving, the structural properties of woven key patterns, and their ultimate relationship to Insular diagonal key patterns in non-textile media – also proves that an older and influential scholarly theory about how Insular artists created diagonal key patterns is incorrect. In both *ECMS* and his 1904 *Celtic Art in Pagan and Christian Times*, Allen argued that Insular makers created diagonal key pattern compositions by first rotating an orthogonal pattern (such as Fig. 6.31a) by 45 degrees, 'so as to make the lines run diagonally with regards to the margins instead of parallel to them' (Fig. 6.31b), and then altering the angles between the outermost trunks and branches from the original 90 degrees to 45 degrees to fit within the outer border (Fig. 6.31c).[564] Allen observed that in some cases, artists simply filled the outermost areas of the key pattern field with 'unornamented triangles', where he believed the border had bisected individual spirals in half after rotation (Fig. 6.32.)[565] However, in basketry and textile weaving, the negative line elements of diagonal key patterns were never rotated as Allen describes. Instead, they were skewed in relation to the outer border of the pattern from the moment of creation, as a natural result of the weaving process, so that they intersected the border at 135°/45° angles rather than at 90°. When creating diagonal key pattern in non-textile media, Insular makers also *never* rotated orthogonal patterns, but followed the woven paradigm and skewed the trunks in diagonal orientation to the outer border from the beginning of the process (Fig. 6.33a-b). The 'unornamented triangles' that Allen described at the edges of some diagonal Insular key patterns were simply the outermost individual spiral base units, filled in with solid colour in order to imitate a convention from woven analogues.

It is important to note at this juncture that in weaving, it is possible to create orthogonal key pattern compositions so that they lie at a diagonal to the edges of the cloth, as seen in the central field of decoration on the tablet-woven band from Hallstatt (Halstatt Textile 123A, Fig. 6.10). However, these key patterns are not diagonal in their fundamental structure, as their negative lines are still orthogonally arranged in relation to their *own*

[563] I thank Katherine Forsyth for introducing me to phrases such as 'fracturing' and 'geometricizing' in our discussions of patterns in La Tène and Insular art.
[564] Allen 1904, 281, 283; Allen and Anderson 1903, vol. 1, part 2, p. 325-328.
[565] Allen 1904, 281, 283.

borders (i.e. the frames that the outermost trunks intersect), which in this case are distinct from the edge of the cloth itself. Viewers can ascertain whether a pattern is diagonal or orthogonal by the following test: a key pattern is orthogonal (in relationship to its own border, rather than the border of the cloth) if, when the entire composition is rotated back at a 45-degree angle, it becomes orthogonal again (with its negative lines parallel to the horizontal or vertical axis). In contrast, no amount of rotation will change a diagonal key pattern into an orthogonal one, because all of its internal lines were individually skewed in relation to edge of the pattern border itself (and not just the cloth border).

6.3. Conclusion

Comparative structural analysis of key patterns from prehistoric Eurasia, both in woven form and in other media, provides firm evidence for the pattern's origin in basketry and textile weaving, a development which scholars had only suggested before in a general way. This comparative analysis also demonstrates that Insular key pattern was one branch of a larger, enduring, and ultimately prehistoric tradition in the Old World, which Insular artists then took in a new and unique structural direction with their symmetrical iteration of spiral units and reductive manipulation of negative space.

Chapter 7 will explore other key pattern traditions beyond the Insular world. These date from the Iron Age to the Middle Ages, and span from the ancient Greek world to the Arab Empire and China. The chapter also includes in-depth analysis of ancient key pattern traditions from the Americas (the majority roughly contemporary to Insular art or post-dating it), and offers an explanation for how, after the Stone Age, key pattern developed in both hemispheres. Extended comparison of these other traditions with Insular key pattern has never before been attempted. The exercise sheds new light on how these other peoples saw and understood such concepts as line, space, and symmetry within their own artistic cultures, and how this affected their approach to key pattern's structural properties in different ways. This comparative analysis in turn deepens our knowledge of Insular key pattern, revealing why the extreme physical, geometrical complexity of Insular key patterns is almost completely unrivalled by all other key pattern traditions, from any other time period and part of the world.

7. Chapter 7: Key Pattern in a Global Context

After key pattern's invention in basketry in prehistoric eastern and/or central Europe and its geographical dissemination outward thereafter, makers around the world have developed it further in distinctive yet parallel traditions, applying it to a variety of media. The overall number of surviving key patterns markedly increased from the Iron Age onwards. Pattern-makers from some cultures and time periods also utilized key pattern much more frequently than others, with Insular makers at the top of this scale.

Wherever and whenever key pattern has been used, the basic structural properties for the pattern, included in the technical definition in Chapter 2, are *always* maintained. All key patterns, whatever their context, possess both positive and negative space; the same sets of negative line elements (trunks, branches, and embellishments) in generally parallel and perpendicular arrangement with each other; and rectilinear, repeating units formed from either single-stranded or multiple-stranded spirals. Maintaining a path of consistent width throughout a key pattern composition is also a universal priority, and makers around the world have always ensured that all spiral units in the same composition are of approximately equal size to each other. In all key pattern compositions, the sets of negative line elements likewise follow the same hierarchy: the outermost trunks in a composition must intersect the border of the pattern field, and branches intersect trunks, while embellishments can intersect both branches and trunks. All negative line elements are eventually discontinuous, within the composition as well as at the outer border. Pattern-makers also avoided including free-floating negative line element that did not at least intersect either with another negative line element or the outer border.

However, these structural properties are shared on a global scale simply because they are the bare minimum required to prevent key pattern from physically breaking down and becoming unrecognisable. Other structural properties or artistic conventions that were characteristic of Insular key pattern, are in contrast *not* universal in other places and time periods. These include the practice of fitting each key pattern composition fully within the outer border (so that the border does not cut off the pattern and therefore cause the path to cul-de-sac at the edge of the field). When artists of other time periods and regions allowed the outer border to cut off the key pattern composition within it (if for example, they purposefully isolated a small area of a conceptually larger pattern, as if making a snippet or cut-out), this also could give the superficial impression that an individual negative line element or series of intersected negative line elements intersected two or more sides of the border. In some other, non-Insular key pattern traditions, artists also avoided expanding the width and altering shape of negative space. Finally, while Insular makers also faithfully adhered to the reductive creative approach – by actively, physically creating and manipulating only negative space, and leaving the path or positive space as a passive by-product – some makers of other time periods and cultures preferred an additive approach to key pattern (actively conceiving and creating the positive space), while still others flip-flopped between the two.

This chapter focuses on world key pattern traditions that pre-dated, or were roughly contemporary to, the early medieval period, leaving aside those from the modern era. It compares Insular key pattern with these other traditions, and – for the first time – analyses how pattern-makers from different cultures handled the form, according to conventions either universal and specific to local idioms. Around the world, the creative approach and conventions chosen by makers for handling structural properties defined their artistic traditions, and as a result, limited or expanded their opportunities to create visual variety and physical complexity in key pattern compositions.

Comparison with key patterns from other traditions reveals that Insular key pattern is one of the most visually diverse and structurally complex in the history of art, surpassing its cousins from prehistoric Eurasia, ancient Greece, the Roman Empire, the Celtic Iron Age, the Arab Empire and Coptic Egypt, China, as well as the traditions in Mesoamerica and South America. There are three reasons for the uniqueness of Insular key pattern: 1) the frequent placement of its individual, negative line elements in diagonal orientation rather than just orthogonal orientation; 2) the manipulation of the width and shape of these negative line elements (facilitated by the reductive creative approach as well as the use of diagonal orientation, which results in larger voids of positive space that require creative infilling (Fig. 6.28), while still maintaining a path of consistent width; and 3) the fundamental conception of key pattern not as a continuous rectangular swathe or band – as the pattern first appeared in basketry and woven cloth – but as a series of disarticulated component parts (spiral base units) that could be iterated and joined into larger fields like individual puzzle pieces, using a wide variety of symmetry operations (which in turn could be multiplied again using symmetry). This triad of strategies for handling structural properties increased Insular pattern-makers' ability to infuse their compositions with variety and push the pattern to its structural limits. Key patterns in other places and historical eras possessed some of these characteristics, but rarely all three. This assessment of Insular key pattern's deep structural complexity is not a value judgement of the comparative worth of Insular art versus that of other eras and places. It is simply an empirical, mathematical observation. The utilization of a wide range of symmetry operations and inclusion of a variety of negative shapes and line elements simply resulted in greater visual and physical structural range in the geometric sense – or as it may be described more simply – in 'busier' key patterns.

Only one other key pattern tradition discovered so far has rivalled the Insular corpus in this arena: that of the ancient North American Southwest. Ceramicists in the Ancient Puebloan and Mimbres cultures (AD 700-1600) applied key pattern to their pottery using the same three strategies as Insular artists. Not only does the complexity of these key patterns from the American Southwest and the approach of their creators to structural properties deserve widespread recognition in its own right, but comparison also increases our understanding of Insular makers' thought processes and working treatment of key pattern.

Insular key pattern has never before been comprehensively compared to those of other art historical traditions, and therefore its geometric rigour and the unusual complexity of its underlying structure has never been fully appreciated. As we shall see, some modern Insular specialists have assumed incorrectly that key pattern was manipulated in the same way across different art historical traditions. Insular specialists' overall lack of discussion of the role of symmetry, and of the importance and impact of additive and reductive creative approaches, therefore has also led to misunderstandings not only of Insular key pattern but also of its cousins in other cultures. Furthermore, the same constellation of issues has affected scholarship focused on non-Insular key pattern, by classicists as well as art historians and archaeologists specializing in other parts of the world.

7.1. Key Pattern in Ancient Greek Art

Ancient Greece was home to one of the earliest significant and well-evidenced key pattern traditions. Greek craftspeople used the pattern very frequently, in a variety of media. This sudden explosion of key pattern in the Iron-Age Mediterranean indicates an increase both in survival and general use. It was particularly ubiquitous as a form of decoration on vases and other pottery vessels, which spread throughout the Mediterranean through trade and colonization. As noted previously, ancient Greek key pattern is sometimes erroneously assumed to have had an influence on Insular key pattern. Greek key pattern of course shared with Insular key pattern the basic structural properties required to maintain the pattern's structural integrity. However, Greek makers did not utilize other structural properties or conventions for handling the pattern to which Insular artists later would strictly adhere. This section outlines the various reasons why Greek artists never fully explored key pattern's full potential or developed it to the same level of complexity as seen in Insular art. Namely, the Greeks almost never used diagonal pattern, preferred single rows of pattern over large all-over fields (which limited their opportunities to use symmetry), and lacked commitment to the reductive approach. This latter trait in turn limited the Greeks' awareness of or interest in the manipulation of negative line elements into shapes. Many aspects of Greek key pattern discussed here have remained relatively untouched by modern scholars, and so this section also provides new insights about the use of the pattern in ancient Greek art itself.

Greek key pattern in vase painting will be treated as a two-dimensional medium here. The pattern first appeared in Greek vase painting in the Geometric period, dating from the late 9th to the end of the 8th century BC.[566] In this period, abstract ornament was the dominant decorative mode on pottery, which artisans painted onto the surfaces of their vases in a brown or otherwise dark 'glaze'.[567] They introduced a range of key patterns, all orthogonal, some of which would continue in later vase painting. Most were arranged in a single row that traveled around the vase. These included a key pattern with trunks only (entirely lacking branches) and key patterns with a single branch per trunk, arranged to create single or double-stranded spirals within the pattern (Fig. 7.1a-c). For the most part, Geometric vase painters created these key patterns using an additive approach (painting the

[566] Boardman 2006, 12, 17.
[567] Richter 1987, 294.

path with the glaze, and leaving the negative line elements passive, in the background colour of the clay). However, a smaller number of pots show reductive key patterns, with the negative lines only painted in dark glaze, and the path left uncoloured (Fig. 7.2). This began a tradition in which Greek painters would flip-flop between the two creative approaches when applying key pattern to two-dimensional media.

Geometric-period vase painters maintained the basic structural properties which are required to create key pattern, and which as a result are shared with all other key patterns around the world, including Insular ones. However, they ignored other structural properties that Insular makers later emphasized, as a result their key patterns were less geometrically, physical complex in comparison. Unlike Insular artists, Greek painters were not concerned with fitting all the structures of a key pattern composition within the border, and so permitted these outer borders to cut off the edges of the pattern, thus causing the positive path to dead-end at the edges of the field (Fig. 7.3a-b). This was certainly the simpler solution for framing a key pattern composition, but it inhibited the Greeks from inventing creative means of manipulating the pattern's structural properties in order to fit it within the border. In addition, Geometric vase painters made only limited use of symmetry. For the most part, key pattern spiral units were arranged in single rows, using only translational symmetry (as though the painters had slid each unit sideways to create the next unit and thus the entire row). Occasionally, vase painters created key pattern compositions that contained two, two-fold rotationally symmetric rows (Bernhard Schweitzer, an expert of Geometric period vase painting, refers to these pattern compositions as 'antithetical', perhaps in reference to the rotational symmetry, though his meaning is unclear) (Fig. 7.4).[568] In addition, Geometric vase painters did little to manipulate negative space. For example, they also created larger key pattern compositions in a second way, by elongating the trunks and adding embellishments along their length to further bend the path. This manipulation of negative space was more conceptual rather than directly physical, as the painters only used the additive approach for such compositions (Fig. 7.5). Otherwise, Geometric vase painters did no more to manipulate negative space than to choose which side of the trunk would intersect with its branch, thereby determining whether the key pattern composition would contain single or double spiral units (Fig. 7.1b-c). The specific strategy for enlarging key pattern compositions by adding embellishments along the length of the trunks (Fig. 7.5) never re-appeared again in later phases of ancient Greek art.

[568] Schweitzer 1969, pp. 37, 106, fig. 75

By the early to middle 7th century BC, a new style of vase painting known as 'black figure' developed, which continued until the early 5th century BC, after which it mostly fell out of use.[569] Artisans painted scenes and patterns in a glaze that fired black, leaving the original, lighter colour of the clay as a background 'behind' their human figure subjects.[570] To create outlines or details, painters scratched incised lines into the black areas to reveal the colour of the clay beneath.[571] By this time, figural iconography took precedence over abstract patterns, which now were limited to single, narrow rows, typically functioning as borders underneath the figural scenes or around the neck or mouth of the vessel.[572] Branchless key patterns or those with single branches per trunk were inherited from the Geometric period and remained common. Black figure vase painters also continued the tradition of switching between the additive and reductive creative approaches, sometimes on the same vase. For example, on a hydria dated sometime after the mid-6th century BC from Rhodes, the artist, known as the Hunt Painter,[573] painted two key patterns, one below the figural scene and the other above it. Both key patterns are identical in basic structure, with a single branch per trunk and double-stranded spiral units, but the Hunt Painter took an additive approach to the key pattern on the bottom, painting the path in a black line, and a reductive approach to the upper key pattern, painting the trunks and branches in black and leaving the path in the colour of the underlying clay (Fig. 7.6a). In black figure, vase painters also introduced a second, new way of creating additive key pattern, by scratching lines in the black glaze to create a light-coloured path.[574] The technique was often used to portray decoration on clothing in figural scenes. This treatment is seen on the hems of figures on an early 6th-century Attic crater from Chiusi, Italy, by the vase painters Kleitias and Ergotimos (Fig. 7.7).[575] In black figure, vase painters also departed further from the Geometric style by introducing two new ways of manipulating negative space: 1) more frequently than in the Geometric period, they added one or more distal embellishment line segments to the branches, in order to create the appearance that the individual spiral units 'turned' more tightly (as seen on the top key pattern on the Hunt Painter's hydria); and 2) they sometimes joined the negative line elements within each spiral unit, making the path discontinuous at the centre of each unit, so that the path appears to form a series of black S-like shapes (demonstrated on the bottom key pattern of this hydria) (c.f. Figs. 7.1b, 7.6a-b).

[569] Moignard 2008, 12.
[570] Richter 1987, 316-317.
[571] Moignard 2008, 23.
[572] Richter 1987, 323.
[573] Boardman 2006, p. 68, fig. 90.
[574] For a general description of this technique of incision, see Moignard 2008, 46.
[575] Boardman 2006, p. 52-3, fig. 62, 64.

Near the end of the 5th century BC, vase painters developed yet another technique, known as 'red figure'.[576] Here the logic of black figure was reversed, and the figural subjects were left in the red colour of the clay, while their background was covered in black glaze.[577] As with black figure, key pattern was limited to single-rowed borders. Once again, branchless key patterns or those with single branches on each trunk (forming either with single- or double-stranded spiral units) were most common. Vase painters continued to allow key pattern to be cut off at the outer border of the composition, or when in a circular field, to even run into itself (causing a physical break in the pattern where two spiral units overlapped each other, a treatment unheard of in Insular art, as it causes the path to become prematurely discontinuous), the latter which P.E. Arias described in passing as 'incomplete meander' (Fig. 7.8).[578] While the black glaze now was used to represent the background, or negative space, for the human subjects, red figure vase painters continued the traditional lack of commitment to one creative approach in key pattern, sometimes rendering the negative line elements of their key pattern compositions in black (Fig. 6.2), and at other times drawing the path in black instead (Fig. 7.9). Vase painters no longer used incision to create key pattern, however, and a limited number of key pattern compositions with new physical structures began to appear on vases as well. Vase painters added second branches to their trunks, often also drawing an additional, continuous, decorative black line down the centre of the path in these compositions (Fig. 7.10) (a treatment also found occasionally in bright colour in Insular manuscript illuminations (Chapter 8)). An additive key pattern with a continuous path and spiral units in the shape of swastikas also became common in vase painting (Fig. 7.11). Ancient Greek key pattern in both black and red vases never reached the same level of geometric, structural complexity as in Insular art, however, despite the limited visual variety that Greek vase painters injected into their corpus by switching between the additive and reductive creative approaches. The Greeks were unable to exploit a wide variety of symmetry operations beyond translation and reflection because they limited their key patterns to single rows, and they never expanded their negative line elements into shapes.

Greek key pattern was not limited to the medium of vase painting. The survival of wall painting is poor, but a third genre of vases, the white-ground lekythoi, were very similar in appearance and technique to wall painting.[579] Produced for use in funerary contexts,

[576] Ibid., 66.
[577] Richter 1987, 316-317.
[578] Arias 1962, p. 341, plate 145.
[579] Richter 1987, 273; Boardman 2006, 92.

white-ground lekythoi were covered with a white wash, over which artists painted figures and patterns.[580] Here vase painters handled key pattern and its structural properties in the same manner as in black and red figure, using both the additive and reductive approach and limiting their compositions to single rows (Fig. 7.12).

Key pattern also survives on sculptures, painted on the clothing of figures.[581] While the author is not aware of any surviving ancient Greek textiles with key pattern, these painted figures provide further evidence that the Greeks also wove key pattern, echoing similar depictions of key pattern on the hemlines of figures in black figure vases (Fig. 7.7). Sculpture painters also continued the convention of switching between the additive and reductive creative approach. For example, the orthogonal key pattern with swastika-shaped spiral units – the same that appeared later on red figure ware – is painted in single rows on the dresses of two Archaic korai from the Acropolis Museum (possibly representing the decorated edges of the garments).[582] While it is technically impossible to identify the painters' creative approach (i.e. whether the dark or light colours were painted on the sculpture first), the key patterns on these sculptures still represent *conceptually* additive and reductive approaches. On one kore, the key pattern is painted in an additive manner (with the path rendered in continuous dark lines), while the other is reductive, with the negative lines painted in dark colour (Fig. 7.13a-b). Sculpture painters also maintained other conventions characteristic of ancient Greek key pattern, using orthogonal key patterns limited to single rows, without any significant expansion of negative line elements into shapes.

Greek makers consistently used a reductive creative approach only when rendering key pattern in three-dimensions, but otherwise in structure these key patterns followed those found in vase painting and sculpture painting. An ivory figurine of a goddess from the Geometric period (c. 750-600 BC) wears a carved row of meander around her 'polos' or cap.[583] This key pattern, with single branches per trunk and no embellishments, is identical to many seen on Geometric vases. However, here the craftsperson reductively carved away the negative line elements and left the path raised in relief (c.f. Figs. 7.1b, 7.14). Because furniture was mainly carved from wood, survival rates are also poor, however, a

[580] Richter 1987, 319, 348-350.
[581] I am thankful to Dr. Susanna Harris for alerting me to the existence of painted patterns on Archaic sculpture. Dr. Susanna Harris, pers. comm., 4 September 2017.
[582] Payne and Young 1936, pp. 69-70, plates 48, 54.
[583] Schweitzer 1969, pp. 135, 137, plates 146-148.

mid-5th-century terra-cotta depicts a garment-chest decorated with the same, single-branched, double-stranded key pattern as seen on the ivory goddess.[584] Again, the pattern's negative line elements are recessed and the path is raised in relief. It is as though Greek artists in the Geometric period often mentally translated a key pattern path that was raised in three-dimensional media into painting as an additive, continuous, dark line, or vice versa, a habit of mind that then continued through later centuries of vase painting, though with less consistency. This contrasts with Insular practice, because early medieval British and Irish artists focused instead on the shadows created in three-dimensional key pattern by carved-out or recessed negative line elements, translating them reductively as lines of black ink in manuscript art.

Perhaps because the Greeks treated key pattern in a marginal fashion, modern scholars seldom turn their analytical focus from figural iconography to the pattern except to classify it or simply to note its presence. For example, the reigning Greek vase expert, John Boardman, never once analysed key pattern in his entire recent overview, *The History of Greek Vases*, and Gisela Richter dedicated only two pages to abstract ornament (with no discussion of key pattern structure) in *A Handbook of Greek Art*.[585] Classificatory terms for different key pattern compositions are based more on their superficial appearance than their structural properties. For example, in his classification of Geometric patterns, J.D. Coldstream referred to branchless key pattern as 'battlement meander', single-branched rows of key pattern with double-stranded spirals as 'orthodox', and the larger key pattern compositions (with elongated trunks and additional embellishments) as 'double' or 'triple' meander.[586] Greek art specialists either have not recognized or chosen not to discuss the artists' creative approach or its impact on key pattern structure and thereby on individual compositions' physical appearance, frequently referring to reductive key patterns as 'meander hooks', in the mistaken assumption that these compositions were different patterns altogether from additive versions.[587] Boardman may have referred once to creative approaches when noting that in Greek pottery, 'some maeander patterns can be 'read in a reserving, red figure manner', perhaps referring to reductive key patterns, though it is unclear what he meant or how fully he recognized the implications, as he did not elaborate.[588] In fact, only one non-academic, enthusiast's website contains the most

584 Richter 1987, pp. 370, 378, fig. 505.
585 Boardman 2006; Richter 1987, 386-387.
586 Coldstream 2008, 12, 396.
587 Ibid., 396.
588 Boardman 1975, repr. 1997, 214.

detailed analysis of Greek key pattern structure known to the author. The creator recognised and diagrammed the symmetric multiplication of spiral units down single rows (with mirror and rotational symmetry), the addition and omission of negative line elements to create embellishments with greater or lesser ‘turns’, and the fact that additive and reductive compositions are equivalents or ‘inverse’ (though without any discussion of positive and negative space or the creative approach and its implications).[589] The website author also did not fully recognise the artists’ manipulation of negative space, for example, they classed orthogonal rows with trunks possessing single branches as different patterns than those with two branches, when in fact these two compositions share the same basic structure.[590]

Schweitzer was the sole academic to discuss Greek artistic agency, use of symmetry, and manipulation of negative space in key pattern. In his overview of Geometric art, Schweitzer observed that ‘mathematical, abstract, creative technique of variation’ was used for key pattern, ‘developing simple basic shapes into a richer range of forms’.[591] His brief discussion of symmetry focused solely on a corpus of unusual, later Geometric key patterns on vases from Rhodes, which were structurally distinct from all other Greek key patterns discussed above.[592] According to Schweitzer, the painters took patterns of triangles and lozenges attached to ‘meander hooks’ arranged in rows, and then ‘dismembered’ their components and used mirror symmetry to rearrange them into cruciform compositions (Fig. 7.15).[593] Schweitzer also described how the lines in these patterns could be further ‘broken down’ and separated from one another,[594] that is, vase painters on Rhodes manipulated negative line elements by splitting them in two (Fig. 7.15). Schweitzer does not appear to have recognized that these rows of ‘meander hooks’ attached to ‘lozenges’ or ‘triangles’ were actually painted versions of the ‘running dog’ from basketry and/or textiles, just like the one on the Neolithic pot from Moravia (Fig. 6.8). In a rare departure from the general Greek *modus operandi*, vase painters from Rhodes briefly produced key pattern compositions in a spirit similar to that of Insular artists much later, by disarticulating diagonal, woven key patterns and rearranging their components through the manipulation of symmetry and negative line. This detour,

589 Edkins 2007a; 2007b.
590 Edkins 2007a.
591 Schweitzer 1969, 27.
592 Ibid., 84-85, 94-95.
593 Ibid.
594 Ibid., 94-95.

however, did not last beyond the Geometric period, and in modern scholarship Schweitzer is a lone voice and his published analysis remains limited.

Readers may have noticed that, besides the 'running dog' from Rhodes, diagonal key pattern was conspicuously absent from ancient Greek art. It was extremely rare indeed, and the author has found only six examples in total despite deep surveys of ancient Greek pottery, painted sculpture, mosaics, and other media. All of these diagonal patterns imitated woven key patterns, and no modern scholar has discussed their structure. First, four early, black figure vessels are decorated with exact imitations of woven diagonal key pattern with single-stranded spirals, similar to the pattern found on the 3,000-year-old trousers from western China. The painters of all four vessels used the additive approach, rendering the path in a black line. They include two amphora by the Piraeus painter, a skyphos crater from the Nessos Painter, all dated to the late 7th century BC, and a plate from Thasos for which Boardman did not provide a date, but which is stylistically similar to the other vessels (Fig. 7.16).[595] All four pots date to the end of the 'orientalising' period, during which Greek vase painting was influenced by new motifs and images brought by 'immigrant craftsmen' from the east, such as the Phoenicians and Syrians.[596] Although the western Chinese trousers pre-dated these pots by approximately 400 years, it is possible that the diagonal key pattern compositions on these vessels reflect the short-lived application of ideas drawn from eastern influences.

The Greeks' association of diagonal key pattern with civilizations to the east is corroborated by a surviving painted depiction of a running dog pattern on a sculpture of a rider dressed in colourful clothing, thought to represent a Persian horseman.[597] This sculpture (no. 606) is now held in the Acropolis Museum and is thought to date to the early 5th century BC.[598] The running dog survives in remnants of paint, in a single row along the hem of the rider's vest,[599] perhaps depicting a tablet-woven band (Fig. 7.17). Polychromy expert Vinzenz Brinkmann analysed the original paint but said little about the running dog, only identifying it as 'diagonal meander' located on the rider's vest hem, painted in

595 Richter 1987, p. 300, fig. 415; Boardman 1991, repr. 1997, pp. 14-16, 22-23, fig. 6, 9; Boardman 1998, p. 131, fig. 256.
596 Boardman 1998, 83; 2006, 12.
597 Brinkmann 2010, 116.
598 Ibid., Payne and Young 1936, p. 74, plate 134.2.
599 Brinkmann 2010, 116.

green.[600] In fact the running dog has two colours: green for the continuous path and yellow for the negative line elements. Brinkmann did not stipulate whether the painter painted the green or yellow colour first. Nevertheless, the Persian Rider's key pattern is conceptually additive, just like the single-stranded diagonal key patterns on the four black figure vessels discussed above, because the path is painted in a dark colour (green).

Finally, a spectacular Attic amphora from Vulci, Italy, painted by Exekias, is also decorated with the running dog.[601] This vase painter (fl. 560-525 BC) is known to modern scholars as one of the great masters of black figure.[602] His work is characterised by precise incisions in the black glaze that created detail and texture in his figures' hair and clothing.[603] The amphora depicts a scene with Achilles (left) and Ajax (right). Their clothing is decorated by narrow bands running across their bodies and on their hems. Exekias incised these bands with a variety of patterns, including curvilinear spiral patterns, chevrons, and orthogonal key patterns with single-stranded spirals. However, in three bands, across Ajax's shoulder blades and around Achilles' torso and down the long edge of his cloak, Exekias depicted single rows of running dog (Fig. 7.18). He used the additive approach, scratching the positive path into the black glaze. Both the structure of the patterns and the location of the bands, particularly at the hem of Achilles' cloak, may depict tablet-woven strips of cloth. Modern scholars have never commented on these key patterns on this amphora before.

Greek artisans were clearly aware of diagonal key pattern, but for unknown reasons decided not to utilize it widely, unlike other eastern motifs and decorations that entered Greek art in the 'orientalising' period. It is reasonable to assume that the dearth of diagonal key pattern in ancient Greek art reflects deliberate artistic choice, rather than chance survival, given the contrasting, extreme frequency of orthogonal key pattern across all ancient Greek media, including depictions of textiles. Greek makers not only under-utilized diagonal key pattern, but also did not exploit the opportunities inherent in diagonal orientation (i.e. the necessity of expanding negative line elements into shapes, because of the large areas of positive space left between the diagonally oriented trunks), in order to develop it further in a structural sense. None of the examples listed above contain any

[600] Ibid., 116-17.
[601] Boardman 2006, p. 62-63, fig. 80-81.
[602] Boardman 1991, repr. 1997, 52.
[603] Moignard 2008, 46; Arias 1962, 302-303.

expansion of negative lines into shapes, nor are their individual spiral units symmetrically rearranged from single rows into larger compositions.

In sum, though the ancient Greeks applied key pattern very frequently in their art, the visual variety and structural complexity of their patterns remained limited when compared to Insular key pattern, whether orthogonal or diagonal. This was in part because, after the Geometric period, Greek artists did not prioritize abstract pattern and so did not expend much effort to develop it. The Greeks' treatment of key pattern also lacked the crucial combination of three traits that gave Insular pattern-makers their edge: the symmetrical arrangement of spiral units not just in single rows, but in larger and larger fields of pattern; the exploitation of diagonal orientation; and the manipulation of negative line elements and their expansion into shapes (facilitated both by total commitment to the reductive approach across all media and by diagonal orientation). The Greeks instead flip-flopped between the additive and reductive creative approaches, and this lack of focus on the reductive approach also perhaps prevented them from developing more complex strategies of manipulating negative space. Their manipulation of negative line elements was as a result quite modest, consisting of the occasional addition of a second branch to each trunk, additional embellishments to the branches in order to increase the number of angled lines within each spiral unit, or the joining of negative lines in the centre of the units to make the positive path discontinuous. For whatever reason, the Greeks chose not to apply diagonal key pattern to any medium in any sustained way, even in depictions of textiles, indicating that they preferred orthogonal key pattern in woven media as well. Finally, after the Geometric period, which saw a finite moment of experimentation with symmetrical arrangements of disarticulated diagonal key pattern structures (at Rhodes), Greek makers focused instead on iterating a limited variety of orthogonal spiral units in single rows (in single-stranded, double-stranded, or swastika-shaped three- and four-stranded spirals), using the symmetry operation of translation most often. These limitations prevented them from boggling their viewer's eyes with negative line elements of varying widths and shapes, or combinations of multiple symmetry operations within the same composition. It is unlikely that the ancient Greek key pattern tradition (likely mediated through Roman art) had any impact on later Insular key pattern, despite their shared prehistoric roots, given their significant differences in the structure and handling of the pattern.

7.2. Key Pattern in Iron-Age Celtic Art

The Greeks' Celtic-speaking neighbours in Iron-Age, central and north-western Europe occasionally decorated objects and textiles with key pattern. They need not have relied on Mediterranean (or even eastern) influence in every single case, as their key pattern may have been a contemporary multigenesis ultimately born, like all others, from prehistoric basketry and textile weaving. Key pattern survives on three metal objects, four textiles, and one stone monument dating between the 9th to 4th centuries BC, from the Hallstatt to the middle La Tène periods, after which the pattern either fell out of use or has not survived. The key pattern compositions in question are predominantly orthogonal, with only three diagonal examples represented. However, on multiple occasions, Iron-Age Celtic key pattern compositions contain more combinations of symmetry than the individual rows that dominated Greek art, reflecting the characteristic practice of fracturing and rearranging the components of geometric patterns in Iron-Age Celtic art. Ancient Celtic craftspeople also tended to switch between the additive and reductive approaches, in two cases within the same artwork – most likely in a deliberate effort to heighten the ambiguity between positive and negative space, itself also characteristic of Iron-Age Celtic art in general.

While it is possible that key pattern was more common in textiles which are now lost, key pattern of any kind appears to have been rare in Iron Age Celtic art, even in other media that survive in very large quantities, such as metalwork. Indeed, key pattern may have been uncommon in woven media as well, given its comparative rarity at sites like Hallstatt, where the level of textile preservation is very high. This relative lack of key pattern is striking, because geometrically complex abstract patterns were the dominant decorative mode in both the Hallstatt and La Tène periods, indicating that the diverse Iron-Age Celtic-speaking peoples across Europe may not have had widespread or established key pattern traditions, despite the occasional occurrence of key patterns that surpassed contemporary Greek compositions in their structural complexity. Two of these surviving objects with key pattern, in the pattern's placement and/or the overall material, also reflect the likely use of Greek models rather than local tradition. Art historians and archaeologists generally have not discussed any of these key patterns in any way, except to remark upon their presence.

Only three woven key patterns survive from the Hallstatt period (c. 800-400 BC), despite the fact that hundreds of textiles have been recovered from the site of Hallstatt itself. Some of the key patterns have similarities to contemporary Greek examples, but they also depart from the latter in two significant respects. In these cases, any superficial similarity with Greek key pattern therefore more likely reflects ancient Greek and Iron-Age Celtic key patterns' shared roots, rather than direct, contemporary Greek influence. All of the Hallstatt compositions are orthogonal. Two textiles contain single-rowed key patterns commonly found in the ancient Greek corpus, including the tablet-woven band from Hallstatt ('HallTex 123A', Fig. 6.10).[604] This band originally may have been a sleeve hem,[605] and has a single row of orthogonal key pattern, with two-stranded spiral units and a single branch on each trunk. A second tablet-woven band, from the princely burial at Hochdorf in Germany,[606] also contains a key pattern composition common in Greek art: single, branchless, orthogonal rows (Fig. 7.19a). However, the same Hochdorf band includes key pattern with a specific symmetrical arrangement absent from Greek art: multiple orthogonal, tile-shaped compositions run down the band's central section, each formed by a single spiral unit (with one branch on the trunk) rotated four times at 90 degrees (one-fold rotation) (c.f. Figs. 6.29, 7.19a). A third, blue-colored tablet-woven band with key pattern, also from the Hochdorf grave, contains the same the orthogonal, tile-shaped key patterns with one-fold rotated spiral units (c.f. Figs. 6.29, 7.19b).[607] In addition, all of the orthogonal compositions on all three bands are themselves rotated at 45-degree angles to the edges of the cloth. This treatment is not found in ancient Greek art (or in any other preceding or contemporary key pattern tradition in Europe), and may have been a product of the tablet-weaving process, which facilitates the creation of lines that are diagonal to the edges of the cloth. Finally, it is impossible to state whether the key patterns are reductive or additive, as both positive and negative space were created simultaneously in the weaving process. Nevertheless, on the third band discussed above, the weaver repeatedly alternated the colours of the path and negative lines from one tile-shaped composition to the next (light and dark blue), creating the illusion of switching between the additive and reductive approaches (Fig. 7.19b). This flip-flopping between creative approaches is similar to Greek conventions for key pattern, but may also reflect early glimmers of the Iron-Age Celtic reflex for deliberately creating ambiguity between positive and negative space, which later became extremely pronounced in all aspects of La Tène art.

[604] Grömer and Römsel-Mautendorfer 2013, 451-52.
[605] Ibid.
[606] Grömer 2016a, p. 185, fig. 105.
[607] Ibid. Grömer does not discuss the key pattern except to note their presence on these bands.

Both orthogonal and diagonal key pattern are stippled on a Hallstatt-period bronze hand (accompanied by another hand and face mask, without key pattern) that was deposited in a high-status, 7th-century BC burial in the Iron Age cemetery of Kleinklein, Austria.[608] The orthogonal key pattern on the heel of the hand has two branches per trunk (a composition also occurring in later Greek red figure ware) and is additive, with the path stippled in a continuous line. In the palm of the hand, the smith stippled a diagonal key pattern composition with single-stranded spirals (Fig. 7.20). The spiral units are arranged in a square, in a spirit similar to the one-fold rotated orthogonal patterns from the Hochdorf tablet-woven bands (Fig. 7.19a-b). However, the units are not structurally identical to each other and do not appear to follow an ordered program of symmetry, unlike both Hochdorf key patterns. It is also impossible to tell whether the pattern on the hand is additive or reductive, as the smith allowed both the raised path and recessed lines to dead-end at the border. It is unclear whether this ambiguity was deliberate, or resulted from a lack of artistic control over the pattern's structure or a disinterest in precision. Like the other one-fold rotated key patterns, this composition is not found in neighbouring Greek art. These textiles and metalwork demonstrate that Hallstatt key pattern, though extremely limited, was comparatively innovative in its inclusion of one-fold rotational symmetry.

Orthogonal key pattern continued in the middle La Tène period. Two orthogonal, reductive key patterns were carved on a 4th-century (BC) stela of uncertain function from Kermaria en Pont-L'Abbe, Brittany.[609] A row of reductive key pattern with a single branch per trunk was carved around the top of the stela, identical to that on Hallstatt Textile 123A. Below this is an orthogonal key pattern in a square field, identical to one-fold rotated compositions on the Hochdorf bands (Fig. 7.21). On a bronze belt hook from Želkovice in the Czech Republic, also dated to the 4th century BC, a metalworker stippled the same single row of reductive, orthogonal, single-branched key pattern.[610] It is located above a single row of step pattern (Fig. 7.22). These single-rowed orthogonal patterns are shared with Hallstatt textile 123A and so, in their structure, could have been drawn from an independent, local key pattern tradition, like the orthogonal one-fold rotated composition on the stela. However, in their placement on a stone monument specifically, the Kermaria key patterns otherwise are outliers. In the local tradition, stone monuments were not

[608] Megaw and Megaw 2001, pp. 24-25, fig. 4.
[609] Cunliffe 1999, pp. 157-158, fig. 129. Cunliffe does not discuss the patterns in any detail.
[610] Megaw and Megaw 2001, p. 258, fig. 429b.

usually decorated, and so the choice to add key pattern may reflect awareness of the general classical practice of carving stone columns with ornament.[611]

The first surviving diagonal key patterns from a Celtic context appear alongside orthogonal ones in the La Tène period, on a single metalwork object and an embroidered textile. Both examples are the running dog. First, a 4th-century iron and bronze scabbard from a La Tène period grave from Hallstatt, Austria, is engraved with single rows of both orthogonal key patterns and the running dog (Fig. 7.23).[612] The same orthogonal, single-rowed, single-branched key pattern compositions as found on Hallstatt Textile 123A, the Kermaria en Pont-L'Abbe stela, and Želkovice belt hook were engraved around wagon wheels and the shield rims of warriors depicted on this scabbard. The male figures' trousers are also engraved with single rows of branchless key pattern, and single rows of key pattern with swastika-shaped spiral units placed vertically to divide the figural scenes. The diagonal 'running dog' pattern is engraved in the border around the scabbard tip. All are reductive except for the key pattern with swastika-shaped units (here, the path is engraved in continuous lines in the additive approach).

Ruth and Vincent Megaw referred to all the key patterns on the scabbard as 'Greek key designs',[613] however, with the exception of the additive, swastika-shaped key pattern (a variety which in European Antiquity otherwise clustered solely in the Mediterranean), these patterns could just as easily have originated in local textile production. The rows of orthogonal key pattern on the men's trousers support this possibility. Without reference to the key patterns themselves, Karina Grömer, Helga Römsel-Mautendorfer, and Hans Reschreiter have suggested that the bands depicted on the men's trousers may represent 'leg bindings', a specific textile type found at Hallstatt that was characterized by 'weave structures that would produce the pliability to wrap closely around the leg.'[614]

Nevertheless, the figural scenes on the scabbard and the arrangement of the key pattern compositions, though not the structure of the patterns themselves, also demonstrate simultaneous, strong influence from ancient Greek art, likely via the exchange of objects

611 Dr. Katherine Forsyth, pers. comm., 18 January 2018.
612 Megaw and Megaw 2001, pp. 80-81, fig. 92.
613 Ibid., p. 80.
614 Grömer et al. 2013, pp. 127-29, fig. 42.

through trade. The scabbard is mainly decorated with figural scenes, a trope common in Greek art but extremely rare in Iron-Age Celtic contexts. The key pattern is used as a ground line and to divide the figural scenes, as done on Greek vases. Finally, the orthogonal key patterns around the foot soldiers' shields and wagon wheels are identical to those on the shield rims of hoplite soldiers depicted on the 'Chigi vase', a 7th-century ancient Greek olpe from Etruria.[615]

The final artefact discussed in this section, however, completely departs from the Greek idiom. An embroidered example of running dog discussed by Karina Grömer, from an early La Tène grave at Nové Zamky, Slovakia,[616] exhibits the Iron-Age Celtic habit of creating deliberate ambiguity between positive and negative space. Here, the craftsperson repeatedly switched between the additive and reductive approaches within the same composition. The evidence for the embroidery itself survives in 'distinct puncture holes in which some…threads of red wool are still preserved.'[617] The craftsperson sewed two adjacent rows of running dog that are two-fold rotationally symmetric to each other. In each row, from left to right, they sewed a reductive section (embroidering two negative trunks and their branches in red, and leaving the path in between in the beige base cloth), and then an additive section (leaving two negative trunks and their branches in the beige base cloth, and raising the path with red embroidery) (Fig. 7.24). The effect is visually bewildering and so it is understandable that Grömer did not recognize it as key pattern and mistook it for 'interlocking trumpet motifs' (a curvilinear spiral pattern common in La Tène art).[618] The Greeks flip-flopped between the additive and reductive approaches in different key pattern compositions, but this deliberate creation of ambiguity between positive and negative space within the *same* composition was specifically characteristic of La Tène art, whatever the type of abstract pattern. This treatment never occurred in any other key pattern tradition in the Old World, including in Insular art.

It is tempting to argue that Iron-Age Celtic key pattern was the direct ancestor of Insular key pattern, in particular because artists in these two traditions shared some unique conventions for manipulating the pattern. For example, the one-fold rotational symmetry of spiraliform units on the Hochdorf bands, the Kleinklein hand, and the Kermaria stela

[615] Boardman 2006, p. 31, fig. 30.2. Boardman does not discuss the key pattern on this vase.
[616] Grömer 2016, p. 203-204, fig. 120.
[617] Ibid., 204.
[618] Ibid.

only otherwise occurs in key pattern in a Eurasian context in Insular art. In addition, although Insular artists clung to their reductive approach and never switched with the additive approach in a single key pattern composition, the unusually inventive treatment of positive and negative space in the Nové Zamky embroidery is somewhat similar in spirit to the Insular treatment of key pattern. Perhaps it was such Hallstatt and La Tène key patterns to which George Bain referred when arguing that Insular key pattern had developed from ancient Celtic rather than Mediterranean sources, though he never explained his logic or named any Iron Age examples. However, to make this argument is to go too far. Firstly, no key patterns from Iron-Age Britain or Ireland survive in any medium, so there is no proof that continental, Hallstatt or La Tène key patterns transferred across the Channel and provided the spark for later Insular versions to suddenly explode into widespread use in the Early Middle Ages. Secondly, though Iron-Age Celtic artists utilized diagonal key pattern in the form of the running dog, Insular diagonal key patterns have significant structural differences. Namely, Iron-Age Celtic key patterns contain none of the manipulation, omission, and expansion of negative lines into shapes that was characteristic of Insular key pattern. Thirdly, while there was an Iron Age Celtic, local tradition of key pattern, it was very limited. Neither Hallstatt nor La Tène artists developed a significant key pattern tradition in textiles or other media, as so few examples survive from a rich and ultimately pan-European corpus of other abstract ornament that is attested on a large number of objects of a variety of media. Two objects from this tiny corpus of ancient Celtic key patterns even were themselves inspired by the classical key pattern tradition. Therefore, it is more likely that continental Iron-Age Celtic and later Insular makers developed their key patterns as physically (and temporally) divergent traditions that simply shared a common prehistoric root. What Insular artists *did* inherit from their Iron-Age predecessors was a more general interest in fracturing and symmetrically rearranging the component parts of all abstract patterns and in manipulating the relationship between positive and negative space. As a result, Iron-Age, continental Celtic and Insular key pattern compositions display similar treatments of symmetry and space. Otherwise, each belonged to their own chronological moment, so Iron-Age Celtic key pattern cannot be claimed as a direct source for the Insular tradition.

7.3. Key Pattern in Ancient Roman Art

Returning now to the Mediterranean, we find frequent use of key pattern in Roman art, again reflecting the same increase in both survival and use as seen in ancient Greek art. As part of the classical milieu, Roman key pattern shared much with that of the Greeks, however Roman patterns differed by being entirely orthogonal – without exception. The Romans were more consistently additive in their creative approach than the Greeks when creating two-dimensional key patterns. Roman artists also heavily favoured key patterns with swastika-shaped spiral units across all media, more so than the Greeks. Such compositions with swastika-shaped spiral units were also extremely rare by comparison in the Insular milieu. As with all key pattern traditions, the Romans maintained the structural properties necessary to keep key pattern from physically breaking down, such as the maintenance of a consistently even path and spiraliform units of generally uniform size, and the prevention of negative lines from touching more than one side of the border. However, like all artists in all non-Insular traditions discussed so far, Roman pattern-makers also chose not to engage with other structural properties that Insular artists would emphasize later, such as the manipulation of negative line elements. Because of this, and because of their predominantly additive approach to key pattern (which prevented them from omitting, adding, or expanding negative line elements into shapes), Roman makers never developed their key pattern to level of visual variety and structural complexity seen in Insular art.

Roman makers took the additive creative approach to key pattern in two-dimensional media, bucking this convention in very few artworks. All Roman examples of key pattern known to the author are those that Roman art specialists commonly refer to as 'swastika-meander',[619] and which Greek artists also used across their media, though to a comparatively lesser extent. This key pattern is found throughout the Roman Empire, including in Britain, where it occurs in over a third (i.e. 26 of approximately 86) of the mosaic pavements and fragments illustrated in David Neal's 1981 catalogue, *Roman Mosaics in Britain*.[620] In the barest technical sense, it is impossible to know whether mosaicists lay down the tesserae meant to represent positive or negative space first, or at

[619] Smith 1983, 120.
[620] Neal 1981, plates 2, 3, 5, 8, 9, 19, 20-21, 23, 26-27, 29-30, 38, 42, 49-50, 58, 63, 68, 71, 74, 78-79, 82, 87a. Once again, the author is grateful to Dr. Michael Brennan for encouraging her to look into Roman mosaics as a source for key pattern in general. Dr. Michael Brennan, pers. comm., 13 May 2015.

the same time, for as Neal noted, 'how the mosaicist went about setting out patterns is open to conjecture'.[621] Nevertheless, most Roman mosaicists took a *conceptually* additive approach by imitating the appearance of additive key patterns painted on pottery. That is, they lay down the tesserae representing the positive space, or the continuous path, in black or another dark colour (as though painted on a vase). The discontinuous negative line elements were left over as a conceptual by-product, in a neutral colour between the path. A mostly complete mosaic from an early 4th-century (AD) Roman villa at Woodchester, in Gloucester, England,[622] contains multiple key pattern compositions with swastika-shaped units demonstrating this conceptually additive approach (c.f. Figs. 7.11, 7.25).

Roman textile weavers likewise took a conceptually additive approach to key pattern by rendering the paths in dark-coloured thread. They also favoured the same key pattern with swastika-shaped units.[623] Late Antique Egypt was a centre for textile manufacture in the late Roman period, the products of which (along with later local, non-Islamic textiles from the Early Middle Ages) are referred to as 'Coptic'.[624] Panels of key pattern survive from this corpus, such as those from a 4th- or 5th-century (AD) shroud fragment and 5th-century tunic decoration, both woven in purple wool and undyed linen (Fig. 7.26).[625] This variety of key pattern was used in the Mediterranean world into the early medieval period, and can be found on a third purple and white panel dating from the 7th to 8th centuries illustrated in Alexander Badawy's survey, *Coptic Art and Archaeology*.[626]

Roman craftspersons' treatment of key pattern in both mosaics and textiles differed from the Insular context in several ways. Because both weavers and mosaicists focused heavily on directly creating a consistently even and continuous path in strong, visually distinctive, dark lines, they never manipulated the patterns' negative line elements by omitting, adding, rearranging, or expanding them into different thicknesses or shapes. The weavers also cut their key pattern compositions off at the border of the field, rather than adjusting the structure of the patterns to fit entirely within the assigned space. This caused the dark lines of the path to cul-de-sac at the outer border (Fig. 7.26). Finally, no diagonal key pattern

[621] Ibid., 22.
[622] Ibid., plate 87.
[623] Trilling 2008, p. 90, no. 100.
[624] Ibid., 11, 13; Badawy 1978, 298. The author is grateful to Dr. Michael Brennan for encouraging her to look into Trilling's publication on Coptic textiles as a source for key pattern in general. Dr. Michael Brennan, pers. comm., 13 May 2015.
[625] Trilling 2008, p. 90, no. 99-100.
[626] Badawy 1978, p. 298-299, fig. 4.86.

survives in Roman art. The key pattern on the 4th- to 5th-century Coptic shroud decoration described above appears to be diagonal at first glance, however, it is simply an orthogonal pattern that has been rotated at 45 degrees (Fig. 7.26), like the Hallstatt patterns on the tablet-woven bands in Figs. 6.10 and 7.19a-b. For these reasons, Roman key pattern was less structurally complex and visually diverse than Insular key pattern.

Roman makers did use symmetry to multiply the pattern's spiral base units, however, to create all-over compositions larger than the single rows favoured in Greek art. This was done on both the Woodchester mosaic and Coptic textiles discussed above. However, the Romans achieved this goal using very different means than did Insular pattern-makers. The Romans laid out (or otherwise planned) the darker lines of the path in each swastika-shaped spiral unit first. They arranged these spiral units throughout the composition in different symmetrical relationships to each other (mirrored, rotated, translated, or some combination of these operations), and then proceeded to connect them to each other to complete the continuous, positive path. Neal partly suggested this when he observed that Roman mosaicists in Britain created key patterns in 'continuous runs' or in 'a staggered arrangement' (that is, by translating the swastika-shaped units all in the same direction) or in the case of a fragment from Chichester, West Sussex, England, by reversing them 'to form mirror-repeats' (mirroring each unit in relation to others in the composition).[627] This process is clear in his reconstructive drawings of mosaics from Roman Britain (Fig. 7.27).[628] In some cases, mosaicists even arranged the spiral units so that the path connecting them formed octagonal shapes (Fig. 7.28).[629] The Romans' treatment of key pattern thus was simultaneously a product of their additive creative approach, but also in itself a construction method. They centred their creative attention on iterating the same

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[627] Neal 1981, pp. 33, 53-55, fig. 7c-d, 14-15.
[628] Ibid., pp. 18, 33, 53-54, fig. 7c-d, 14-15.
[629] Ibid., 28, figs 7C, D. The artist Yang Liu and computer scientist Godfried Toussaint offered another explanation for how Roman mosaicists created key pattern. They argued that Roman artists used an algorithm to create the 'closed curves' (fully connected lines of the path) in the mosaic. In the areas where different sections of the path intersected each other, the swastika-shaped spiral units were created by manipulating the lines at the path intersections, as though the path were formed of ropes, and could be twisted into spiral form by the artists' fingertips, without disturbing other parts of the key pattern. After twisting, minor adjustment or 're-scaling' of units would have been necessary. Spirals twisted to the right and left are mirror-symmetric. However, Liu and Toussaint's conclusions are unfeasible in an ancient context. They used computer software to construct schematic diagrams of the 'closed curves' (the path), as well as the formation of spiral units by twisting it. Roman artists did not have access to vector graphic software and so would not have been able to twist and 're-scale' components within their key patterns unless they used actual string. If the latter, any twisting or 're-scaling' of units would have been an inconvenient or impossibly difficult task, for such actions would have dragged other parts of the pattern composition out of place. Liu and Toussaint 2010, 2, 8-10, 13, fig. 10-11, 13-14.

spiral shape in the path, instead of composing key pattern by manipulating the negative line elements in the Insular fashion.

The Romans reversed their creative approach to the reductive in mosaics or other two-dimensional media only occasionally. In the border of a mosaic from Antioch-on-the-Orontes in Turkey, from the mid 1st to the early 2nd century AD,[630] the mosaicist used black tesserae for the negative line elements and beige for the path, in a reversal of common practice (Fig. 7.29). Eva Wilson likewise observed such 'reversing [of] colours' in Roman key pattern, though she made no comment on the Romans' creative approach.[631] Mosaicists also sometimes used shading and perspective to create an illusion that their swastika-shaped key patterns were three-dimensional, as in a mosaic from the Mausoleum of Galla Placidia dating to AD 430 (Fig. 7.30a).[632] Wall painters created the same effect, as seen in the upper border of a 1st-century (BC) fresco in the Villa of the Mysteries in Pompeii (Fig. 7.30b).[633] In both examples, Roman artists created the illusion of reductive key pattern, as though the negative line elements were carved away and the path was left raised in relief.

The instances listed above were therefore imitative of how Romans created key pattern in three-dimensions. While the Romans largely took the additive approach in mosaics and textiles, like the Greeks they consistently switched to the reductive approach only in sculpture and metalwork. On a frieze fragment from the Great Baths in Bath, the stone carver cut away the negative line elements of a typical swastika-shaped key pattern and left the path in relief (Fig. 7.31a).[634] A single row of swastika-shaped key pattern is engraved on the border of the silver Anastasius Dish (c. 491-518 AD) from the Sutton Hoo treasure, so-called because the dish contains control-stamps of Emperor Anastasius I (Fig. 7.31b).[635] Here the negative line elements are also depressed, and the positive path is left raised.

In total, however, the Romans took an additive creative approach to key pattern far more consistently than the Greeks, who frequently switched between the additive and reductive

[630] Henig 1983, plate 9.
[631] E. Wilson 1994, p. 31, fig. 1:10.
[632] Smith 1983, 120; Henig 1983, plate 15.
[633] Henig 1983, plate 2.
[634] Cunliffe and Fulford 1982, p. 16-17, no. 54-57, plate 15.
[635] The British Museum [accessed 19 March 2017].

approach even in two-dimensional media. The Romans also employed symmetry to a greater extent than the Greeks, to create patterns that covered much wider areas than single rows in their artworks. Their conception of the pattern as the sum of its individual parts, arranged symmetrically over large fields, is similar in spirit to later Insular practice. However, there the similarity ends, and as a result, Roman key pattern was less structurally complex and visually various than Insular key pattern. Because of their additive approach to and conceptualization of key pattern, they were even less inclined than the Greeks to manipulate negative space. They never added embellishments to branches in order to create the appearance of more tightly turned spiral units, nor did they expand or contract negative line elements into shapes. Indeed they appear to have thought about negative space very little. The Romans instead focused on iterating a single shape to create orthogonal key pattern compositions – the swastika-shaped spiral unit, formed from the often black-coloured path. The total dearth of diagonal key pattern compounded this comparative lack of geometric complexity.

This analysis has also proven that Insular makers did not take key pattern from Roman models, because their creative approach and conventions for handling key pattern's structural properties were so different. Insular pattern-makers were aware of Roman versions, but they reproduced it on only one surviving monument – the Abercromby 2 cross-slab – perhaps because they found it ill-suited to their staunchly reductive approach (Fig. 7.32).[636] Unfortunately, though Allen noted the presence of this key pattern on the slab, it is no longer visible due to weathering, and we are therefore must trust that he accurately rendered the pattern.[637] If Allen accurately rendered it and a Roman key pattern was carved on the Abercromby stone, such Insular awareness (and overall rejection) of Roman key pattern may be explained by the exchange of goods (such as Coptic textiles) with the Mediterranean. There is evidence for such exchange at Dinas Powys in Wales, where important Roman or post-Roman glass vessels originating somewhere in the Mediterranean (including possibly Egypt), and in the 9th-century Faddan More Psalter, discovered in 2006 in a bog in Tipperary, Ireland.[638] The cover of this Irish psalter is lined with papyrus from Egypt.[639] Nevertheless, whatever the means Insular artists gained access to Roman key pattern, the latter did not impact their unique local tradition.

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636 Allen and Anderson 1903, vol. 1, part 2, p. 333, no. 898; vol. 2, part 3, pp. 348-349, fig 362. On page 333 of part 1, Allen also states that this swastika-shaped key pattern occurs on a sculpture at Millport, however, the author was unable to identify this monument among the surviving corpus of stones from Millport.
637 Historic Environment Scotland [accessed 20 March 2017].
638 Read 2011, 8; Campbell 2000, 38-39.
639 Read 2011, 54-55.

Indeed, the Roman's additive approach to key pattern and habit of arranging spiral units first before connecting the rest of the path appears to have caused Allen confusion in his structural analyses of Insular key pattern in both his 1885 and 1903 classifications. He may have attempted to apply the Roman treatment to the Insular context when he argued that Insular makers drew the spiral units of their key pattern first, and only then connected them with trunks and branches.[640] And though Allen was aware that 'each key-pattern has a reciprocal…produced by interchanging the black and the white' (i.e. the positive and negative space), he was not aware of the differences between the additive and reductive approach.[641] This led him to mistake the path in additive key patterns (for example, the S-shaped, discontinuous, black path formed by the joining of negative lines on some Greek pottery) as the same physical structure as negative trunks and branches in reductive key patterns (Fig. 7.33).[642] This mistake continued throughout his introductory structural analysis for his classification in *ECMS*, also affecting his understanding of Roman key pattern.[643]

7.4. Key Pattern in Early Islamic Art

Key pattern was not the sole purview of Iron-Age Europe or early medieval Christendom. After the spread of the Arab Empire through the Near East and into Spain, artists there developed a decorative style dominated by complex abstract patterns, including interlace. However, early Islamic makers used key pattern very rarely, and when they did, they relied solely on swastika-shaped varieties inherited from the Romans. Why key pattern was so rare in early Islamic art remains an open question, especially given how they developed Roman interlace into a new and complex idiom unique to their milieu. Even though the following analysis is of key pattern that dates to the early medieval period only, key pattern continued to be rare in Islamic art thereafter.[644] Because Islamic key pattern directly followed that of the Romans, it likewise lacked the same geometric complexity and visual variety found, in contrast, in Insular art.

[640] Allen 1885, pp. 274, 290-291, fig. 10B, 64.
[641] Allen and Anderson 1903, vol. 1, part 2, p. 310.
[642] Ibid., p. 314, no. 827a-c.
[643] Ibid., pp. 314-322, no. 827-838c.
[644] For a range of texts on Islamic pattern and art (which provide a sense of the general lack of key pattern), see Jan Abas and Salman 1995, repr. 2007; Bend 1991; Bloom 2002; Critchlow 1976, repr. 1983; Ekhtiar et al. 2011; Ettinghausen et al. 2001; Field 2004; Grabar 2005; Hillenbrand 1999; Irwin 1997.

The key patterns were architectural, decorating mosaic panels on floors and the walls of buildings. As in the Roman tradition, they were predominantly additive, with swastika-shaped units arranged symmetrically and connected to create the path. The mosaicists also allowed the key patterns to be cut off by the borders at the edges of the pattern fields, as in Coptic textiles (Fig. 7.26). These patterns decorated roundels and infills of archways in the Great Mosque at Cordoba in Ummayyad Spain (Fig. 7.34). The mosaics were created some time during the mosque's multiple phases of early medieval construction, between the late 8th to late 10th centuries AD.[645] Across the Mediterranean, in the palace of Khirbat al-Mafjar in Jericho (c. 8th-9th centuries AD), a section of the mosaic floor of the bath hall contains a swastika-shaped key pattern in three-dimensional illusion, similar to that from the Mausoleum of Galla Placidia.[646] While modern experts have not commented specifically on Islamic key pattern, they have discussed the imperial Roman and Byzantine influence on the architecture of the Ummayyad Caliphate itself, as well as the abstract patterns adorning these buildings.[647] Despite these monumental examples, key pattern remained extremely rare in early Islamic art and did not in any place in the Arab Empire innovate beyond the Roman key pattern tradition.

7.5. Key Pattern in the Americas

7.5.1. Key Pattern in Ancient South America and Pre-Columbian Mesoamerica

Key pattern was not unique to the eastern hemisphere. Traditions also existed in ancient Peru and pre-Columbian Mesoamerica. These too ultimately originated from basketry and textile weaving, as in the Mediterranean world. If the hypothesis presented in this thesis is correct, that prehistoric humans developed key pattern through basket- and/or textile weaving technologies far earlier than longstanding archaeological theories would have allowed possible, then the parallel existence of key pattern in the Americas can be explained in the following three ways. Scholars largely agree that migration from Eurasia through Beringia and into North America occurred around 18,000-17,000 BC.[648] This migration post-dates the key pattern on the Mezin armband by approximately 2,000 years.

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[645] Ettinghausen et al. 2001, 84; Field 2004, 16-19.
[646] Ettinghausen et al. 2001, p. 40-42, fig. 46.
[647] Ibid., 41-42, 90.
[648] See for example Blaise et al. (1990).

It is therefore possible that migrating populations carried their key patterns with them in woven form (and/or in other media) into the Americas. Secondly, if they did not bring key pattern directly, then they may have brought early basketry and weaving technologies, and invented woven key pattern after settling in the Americas. Finally, it is also possible that the ancient indigenous populations of the Americas invented both basket- and textile-weaving and key pattern for themselves once in the New World, independently of their ancestral populations from prehistoric Eurasia.

The key patterns in question were fundamentally the same woven, diagonal single-stranded spiral key patterns and double-stranded running dog seen in prehistoric and ancient Europe, but with structural variations unique to South and Central America. These key patterns also differed from those of the Mediterranean specifically, because the makers used a significant amount of pattern in diagonal orientation. Mesoamerican and Peruvian artists also played with positive and negative space in unusual ways, in one case even switching back and forth between the additive and reductive approach within the same composition, in a coincidentally similar spirit to that of the La Tène embroiderer from Nové Zamky. However, beyond this unusual, simultaneous employment of the reductive and additive creative approaches in a three-dimensional medium, there otherwise appears to have been little manipulation of negative space or exploitation of symmetry, and patterns remained very close to woven exemplars. As a result, the key patterns of ancient Peru and pre-Columbian Mesoamerica, like all other global traditions reviewed so far, did not reach the same geometric complexity and visual variety as those of Insular art.

A diagonal key pattern runs around the border of a cotton panel produced in the Nazca culture of Peru, sometime between 200 BC and AD 200 (Fig. 7.35a).[649] Heddle looms had been in use in Peru starting between 2,000 and 1,000 BC, but this particular panel was not woven, but made from brightly-coloured feathers held down by 'a twining stitch'.[650] The pattern on the panel, however, is a running dog imitative of weaving and/or basketry, with the characteristic expanded triangular areas of negative space where the trunks meet the outer border. The edges of the negative line elements have a zig-zagging quality that did not occur in any running dog patterns from Europe. Allen, in a brief aside from his introduction to Insular key pattern in *ECMS*, briefly mentioned other cultures who used

[649] Schoeser 2003, pp. 42-43, fig. 34.
[650] Ibid, pp. 42-44, fig. 34.

key pattern and likened these jagged edges from South and Central America to ‘a flight of steps’.[651] He suggested that they resulted from ‘the mechanical necessities of the process of weaving textile fabrics’ (before proposing that key pattern also originated from prehistoric labyrinths).[652] The opposing trunks on the Nazcan panel have the two-fold rotational relationship characteristic of running dog, and their branches interlock to form spiral units down the centre of the band. Like the Anatolian running dog illustrated in Collingwood’s guide to tablet weaving (Fig. 6.18), these rotationally symmetric pairs of trunks were rendered in two different colours, here black and green, or orange and blue. However, the artisan did not assign an additional colour to the path, and in fact left it as an implied line between adjacent trunks and branches – a phenomenon never found in key pattern of any kind in Insular art or in any European, North African, or Middle Eastern tradition. Each trunk and its intersected branch are also allowed to touch both sides of the border, also a treatment that Insular artists never permitted in their own key pattern. This may have occurred because the invisible but implied path was notionally understood as passing between these negative line elements and the border. Each pair of interlocked trunks are separated from neighbouring pairs by four zig-zagging diagonal lines in yellow, black, green, orange, and blue.

The same key pattern occurs on a fish-shaped vessel in the British Museum, also from Peru, illustrated in a line drawing in Allen’s 1903 classification of key pattern (Fig. 7.35b).[653] Unfortunately, Allen provided no information on the date of the object, its material, colour, or whether any parts of the pattern were raised in relief. The author has been unable to locate this object in the British Museum’s displays or on its website. The body of the fish was decorated with the same running dog as the Nazca cotton panel. It is clear from Allen’s drawing that the maker differentiated between each trunk and its rotationally symmetric partner by contrasting their textures. One trunk and branch in each pair was smooth, and the other was stippled (and potentially recessed, though it is hard to confirm this from Allen’s drawing). This was likely intended to imitate the use of multiple colours for the negative lines and shapes, as seen on the Nazcan panel. While multi-coloured negative line elements do occur in running dogs elsewhere, this artistic decision to render the negative line elements in key pattern in three-dimensional media in two different textures has not been found anywhere else in the world thus far. Again, the path

[651] Allen and Anderson 1903, vol. 1, part 2, p. 309.
[652] Ibid.
[653] Ibid.

is left as an implied line between adjacent trunks and branches, and each trunk and its intersected branch are permitted to touch both sides of the border as a result.

Over 2,000 miles away and hundreds of years later, the same running dog with zig-zagging negative lines and an implied path appeared in massive architectural mosaics in the Hall of Columns at Mitla, in Oaxaca, Mexico. The Hall of Columns, with walls decorated by mosaics made of volcanic tuff in monumental scale, was the palatial residence of Mitla's oracular priest in the Postclassic period (1200-1521 AD).[654] Here a mosaicist rendered one running dog composition using a mind-boggling technical innovation: they created the negative lines in both positive (raised) and negative (depressed) space within the same composition, raising one trunk and branch in relief in the mosaic, and leaving its partner recessed (Fig 7.36a). The effect is similar to the texture contrast on the Peruvian fish-shaped vessel and echoes the use of multiple colours for negative line elements in woven patterns, and so perhaps the mosaics were intended to imitate tapestries or wall-hangings. The mosaic also may have been painted to enhance this effect. In a painted illustration in the Codex Zouche-Nuttall, a 14th-century Mixtec narrative annal now displayed in the British Museum, the negative line elements in architectural running dog patterns are rendered in two colours (red and white) (Fig. 7.37). In a slight differentiation from the other Mesoamerican and Peruvian compositions discussed above, the path is not implied but delineated by a continuous, thin black outline. It is, however, visually reminiscent of the other key patterns discussed above, which were wholly reductive and in which the path was simply implied.

The mosaicist(s) decorated the same building with a variety of other key patterns, some diagonal and others orthogonal (Fig. 7.36b). In one of these, the pattern-maker made another striking choice: to switch between the additive and reductive creative approaches within the same composition. The key pattern structure itself is identical to the diagonal tablet-woven pattern with single-stranded spirals that was posted to Pinterest by a modern weaving enthusiast, and therefore similar to the unusual bi-coloured composition in the MacRegol Gospels (the Pinterest enthusiast did not mention the mosaics of Mitla either) (c.f. Figs. 7.36c, 6.21a-b). The mosaicist innovated beyond the original woven medium by recessing both the negative line elements (trunks and branches), as well as the positive path between them. Negative lines and path are distinguished from each other only by outlines

[654] Blomster 2012, pp. 335, 337, 339, fig. 24.2.

raised in relief, and it is unclear whether these outlines were intended to belong to the path or negative lines or both. If the latter, this would make the composition both additive and reductive at the same time. This unusual transcendence of both creative approaches in a single composition is unique from all key pattern traditions around the world, and is found in only one other surviving example, the early La Tène embroidery from Nové Zamky.

However, ancient Peruvian and pre-Columbian Mesoamerican key pattern still did not reach the same level of geometric complexity found in Insular key pattern. Though the artisans and mosaicists of both regions used diagonal patterns, and masterfully manipulated negative and positive space using two unique strategies, they chose not to disarticulate the key patterns into their component spiral units and symmetrically rearrange them. The key pattern compositions therefore remain very close to versions seen in basketry and/or textile weaving. For example, the double-stranded key pattern in Fig. 7.36a contains two rows of ‘running dog’, mirrored across the horizontal axis to create a ‘ram’s horn’ pattern, as Collingwood would have referred to it in his overview of tablet-weaving. Both ancient Peruvian and pre-Columbian Mesoamerican art historical traditions are vast and still require deeper and broader study, however the author has yet to find key pattern compositions from these traditions that alter this conclusion. Beyond the architectural mosaics from Mitla, craftspeople in pre-Columbian Mesoamerica appear to have used key pattern seldom. In the British Museum’s collection of Mesoamerican pottery, friezes, manuscripts, figurines and statues, including the Aztec, Mixtec, Veracruz, and Mayan cultures, less than a handful of ceramics are decorated with simple, single-branched, single-stranded orthogonal key pattern. So far, no other key pattern traditions in the pre-modern world rivalled the structural complexity and diversity of Insular key pattern. This conclusion must change, however, when Insular key pattern is compared to a corpus from North America that reached full development just as the early medieval period in Europe was coming to an end.

7.5.2. Key Pattern in Ancient Puebloan Ceramics, c. AD 700-1600

The Ancient Puebloan culture of the Four Corners region (southeastern Utah, southwestern Colorado, northeastern Arizona, and northern New Mexico) and the Mimbres culture in southern New Mexico (part of the wider Mogollon culture in that region) developed black-on-white (and other dark-on-light-coloured) ceramic traditions between roughly AD 700-1600 and 1000-1130 respectively (Fig. 7.38).[655] Until recent decades, the Ancient Puebloans were often referred to as the 'Anasazi', translated from Navajo as 'ancient enemy'.[656] This name is no longer accepted because of its 'derogatory, racially offensive connotations', and the term Ancient Puebloan is preferred.[657] The key pattern tradition in Ancient Puebloan and Mimbres ceramics is the only one in the world that rivals that of Insular art. Their equal and otherwise unparalleled structural complexity and visual variety are due to fruitful coincidence: without any communication with each other, pattern-makers in both cultures chose the reductive creative approach, exploited diagonal orientation to a high degree, manipulated negative line elements by omitting, adding, and expanding them into shapes, and dissected their key patterns and rearranged their components using different combinations of symmetry operations.

The following study focuses on Ancient Puebloan vessels dating between 1000-1300 AD, as those under discussion date to these centuries, and will not touch significantly on Mimbres ceramics, though their decoration is very similar.[658] A variety of pigments were used to paint decoration on white or otherwise light-coloured clay, the applied patterns then firing black, brown, or red depending on the process or chemical reactions.[659] This section makes heavy use of Paul S. Martin's and Elizabeth S. Willis' corpus, *Anasazi Painted Pottery in Field Museum of Natural History*, though published in 1940 and out of date, because it provides hundreds of photographs. The New Mexico Office of Archaeological Studies' online 'Pottery Typology Project' provides useful information for the relative dating of each vessel (in comparison to the stylistic groups assigned by Martin and Willis).[660] The analysis of Ancient Puebloan key pattern in this section touches upon a mere fraction of this enormous, rich, art tradition, and the author is continuing to educate herself in this area. It is important to note that Puebloan ceramic production has continued both as a tradition and creative industry through the present day.[661] The late and world-famous Maria Poveka Martinez (born c. 1887), for example, revived and improved an earlier black-on-black technique, while her husband Julian studied and compiled patterns from archaeological sites to apply to both their black on black and polychrome ceramics, a

655 Blinman 1993, 14, 18; Farmer 2016; Hurst Thomas 1999, 90-91; LeBlanc and Hegmon 2017.
656 Farmer 2016.
657 Ibid.
658 For a photographic database of Mimbres ceramics, see LeBlanc and Hegmon 2017.
659 Blinman 1993, 18-20.
660 New Mexico Office of Archaeological Studies, 2008-2017.
661 Schaefer Dentzel 1977, 11.

legacy continued by their descendants.[662] The author of this thesis has not had the opportunity to discuss with contemporary Puebloan ceramicists their decorative patterns and working processes. Furthermore, the symbolic meanings and associations of the ornament are likely kept private by these artists today.[663] Therefore the following analysis must remain at present an external one, and so out of respect for contemporary ceramicists, it will focus only on key patterns from ancient vessels.

Ancient Puebloan ceramicists decorated their pottery with a variety of patterns. Key pattern featured frequently, and both orthogonal and diagonal orientations were used. For example, a black-on-white bowl from Sikyatki, Arizona, dating to the 11th century AD, is painted with two rows of single-branched, double-stranded orthogonal key pattern (Fig. 7.39).[664] Many diagonal key patterns are the running dog, as on a 13th-century, black-on-white bowl thought to have been found at the Lower Little Colorado River, Arizona (Fig. 7.40a).[665] In this period there was a healthy cotton textile trade in the Southwest, and archaeologists agree that these ceramics and their designs developed out of earlier basketry and textile weaving traditions.[666] Ancient Puebloan key pattern and other rectilinear ornament is characterized by lines and shapes with jagged edges, similar to those in Peruvian and Mesoamerican key pattern, and S.G. Ortman has also pointed out that on ceramics this jagged effect imitates similar contour lines created in the basket-weaving process.[667]

The Ancient Puebloans differed from Insular makers in their handling of key pattern's structural properties in a few ways. They ensured that the key pattern fitted within the border in some compositions, while they allowed it to be cut off by the outer border in others (c.f. Fig. 7.40b-c). The latter case also caused the path to cul-de-sac at the outer border (Insular makers, by contrast, only permitted the path to dead-end in the centres of single-stranded spirals, or closed multiple-stranded spirals, but never at the outer border) (Fig. 7.40b-c).

662 Peterson 1977, 73, 89, 92-94; Spivey 2003, 17, 20.
663 Peterson 1977, 94.
664 Martin and Willis 1940, pp. 22-23, plate 6, fig. 2; C. Dean Wilson 2012a.
665 Martin and Willis 1940, pp. 30-31, plate 10, fig. 5; C. Dean Wilson 2012b.
666 Hurst Thomas 1999, 109, 111; Peterson 1977, 94; Ortman 2003, 619, 621. Ortman provides a useful overview of scholarly opinion on the subject since the 19th century.
667 Ortman 2003, 627-28. I am grateful to Dr. Susanna Harris for encouraging me to review Ortman's scholarship for links between Puebloan basketry and ceramics. Dr. Susanna Harris, pers. comm., 4 September 2017.

However, though their key patterns were visually distinct, the similarities between the working processes of Ancient Puebloan ceramicists and Insular pattern-makers greatly outnumbered their differences. The Ancient Puebloan ceramicists' creative approach was almost entirely reductive, as was that of Insular artists, and additive key patterns are rare in their corpus (Fig. 7.41). In addition to favouring diagonal key patterns, Ancient Puebloan artists used their reductive approach to manipulate negative line elements, expanding the embellishments of the spiral units into a wide variety of spiraliform or angular shapes, sometimes differing within the same composition (Fig. 7.42). They even expanded negative line elements into shapes within orthogonal patterns, something Insular makers never did (Fig. 7.39). As in all key pattern traditions around the world, Ancient Puebloan artists carefully ensured that the path remained a consistent width throughout each composition, even as they expanded and contracted the negative line elements.

Similarly to Insular artists, the Ancient Puebloans also departed from their original woven exemplars for key patterns when painting on clay, by breaking the patterns into their component parts and radically re-arranging them into new symmetrical relationships. These compositions were unique to the era and region, but the act of disarticulation and symmetrical rearrangement shared much with the Insular world. Deeper study of the Ancient Puebloan corpus is required to fully identify all the ways that the artists used symmetry, and two examples must suffice here. On another 13th-century, black-on-white bowl also thought to have been found at the Lower Little Colorado River, Arizona, four double-stranded units of diagonal key pattern are arranged in one-fold (90-degree rotation) around the centre (Fig. 7.43a).[668] On a black-on-orange jar from Bidahochi, Arizona (date not provided), a series of square-shaped key pattern compositions travel around the belly of the vessel, each one divided from the others by three vertical black lines.[669] At first glance, these square fields look nothing like the other Ancient Puebloan key patterns discussed above. However, each square field is diagonally divided in half, and in each half, the ceramicist actually inserted a truncated portion of a running dog (containing one full trunk and its branch, interlocked with part of another trunk and branch, as well as the beginnings of a third trunk on the same side as the first). In each square field, these two dissected running dog portions are two-fold rotationally symmetric to the other (Fig. 7.43b). The entire square field is then translated in a row around the pot.

[668] Martin and Willis 1940, pp. 30-31, plate 10, fig. 6; C. Dean Wilson 2012b.
[669] Martin and Willis 1940, pp. 64-65, plate 27, no. 4.

Experts in Ancient Puebloan ceramics who have addressed the decoration on the vessels have tended to focus on the types and reactions of pigments and clay, on classifications by region, vessel shape, style, et cetera, or on how the decorations reflect the Ancient Puebloans' cosmological worldview.[670] For example, in his study of ceramics from the ruined pueblo of Awatovi in Arizona, Watson Smith devoted a chapter to structural analysis of abstract patterns, however he classified them mainly by their basic appearance for the purpose of conducting statistical analyses.[671] He also was more interested in identifying the areas ('zones') of the vessels that received decoration and their large-scale 'layouts', rather than the patterns' internal structures.[672] In his section on key pattern ('Hooks, Scrolls, and Keys'), he rightly noted some structural aspects (such as the expansion of negative line elements into different shapes, or the difference between patterns with single- or double-stranded spirals).[673] He emphasized the importance of symmetry in abstract patterns in general terms and praised the artists' combination of different structures in 'an almost endless proliferation of increasingly elaborate and involved combinations', while also recognizing that some key pattern compositions possess rotational symmetry (the 'running dog', though he did not use this term, and 'radial layouts' like the one-fold rotationally symmetric key pattern illustrated in Fig. 7.43a).[674] However, Watson did not distinguish between trunks and branches, or recognize that orthogonal and diagonal patterns are structural equivalents, or that certain diagonal compositions with alterations in the structure of their negative space or symmetry were not separate groups of patterns altogether from the running dog, but had simply undergone a specific type of manipulation by the artists.[675] For example, he did not realize that the square key pattern compositions on the jar pictured in Fig. 7.43b were composed of disarticulated sections of running dog that had been symmetrically rearranged, and as a result he classified them as a separate group.[676] These are just a few examples of the difficulties in Watson's classification system. In short, his recognition of key pattern's structural properties and the Ancient Puebloans' reductive creative approach was not complete enough to fully explore how the different key pattern compositions in his classification system were related, or how the makers manipulated negative space and re-arranged the pattern's disarticulated components using symmetry. Nor was it his purpose to do so.

670 For example see Blinman 1993; Martin and Willis 1940; Lister and Lister 1978, 2; Ortman 2000.
671 Watson 1971, 1, 74-178.
672 Ibid., 154, 156-75, esp. 156, 160-66.
673 Ibid., 85-97, esp. 87-90, fig. 44-46.
674 Ibid., pp. 79-81, 85, 88, 160-61, 170-71, fig. 42.
675 Ibid., pp. 85, 87-92, c.f. fig. 44, 46, 48.
676 Ibid., p. 93, fig. 49.

S.G. Ortman examined Ancient Puebloan patterns not to understand their structural properties but to identify similarities in the layout of patterns on ceramic vessels with that of baskets and textiles, in order to argue that the form and decoration of Ancient Puebloan ceramics were transferred from older basketry and weaving traditions.[677] He used these findings to argue that the Ancient Puebloans encoded both baskets and ceramic vessels with their cosmological worldview, in which the world was metaphorically conceptualized using 'container imagery'.[678] While the author has no wish to challenge Ortman's theories regarding Ancient Puebloan cosmology, he neither names key pattern in his study nor examined its structure, and as a result some of his conclusions about the pattern itself and the relationship between textiles and ceramics are incomplete or even inaccurate. He briefly discussed how small sections of larger pattern compositions on textiles could be transferred to and multiplied on pots, perhaps in recognition of the disarticulation and rearrangement of pattern components, and he also noted that on ceramics the 'negative space is active', but he did not explore either concept as they relate to key pattern.[679] As a result, he incorrectly argued that a ceramicist created a design on a bowl, which contained four separate, radially arranged rows of running dog, by conceptually 'mapping' or transferring over the decoration from a textile onto the clay.[680] However, the textile example he provides instead contains a series of individual spiral units, with trunks entirely omitted. They are so disarticulated and unconnected that they are no longer structurally part of a running dog (or any key) pattern, and so could not have been 'mapped' to create the complete running dog compositions on the bowl.

As a result of these gaps in previous scholarship, the structural properties of Ancient Puebloan key pattern and the ceramicists' artistic agency have never before been fully explored or appreciated in their full complexity and depth, either on their own terms, or in comparison to other key pattern traditions around the world, especially that of the Insular world.

[677] Ortman 2000, 623, 630.
[678] Ibid., 613, 619.
[679] Ibid., pp. 633-34 fig. 11-12.
[680] Ibid., pp. 633, 636, fig. 13.

7.6. Conclusion

This global comparison of key pattern is not yet complete. An overview of the British Museum's ceramics collection, as well as various published art-historical overviews,[681] confirms that while ancient and imperial Chinese art of all media frequently includes key pattern, it was extremely similar in structure to the ancient Greek tradition, with a lack of commitment to either the reductive or creative approach, no expansion of negative line elements into shapes, and a preference for orthogonal key patterns in single rows, predominantly as ground lines and borders, with single- and double-stranded spiral units as well as swastika-shaped units. Given their similarity and shared location in the northern and eastern hemispheres, the ancient Greek and Chinese conventions for key pattern may well have transferred both eastward and westward via long-distance trade between the Near East and Asia, though at great remove. In contrast, the key patterns of the Americas still require further study. The author has yet to examine fully the art from many other parts of North, Central, and South America, as well as other media besides mosaics, ceramics, and textiles. However, preliminary investigation of the British Museum and National Museum of Scotland collections indicates that, outwith the cultures and regions discussed in this chapter, key pattern was rarely used historically in the Americas. Southeast Asia, India, Australia and sub-Saharan Africa also require further attention, though again preliminary investigation also indicates a notable absence of key pattern in sub-Saharan Africa, despite very complex textile traditions on the continent.[682]

Out of the global traditions explored thus far, Ancient Puebloan and Insular key patterns stand apart because of their coincidental yet shared reductive approach, interest in diagonal key pattern, lively manipulation of negative space, and complex symmetrical rearrangement of the spiral units. Recognition of the importance of this constellation of traits not only improves modern scholarly understanding of key pattern across the board – previously overlooked both in studies of Insular art and the art of other eras and places – but also reveals the different ways that artists around the world and throughout time variously conceived of space, line, and symmetry. In particular, artists' chosen creative approach betrays their way of seeing or thinking about key pattern. These thought-processes either limited or expanded their opportunities for invention and alteration,

[681] See for example K.R. Wilson and C. Clunas 1991; Rawson 1984.
[682] For example, see LaGamma and Giunti 2008.

dictating whether their key pattern paths would plod steadily through compositions of relatively simple structure (as with Roman key pattern in particular), or their negative line elements and spiral units would form dizzying kaleidoscopes of light, shadow, and shape. Furthermore, deeper study of key pattern structure in basketry and textile weaving, which also has been absent from previous studies Insular or otherwise, contextualises the production of Insular key pattern. It certainly lends new meaning to the use of key pattern in illuminated manuscripts and the term 'carpet page.' Deeper understanding of global key pattern traditions and their parallel origins in basketry and textiles also demonstrates the incorrectness of the common scholarly reflex of referring to key pattern as 'Greek' (as in *ECMS*: 'Another name for key pattern is the Greek fret').[683] Overly favoured for too long by many art historians and archaeologists as the West's greatest cultural forebears, this Greek-centred terminology is not only inappropriate in Insular studies, but is also insulting if included in discussion of the Americas, where the ancient Greeks had neither place nor input. Finally, comparison of Insular key pattern to key patterns in other world cultures clarifies its uniqueness and significance on a global scale, as one of Britain and Ireland's great art historical contributions.

Now, even deeper study of Insular key pattern's structural properties is possible. The next chapter contains detailed analysis not of those most basic properties required to maintain key pattern's physical integrity and distinctiveness from other types of ornament, but instead additional elements and principles with which Insular makers engaged to fulfill higher-order creative goals. Many of these properties were unique to the Insular tradition, and so lent Insular key pattern its singular structural intricacy. Several case studies of individual artworks support the following structural analysis and highlight its practical benefits in providing further access to anonymous Insular makers' intellectual approach to and conception of key pattern, and a view of their thought processes in the workshop.

[683] Allen and Anderson 1903, vol. 1, part 2, p. 308.

8. Chapter 8: Insular Key Pattern in Action: Additional Structural Analysis and Case Studies

This chapter expands upon the information provided in the new, technical definition of Insular key pattern and terminology given for spiral structures and symmetry operations in Chapter 2. It deepens the investigation of Insular key pattern by exploring its most complex structural properties. Again, these properties consist of the structural elements, or the physical components or building blocks of the pattern, and the structural principles, or the abstract, often mathematical concepts that Insular artists used to manipulate these elements.

This chapter focuses on individual artworks and their individual makers, and how these makers made ongoing, strategic choices *from moment to moment* while creating key pattern, from planning to completion. Investigation of key pattern's structural properties therefore provides the first-ever view of Insular artists' own understanding of and conventions for key pattern, and of their thought processes, intelligence, and creative agency in the production of this ornament. Most importantly, it reveals that Insular makers were not limited by the basic structural parameters they themselves had established for key pattern, but that in fact, they often pushed against and improvised with them in pursuit of maximum creative effect. The following structural analysis is grounded in a series of case studies of Insular artworks, which keeps the investigation centred upon real objects or monuments, instead of abstract types or templates for the pattern. This method of analysis can be applied to *any* artwork containing key pattern, and in the process reveal previously hidden, lost information about real, known objects. It provides an unprecedented view over these artists' shoulders in the workshop, a glimpse of key pattern in action.

This chapter does not focus on the properties belonging to the small, basic group *required* in every key pattern (because their presence prevents the loss of its structural integrity), as these properties were adequately discussed in previous chapters. This small, mandatory group includes the requirement that at least one set of negative line elements exist in a key pattern (the trunks); the principles that all negative line elements must either lie parallel only or both parallel and perpendicular to each other (c.f. Fig. 8.1a-b) and be ultimately discontinuous; the requirement that the path element must be maintained at an even width throughout any given composition; and the formation and maintenance of spiral base units at the same size throughout that composition. Pattern-makers can create geometrically simple key patterns employing just these basic properties alone (Fig. 8.1a), and all key pattern compositions from around the world and throughout time share these properties, even if the finished products look different. In sum, they are the minimum structural parameters that key pattern makers in all time periods and places worked to uphold. In addition, Insular artists also ensured that the positive path was generally continuous (never terminating) throughout any given composition, excepting the necessary terminations at the centres of single-stranded spiral units. This principle of path continuity was an additional minimum structural parameter that artists *in Insular contexts* consistently strove to maintain (other key pattern traditions did not treat the principle of path continuity as mandatory, (Figs. 7.3a, 7.26, 7.34, 7.40b)).

Instead, this chapter focuses on other properties with which Insular artists engaged to fulfil higher-order goals, such as inventing compositions of ever-increasing visual and structural variety and complexity, addressing specific design goals (for example, fitting a key pattern into an irregular shape, like an illuminated letter, or creating optical illusions), and even fixing mistakes partway through the creative process. We can find some of these structural properties in some non-Insular key pattern traditions from other time periods and parts of the world (mainly that of the Ancient Puebloans), while others are specific to the Insular tradition. Some are direct products of Insular artists' reductive approach to key pattern, which greatly expanded their opportunities to alter pattern compositions. To a great extent, therefore, the structural properties discussed in this chapter were optional and contingent upon Insular pattern-makers' individual choices. Insular artists used them to improvise in the creative process, and sometimes to even bend and push against their own minimum structural parameters for key pattern, in order to achieve maximum invention.

In Insular makers' working processes, such creative decisions to manipulate certain structural properties in turn often required them to engage with other properties, in order to maintain the physical integrity of their key patterns. Michael Brennan first observed a similar phenomenon occurring in Insular interlace (Chapter 5 above). This was especially true if a maker's creative alteration of a composition would otherwise impinge upon the basic, required structural properties necessary for that key pattern to exist. In such situations, makers expended extra effort to maintain these minimum structural parameters, while simultaneously implementing their creative alteration. The following analysis discusses these relationships or domino effects between structural properties, which pattern-makers had to anticipate and manage from the planning process to completion of the composition. In such challenging moments lay the nexus of Insular artists' intelligence, agency, and creativity.

This chapter focuses on two such structural principles of unique and particular importance for Insular artists, and which they employed simultaneously in almost every single surviving key pattern composition.[684] It also will illustrate how Insular pattern-makers' engagement with these principles impacted certain structural elements. First, Insular artists used a wide variety of symmetry operations to multiply single spiral units in different ways, and then to join the resulting compositions to create larger and larger patterns. As noted in Chapter 7, this habit of divorcing key pattern from its original woven form, the swathe or band of textile or basket, and rearranging its disarticulated parts survives from the ancient Celtic art tradition. Second, Insular artists used their reductive approach to manipulate negative line elements for a variety of reasons, by adding, omitting, widening, and even expanding them into shapes, all while still maintaining the evenness and continuity of the path. This heavy, concomitant use of symmetry and manipulation of negative space was largely absent from other historical key pattern traditions (excepting the Ancient Puebloans). These two structural principles and their importance to Insular key pattern have never before been fully analysed, because previous scholars did not discuss them in depth or at all (Chapters 4 and 5).

8.1. The Structural Principle of Symmetric Repetition

8.1.1. Repetition of Spiral Base Units into Complete Compositions: The Row

All artists, Insular or otherwise, created key patterns by repeating and arranging spiral base units with one or more of the following symmetry operations: translation, rotation, and

[684] In their number, though not in detail, these two key pattern principles therefore are similar to the two 'objectives' that Brennan identified as being of high priority for Insular makers of interlace: symmetry and alternation. See Brennan 2011, vol. 1, pp. 4, 7, 32, 40-43.

mirror symmetry.[685] This use of symmetry to repeat a spiral unit over and over is in fact one of the basic, required structural principles of key pattern, because units cannot stand alone as isolated, unconnected spirals, for by definition, key pattern is a repeating pattern. Because the spiral units have been repeated, the resultant composition can then stand alone as fully-formed key pattern, and every single spiral base unit within it has a particular symmetric relationship to every other spiral base unit in that individual pattern. Individual key patterns resulting from such repetition of spiral base units are elements themselves and are referred to in this thesis as 'complete compositions'. Technically, it is possible to create a complete composition with just two spiral units, although key pattern compositions consisting solely of an isolated C- or S-spiral are rare on Insular artworks.

Artists in the Insular tradition created complete compositions in two different ways: rows and rotating unit compositions. To create a row, an Insular maker arranged spiral units in a procession along the horizontal or vertical axis, depending on their choice or needs in an individual artwork. Such rows could contain spirals with one strand (Fig. 8.2) or two strands (Fig. 8.1a-b). An example of a diagonal, two-stranded row can be seen carved on the hem of a cleric on a Pictish stone fragment from Rosemarkie, Scotland (Fig. 6.19b). Insular makers' preference for fitting whole key patterns within the borders of the composition (Chapter 2), as well as their need to maintain the physical integrity of the pattern dictated which symmetry operations they could use to create rows. For every row, makers had to employ the symmetry operation of translation *at least*, in order to arrange the spiral units in a horizontal or vertical succession (Fig. 8.3). In addition to translation, Insular artists employed other symmetry operations (rotation or mirror symmetry) as desired, as long as they followed the principle of symmetric repetition for complete compositions in rows. This principle required that 1) the symmetry operation(s) did not cause the spiral units to run off the edge of the composition when repeated (Fig. 8.4), and 2) if the artist used branches to create two-stranded spiral units, that each branch is able to intersect the end of its trunk (i.e. the end of that trunk which does not intersect the outer border) and form a spiral structure with the next branch down the row (Fig. 8.5a-b). This in turn helped uphold a basic structural principle involving the path: that the path must not terminate abruptly within a key pattern composition.

[685] I am grateful to Dr. Michael Brennan (pers. comm., 13 May 2015), who in conversation not only first alerted me to the internal symmetry and spin direction of spirals but also suggested that the spin directions of spirals throughout key pattern compositions might be useful as a means of exploring those compositions' symmetries – an important early suggestion that led to extended, extremely fruitful original research.

Within these minimum structural parameters for complete compositions in rows, artists used different combinations of symmetry operations as desired to create free variation. All key patterns from all art-historical traditions hold the key pattern row in common, however, pattern-makers outside of the Insular tradition mainly relied on translation only, using mirror symmetry or rotation rarely.

8.1.2. Repetition of Spiral Base Units into Complete Compositions: The Rotated Unit Composition

Insular makers also created complete compositions by arranging four spiral units, so that each unit is one-fold rotationally symmetric (as if physically rotated at 90 degrees) to the units directly before and after it (Figs. 6.29, 8.6a). In this thesis, this complete composition is referred to as a rotated unit composition. Rotated unit compositions are square in shape, in contrast to the long, rectangular frieze characteristic of the row. In rotated unit compositions, the point of rotation is located at the centre of the design, at the ends of the trunks where there is no intersection with branches (and which, if they were located in a row, would intersect at the outer border) (Fig. 8.6b). As a result, one trunk in each unit, and one trunk within another unit rotationally symmetric to it 180 degrees, meet each other at the centre of the composition (Fig. 8.6b). This maintains the structural principle that in the event that trunks do not intersect the outer border, they must intersect other negative line elements on both ends, so that they do not float freely. (In contrast, the second trunk in each unit actually intersects with the outer border of the composition, again fulfilling this same structural principle). In other art-historical key pattern traditions around the world, only the Ancient Puebloans created rotated unit compositions (Fig. 7.43a).

8.1.3. Repetition of Complete Compositions: Multiples

Once Insular makers created the necessary complete composition, in either a single row or rotated unit composition, they could then repeat – or iterate, to use a technical mathematical term – that complete composition itself, to create even larger key pattern compositions. In this thesis, these larger key patterns comprised of repeated complete compositions are referred to as ‘multiples’.[686] Individual rotated unit compositions could be simply multiplied by translation or mirror reflection in any direction, so that they lay side-by-side and filled a larger field (Fig. 8.7). They could be multiplied by rotation as well, but the resulting key pattern field would look identical to one that had been translated, because each rotated unit composition is symmetric to itself (i.e. looks the same as the original) every time it is rotated at multiples of 90 degrees.

Insular artists also multiplied rows to create pairs of rows, so that the resulting two rows lay adjacent to each other. Often Insular pattern-makers omitted the border between these adjacent row multiples. Because Insular makers sometimes chose to omit this shared border, they always chose symmetry operations that allowed the trunks that would have otherwise intersected it to meet with each other, again to prevent the trunks from floating freely. This is demonstrated in Figs. 8.8a-b, 8.9a-b, and 8.10a-c.

Insular artists often multiplied these paired rows further, as if stacking them to create larger and larger key pattern compositions. Again, they used any symmetry operation(s), as long as the chosen symmetry operation permitted the trunks that originally intersected the outer borders of adjacent rows to instead meet each other (Fig. 8.11). Such symmetric multiples of rows were a staple in Insular art, but relatively uncommon in other key pattern traditions around the world, again with the exception of Ancient Puebloan art (and to a much lesser extent, that of the ancient Romans) (Fig. 7.26, 7.39). In this thesis, a single row, multiplied to form a pair, is referred to interchangeably as a ‘pair of rows’ or ‘row multiples’, while multiples containing more than two rows are simply referred to as ‘row multiples’.

However, despite Insular artists’ prioritisation of symmetry and the complexity of its relationships with other structural properties, previous scholars either neglected to discuss it, or did so in an under-developed or even incorrect manner. None but Tetlow and Hull noted the symmetry of individual spiral base units: Tetlow only for single diagonal row compositions (vertical mirror symmetry) (Chapter 5) and Hull only for translational symmetry in single ancient Greek orthogonal key pattern row.[687] Few recognised the

[686] The term ‘multiples’ is borrowed from George Bain’s artists’ manual for key pattern, however, he coined it only to refer to entire rows which had been repeated, rather than repeated rotated unit compositions as well. See Chapter 5 above.
[687] Hull 2003, 102.

symmetry of rotating unit patterns and their relationship to rows (i.e. that they share the same spiral base unit). Allen and Hull each noted 'rotary motion' or 'rotation' in rotated unit compositions, but did not identify their structural link to rows.[688] Only Crawford and Tetlow observed the symmetry of multiples of rows forming pairs – and only those with mirror symmetry (Chapter 5).

8.1.4. Mitres

Comprehensive knowledge of symmetry in Insular key pattern also allows us to gain full recognition – for the first time – of how Insular makers symmetrically repeated individual spiral units to invent a completely unique structural element: the mitre. The mitre is specific to pairs of rows. Insular artists created mitres for a single, specific purpose: to uphold the basic structural principle that the path must remain continuous wherever possible in key pattern compositions. Mitres are utterly unique to the Insular key pattern tradition, even absent in prehistoric and ancient textiles. The mitre, therefore, is further evidence that Insular makers mentally broke key pattern compositions down into their component parts (the spiral unit) and symmetrically re-arranged them.

In any single row that has two-stranded spiral units, the path is continuous until it reaches the last spiral unit on either end of the row. These end units are single-stranded spirals, because they only contain one branch, are not followed by another trunk and branch (the latter of which, if present, would have helped create a two-stranded spiral). As a result, the path terminates in the centre of the single-stranded spiral units at either end of the row (Fig. 8.12). In this thesis, these single-stranded spiral units at either end of a single row are referred as 'terminals' and are themselves a structural element. In the Insular tradition, terminals are one of the rare exceptions to the basic structural property that the path must remain continuous. No scholar has previously discussed them.[689]

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[688] Allen 1885, pp. 288, 290, fig. 60; Hull 2003, pp. 214-155, fig 7.9f. Hull also noted that rotated base unit compositions (though he did not refer to them as such) could be multiplied further to create larger patterns using mirror symmetry (Hull 2003, 217-18).
[689] 'Terminals' here differs from Nancy Edwards' usage in her 1987 classification of key pattern, in which she used the term to refer to a different structural element: the embellishment (Chapter 5).

However, in rows that have been multiplied to form pairs, Insular artists discovered a way to prevent the path from terminating in this manner. Rather than letting it cul-de-sac in terminals at the ends of each row, Insular makers created mitres in the four outer corners of the composition, which permitted the path to circulate continuously and infinitely from the top row to the bottom row of the pair, and back up again. The structure and symmetry of these mitres depended on the symmetric relationship between the two rows themselves (two-fold rotation or mirror symmetry).

In pairs of diagonal rows that are two-fold rotationally symmetric to each other, Insular makers created mitres by arranging successive two-stranded spiral units in each corner of the rectangular composition using mirror symmetry (Fig. 8.13). First, they reflected the final unit of each row across a diagonal axis lying at 45 degrees to the outer corner of the composition where that unit is located (Fig. 8.14a). They then reflected the resulting unit a second time, again across a diagonal axis lying at a 45-degree angle from the *next* corner of the composition (Fig. 8.14b). Because each corner contains a mitre, the spiral units continue to travel infinitely around the composition (Fig. 8.15a). As a result, Insular artists were able to uphold the principle of path continuity, in an infinite, convoluted oval that circles between the top and bottom row in the composition (Fig. 8.15b). Because the pair of rows in this composition are two-fold rotationally symmetric to each other, their mitres at opposite corners are also two-fold rotationally symmetric to each other (and thus look identical across the diagonals of the composition) (Fig. 8.15c).

Few previous scholars discussed mitres in two-fold rotationally symmetric, diagonal row multiples or their symmetries. For example, Allen illustrated them inconsistently, so was aware of them, but did not discuss them at all. Crawford was the first scholar to ever remark on their presence, though he merely observed that they existed in the corners and looked different from the rest of the pattern, and did not attempt to explain them further.[690] George Bain was the first to give these structural elements a name ('mitring', adapted here in this thesis), likely borrowing a term from carpentry for a right-angled joint between two pieces of wood, where the join itself is bisected by a 45-degree angle.[691] Bain also noted that 'diagonally opposite corners' or mitres are identical, but like previous scholars he did not remark upon their symmetry.[692] Only Aidan Meehan actively identified the two-fold

[690] Crawford 1926, pp. 38f, 39, fig. 7f.
[691] G. Bain 1951, p. 75, plate 1.
[692] Ibid.

rotational relationship of diagonally opposite mitres, in a diagram, though he refrained from discussing it further.[693] No previous scholar has ever noted their symmetry and structural purpose, to maintain the continuity of the path itself.

For diagonal, mirror-symmetric pairs of rows, Insular makers also created mitres. Previous scholars have never discussed these mitres. Here artists mirrored the units of the mitres across the horizontal axis (i.e. across the border between the two rows) rather than across a 45-degree, diagonal axis. In contrast to mitres from two-fold rotationally symmetric rows, Insular artists also manipulated the negative lines of the mitres of mirrored rows in order to ensure that the path travelled continuously through them. Finally, each pair of mirror-symmetric rows possesses two different mitres, one at either end of the composition. These two mitres differ in structure, and their placement (either right or left in the composition, respectively) is in turn dependent upon the structure of the units at each end of each row. Within these two mitres, Insular artists were free to further manipulate negative line elements at will, in order to create visual variety or maintain other structural properties as necessary. Therefore, the mitres of mirror-symmetric, diagonal row multiples sometimes show slight internal variance in their negative line elements. The structures of the most commonly occurring mitre variants are illustrated and explained in Fig. 8.16a-d.

Finally, all mitres, whether in two-fold rotationally symmetric or mirror-symmetric multiples, cannot structurally exist unless the multiple contains pair(s) of rows. Therefore, to fully mitre a key pattern, and thereby maintain the continuity of the path, Insular artists had to ensure that it contained an even number of rows. If the multiple contained an odd number of rows, one of those rows would end in a terminal rather than a mitre, causing the path to dead-end in that spot.

8.1.5. Mitre Patterns: The Harley Golden Gospel and Kilmartin Stone Case Study

Insular artists also invented complete compositions *entirely* composed of mitres themselves. No previous scholar has noted that these compositions are actually mitre structures, and none has discussed their relationship to row multiples, with the result that

[693] A. Meehan 1993b, p. 122, fig. 70.

they classified or addressed mitre patterns as being a separate 'type' from rows.[694] This thesis therefore presents the first-ever specific term for them: 'mitre patterns'. Mitre patterns are further proof that Insular craftspeople viewed key pattern compositions not as a range of distinct, classifiable types, but as the conglomeration of different symmetrical arrangements of the same individual spiral units, able to be added, rearranged and – in the case of mitre patterns – omitted as desired. Because mitre patterns contain symmetric repetitions of individual spiral base units, they too can be understood as complete compositions, just like rows and rotated unit compositions. Mitre patterns only occur in the Insular tradition, because mitres are specific to Insular key pattern.

Insular makers created mitre patterns in diagonal orientation in three different ways. First, in pairs of diagonal rows with two-fold rotational symmetry (Fig. 8.10a), Insular makers simply omitted all units except those directly acting as mitres within the four corners of the pattern. In the resulting mitre pattern, the mitre units are made to be contiguous, as if the artist removed the central units within the paired rows, and then pushed its mitres together (Fig. 8.17a-b). Because this mitre pattern is derived from two-fold rotationally symmetric pairs of rows, it too possesses two-fold rotational symmetry, and the path is continuous throughout the composition. Second, Insular artists also created two variants of mitre pattern based upon the two different mitre structures they used in diagonal, mirror-symmetric pairs of rows (Fig. 8.10b). They simply chose one of the mitre units from one end or the other of these paired rows (as illustrated in Fig. 8.16b-c), and then repeated that mitre four times with 90-degree rotation, forming a square-shaped complete composition (Figs. 8.18a-c, 8.19a-c).

Insular makers also created mitres in pairs of orthogonal rows. From these orthogonal mitres, they also created mitre patterns. Previous scholarly awareness of orthogonal mitres and mitres patterns is even lower than for those in diagonal orientation, again because modern specialists have paid insufficient attention to Insular artists' prioritisation of

[694] Allen, for example, separates mitre patterns from rows in his classification because of the former compositions' square rather than rectangular shape. Only Hull and Tetlow identified a few aspects of some mitre patterns. Neither of them, however, noted their derivation from mitres. Hull simply observed that a mitre pattern based on two-fold rotationally symmetric pairs of rows had a 'twofold rotation point', and that mitre patterns derived from mirror-symmetric pairs of rows contained both mirror symmetry and 'fourfold rotation'. Tetlow noted that the units in two-fold rotationally-symmetric mitre patterns are the same units as those found in single row compositions, just arranged differently. However, he did not identify the symmetry operations used in their arrangement. Allen and Anderson 1903, vol. 1, part 2, pp. 355-359, no. 986-1006; Hull 2003, pp. 214-15, fig. 7.9a-b; Tetlow 2013, 26-27.

symmetry and path continuity. None have discussed orthogonal mitres, and only Allen ever illustrated and commented on orthogonal mitre patterns. However, he did not recognise them for what they are, and badly misunderstood their structure because of two weaknesses in his classificatory methodology: 1) he myopically focused on the superficial shapes and layouts of 'bars' (trunks with branches), without exploring the deeper, symmetric arrangements of spiral base units that underpinned the appearance of these 'bars'; and 2) because he divorced his key patterns 'types' from their original contexts within medieval artworks and illustrated them in an artificially isolated manner in his classification, he overlooked crucial evidence that Insular artists deliberately provided for their *own* understanding of mitres and mitre patterns.

This section concludes with a case study of orthogonal mitre patterns in two Insular artworks: the Harley Golden Gospels (British Library Harley MS 2788), an early 9th-century Carolingian manuscript possibly created at Aachen and partly decorated in the Insular style, and the Kilmartin stone cross, a Viking-Age monument from Argyll in western Scotland.[695] Comparative analysis of how the Harley Golden Gospels illuminator and Kilmartin carver purposefully juxtaposed different key pattern compositions, as well as key patterns with other types of ornament in the same artworks, highlights the concrete benefits of this thesis' new artwork- and artist-centred approach to key pattern. We regain an understanding of Insular artists' use of physical proximity to emphasise their own understanding of structural connections between different key pattern compositions, and for the first time since the Early Middle Ages, rediscover these makers' invention of orthogonal mitres and mitre patterns.

In his 1903 classification of key pattern, Allen illustrated an unusual-looking orthogonal pattern that he observed in a handful of Insular artworks, including the Harley Golden Gospels.[696] Allen identified 'T and H shaped bars' arranged in a row-like formation in this pattern, and because he saw these same shapes in compositions formed from pairs of orthogonal rows (like the one illustrated in Fig. 8.9a), he placed this composition and orthogonal row pairs near each other in his classification scheme (Fig. 8.20a-b). However, there is a distinct structural difference between the two patterns Allen illustrated. While the 'H' shape Allen identified in pairs of orthogonal rows (Fig. 8.20b) is in fact a pair of

[695] British Library [accessed 9 July 2018]; Fisher 2001, 149.
[696] Allen and Anderson 1903, vol. 1, part 2, p. 335, no. 908.

mirror-symmetric trunks (one in each row, intersected at the red dot in Fig. 8.9a), the negative line elements that are supposedly equivalent to these two trunks in his template of the pattern from the Harley Golden Gospels appear to have been split in half, allowing the path to travel continuously between them in the middle of the composition (Fig. 8.20a).

Examination of the manuscript reveals that this key pattern to which Allen refers is structurally related to compositions formed of paired orthogonal rows, but not for the reason he implied. This composition Allen reproduced is, in fact, a series of orthogonal mitre patterns multiplied and placed next to one another. Such orthogonal mitre patterns occur singly on folio 14v of the Harley Golden Gospels in the frames around the text (Fig. 8.21a-b), which the illuminator alternately juxtaposed with single diagonal mitre patterns (Fig. 8.21c).[697]

In order to understand orthogonal mitre patterns, we must first explore how Insular makers created mitres in pairs of orthogonal rows. As noted in Fig. 8.9a, Insular artists used mirror symmetry to create paired orthogonal rows with two-stranded spirals. In their planning process, they formed mitres on either end of these rows thus: 1) they ensured that the final spiral units at either end of the rows contained trunks which intersected the adjacent border between the two rows, rather than the outer border of the pattern (Fig. 8.22a); 2) They omitted the adjacent border between the two rows in these outer areas, so that the path could travel continuously between the two rows (Fig. 8.22b); and finally 3) they omitted the branches from the final spiral base units at either end of each row, in order to maintain the path at an even width (Fig. 8.22c-d). Each mitre unit is mirror-symmetric to the one in the row above or below it, because the entire rows are mirror-symmetric to each other (Fig. 8.22d). These mitres occur in orthogonal patterns in the corpus, for example on a stone font from Penmon, Wales (Fig. 8.23), which Allen illustrated, likely based on a rubbing or photograph, but did not explain and does not appear to have recognised.[698] The formation of orthogonal mitre patterns is then much like that of their diagonal equivalents; Insular makers simply omitted the central units in pairs of rows, and made the mitre structures on either end contiguous (Fig. 8.24a-b). The spaces in Allen's drawing, annotated in red in Fig. 8.20a, are simply spaces separating individual orthogonal mitre patterns (their outer borders are missing in Allen's template). The 'T and H shaped

[697] British Library [accessed 23 July 2018].
[698] Allen and Anderson 1903, vol.1, part 2, p. 337, no. 913.

bars' Allen identified in the Harley Golden Gospels pattern therefore are merely superficial by-products of deeper decisions that the artist made, first to repeat units to form individual rows, and then to multiply the individual rows to form a pair, and then to create a mitre pattern from the pair by manipulating negative space.

By repeatedly juxtaposing orthogonal and diagonal mitre patterns on folio 14v, the Harley Golden Gospels illuminator made clear his understanding that orthogonal and diagonal mitres, and therefore the mitre patterns, are structural equivalents. Furthermore, the Harley Golden Gospels illuminator was not the only Insular maker to communicate structural links between mitre patterns by juxtaposing them in the same artwork not only with other mitre patterns, but also other types of ornament altogether. The Kilmartin stone cross carver decorated the top cross arm on one side of the sculpture with an orthogonal mitre pattern (Fig. 8.25a). In the left cross arm on the other side of the stone, the carver made a playful and clever adjustment to a field of curvilinear spiral pattern so that the negative space also took a form reminiscent of an orthogonal mitre pattern (Fig. 8.25b). The artist was able to do this because of key patterns' and curvilinear spiral patterns' shared spiral structure. A carver who decorated the Nun's Church at Clonmacnoise, Ireland, juxtaposed an orthogonal mitre pattern like the one from the Harley Golden Gospels with both variants of mitre patterns derived from pairs of diagonal, mirror-symmetric rows (as illustrated in Figs. 8.18a-c, 8.19a-c), above the columns at the apse (Fig. 8.26), again deliberately making tacit structural references between all three key patterns.

The use of symmetry to repeat individual spiral base units and then to multiply complete compositions to form larger and larger key patterns, as well as to create structural references between pattern compositions, were very rich, complex intellectual Insular artistic practices. Therefore, it is crucial from this point onward that modern Insular art specialists examine both the symmetry in patterns and the surrounding contexts of the artworks to which they belong, because through these two aspects, Insular pattern-makers communicated how they saw and thought about key pattern. The Insular key pattern corpus was not composed of distinct, classifiable types, but rather was a continuum of compositions formed from individual artists' procedures for symmetrically repeating spiral base units and multiplying the resultant complete compositions.

8.2. The Structural Principle of Manipulation of Negative Line Elements

In their staunchly reductive approach to key pattern, Insular makers manipulated negative line elements by adding, omitting, widening, lengthening and even expanding them into different shapes. Artists did so not only to produce visual and structural variety, but also to uphold the principle of path evenness and continuity throughout a given composition, especially in cases where their decisions to manipulate some negative line elements might risk impingement upon the path. As we shall see at the end of this chapter, Insular artists also solved other creative challenges by manipulating negative space.

8.2.1. Negative Line Element: The Branch

Branches are single negative line segments that artists in all key pattern traditions placed distal to – or at the end of – each trunk (highlighted orange and green in Fig. 2.39), where those trunk ends *did not* intersect the outer border or meet another trunk. Branches further extend the negative space within each spiral base unit and create spiral shapes within the path. Insular makers could choose to place either one or two branches on the same end of trunk (c.f. Figs. 8.3, 8.5a), as long as they also arranged other negative line elements within the composition in such a way that the path remained even and continuous. Multiple-stranded rather than one-stranded spirals occur where at least two branches distal to two consecutive trunks face each other, as if interlocking (c.f. Figs. 8.2, 8.3).

In diagonal rows and rotated unit compositions with double-stranded spirals, the pair of branches sharing the same end of a trunk must differ in length. Insular artists did this in response to the skewing of the trunks in diagonal orientation to the outer border of the composition. Two consecutive skewed trunks create a space for the spiral base unit between them in the shape of a triangle with one long side (Fig. 8.27a). The branch distal to the trunk near that long side of the triangle therefore must also be long, in order to keep the path even (Fig. 8.27a-b). Conversely, the other branch within the unit must therefore be the shorter of the two, otherwise it will intersect the longer branch, causing the path to cul-de-sac and the key pattern to lose its structural integrity (Fig. 8.27a-b). Iain Bain was the only previous scholar to comment on these disparities in branch length in diagonal key pattern, referring to the longer branch as the 'leg'.[699] The angles at which Insular makers intersected branches with trunks were influenced not only by the orientation of a given key pattern composition (diagonal or orthogonal) but also by conventions to which artists across the Insular world generally adhered but which were not always necessary for key pattern's structural integrity. In orthogonal patterns, Insular artists always placed branches at 90-degree angles to the trunks (technically not necessary, as acute angles also would be possible with careful adjustment of negative space, but which Insular artists avoided in all surviving compositions). In diagonal patterns, they placed the longer branch in each unit at a 45-degree rather than 90-degree angle to its trunk (to keep that branch from running off the edge of the border) and the shorter trunk at 90 degrees to its trunk (this kept the path even in width). Allen was the first to note that in diagonal patterns, the angle measurements between trunks and their longer branches were necessary for fitting the compositions within their outer borders, though he misunderstood how artists created diagonal orientation in the first place.[700]

8.2.2. Negative Line Element: The Embellishment and the St Gall Gospels Case Study

Embellishments are additional negative line segments or shapes that Insular makers placed distal to or along the length of branches, and sometimes along the lengths of trunks. Embellishments therefore extend the negative space within each spiral base unit even further and create even more complex spiral shapes within the path, beyond the branches. Just as it is possible to create a structurally simple orthogonal key pattern without branches (Fig. 8.1a), Insular artists also could choose to create an orthogonal key pattern with or without embellishments, while still maintaining its structural integrity (for orthogonal compositions with no embellishments, see Figs. 8.3, 8.5). However, embellishments were non-optional for diagonal key patterns, as the skewing of the trunks at a diagonal to the border resulted in large, uneven positive space insufficiently filled by just trunks and branches (Fig. 8.27a).

[699] I. Bain 1994, 7, 10.
[700] Allen and Anderson 1903, vol. 1, part 2, p. 326, 3288.

Insular artists freely invented an infinite variety of embellishments, creating differently structured examples even in the same composition. Because Insular embellishments took significantly different shapes, Allen was very interested in them as they helped him organise key pattern into 'types'. He therefore illustrated and commented upon a vast variety of surviving embellishment forms in both his structural analysis of Insular key pattern and his classification.[701] The following discussion is by no means comprehensive and describes only a few of the embellishments that Insular makers frequently included in key pattern compositions, so that readers become adept in recognising a few of this structural element's endlessly varied manifestations. In both orthogonal and diagonal compositions, Insular makers created embellishments by adding either a single line segment or multiple line segments (the latter successively intersecting each other at angles) distal to – or at the ends of – the branches (Fig. 8.28a-b). On occasion, they altered these distal embellishments by making them curvilinear rather than rectilinear, deliberately exaggerating the spiral structure of key pattern. Insular stone carvers often raised these curved distal embellishments into bosses (Fig. 8.29). Insular makers also added embellishments to the sides rather than the ends of branches. These embellishments took the form of triangles or rectangles, and in fact, here the artists were simply expanding the negative line segments of the branches into these shapes (Fig. 8.30a-b). In Insular contexts, artists created these triangular embellishments only in diagonal patterns,[702] perhaps in reference to similar forms in woven antecedents (Fig. 6.25a-b), as S.G. Ortman suggested for such shapes in Ancient Puebloan key patterns (Chapter 7). It is unknown why no surviving Insular orthogonal key pattern includes triangular or even rectangular embellishments, while in contrast, near-contemporary Ancient Puebloan orthogonal patterns did include triangular shapes (Fig. 7.39). Insular makers often expanded the longer branch in a diagonal spiral unit into two triangular embellishments, using the shorter branch in that unit to fit between those triangles, thus forming a spiral shape and keeping the path even (Fig. 8.30a).

Insular craftspeople generally arranged embellishments at degree angles that kept them parallel and perpendicular to the other negative line elements across the composition (generally at right angles in orthogonal patterns and acute angles in diagonal patterns) (Fig. 8.28a-b). This prevented these negative lines from cutting off the path or making it uneven in width. However, some Insular artists also pushed against their own conventions,

701 Allen and Anderson 1903, vol. 1, part 2, pp. 323-24, 326-27, 341, nos. 840-858, 861-870, 926-31.
702 Allen was first to notice this convention regarding triangular embellishments and diagonal patterns. Allen and Anderson 1903, vol. 1, part 2, p. 327.

making their key pattern compositions defy modern attempts to comprehensively summarize, generalise, or classify them. For example, the Pictish carver of the Hilton of Cadboll cross-slab created unusual angle measurements between embellishments and branches/trunks to great creative effect (Fig. 8.29), a testament to their remarkable creative agency and ability to improvise within a set of minimum structural parameters.

It is unnecessary and even impossible to describe every single embellishment found in every single surviving Insular key pattern composition here, as they had the potential for endless variety. Instead, it is more important to emphasise that whatever variation they created, Insular makers always ensured that these embellishments did not jeopardise the even width or continuity of the path. Within this creative tension lies a crucial aspect of the structural principle of negative line element manipulation, made both possible and necessary by Insular makers' reductive approach to key pattern. For whatever reason, if an artist chose to alter a negative line element by lengthening, widening, or expanding it into a shape, or to add a line element (such as an additional segment in an embellishment), the artist had to anticipate and manage the resultant impingement on the path in their working or planning process. To prevent the path from becoming uneven or discontinuous as a result of an individual alteration in the negative space, the pattern maker had to make a concomitant adjustment to nearby negative line elements by shrinking or omitting them altogether. Such careful adjustments are notable in key patterns from the St Gall Gospels, an 8th-century manuscript of Irish provenance,[703] which the illuminator created for seemingly no other reason than a desire for visual variety. In one composition, containing a pair of diagonal, two-fold rotationally-symmetric rows, the illuminator decided to expand half of the longer branches with single large triangle embellishments, rather than the two smaller triangle embellishments commonly seen in diagonal compositions throughout the Insular world (Fig. 8.31a-b). To do so, however, the artist had to completely omit the second, shorter branch (typically present in most diagonal, doubled rows) from each unit containing this large, triangular embellishment – otherwise that small branch and the expanded triangular embellishment would touch, causing the path to cul-de-sac inappropriately (c.f. Fig. 8.31a, c).

The only previous Insular specialist to ever remark upon these deliberate fluctuations that between negative line elements was Iain Bain, whose brief comment, that 'tails' (i.e.

[703] For date and provenance, see St. Gallen [accessed 23 July 2018].

branches) could be reduced so that 'larger triangles' (embellishments) 'can be formed', is buried in the commentary of his artists' manual and very easily missed.[704] No other previous scholar – including Allen, who classified this St Gall key pattern composition as simply having 'large black squares in the centre instead of pairs of smaller ones', has fully discussed how embellishments do not reflect water-tight, classifiable differences, but rather are the result of the artists' purposeful, organic decisions to manipulate negative space while maintaining the principles of path continuity and evenness.[705] In fact, Derek Hull even accused the St Gall Gospel key patterns of being 'inferior' in quality because their lines are often slightly crooked, leading him to presume that the artist struggled to correctly use a grid.[706] Because Allen and Hull were unaware of the principle of negative line manipulation, and also heavily regularised or 'corrected' hand-made medieval key patterns in their reproductions, they elided the reality that the St Gall Gospel illuminator was in fact an accomplished key pattern-maker, who consistently made similar profound and unusual alterations to negative space in key pattern compositions throughout the entire manuscript. Insular makers even sometimes used differently-structured embellishments in the same compositions, as seen on the Pictish Hilton of Cadboll cross base, a key pattern that would have required complicated mental planning and adjustments during the working process in order to maintain the path (Fig. 8.29).

8.2.3. Altered Diagonal Row Multiples and Single-Stranded Diagonal Compositions

There are only two broad groups of key pattern compositions that are roughly classifiable in any concrete way, because both their structures remain very close to two different, ancient textile or basket-woven antecedents discussed in Chapter 6 (the running dog and diagonal woven patterns with single-stranded spirals). This contrasts with the rather nebulous continuum of complete compositions and multiples described above (rows, rotated unit compositions, multiplied rows and rotated unit compositions, mitre patterns). The first group are the diagonal patterns containing two-stranded spirals and two-fold rotationally symmetry, which were closely comparable to the two-stranded running dog in textiles illustrated and discussed in Chapter 6 (Figs. 6.13, 6.15-6.16, 6.18, 6.22-6.26). As noted in these diagrams, such Insular key pattern compositions have slight structural differences from the running dog, but enough similarities that they might represent an

[704] I. Bain 1994, 2.
[705] Allen and Anderson 1903, vol. 1, part 2, p. 342, no. 934.
[706] Hull 2003, 86, 89.

adaptation of these woven key patterns in new media. They could therefore be understood as complete compositions in their own right, rather than multiples.

However, Insular makers still approached and handled this group as they did all key patterns, divorcing them from their original material paradigm (woven cloth) and altering them according to the Insular paradigm. In doing so, the artists manipulated their negative line elements and the symmetries of the spiral units in a number of ways that indicate that they intended not to view the running dog solely as a complete composition separate from others, but to deliberately create conscious reference between their running-dog-like compositions and diagonal, two-fold rotationally symmetric row *multiples* (Fig. 8.10a). Their ability to make such structural references was aided by the fact that both the running dog and diagonal row multiples contained two-fold rotational symmetry. First, Insular artists altered the triangular-shaped spiral units around the edges of the running dog so that they no longer were filled blocks of solid colour, but the same two-stranded, embellished diagonal units found in single rows and rotated base unit compositions (Fig. 6.25a-b). Second, Insular artists appear to have played with the novel idea that these running-dog-like compositions could – while ancient and thus historically distinct – be understood simultaneously as *being* two-fold rotationally symmetric pairs of rows, rather than distinct complete compositions, but altered so that every adjacent pair of long branches between two individual rows were interlocked, to create a two-stranded spiral – as if bending these negative line elements around each other (Fig. 8.32a-b). Because this new spiral unit is formed from two adjacent, diagonal units formerly neighbouring each other in two separate rows, it becomes twice the size of a typical diagonal spiral base unit (which still inhabit the outer edges of the running-dog-pattern, because they have no adjacent neighbour with which to interlock (Fig. 8.32a-b). This is the only exception to the principle that all spiral base units in a key pattern composition must be the same size. Insular pattern-makers then arranged the embellishments of these two-stranded spirals at right or acute angles, or expanded them into shapes, as seen on the Hilton of Cadboll cross base, just as they did with all other Insular key pattern compositions (Fig. 8.29). Insular makers were doubtless aware that the running dog was a distinct textile-based key pattern and thus a complete composition on its own, but they deliberately, visually advertised its structural similarities to multiples of rows, by combining the two in the same composition (by only interlocking some adjacent pairs of branches and not others) (Fig. 8.33a), and by placing the same mitre structures in the corners as found in diagonal, two-fold rotationally symmetric, paired rows (Fig. 8.33b). This group therefore will be referred to in this thesis as ‘altered two-fold rotationally-symmetric diagonal row multiples', or 'altered diagonal row multiples' for short.

In his 1903 classification, Allen observed very briefly that the single diagonal rows and diagonal row multiples in his classification (including pairs of rows as well as altered diagonal row multiples) were related, because artists created multiples by 'doubling, trebling, or quadrupling' single rows. He then immediately contradicted himself, reiterating his older argument that all diagonal patterns were formed by rotating orthogonal patterns at 45 degrees, and as a result his conclusion on the structural relationship between diagonal row multiples and altered diagonal row multiples was muddled and unclear.[707] The only previous author to comment more clearly on the subject was Iain Bain, who described altered diagonal row multiples as 'Z patterns with internal variations' (Z patterns being diagonal, two-fold rotationally symmetric pairs of rows).[708] No scholar has noted the two-fold symmetry of these altered diagonal row multiples, or their ancient pedigree stretching back to prehistoric Europe and Asia.

Figs. 6.22-6.26 illustrate two different ways that Insular makers manipulated the trunks and branches around the edges of altered diagonal row multiples that differed from the negative line elements in the same areas of running dog patterns. In fact, at least two more versions of this manipulation survive in the Insular corpus (not illustrated here), and the author would not be surprised to discover an artwork in which the artist had managed to invent yet another method for adjusting the outermost negative line elements to create an altered diagonal row multiple. Insular artists' ability to change key pattern structure through the manipulation of negative space was, after all, practically bottomless. To maintain the evenness and continuity of the path, it was structurally necessary for Insular makers to include at least two versions within the same composition (which two depended on the versions the artist chose, as well as the structure of the spirals in the inner area of the composition. Again, there is insufficient space in this thesis to elucidate all possible combinations here). The only previous Insular specialist to correctly recognise three of these four manipulations of outer negative line elements was Iain Bain, who also observed that more than one version would occur in the same composition.[709]

[707] Allen and Anderson 1903, vol. 1, part 2, p. 347.
[708] I. Bain 1994, 11.
[709] Ibid., 11-17.

Away from the edges of the composition, Insular pattern-makers also manipulated the pattern by choosing whether to omit the right or left branches from the end of each trunk, forming two-stranded spiral units, or to retain both branches, forming four-stranded spiral units within the composition (Fig. 8.34a-c). Depending on which branches they elected to omit, each pair of intersected trunks in the altered diagonal row multiple and their remaining branches at either end formed prominent C- or S-spirals within the pattern (Fig. 8.34a-b). In 1885, Allen was aware of the omission (resulting in S-spirals only) or retention of branches and classified the two resulting compositions separately.[710] However, in reality, Insular makers retained or omitted branches within altered diagonal row multiples somewhat haphazardly – often having trunks with just one as well as both branches attached in the same composition, forming S-spirals side by side with C-spirals. Sometimes, only three branches were left at the ends of a pair of intersected trunks (Fig. 8.35). Limited by the rigidness of his methodology, Allen either did not recognise or chose not to illustrate this phenomenon, keeping altered diagonal row multiples with internal C- or S-spirals, or all four branches intact, hermetically separate in his classifications.[711] Following Allen, no other Insular specialist noted this phenomenon except Hull, who once again accused the St Gall Gospel artists of sloppiness for this reason.[712] The Insular reality was far more flexible. Modern classificatory assumptions therefore overlook Insular makers' infinitely creative, intellectual processes in their reductive manipulation of negative space, which were, in fact, nourished by their lack of interest in enforcing strict structural divisions between key pattern compositions.

The second group of Insular compositions that remain close in structure to ancient woven key patterns possess diagonal orientation and single-stranded spirals, very similar to those on the recently-discovered 3,000-year-old trousers from western China (Fig. 6.9). Unusual aspects of their deep physical structure set these key patterns apart from all other compositions and multiples discussed in this chapter, including running dogs with two-stranded spiral units. Previous Insular specialists also often remarked on the unusual structure of these compositions and so separated them in their classifications,[713] but none described the reason for this uniqueness (their descent from an ultimately prehistoric, woven pattern). In this thesis, those from an Insular context will be referred to as 'single-

[710] Allen 1885, p. 279, 279n1, fig. 19, plate 5 figs. IX, X.
[711] Allen and Anderson 1903, vol. 1, part 2, pp. 343-349, 353-55, no. 940-955, 958-963, 973-955.
[712] Hull 2003, 89.
[713] Allen placed these compositions in a separate 'class' and described them as 'branching…from a zig-zag stem', and also confusingly as 'step-like'. Allen and Anderson 1903, vol.1, part 2, pp. 321-22, 350, no. 965.

stranded diagonal compositions', as they are complete compositions (rather than multiples of rows, rotated unit compositions, or mitre patterns) in their own right.

In these single-stranded diagonal compositions, trunks intersect the outer border. A branch with embellishments forming a single-stranded spiral unit is attached distally to the other end of each of these trunks. Along the axis of that branch, this single-stranded spiral embellishment is then reflected with mirror symmetry, forming a C-spiral. The reflection is then reflected again to form another C-spiral, over and over. Because of this mirror symmetry, these repeating embellishments continuously intersect each other at right angles, forming parallel and perpendicular negative lines that echo the parallel and perpendicular trunks seen in other key pattern compositions. These compositions also have one-fold rotational symmetry as a by-product of this continuous reflection: each pair of C-spirals (mirrored embellishments) is one-fold rotationally symmetric (at 90 degrees) to the ones connected before and after it. As in all Insular key patterns, these series of intersecting negative lines always eventually terminate within the pattern, and never intersect more than one side of the border (see Fig. 6.17 for an illustration and description of this composition's structure). In an obvious imitation of woven antecedents, Insular manuscript illuminators sometimes filled the outermost spiral units with simple blocks of colour (Fig. 8.36). Insular artists frequently created orthogonal versions of these single-stranded diagonal compositions (Fig. 8.37), though it is uncertain whether these too imitated specific textile patterns, now lost (the author is not aware of textiles with orthogonal versions surviving from the ancient or medieval period anywhere in the world), or if Insular makers simply manipulated the negative line elements to make them orthogonal rather than diagonal to the outer border.

No other Insular key pattern composition contains such lengthy successions of intersected negative line elements. However, once again, Insular makers blurred the distinctions between single-stranded diagonal compositions and the rest of their key pattern corpus, as part of their reductive approach to negative space and their habit of disarticulating and rearranging patterns' component parts. They often omitted the blocks of colour from the outermost units and filled them with triangular-shaped single-stranded spirals reminiscent to those in both double-stranded diagonal rows and altered diagonal row multiples (Fig. 8.38). They widened the embellishments into shapes (Fig. 8.30b). They used symmetry to create mitre structures in the corners of these compositions (Fig. 8.39). They disarticulated the outermost, triangular-shaped spiral units and symmetrically rearranged them in single rows (Fig. 8.40). On the Kilmartin cross, the stone carver even combined into one pattern the units from single-stranded diagonal compositions with double-stranded spiral units from altered diagonal row multiples (Fig. 8.41).

As with altered diagonal row multiples, Insular artists also took a casual, improvisational approach to spiral unit structure and symmetry, which makes single-stranded diagonal compositions extremely various in the minor details of their structure. In classifications and artists' manuals, modern specialists have been overly rigid in their expectation that every surviving composition must follow faithfully the basic structure described in Fig. 6.17. Iain Bain is one of few to describe the symmetry in this key pattern variety (mirror symmetry, and then the rotational relationship between resulting C-spirals), but he was wrong to assume that the Lindisfarne Gospels illuminator had 'difficulties' because he created an unexpected S-spiral in one such composition (by rotating one embellishment to form the next embellishment, rather than mirroring it to create the expected C-spiral) (Fig. 5.18).[714] In reality, in this specific composition it would have been structurally possible for the illuminator to stick solely with C-spirals, but he appears to have chosen against this or simply was too relaxed or working too quickly to care. In fact, most surviving single-stranded diagonal compositions in any medium contain some amount of such symmetric, structural variation. Because the units are single-stranded, Insular makers did not need to worry about arranging them so that their branches interlocked with those of neighbouring units to form two-stranded spirals. As long as the artists kept the path even and the negative line elements from floating freely, they were free to make such symmetric adjustments to the individual spiral base units (i.e. the repeated embellishments).

[714] I. Bain 1994, 33, 38. In his analysis of the key patterns on folio 210v of the Lindisfarne Gospels, Hull also rightly observed the possibility for a high amount of variance in these key patterns, and that the individual spiral units are mirror- and rotationally-symmetric to each other. However, he did not recognise the importance of the creation of C-spirals (or branches as I. Bain referred to them), as I. Bain did, and their subsequent repetition. To support his argument that the illuminator created deliberate asymmetry in the interlace in this manuscript, Brennan also observed the rotationally- and mirror-symmetric relationships between individual spiral units on the same page in order to suggest that the artist mirrored and rotated a template to trace them. Brennan also observed, like I. Bain, that one spiral unit was not arranged according to the expected symmetry. Brennan did not remark upon the importance of C-spiral structures (mirrored, linked embellishments, then repeated through one-fold rotation) in these compositions, or that the asymmetric spiral unit was the result of a casual creation of a S-spiral instead. Hull 2003, pp. 71-73, 104, fig. 3.3; Brennan 2011, vol. 1, pp. 109-11, vol. 2, pp. 153-55, figs. 6.1-6.3.

8.2.4. The Rosemarkie Panel Case Study

This large sandstone panel (no. 1992.2) from Rosemarkie, Easter Ross, Scotland, is one of several surviving carved panels from the site, now held at Groam House Museum (Fig. 8.34a). It is Pictish and dates to the 8th or 9th century.[715] The edges are dressed on three sides and rough on the fourth. The original purpose of the panel is uncertain, but the Hendersons have suggested that it functioned as part of indoor wall cladding or furniture within a church.[716] It is largely covered with two separate key pattern compositions. The first is a single orthogonal row, with two-stranded spirals and two branches per trunk, traveling around three of the four edges as a narrow border. The majority of the panel is carved with an altered diagonal row multiple, with trunks and branches forming C-spirals.

Study of this panel showcases the practical benefits of the new methodological approach to key pattern outlined in this thesis, uncovering new information about the artwork as well as how the anonymous stone-carver manipulated negative line elements through their reductive approach to key pattern. In 2016, the author spent approximately five days examining the panel in person and measuring the different structures of its altered diagonal row multiple composition. This examination revealed that the stone-carver likely did not manipulate this pattern's negative line elements solely for creative purposes (as did the St Gall Gospels illuminator), but instead to masterfully and almost imperceptibly fix a miscalculation in the structure of the pattern partway through the working process.

At a glance, the structures within this key pattern look very regular and even all across the composition, almost as if they were machine- rather than hand-made. However, a closer look reveals that the internal structure of the spiral units on the far left side of the panel (from the viewer's perspective when looking at the museum display) is different than those on the far right side (Fig. 8.42). On the left side of the panel, the embellishments of each spiral unit are formed from three intersecting negative line segments, carved very thinly out of the stone. This makes these spiral units appear compact or tight, with many internal 'turns'. On the right half of the panel, the embellishments within each unit instead are formed of only two negative line segments, and the final of the two segments within each

[715] Henderson and Henderson 2004, 207.
[716] Ibid.

spiral were carved much wider, giving the unit a more open, 'looser' appearance. The first 'looser' variant occurs approximately one-third of the way from left to right on the panel. The last 'tight' spiral unit occurs approximately at the halfway mark from left to right on the panel, after which only 'looser' spiral units occur. The widening of negative line segments is inconsistent in the middle of the slab within the 'looser' spiral units there, but becomes almost completely universal on the far right end of the slab. This indicates an overall progression of structural change from left to right that was precise and gradual, rather than randomly scattered throughout the composition. Despite their internal structural variations, all spiral units across the panel are roughly the same size. In addition, the path, raised in relief on the stone, is remarkably even in width throughout the pattern, measuring 8 millimetres at its narrowest and 1.2 centimetres at its widest, but mainly hovering around 1 centimetre wide. In contrast, the negative line elements differ wildly in width, with the narrowest carved into the stone at 2 or 3 millimetres wide, and the widest at over 1 centimetre wide. The uniformity of unit size, evenness of the path, and gradual widening of the embellishment line segments from left to right help the viewer's eye overlook these significant structural changes within the spiral units, creating the illusion that the composition is completely uniform throughout.

The author's experiments with the panel revealed that while it would have been possible for the artist to create the 'looser' spiral units instead of the 'tight' variant on the left side of the panel (which is in actuality solely populated by the latter), the reverse is not possible. No matter what adjustments are made to the branches and embellishments on the right side of the panel, if an extra negative line segment is added within the spiral units (to make them the same as the 'tight' units on the left of the panel, with three negative line segments per embellishment), the path becomes too narrow or is cut off altogether (Fig. 8.43). This indicates that the carver may have begun on the left side of the panel with an initial plan for the structure of the key pattern composition ('tight' spirals), but then changed their mind in the middle of carving.

The Rosemarkie carver likely made this alteration deliberately, out of urgent necessity. After measuring every pair of intersected trunks in the composition, the author discovered a cluster on the left side of the panel that were unusually long (around 11.5 centimetres). The paired trunks then become shorter and shorter overall as the eye moves from left to right across the panel (at generally around 10.5 centimetres in the middle, and with some as short as 9.6 centimetres on the far right end) (Fig. 8.44). Again, the author experimented with a scaled drawing of the pattern and discovered that if the Rosemarkie carver had continued to carve the intersected pairs of trunks from the left side throughout the pattern, the composition would not have fitted within the panel. The key pattern would have run off the edges of the border, an effect that Insular artists strictly avoided. The paired trunks, therefore, had to be made shorter than 11 centimetres out of necessity. As a result, it was also necessary for the carver to alter the internal structure of the spiral units from left to right. This relationship between trunk length and internal spiral unit structure reveals another important aspect of the principle of negative line element manipulation. If the paired trunks in one area of the composition are longer, the path in that area becomes (very slightly) narrower, because trunks with perpendicular relationships to each other must lie closer together in order to fit within the composition (Fig. 8.45). Their distance apart therefore dictates the width of the path within that spiral, and as a result, the branch and its embellishments must also be arranged slightly closer together. This leaves more space within the spiral unit for more negative line segments in the embellishments, even though the overall size of each spiral unit does not change (Fig. 8.45). Conversely, if paired trunks become shorter in another area of the same composition, those with a perpendicular relationship to each other do not lie as close together, and as a result, the path is (slightly) wider within the resulting spiral units (Fig. 8.45). Because the path is slightly wider, the branch and embellishments also lie slightly farther apart from each other, with the result that there is not enough room within the spiral unit for an additional negative line segment or ‘turn’. To keep the path even, the final line segment in the embellishment also must be dramatically widened (Fig. 8.45). These fluctuations in the path are very slight, measuring in the Rosemarkie panel at a maximum difference of only four millimetres, not immediately visible to the naked eye, but they are the result of profound alterations to the negative space. It appears that the Rosemarkie carver realised their miscalculation regarding trunk length about one-third of the way from left to right across the panel and began adjustments accordingly.

Finally, it is also possible that the carver made these structural alterations on purpose to manipulate medieval viewers’ perspective and to create an optical illusion by ‘bottom-weighting’ the composition. Modern picture framers create the same optical illusion by leaving more matting at the bottom of the picture frame, below the painting or image, than at the top of the frame. When viewing a bottom-weighted frame, the brain registers the matting around the image as being perfectly even (when in reality it is thicker at the bottom, below the image). If the matting is actually left perfectly even in width around the image, the brain will register it as uneven.[717] If the Rosemarkie panel were set vertically into a wall or as an altar screen (so that the rough side, currently oriented along the bottom in the museum display, were oriented as the 'left' side of the panel and concealed in a setting), the 'tighter' spiral units, which have the illusion of being smaller, would be oriented at the top of the field. The 'looser' spiral units, which appear deceptively larger, would be oriented at the bottom of the panel, thus achieving this bottom-weighted illusion. This suggestion remains very speculative, but all aspects of the artist's intellect and intentions are worth considering.

Previous scholars would not have been unable to account for such alterations in a single pattern composition, because they defy modern classification systems. Allen was not aware of this particular panel from Rosemarkie and so did not classify it. However, he did classify a different altered diagonal row multiple that is very similar in structure (with S- instead of C-spirals).[718] In his line-drawn template of this composition, he conveys no such widening of negative space or alterations in spiral unit structure that might occur in a real key pattern on an Insular artwork (Fig. 8.46). If he had been aware of the Rosemarkie panel, Allen might have concluded that the two different key patterns existed in the same composition, a conundrum he would not have been able to reconcile in his classificatory paradigm. Hull was aware that a single key pattern composition could be altered to fit differently-sized fields, but he explained this through the use of vector-graphic software, as if the entire pattern was stretched or shrunk as one.[719] This is unrealistic in a medieval setting, in which artists like the Rosemarkie carver individually manipulated negative line elements by hand, sometimes in different ways in the same composition, from one to the next.

Only two other modern medievalists, neither of whom are key pattern specialists, suspected the Rosemarkie panel to contain deep structural idiosyncrasies, although they were unable to fully explain them. Alastair Morton, a staff member at Groam House Museum who kindly oversaw the author's first visit to the collection, observed while standing beside her that something about the appearance of the pattern and shapes from either end of the panel was indeed unusual – an impression he gathered after staring at the

[717] Archival Methods 2015.
[718] Allen and Anderson 1903, vol. 1, part 2, p. 348, no. 958.
[719] Hull 2003, 104-108.

panel for some time.[720] In 2008, Martin Goldberg of National Museums Scotland and professional furniture maker Adrian McCurdy collaborated to recreate a wooden version of a Pictish throne depicted on a cross-slab from Fowlis Wester as part of the Glenmorangie Research Project.[721] This throne reconstruction remains unpublished. Goldberg and McCurdy chose the key pattern from the Rosemarkie panel to decorate the throne reconstruction, but quickly realised it was very difficult to adapt to the curved fields on the sides of the chair and so required substantial reworking (Fig. 8.47).[722] In the heuristic process of struggling to fit the Rosemarkie pattern onto the throne, Goldberg and McCurdy discovered the same internal alterations to spiral units and trunk lengths in the panel as described above, although Goldberg could not fully explain the artistic reasons that underpinned them, other than that McCurdy found it impossible to fit a key pattern composition based on the left side of the Rosemarkie panel – with its 'tight' spiral units and long trunks – within the assigned space on the throne.[723] The author's conclusions in this thesis, drawn independently from close physical examination of the Rosemarkie panel, are therefore strengthened by McCurdy and Goldberg's separate observations from their archaeological experiment.

8.3. Conclusion

This new artist- and artwork-centred approach to the study of key pattern not only corrects and expands our understanding of its structure, but also uncovers completely new evidence for Insular artists' working processes and their own conception of the pattern, which previous scholars were unable to access due to their methodologies. Typological classifications of the kind attempted by Allen are therefore doomed to failure because of their tendency to analyse discrete 'ideal types' rather than extant examples of patterns. This misunderstanding of the creative process of key pattern-making contradicts Insular artists' own view of the pattern, in which they blurred distinctions between compositions through the use of symmetry and manipulation of negative space. Allen typically described key pattern compositions that did not fit into his classification groups as being 'rudely executed', an inappropriate value judgement that fails to recognise the

[720] Alastair Morton, pers comm, 8 December 2014.
[721] National Museums Scotland [accessed 17 March 2018]; Dr. Martin Goldberg, pers. comm., 24 January 2017.
[722] Dr. Martin Goldberg, pers. comm., 24 January 2017.
[723] Ibid.

experimental and often improvisational nature of key pattern-making.[724] Actual Insular key patterns are therefore records of their makers' mental procedures, as they negotiated with its structural properties for individual creative purposes, in a manner similar to how modern jazz musicians improvise with chord structure today. In the case of the Rosemarkie panel, for example, its carver was fully fluent in key pattern. Modern scholars often assume that the roles of the designer (as intellectual) and executor or artist (as manual labourer) were separate (as evidenced, for example, by a museum display at the early medieval Irish monastic site of Clonmacnoise, in which a mannequin depicting a monk-artist, clutching a parchment diagram, instructs two labourers who are in the middle of carving a high cross). However, the Rosemarkie panel indicates that in the Insular milieu, designers and carvers could be the same person, with both roles performed by one individual (or craftworking team) in a single creative process. As a result, the Rosemarkie carver was able to make visually subtle but virtuoso adjustments in the middle of their working process in order to gracefully salvage the design and create a masterpiece. Furthermore, if the Rosemarkie artist had altered the key pattern in this way to fix a mistake, this adds to the mounting evidence that patterns were not always meticulously planned and set out on a grid at the beginning of work. If the Rosemarkie carver instead manipulated their key pattern to 'bottom-weight' the composition, this in turn reveals that Insular makers possessed a working knowledge of one type of realistic perspectival illusion, a creative ability typically denied medieval artists. Artist- and artwork-centred analysis of key pattern's structure therefore not only reveals brand-new information about the pattern itself, but also about Insular artistic culture.

[724] Allen and Anderson 1903, vol. 2, part 3, p. 336, fig. 349.

9. Conclusion

Until this point, key pattern had languished as an untapped resource of information about Insular artists' working processes, as well as the making of ornament as a whole, in any art tradition. This thesis adapts the core of Michael Brennan's groundbreaking method of studying interlace from his 2011 doctoral thesis (Chapter 5), in order to suit key pattern's distinctive structure. Its foundation lies in structural analysis, or the identification of the structural properties of all key patterns, Insular or otherwise. The most basic structural properties, required for upholding key pattern's physical integrity and distinctiveness from other patterns, are recognizable as such because they are found in every key pattern composition, wherever it occurs, anywhere in the world (Chapters 2, 6, and 7). An additional set of more complex structural properties also existed in the Insular tradition (Chapter 8). These additional properties likewise appear in key patterns on Insular monuments, manuscripts and objects, hundreds of which the author examined as part of her doctoral research, with such predictability as to reflect Insular artists' shared way of seeing the pattern and their creative priorities in its production.

This thesis places key pattern under a completely new analytical lens. Previous methodologies for the study of ornament – key pattern or otherwise – did not permit scholars to recognise pattern-makers' intellectual agency in this way. Archaeological typologies based on formal analysis of patterns, born in the 19th-century and typified by Allen's influential classification of key pattern in *ECMS* (Chapters 4 and 5), effectively made medieval artists' creative role invisible to modern scholars, because the purpose of these typologies was to record and organise ideas or 'types' of key pattern rather than actual, individual compositions. Many postwar art historians, archaeologists, and even anthropologists – mostly outwith Insular art studies but increasingly within the discipline as well – then side-stepped examination of ornament structure, in a critical reaction to the flaws inherent in typological analysis, and much less understandably in some cases, in a cosmophobic rejection of ornament as a marginal topic, unless that study pertained to thematic subjects such as how patterns excite social responses or are a repository for cosmological beliefs (Chapters 1 and 4). This later 20th-century academic unwillingness to address the physical structure of patterns is paralleled by the disdain for ornament seen even earlier in Modernist design, as encapsulated by the architect Adolf Loos' 1908 essay

‘Ornament and Crime’ (though without, of course, Loos’ racism): ‘The evolution of culture is synonymous with the removal of ornament from utilitarian objects.’[725]

With key pattern as its vehicle, this thesis continues Michael Brennan’s pioneering work in rescuing ornament, as well as the intellectual processes of the artists who crafted it, from both longstanding scholarly neglect and rejection. Its new method for studying key pattern is in fact a formal analysis of the pattern’s physicality, ultimately Morellian in its focus on empirical detail. However, it is unlike earlier methods of formal analysis because it departs from connoisseurship, typology, and style, and re-focuses the inquiry instead on firmer ground: the individual makers and their creations. Structural analysis therefore does not just improve our understanding of key pattern for its own sake, but also allows us to re-access its anonymous makers’ step-by-step decisions, from their first imagining of a composition to its physical completion.

The analysis of key pattern in this thesis has wide-ranging benefits for Insular art studies and beyond. Chapter 1 clarified key pattern’s structure as being comprised of two aspects: structural elements and structural principles, which together are the pattern’s structural properties. This chapter demonstrated the importance of first establishing this comprehensive understanding of key pattern’s structure before theorising, as scholars have done previously, about such matters as the tools Insular artists may or may not have used in its construction (i.e. grids), or about the pattern’s meaning or effect in social interactions. Analysing these latter subjects without a stable foundation in structural analysis can lead to an incorrect understanding of key pattern’s structure as well as artists’ methods for handling it. Chapter 2 then laid important new groundwork by differentiating key pattern’s structure from other types of ornament and clarifying its multi-level relationship both with other, individual rectilinear patterns as well as larger categories of rectilinear ornament, thereby developing a revised, streamlined vocabulary for scholars to use in future. The new technical definition in this chapter introduced the basic structural properties that all key patterns share in all art traditions. Chapter 3 presented the first-ever analysis of artists’ creative approach to positive and negative space in ornament of any kind, either additive or reductive. The creative approach is equally as crucial as a pattern’s structural properties, for it reveals how makers thought about line and space in pattern. In an Insular context, its recognition also improves our understanding of how key pattern

[725] Loos 1908, repr. 1930, 20.

(which Insular artists created solely in a reductive manner) is structurally distinct from other rectilinear patterns with which they took an additive approach, such as complex step pattern.

Chapters 4 and 5 presented a complete overview of previous scholarship on Insular key pattern, each in its historical context, including archaeological classifications, artists' manuals, one mathematical study, and Derek Hull's and Michael Brennan's new, artist-centred approaches. This overview comprehensively highlighted each study's correct, crucial contributions upon which this thesis builds, but also the shortcomings – many adopted from Allen's seminal study and then repeated throughout the 20^{th} century – that ultimately made them all inadequate, and which this thesis corrects. This historiography was not just an exercise in criticism, for it is important to point out the pitfalls of previous methodological approaches and subsequent misunderstandings of key pattern structure, so that specialists do not inadvertently repeat them again in future.

Chapters 6 and 7 show that Insular key pattern is neither a parochial nor antiquarian issue, but one with global implications for the study of ornament across disciplines. First, scholars have noted, without dedicated analysis, that the pattern may have originated in basketry and/or textile weaving more generally. Through comparison of Paleolithic and Neolithic key patterns with those on ancient and modern textiles, Chapter 6 confirmed that Insular key pattern and its global cousins are each more-or-less distant branches sharing a prehistoric root, which spread across Eurasia and likely also was carried over Beringia into the Americas. The conclusions of the chapter also lent support to recent archaeological finds that suggest that the earliest weaving technologies in Eurasia appeared much earlier than previously supposed. The comparative analyses of global key pattern traditions in Chapter 7 also constitute several concrete advances. This chapter placed Insular key pattern in its global context by identifying specific structural reasons for its almost unparalleled geometrical complexity, and thereby demonstrated that dual analysis of structural properties and the creative approach are critical in ornament studies. Namely, artists' choice of either the reductive or additive creative approach to key pattern reveals their understanding of and engagement with concepts such as space, line, and symmetry within their own traditions, and depending on their choice, opened or closed opportunities for creating physical complexity and visual variety in their patterns. This analysis also uncovered new information about well-studied art traditions, such as those of the ancient

Greeks and Romans or Ancient Puebloans, in which key pattern was ubiquitous but hitherto has been largely overlooked in modern scholarship.

Finally, the case studies of individual Insular artworks in Chapter 8 showcased the practical benefits of this new method of structural analysis: that formal analysis can move beyond questions of influence, quality, and style, and that it can be applied successfully to many key patterns on many different artworks. The St Gall Gospels, Harley Golden Gospels, Kilmartin Cross, Clonmacnoise Nuns' Church carvings, the thistle brooch from the Skaill hoard, and Rosemarkie panel represent a mere handful of the many artworks to which the author usefully applied this method during her research. For example, a carved stone cross-base from Llangyfelach in Wales sports a key pattern on one of its sides that is composed of two, mirror-symmetric diagonal rows (similar to those illustrated in Figs. 8.18a, 8.19a). Redknap and Lewis noted that this composition was 'compressed towards the right owing to the reduction of the size of the field.'[726] It is true that on the right side of the composition, the units in each row do cease to repeat sooner than they normally do in other surviving mirror-symmetric diagonal rows (in such rows, the last trunk on one side typically intersects the outer border, while the last trunk on the other side intersects the adjacent border between the two rows, as illustrated in Fig. 8.18a). There was not enough room on the Llangefylach cross-base for this to occur, or for the carver to use typical mitre structures (like those in Figs. 8.18a, 8.19a). However, the carver took advantage of this challenge, and inserted trunk-like negative lines intersecting the outer border on the right side of these paired rows in order to create an illusion that the composition was not just mirror symmetric across the horizontal axis (i.e. the adjacent border between the two rows), but also across the vertical axis. The latter effect is normally impossible because the mitre structures on either side of mirror symmetric diagonal rows typically differ (as in Fig. 8.18a, 8.19a). The artist creatively manipulated negative space in order to parachute an illusion of type of symmetry into a composition that otherwise would not possess it (Fig. 9.1). Structural analysis therefore demonstrates that although Insular artists developed a set of shared conventions for key pattern, the creative process underlying each surviving composition was in many of its details unique from that of every other composition in the corpus. The methodological strength of structural analysis therefore lies in its usefulness as a tool for pinpointing such idiosyncrasies, which reveal the humanity and individuality of each anonymous maker, preserved in the structure of their key pattern. Key pattern provides us an opportunity to peer through a window into the

726 Redknap and Lewis 2007, 349-352.

workshop or scriptorium, and to grasp for the first time how Insular makers improvised with their own understanding of line space and symmetry, and their basic conventions or structural parameters for the pattern, much like modern jazz musicians do with chord structure today.

Analysis of the key patterns in these case studies also sharpened our view of wider Insular artistic culture. Insular artists viewed key pattern not as a collection of classifiable templates or types, but as a continuum of compositions between which they could create deliberate structural references. The Rosemarkie panel also indicates that Insular makers did not always plan their patterns in fixed detail before commencing work, but rather made fluid, informed decisions throughout their working processes. This ad-hoc flexibility and fluency with key pattern also reveals that in Insular artistic culture, there was no need for hierarchy between designer and maker. They could be the same person. This overturns an assumption often found in Insular art studies, that highly-trained artists-as-designers were distinct from craftspeople, who in contrast were less-inspired manual labourers that merely executed the designers' plans (Fig. 9.2).[727]

Finally, by adapting Brennan's new methodology to suit key pattern, this thesis demonstrates the approach's flexibility and applicability to further analyses of other types of ornament, both within an Insular context and from other cultures. This approach treats ornament structure not as an abstract phenomenon but the product of embodied, human action. It is a study not of made objects, but of making. Ultimately, this methodology should not be limited to historical traditions only, as it will allow academics to tactfully support and collaborate with modern makers in indigenous and local traditions (including Celtic Revival artists in Britain and Ireland, who work with Insular and later patterns, like those from the early-modern Highlands) in their recovery of ornament that has been endangered or lost due to colonialist violence and/or global industrialisation.[728] Previous scholarly approaches, while informative and beneficial in other ways, did not permit academics to view ornament structure in this way, through its makers' eyes. As a result,

[727] Murray 2013. Griffin Murray also challenged this assumption of a 'dichotomy' between designer as supervisor and craftsperson as manual labourer, however, he focused specifically on metalwork. Rather than analyzing ornament, he gathered evidence from inscriptions on the metalwork objects and early medieval law tracts.
[728] The author is grateful to Dr. Mark Hall of the Perth Museum and Art Gallery (pers. comm., 13 June 2018) for discussion of the museum's work in sharing its collections with indigenous makers, in order to aid their efforts in the recovery of lost, traditional craft technologies. Although these efforts did not focus on patterns specifically, this conversation led the author to recognise this wider application of structural analysis.

the voices of artists largely have been silenced in modern ornament studies for the past two centuries. This thesis provides scholars with the vocabulary and tools necessary to recognise ornament-makers' intellectual agency in their diverse ways of manipulating patterns and seeing line, space, and symmetry, thereby remedying the chronic academic neglect of artists from cultures that favour abstract ornament over the human figure. It represents a larger paradigm shift that will bring study of ornament into the 21st century.

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Making Key Pattern in Insular Art: AD 600-1100

2 Volumes
Volume 2: Figures

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Table of Contents

Volume 2: Figures

*For Table of Contents for Volume 1: Text, see Volume 1.

1. Chapter 1: Prolegomena

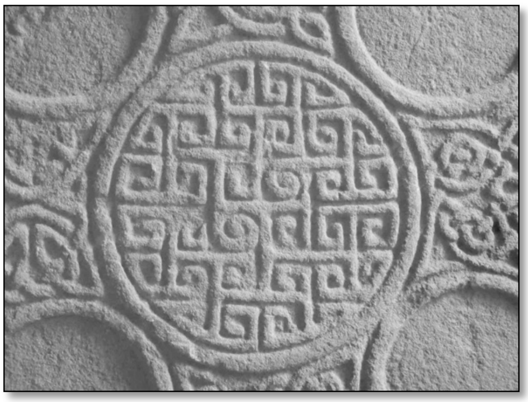

Fig. 1.1

Key pattern in a circular field at the centre of a cross head. Cross-slab, 8th century, Rossie Priory, Perth & Kinross, Scotland. With detail (© Author)

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Fig. 1.2

Key pattern in the columns and curved arch of a canon table page. Lindisfarne Gospels fol. 17v. With detail (British Library [accessed 1 February 2018])

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Fig. 1.3

Ardagh Chalice, with detail of chip-carved key pattern on the gilded ring below the stem (By permission of the National Museum of Ireland)

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Fig. 1.4

Scabbard chape, St Ninian's Isle hoard (no. 16), Shetland, 8th century AD, gilded silver. With detail of key pattern (Youngs, ed. 1989, plate 103)

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Fig. 1.5

Engraved key pattern at the base of the Cashel Bell, County Tipperary, Ireland (detail poor) (Hunt Museum 2018)

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Fig. 1.6

Key pattern in the border of the Genoels-Elderen Diptych, ivory, 8th century AD, Northumbria (Beckwith 1974, p. 21, no. 4)

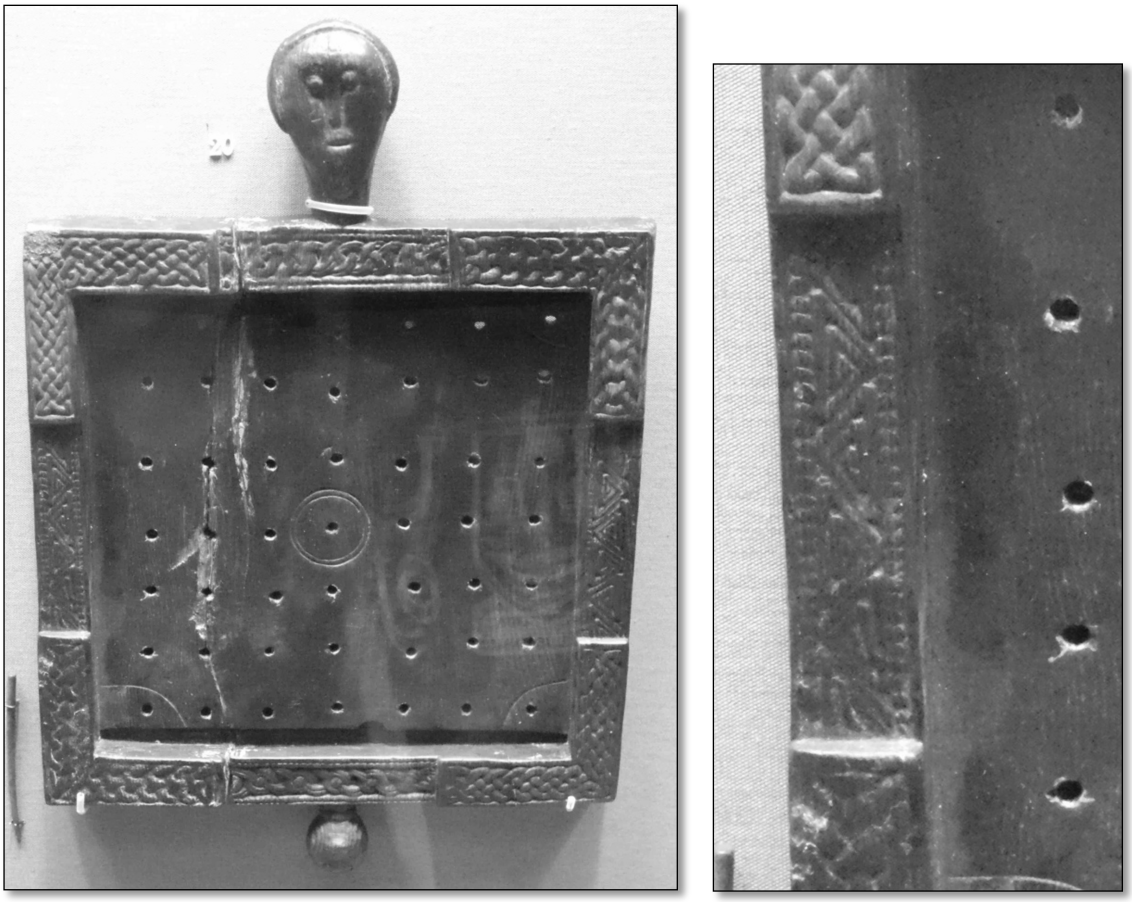

Fig. 1.7

Key pattern at the edge of a gaming board, yew, 10th century AD, Ballinderry 1 crannog, now held in the National Museum of Ireland, Dublin (National Museum of Ireland 2018a). With detail (© Author)

Fig. 1.8

Cross-slab from Bride Parish Church, Isle of Man. A fragment of key pattern survives in topmost left area outside the cross shaft, before transforming into interlace as it travels downward. Viking-Age ring-chain pattern located on the other side of the slab (not pictured here) (Kermode 1907, p. 168-70, no. 92, plate xlii)

Fig. 1.9

The Clonmacnoise Nun’s Church chancel arch, with detail of key pattern compositions at the top of columns, 12th century AD (© Author)

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(a)

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(c)

Fig. 1.10

(a) Reconstruction of one of two textile bands (silk and gold thread) from Walter de Gray's grave, York Minster crypt. Silk and gold thread, AD 1255 (with details, Ramm et al 1971, plate LVIb)

(b) Detail of 'running dog' key pattern section from the reconstruction.

(c) Detail of key pattern with swastika-shaped spirals from the reconstruction.

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Fig. 1.11

(a) Detail of key pattern panel from the Lindisfarne Gospels cross-carpet page, folio 210v (detail, British Library [accessed 8 June 2018])

(b) Bruce-Mitford's reconstruction of the grid used for the key pattern panels on Lindisfarne Gospels, folio 210v. Bruce-Mitford noted that he – rather than the medieval illuminator – added horizontal and vertical lines to this grid, to indicate which parts of the key pattern aligned with surrounding decoration. These lines should be disregarded (Bruce-Mitford 1960, p. 224, fig. 52)

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Fig. 1.12

O’Meadhra’s reconstructive drawing of a partially-finished key pattern with grid, from an early medieval wooden fragment (O’Meadhra 1979, pp. 29-30, no. 10A2)

Fig. 1.13

Black-and-white detail of key pattern drawn freehand in black and coloured ink in the St Gall Gospel Book, p. 266. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

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(a)

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(b)

Fig. 1.14

(a) George Bain's recommended construction method. The pattern's longest lines are drawn first (1), the longer intersecting lines second (2), and the shorter intersecting lines third (3). The triangular shapes are created fourth (4), and then filled in with black fifth (5) (based on detail, G. Bain 1951, p. 75, plate 1)

(b) Iain Bain's recommended construction method. The longest lines in the pattern are drawn first (1) and their longest intersecting lines second (2), as with George Bain. However, Iain Bain recommends the triangular shapes be created third (stage 3 here, but stage 4 for George Bain), and the shorter intersecting lines last (4 here, but 3 in for George Bain). Bain's original, black numbers in the diagrams refer to the length of each line in grid units, and should be disregarded here (based on I. Bain 1994, p. 1, fig. 1-4)

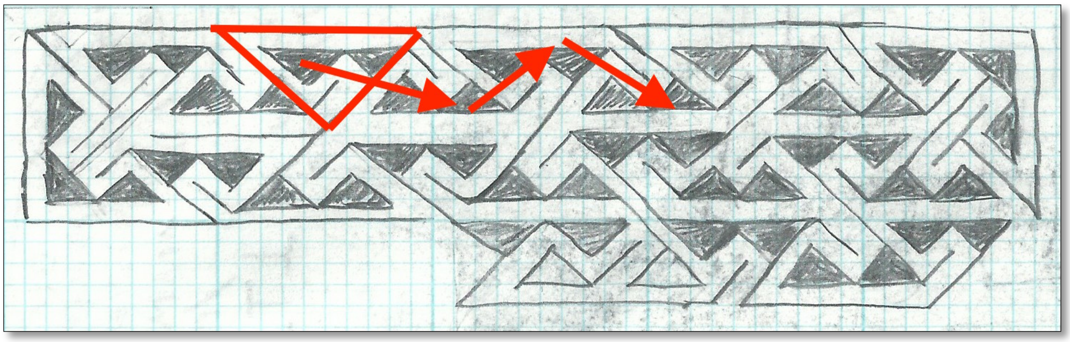

Fig 1.15

Ann Lorenc's construction method, as observed in person by the author: creating one spiral shape fully (red triangle), before moving on sequentially to the next spiral shapes, as indicated by red annotations. Lorenc stopped without finishing a spiral shape at the bottom of the composition, upon making a mistake in its structure (By permission of Ann Lorenc)

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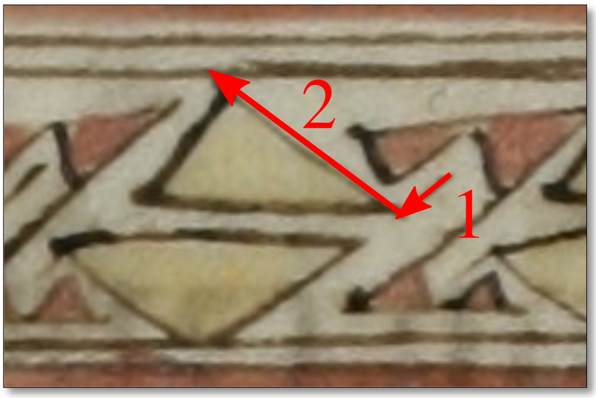
Fig. 1.16

Gifford Charles-Edwards' diagram of the Insular method of writing serifed ascenders. Steps 1 and 2 (done without lifting the pen) are equivalent to the creation of the key pattern structures highlighted in Fig. 1.17 below (Charles-Edwards 2007, p. 83, fig. 54)


(a)



(b)

Fig. 1.17

Detail of key pattern in the St Gall Gospels, p. 266, with annotation. (B) indicates the ductus of the illuminator's stroke, where he created two key pattern structures (1 and 2 in red, with arrows) in one step without lifting his pen, like a serifed ascender. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

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Fig. 1.18

Robert Stevick’s diagram of how an Insular metalworker laid out the large fields and sections on the reverse side of the Tara brooch, using a compass (Stevick 1998, p. 12, fig. 5).

2. Chapter 2: Key Pattern: Terms and Definitions

(a)

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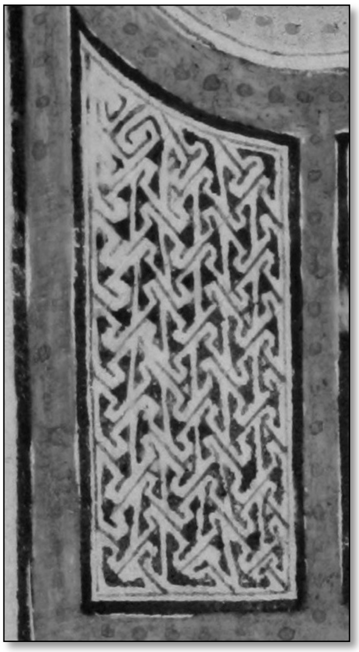
(b)

Fig. 2.1

(a) Interlace on a bone motif piece from Christchurch Place, Dublin. National Museum of Ireland (© Author)

(b) Spiral pattern. Book of Kells fol. 34r, detail, 8th-9th century AD (Trinity College Dublin MS 58) (detail, Hawkes, ed. 2013, fig. 25.5)


(c)

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(d)

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(e)

Fig. 2.1

(c) Key pattern (rectilinear pattern). Black-and-white detail from the St Gall Gospels, p. 208, 8th century AD, Ireland. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 208 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

(d) Complex step pattern (rectilinear pattern). Ardagh Chalice, Ireland, County Limerick, 8th century AD (detail, by permission of the National Museum of Ireland)

(e) Simple step pattern (rectilinear pattern). Ardagh Chalice, bottom of lower foot ring (detail, by permission of the British Museum)

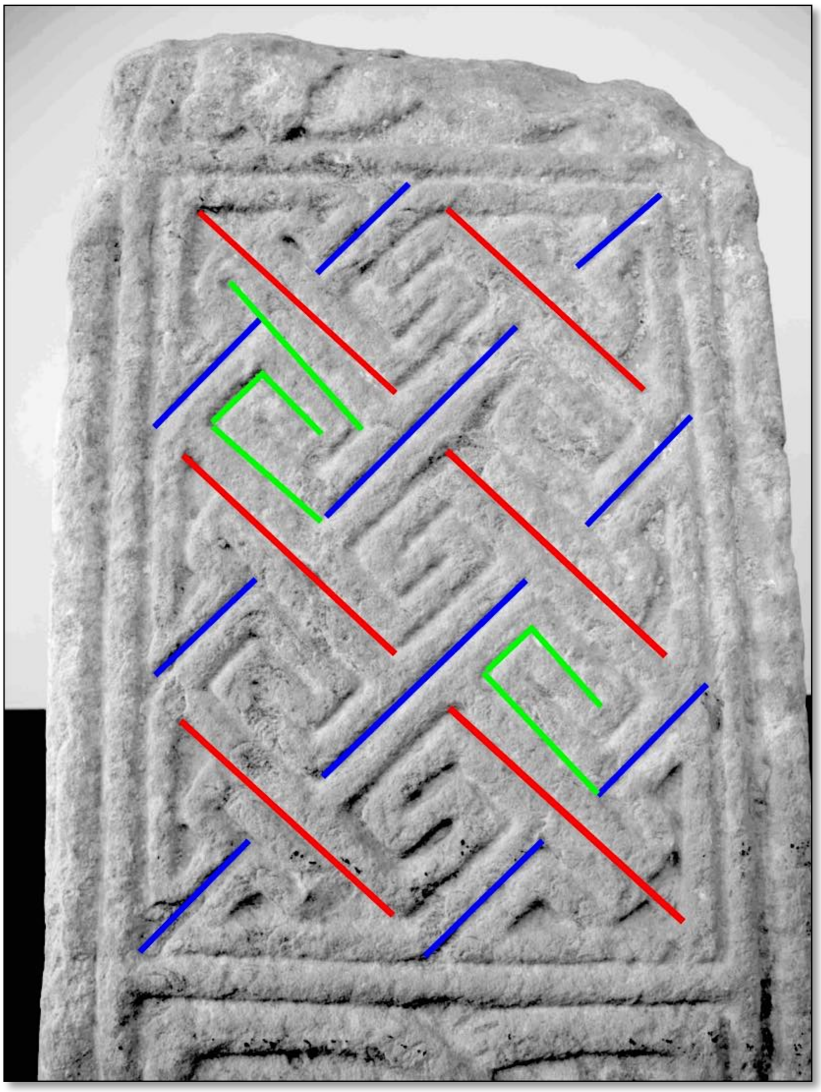


Fig. 2.2

Parallel and perpendicular lines switching back and forth in key pattern (red, blue, and green). Those that intersect are highlighted in green. (Detail, cross-shaft fragment, Abercorn 1, West Lothian, Scotland) (© Author)

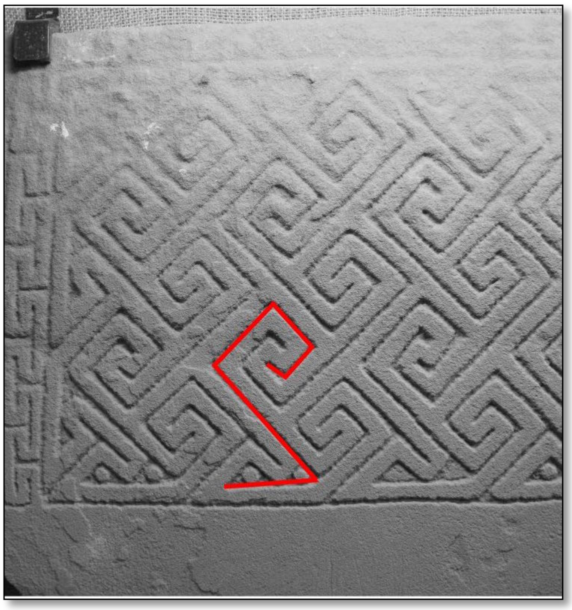


Fig. 2.3

Each series of intersecting lines eventually terminates (red). Sandstone panel, Rosemarkie 1992.2, Groam House Museum collection, Ross & Cromarty, Scotland (© Author)

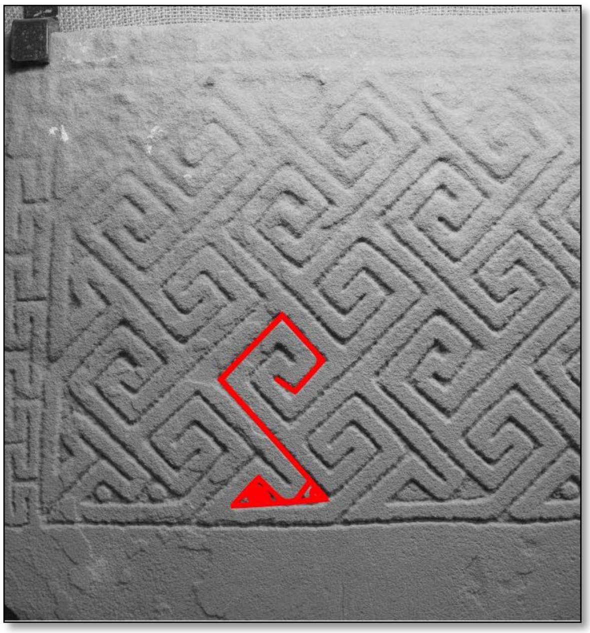


Fig. 2.4

Negative lines expanded into shapes (red) (© Author)

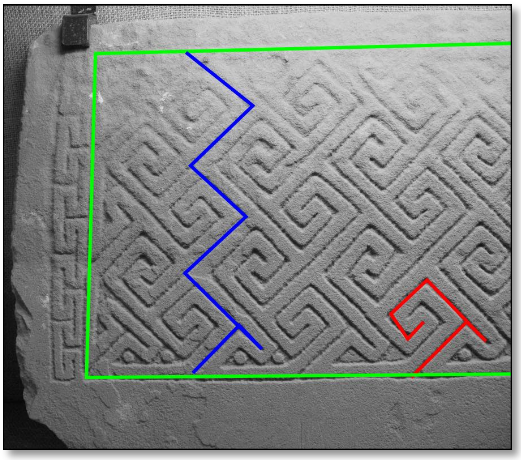


Fig. 2.5

Insular artists only allowed a series of intersected negative line segments (red) to intersect *one* side of the outer border of the pattern (green). Insular artists *never* allowed a series of intersected negative line segments to intersect more than one side of border, as simulated here in blue, where the author made them to continue so that they touch two sides of the border. Therefore, this simulated series of negative line segments (blue) would *never* be carved or drawn in an actual Insular artwork (© Author)

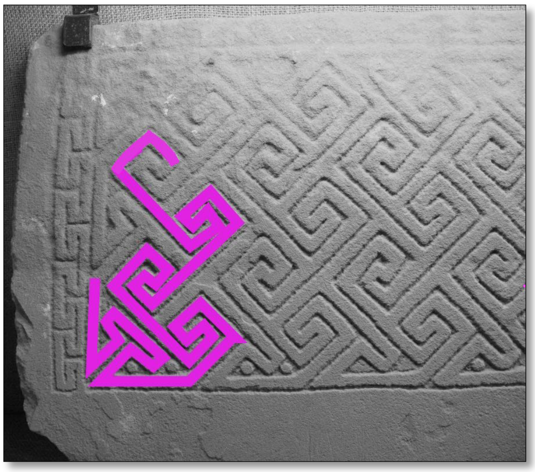


Fig. 2.6

The positive space or path, partially highlighted in pink. It is continuous, at a constant width, and never touches the outer border of the pattern field. Instead, as it reaches the border, it turns to run parallel alongside it (© Author)

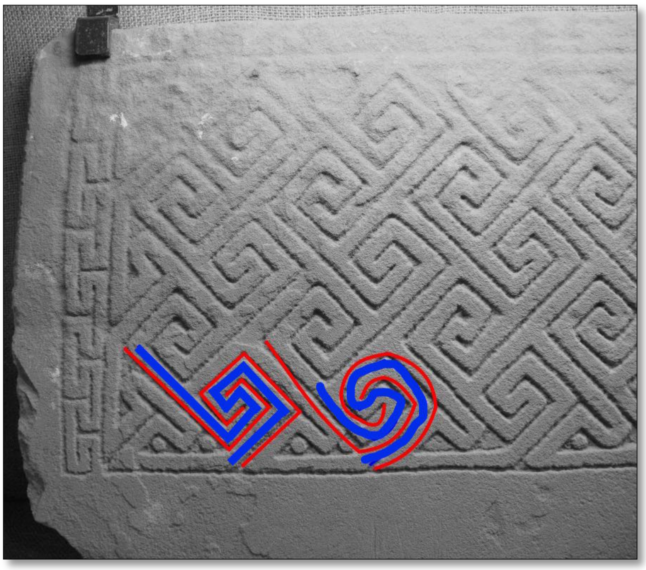
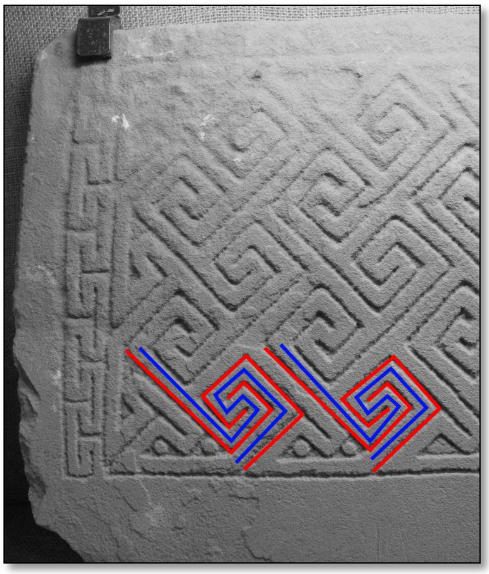


Fig. 2.7

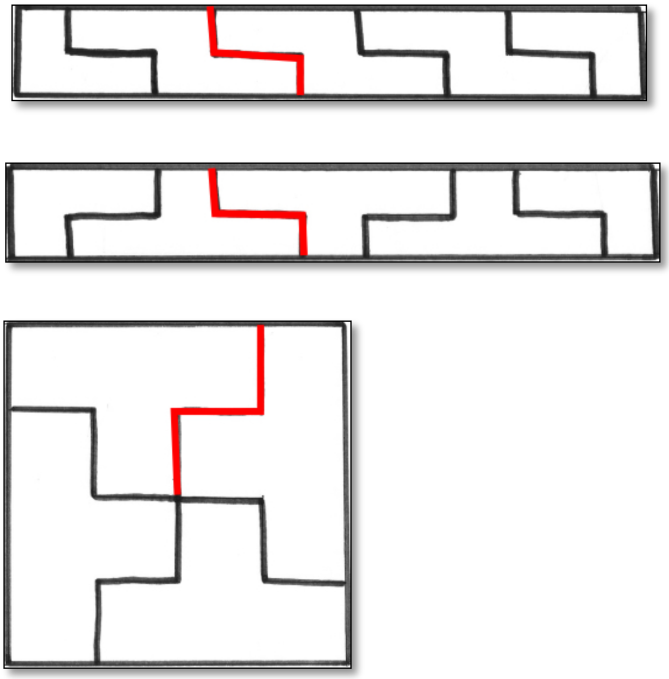
Negative lines (red) and positive space (blue) form rectilinear spiral shapes (left). Juxtaposed with hypothetical curvilinear spiral shape for comparison (right) (© Author)

(a) 

(b) Image has been removed due to copyright restrictions

Fig. 2.8

Spirals repeated at the same size in key pattern (a), versus a spiral pattern with varying-sized spirals, in the Book of Kells (b) (a: © Author; b: Detail, Hawkes, ed. 2013, fig. 25.5)



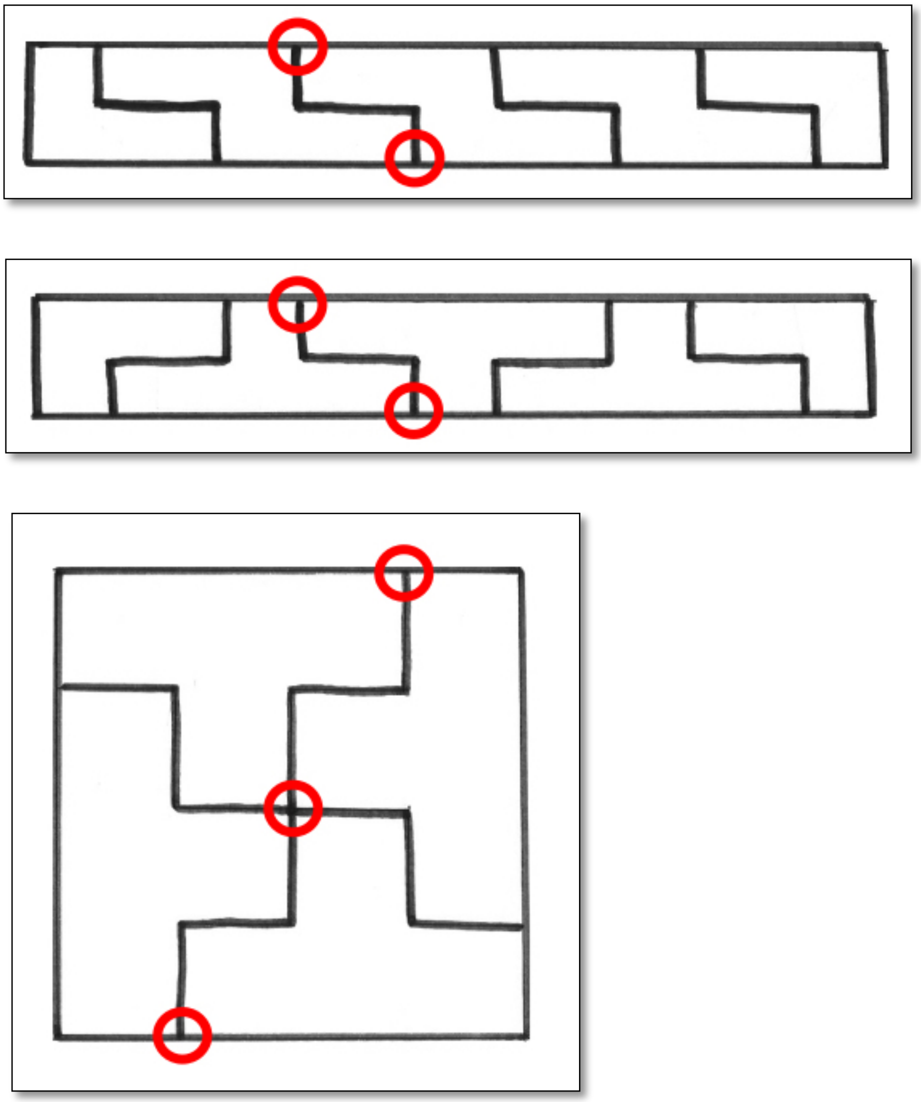
(a)

(b)

(c)

Fig. 2.9

Three simple step patterns, with angled lines highlighted in red. Angled lines in (c) form a ‘swastika’ (© Author)



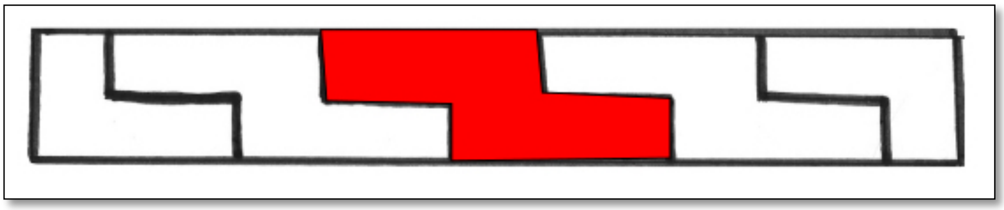
(a)

(b)

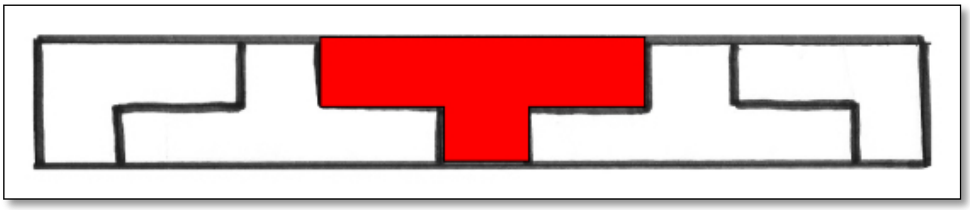
(c)

Fig. 2.10

Three simple step patterns. Intersections between angled lines and the border/another angled line highlighted in red (© Author)



(a)



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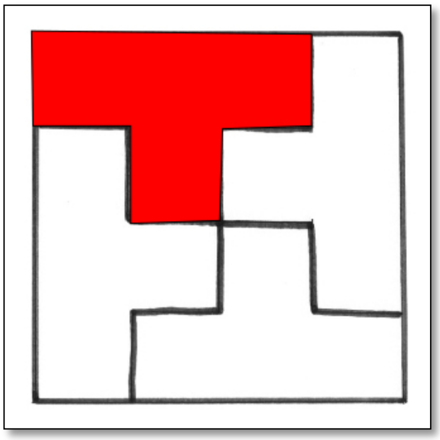
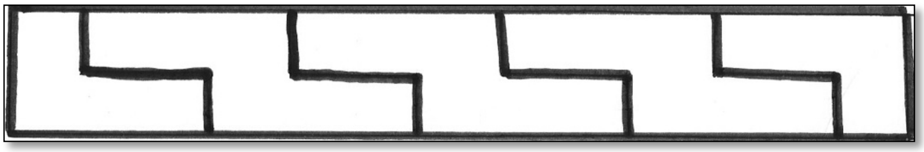


(c)

Fig. 2.11

‘T’- and ‘S/Z’-like shapes in the positive space of simple step pattern, highlighted in red (© Author)

(a) 

(b) 

Fig. 2.12

Simple step pattern (a) and a detail of an interlace pattern or ‘twist’ of two cords on a belt fitting from Sutton Hoo (b) (a: © Author; b: detail, Nees 2007, plate 1)

(a)

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(b)

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(c)

Fig. 2.13

Simple step pattern in (a) sculpture: detail from the Dupplin Cross, Perthshire, Scotland (© Author), (b) a manuscript: detail from folio 4v of the ‘Royal Bible’, Gospel book, 9th-11th century AD, Anglo-Saxon (detail, British Library, Royal MS 1 E VI [accessed 3 November 2017]), (c) metalwork: Ardagh Chalice, bottom of foot ring (detail, by permission of the British Museum)

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(d) **Image has been removed due to copyright restrictions**

Fig. 2.14

Complex step patterns in various media:

(a) Ardagh Chalice, handle decoration, champlevé enamel, cloisonné, or glass inlaid with silver wire[*] (detail, by permission of the National Museum of Ireland);

(b) The Lindisfarne Gospels, fol. 2v, cross-carpet page (detail, British Library [accessed 3 November 2017]);

(c) The Bealin Cross, County Westmeath, Ireland (detail, Crawford 1926, p. 30, no. 67, plate xxix, no. 67;

(d) Ardagh Chalice, from band of decoration around the bowl, champlevé enamel, cloisonné or glass inlaid with silver wire * (detail, by permission of the National Museum of Ireland)

[*]Available publications do not make clear which technique was used for the bosses and inlay on the Ardagh Chalice. For example, see Organ 1973, 238-71. Organ does not describe the techniques used for the areas pictured above. On p. 252, he does note the artists inlaid both enamel and solid glass into another boss on another area of the chalice.

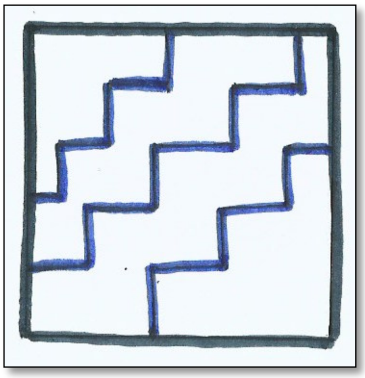


Fig. 2.15

Positive lines (blue) in a single field of complex step pattern. Each line intersects two sides of the border. Negative space left in white (© Author)

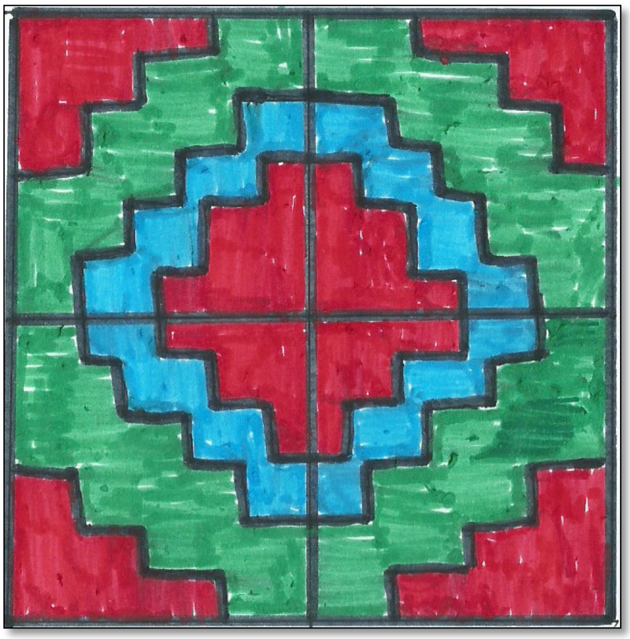


Fig. 2.16

Four complex step pattern squares joined to form concentric positive lines (black) and concentric coloured negative space (© Author)

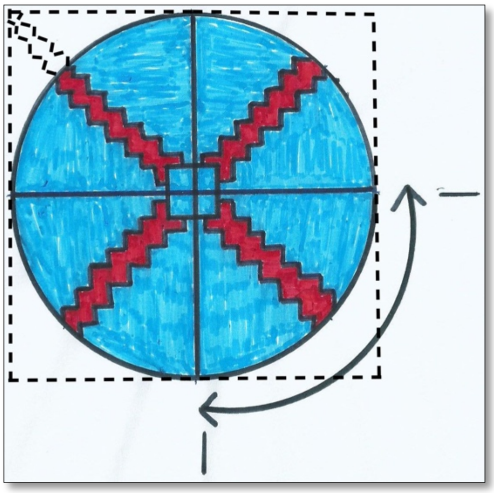


Fig. 2.17

A complex step pattern arranged in a cruciform manner. Positive angled lines are black, negative space is blue and red. In an optional variation, pattern-makers often bisected each of the four fields and made the outer border curved, to create a circular composition. The original square shape and the continuation of the angled, stepped lines are indicated by dotting. Based on the Ardagh Chalice (Fig. 2.14d) (© Author)

(a) **Image has been removed due to copyright restrictions**

(b) **Image has been removed due to copyright restrictions**

Fig. 2.18

(a) A cloisonné metalwork stud. Wickhambreux, Kent, Anglo-Saxon, 7th century.

(b) A glass boss with impressions for silver inlay in the form of complex step pattern (top) and clay mould (below), made to imitate cloisonné. Lagore Crannog, County Meath, Ireland, 8th century (Youngs, ed. 1989, pp. 53, 205, no. 39, 209, fig. 39, 209)

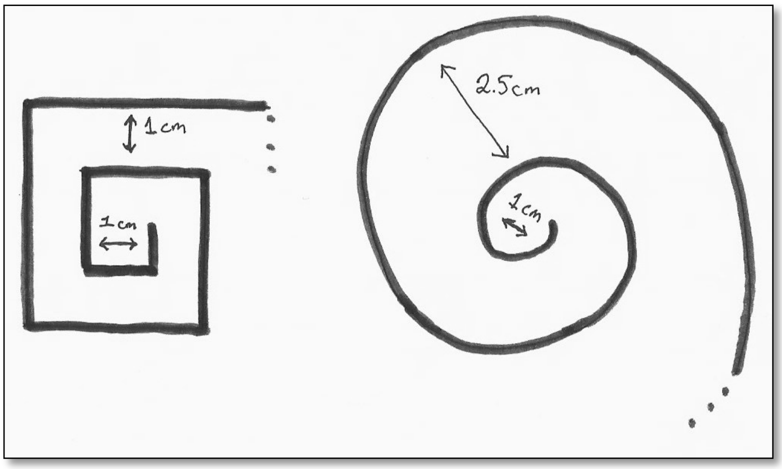


Fig. 2.19

Comparing key pattern (right) and spiral pattern (left): (a) positive (white) and negative (black) space are spiraliform in both, (b) in spiral pattern, positive space (white) can widen from centre, but in key pattern it remains a constant width, (c) positive space (white) also called a ‘strand’ (© Author)

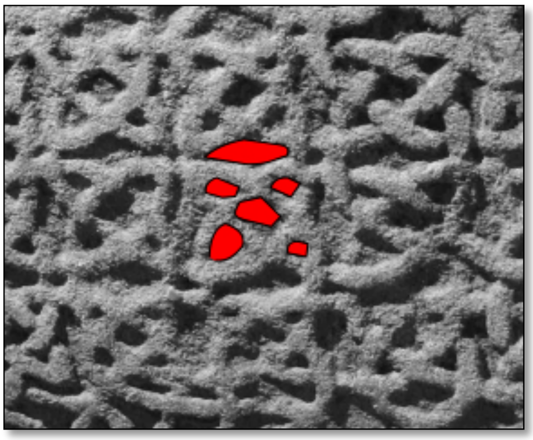
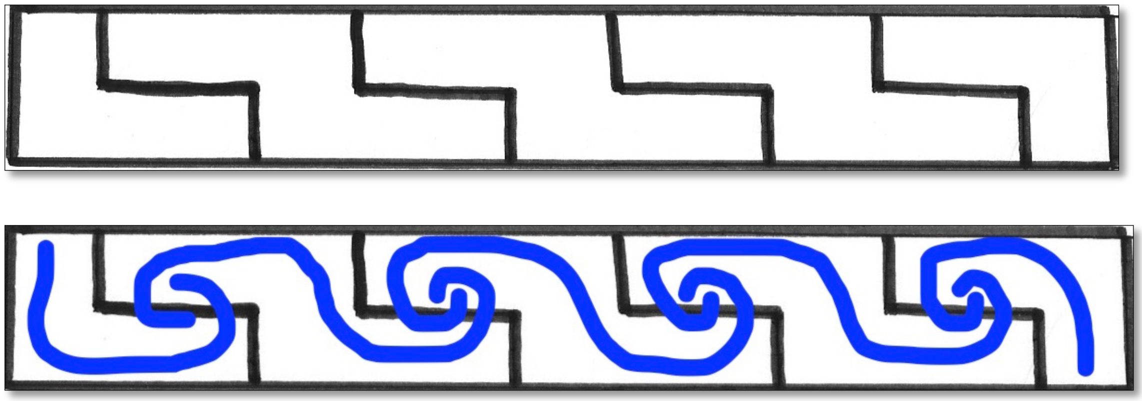
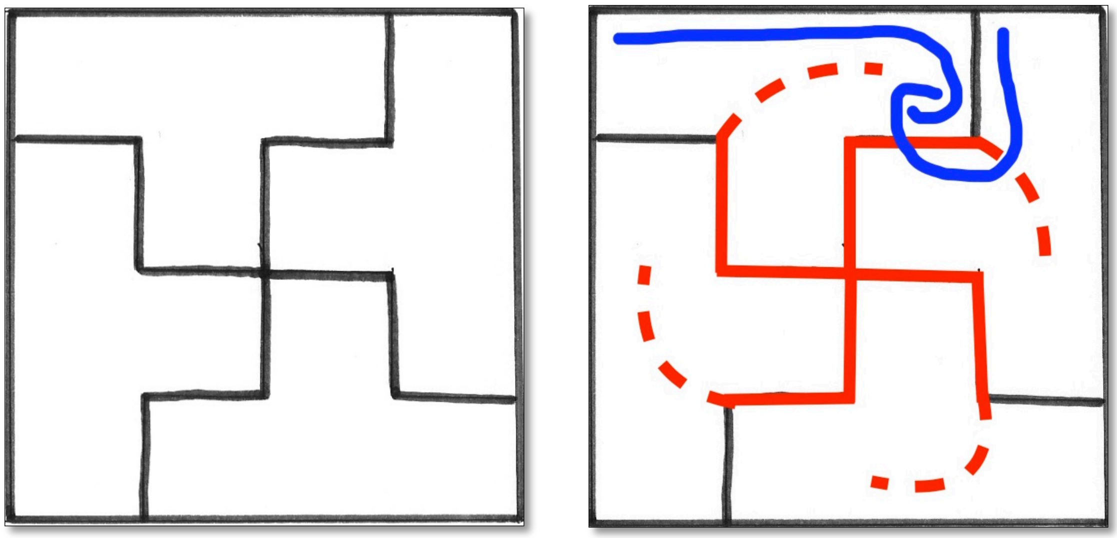


Fig. 2.20

Discontinuous negative space in interlace, with detail (sample highlighted in red). The Forteviot Cross, Perthshire, Scotland (© Author)



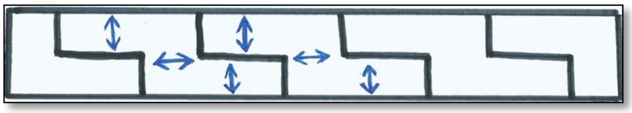
(a)



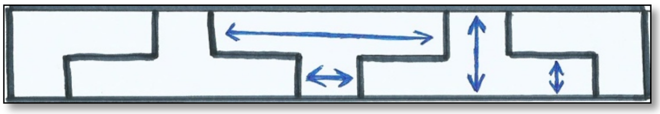
(b)

Fig. 2.21

In simple step pattern, when the angled lines are arranged in a row, only the positive space (exaggerated in blue) is spiraliform (a). When lines are arranged in a radial fashion (b), both positive (blue) and negative space (red) are spiraliform (© Author)



(a)



(b)

Fig. 2.22

The path has consistent width in simple step pattern (a) (indicated by blue arrows), but inconsistent width in simple step pattern (b) (blue arrows) (© Author)

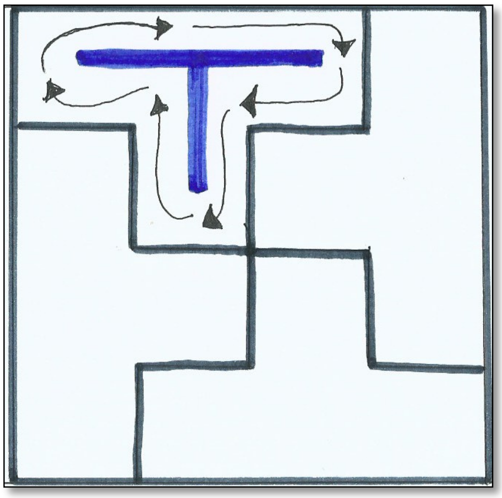


Fig. 2.23

Additional line in simple step pattern (blue) makes the path continuous in a closed loop (arrows) (© Author)

Fig. 2.24

Coiling interlace on the Forteviot Cross (detail) (© Author)

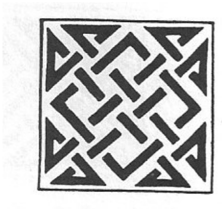


Fig. 2.25

Line drawing of rectilinear interlace from the Ulbster cross-slab, Caithness, Scotland (Allen and Anderson 1903, vol. 1, part 2, p. 287, no. 729)

Fig. 2.26

An interlace pattern where the path (animals' bodies) varies in width (compare circled regions: animals' bodies versus legs). Detail of Aberlemno Churchyard Cross, Angus, Scotland (© Author)

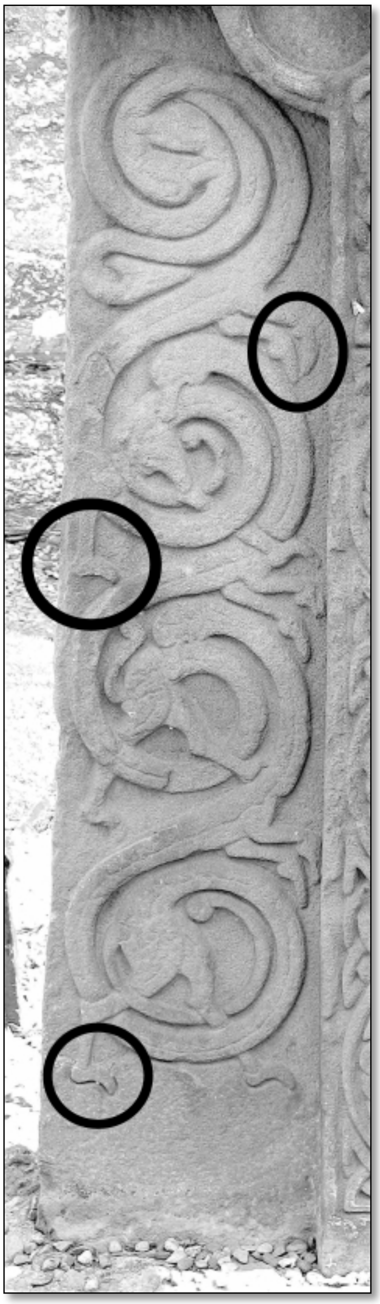


Fig. 2.27

An interlace path with discontinuous areas (animals' feet) (© Author)

Fig. 2.28

An interlace pattern with differently sized and shaped motifs juxtaposed within a single field. Detail, St Vigeans 7, Angus, Scotland (© Author)

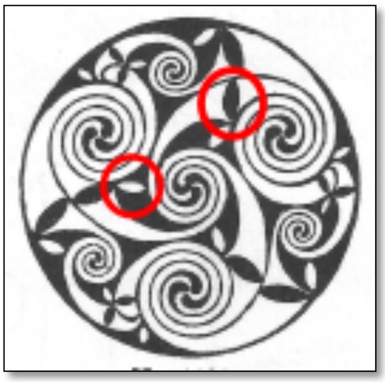


Fig. 2.29

Allen's line drawing of spiral pattern from the St Gall Gospels. Both the path and negative space are discontinuous throughout the pattern (terminations occur in red circled areas) (Based on Allen and Anderson 1903, vol. 1, part 2, p. 381, no. 1033)

Fig. 2.30

Animal and human heads at the centres of spirals. Detail, St Vigeans 7 (© Author)

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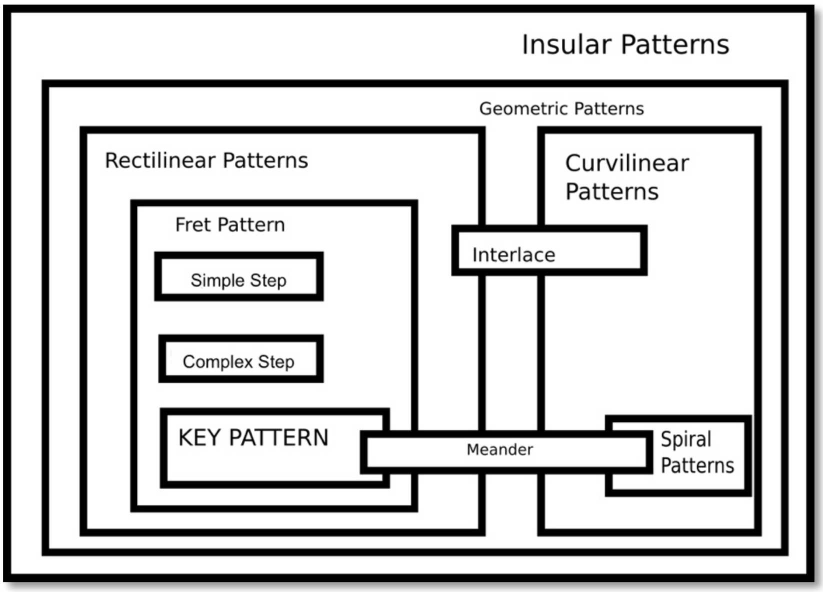
(b) Image has been removed due to copyright restrictions

Fig. 2.31

(a) Interlacing Insular plant-scroll. (b) Spiraliform Insular plant-scroll. Cramp refers to these as ‘tangled scroll’ and ‘spiral scroll’ respectively (details, Cramp 1984b, xxv, fig. 10)



(a)

	Key Pattern	Simple Step	Complex Step	Spiral Pattern	Interlace
Rectilinear	√	√	√	X	*
Repeating (units same size)	√	√	√	*	*
Non-representational	√	√	√	*	*
Alternating positive space	X	X	X	X	√
Positive and negative space *both* spiraliform	√	*	X	√	*
Positive space (path) typically continuous	√	X	X	X	*
Positive space (path) consistent width	√	*	√	X	*
Negative lines intersect one side of border *only*	√	X	X	*	*
Negative lines discontinuous (within pattern/at border)	√	√	*	*	√
Negative lines can change width	√	X	X	√	√

Key:
√: Yes
*: Sometimes (depends on artist's decisions in handling of pattern's structures)
X: Never

(b)

Fig. 2.32

Structural relationships between key pattern and other Insular patterns (© Author)

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Fig. 2.33

Cramp's 'meander' (c.f. RCAHMS' term: 'T-fret') (detail, Cramp 1984b, p. xlv, fig. 27)

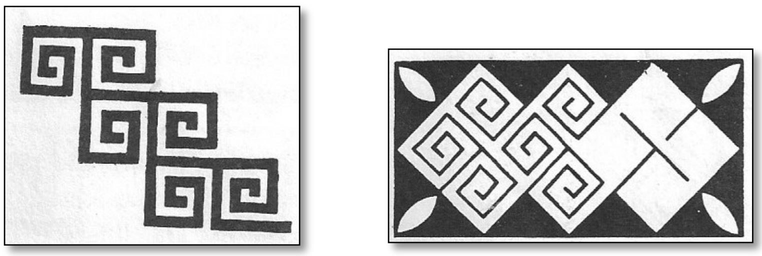

Fig. 2.34

A type of key pattern that Allen labeled 'step pattern' because of its stair-like quality (details, Allen and Anderson 1903, vol. 1, part 2, pp. 321, 350, no. 837a, 966)

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Fig. 2.35

A fret pattern (Lewis and Darley 1986, 137)

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Fig. 2.36

Trellis as fret (Lewis and Darley 1986, 11)

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Fig. 2.37

(a) Running spirals or wave scroll (curvilinear). (b) Meander (rectilinear) (details, E. Wilson 1994, p. 30, fig. 1:6, 1:9)

Fig. 2.38

Allen's line-drawing of an Insular piral pattern with trumpet and vesica shapes (highlighted in red). From the St Gall Gospels (based on Allen and Anderson 1903, vol. 1, part 2, p. 381, no. 1033)

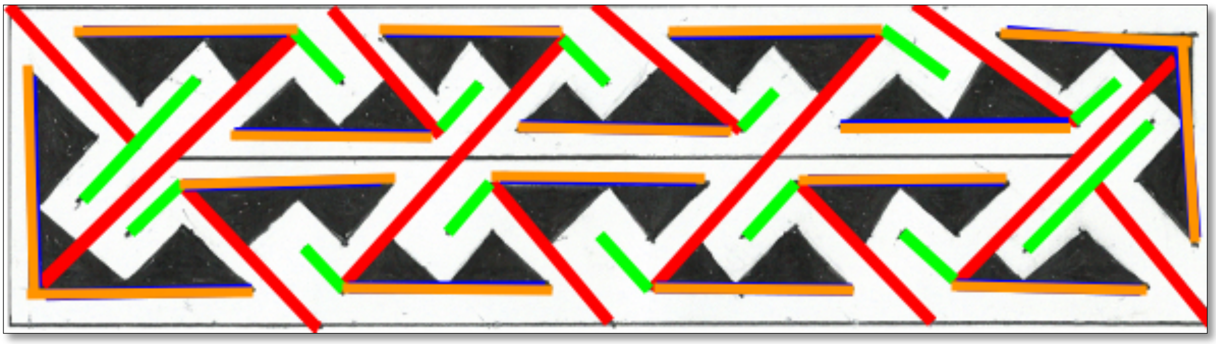

Fig. 2.39

Different sets or types of negative line segments in key pattern (orange, green, red respectively) (© Author)

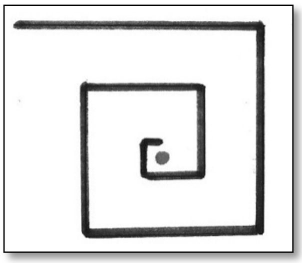

Fig. 2.40

A single-stranded spiral. The path (white) is discontinuous at the centre (indicated by dot) (© Author)

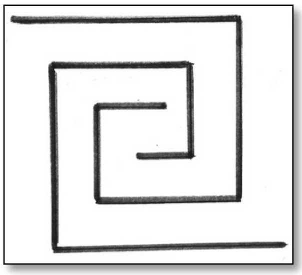

Fig. 2.41

A multiple-stranded spiral (double-stranded). The path (white) is continuous through the spiral (© Author)

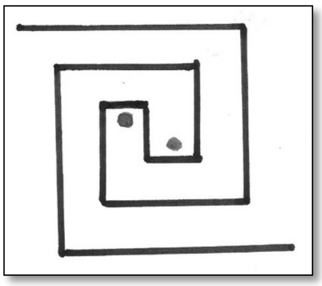

Fig. 2.42

A closed spiral. The path (white) is discontinuous at the centre of the spiral (indicated by dots) (© Author)

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Fig. 2.43

The orientation of figures. Triangle 1 has clockwise orientation (read A-B-C). Triangle 2 has counter-clockwise orientation (read A-B-C) (Based on Bronshtein et al. 2015, p. 133, fig. 3.12)

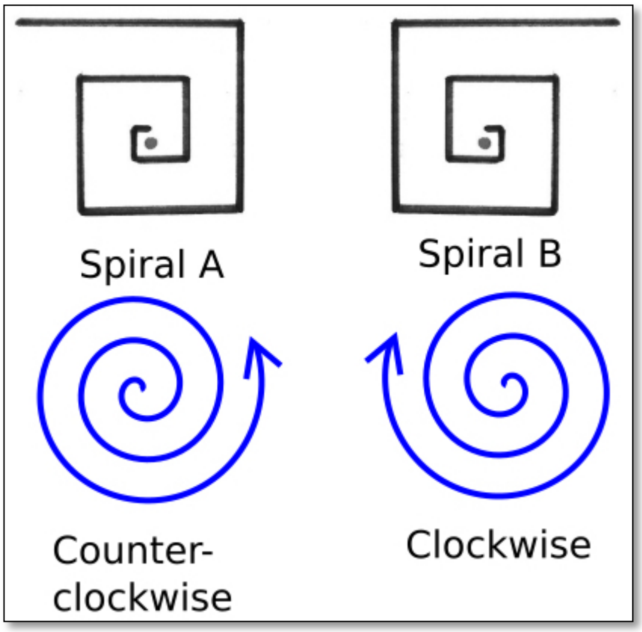
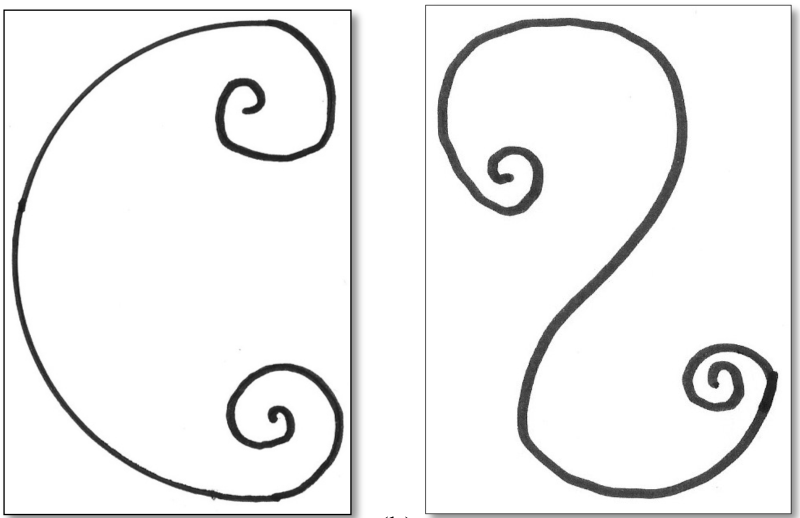


Fig. 2.44

Spiral spin direction (starting from centre point of spiral). Spiral A spins counter-clockwise and Spiral B spins clockwise (© Author)



(a) (b)

Fig. 2.45

(a) C-spiral (© Author)

(b) S-spiral (© Author)

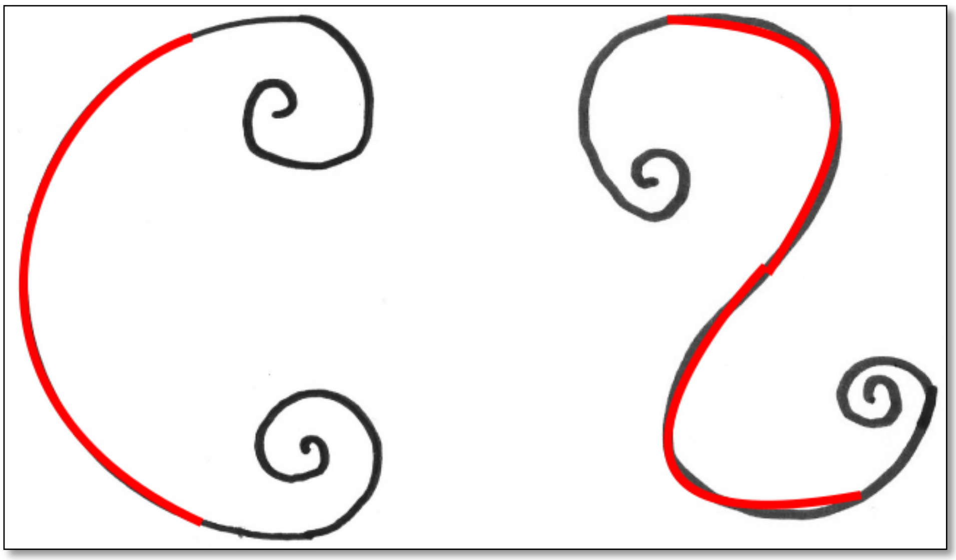
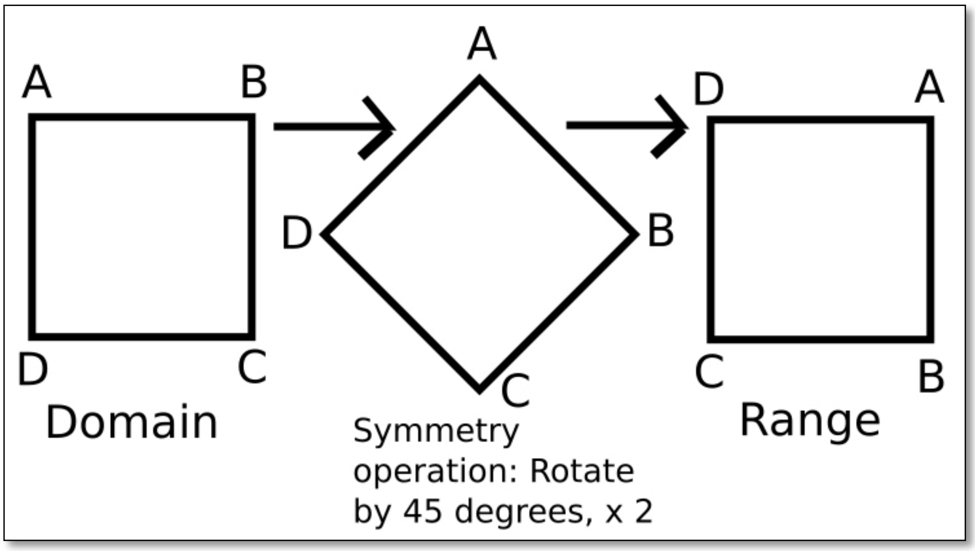
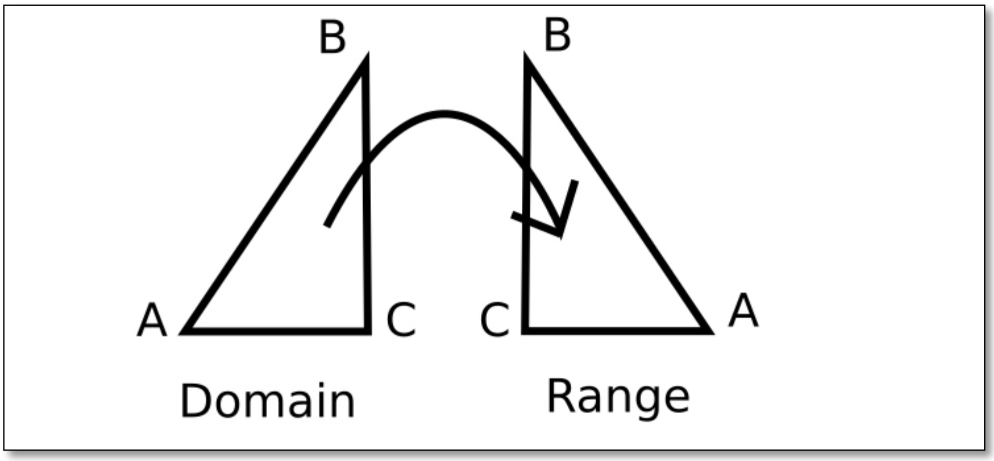


Fig. 2.46

C- and S-spiral ligatures (highlighted in red) (© Author)



(a)



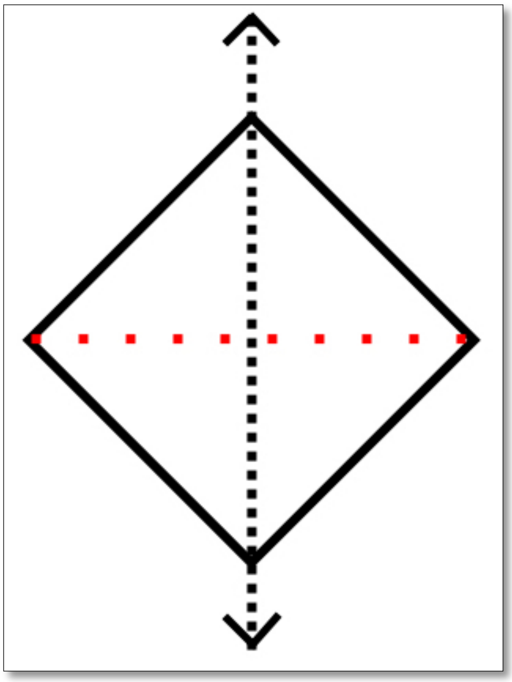
(b)

Fig. 2.47

(a) Square (A-B-C-D) is symmetrical to itself when rotated twice at 45 degrees. The location of angles A-B-C-D do change, but the range (right) otherwise is identical to the domain or original (left) (© Author)

(b) Two objects (A-B-C and C-B-A) are in a symmetrical relationship with each other. If the domain (left) now undergoes the same symmetry operation as the one that created the range (right), it will cover the range perfectly, and vice versa. Readers can imagine flipping or turning one of the objects so that it covers the other (© Author)

(a)



(b)

Fig. 2.48

(a) Two objects reflected or mirror symmetric to each other across an axis (black dotted line) (based on Abdul-Aziz 2018)

(b) The two halves of this object are mirror symmetric to each other across an axis (black dotted line) (© Author)

Image has been removed due to copyright restrictions

(a)

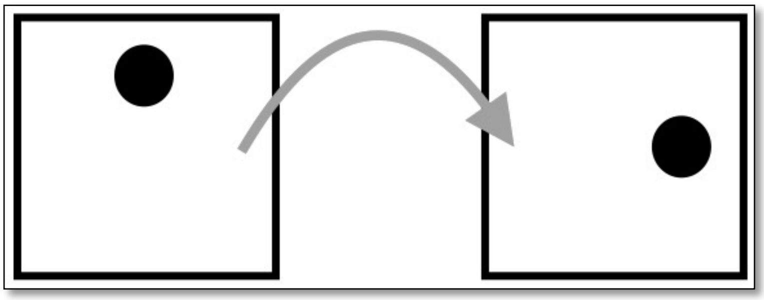
Image has been removed due to copyright restrictions

(b)

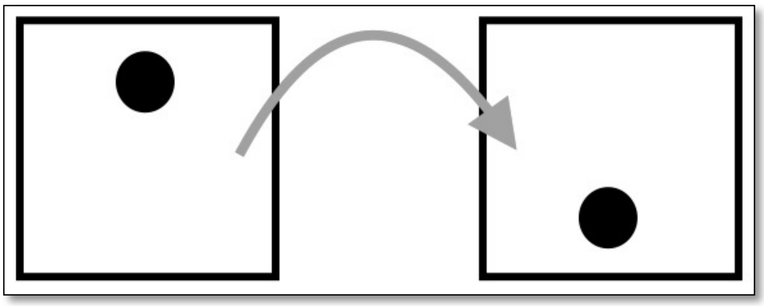
Fig. 2.49

(a) Horizontal reflection (along the horizontal axis and across the vertical axis) (based on Abdul-Aziz 2018)

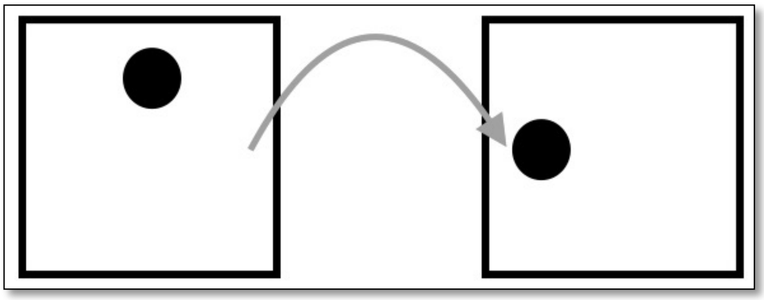
(b) Vertical reflection (along the vertical axis and across the horizontal axis) (based on Abdul-Aziz 2018)



(a)



(b)



(c)

Fig. 2.50

(a) 90° rotation or 1-fold rotational symmetry. The original and multiple have a 1-fold rotationally symmetric relationship (based on Brennan 2011, vol. 2, p. 45, fig. 3.21c)

(b) 180° rotation or 2-fold rotational symmetry: The original and multiple have a 2-fold rotationally symmetric relationship (rotated twice 90°) (based on Brennan 2011, vol. 2, p. 45, fig. 3.21c)

(c) 270° rotation or 3-fold rotational symmetry: The original and multiple have a 3-fold rotationally symmetric relationship (rotated thrice 90°) (based on Brennan 2011, vol. 2, p. 45, fig. 3.21c)

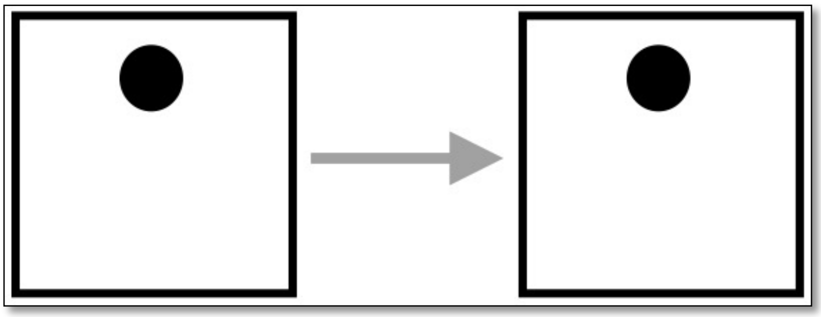


Fig. 2.51

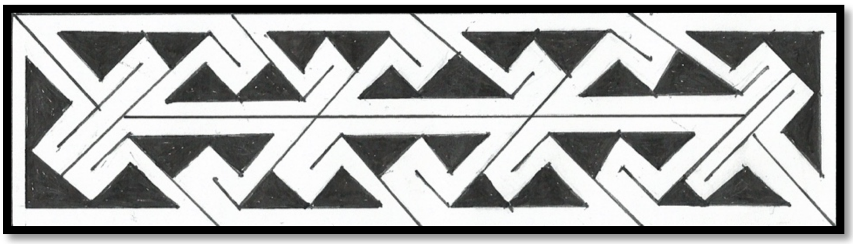
Translational symmetry (based on Brennan 2011, vol. 2, p. 45, fig. 3.21c)

Fig. 2.52

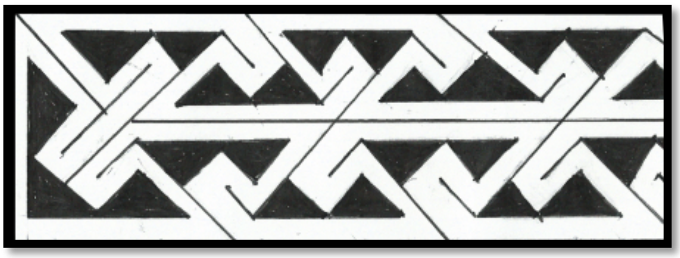
Three different sets of negative lines in a key pattern (orange, blue, green). The orange lines are arranged at oblique angles in relationship to the lines in other sets (© Author)

Fig. 2.53

Floating negative lines (red) that do not intersect other negative lines and/or the border. Insular artists never allowed this to occur in key pattern (© Author)



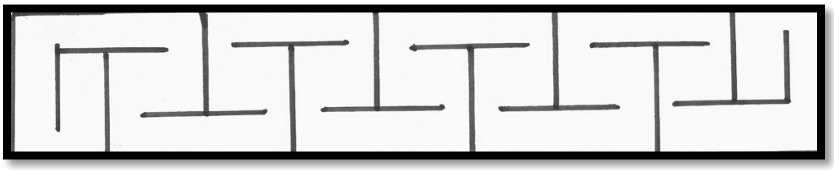
(a)



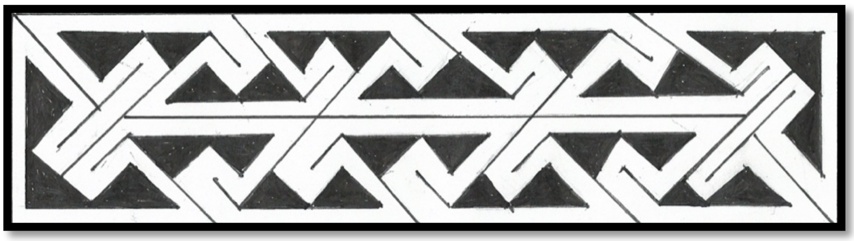
(b)

Fig. 2.54

Insular artists fit whole key pattern compositions within a bordered field (a), and never bisected a key pattern with the border (b, see right side of pattern) (© Author)



(a)



(b)

Fig. 2.55

(a) Orthogonal key pattern. (b) Diagonal key pattern (© Author)

3. Chapter 3: Key Pattern in Insular Art: The Creative Approach

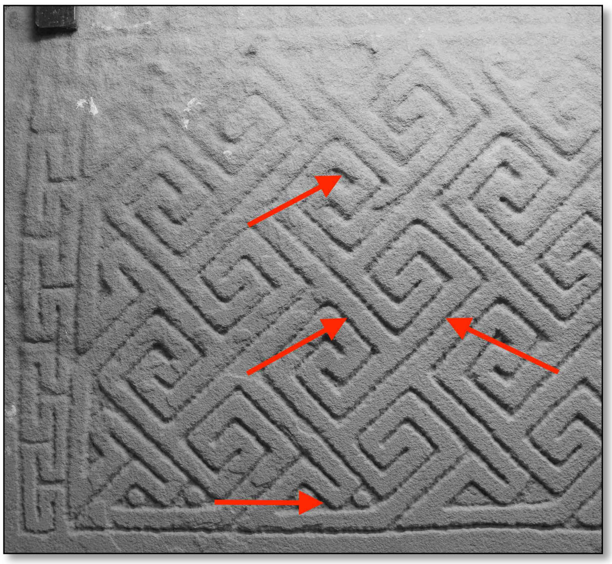
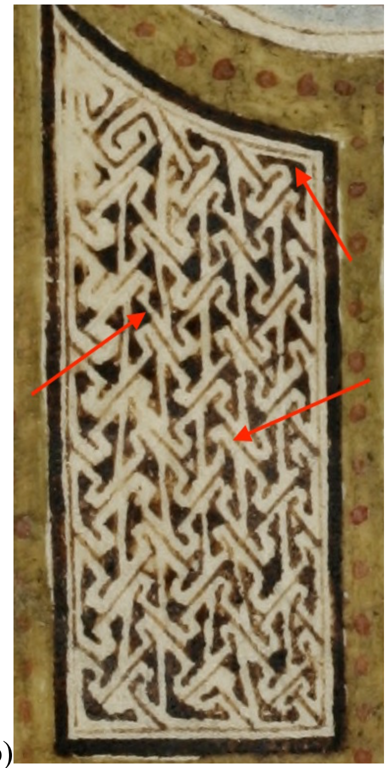
(a)  (b) 

Fig. 3.1

Red arrows indicate a selection of negative lines and spaces in Insular key pattern, carved away from a stone panel (a) and drawn in black ink on a manuscript page (b)

(a) Sandstone panel, Rosemarkie 3.1, Groam House Museum collection, Ross & Cromarty, Scotland (© Author)

(b) Detail from the St Gall Gospels, p. 208, with annotation. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 208 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

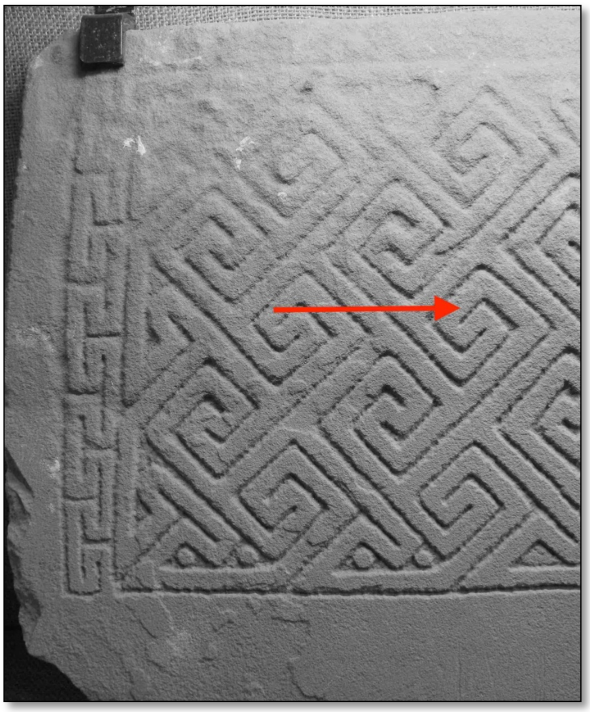
(a) 
(b) 

Fig. 3.2

(a) Red arrow indicates the path in key pattern in sculpture, or the area left raised in relief after the negative lines were carved away (© Author)

(b) Red arrow indicates the path in key pattern in manuscript illumination, or the untouched area that remained after the artist illuminated the negative lines in black or dark ink. Detail from the St Gall Gospels, p. 208, with annotation. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 208 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

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Fig. 3.3

Key pattern stippled near the bottom of an 8^{th}-century silver bowl (no. 2) from the St Ninian's Isle hoard (Youngs, ed. 1989, p. 109, no. 98)

Image has been removed due to copyright restrictions

Fig. 3.4

Key pattern in openwork on the upper foot-girdle of the Ardagh Chalice (by permission of the National Museum of Ireland)

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(a)

Image has been removed due to copyright restrictions

(b)

Fig. 3.5

(A) Clay brooch mould, Dunadd, Argyll, Scotland, 7th century AD. (B) Lead brooch model, Dooey, County Donegal, Ireland, 8th-9th century AD (Youngs, ed. 1989, pp. 191, 193, no. 181, 185)

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Fig. 3.6

Carving the positive space of an interlace pattern directly into a plaster mould (Walker 2013, p. 28, fig. 3.3)

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Fig. 3.7

The Emly Shrine, County Limerick, Ireland, 7th-8th century AD, with detail (Cone, ed. 1977, plate 31)

Image has been removed due to copyright restrictions

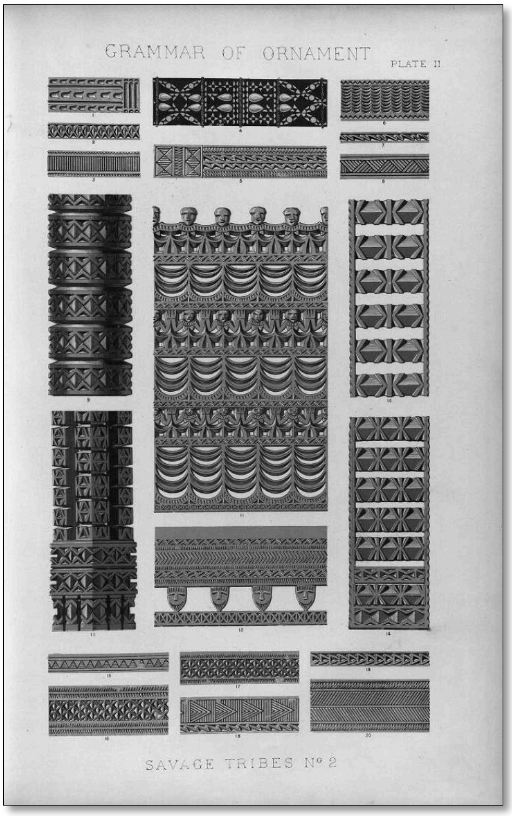
Fig. 3.8

Copenhagen shrine, copper alloy plates with step pattern over wood, 8th century, unknown origin (Youngs ed. 1989, p. 138, no. 131)

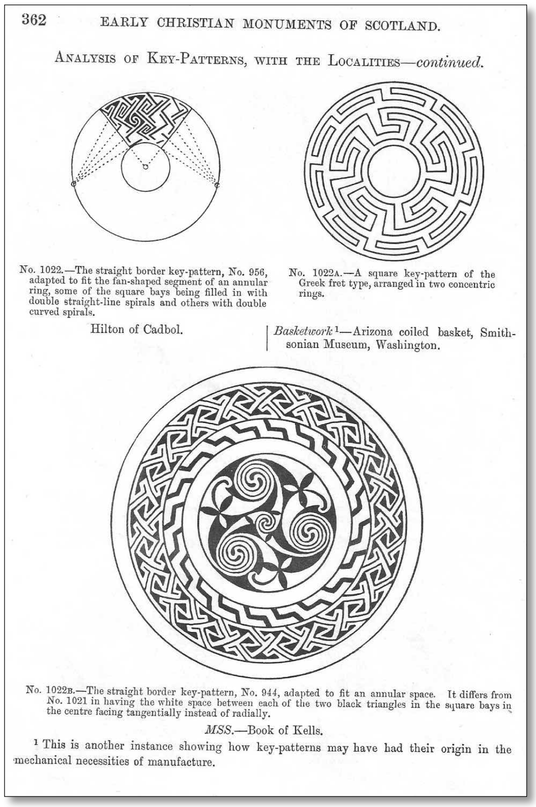
Fig. 3.9

Key pattern carved on a boss (left) on the Nigg cross slab. Nigg Old Church, Ross and Cromarty, Scotland (© Author)

4. Chapter 4: The History of Studies of Insular Key Pattern, Part I



(a)



362 EARLY CHRISTIAN MONUMENTS OF SCOTLAND.

ANALYSIS OF KEY-PATTERNS, WITH THE LOCALITIES—*continued.*

No. 1022.—The straight border key-pattern, No. 956, adapted to fit the fan-shaped segment of an annular ring, some of the square bays being filled in with double straight-line spirals and others with double curved spirals.

Hilton of Cadbol.

No. 1022A.—A square key-pattern of the Greek fret type, arranged in two concentric rings.

Basketwork [1]—Arizona coiled basket, Smithsonian Museum, Washington.

No. 1022B.—The straight border key-pattern, No. 944, adapted to fit an annular space. It differs from No. 1021 in having the white space between each of the two black triangles in the square bays in the centre facing tangentially instead of radially.

MSS.—Book of Kells.

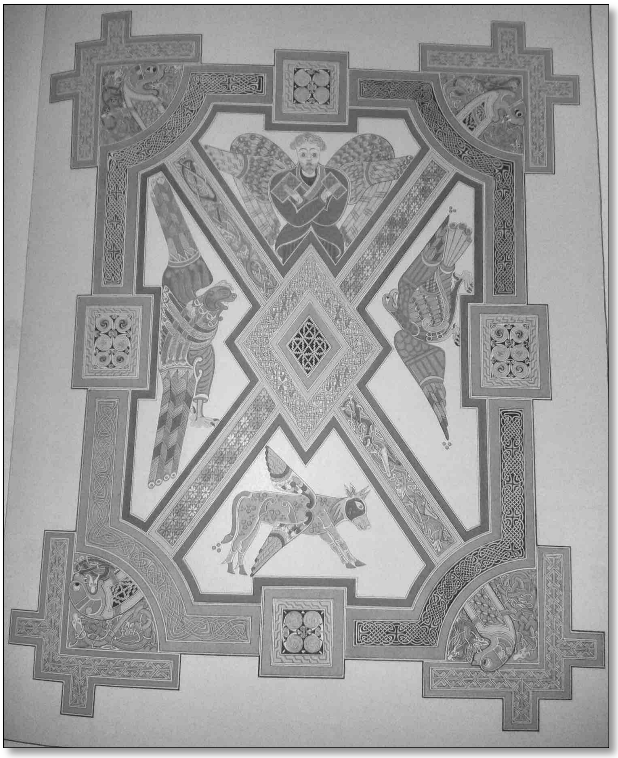
[1] This is another instance showing how key-patterns may have had their origin in the mechanical necessities of manufacture.

(b)

Fig. 4.1

(a) Plate from Jones' pattern book (Jones 1856b, plate 2)

(b) Allen's classification in the *ECMS* (Allen and Anderson 1903, vol. 1, part 2, p. 362)



(a)

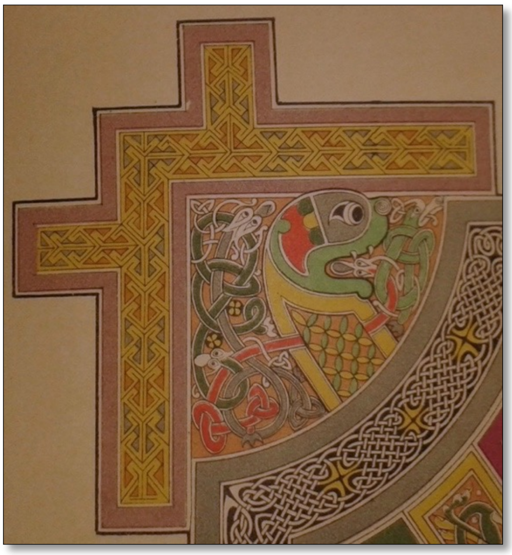
Image has been removed due to copyright restrictions

(b)

Fig. 4.2

(a) Westwood’s facsimile of the Book of Kells, folio 290v (Westwood 1868, plate 9)

(b) The original manuscript page (B. Meehan 1994, 38)


(a)

(b)

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(c)

(d)

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Fig. 4.3

(a) Westwood: detail of top left finial, compared to original (b). Facsimile and original are identical

(c) Westwood bottom left finial (identical to Westwood's top left finial (a), mirrored over horizontal access), compared to original manuscript (d). Facsimile and original are not identical.

(a and c: details, Westwood 1868, plate 9; b and d: details, B. Meehan 1994, 38)

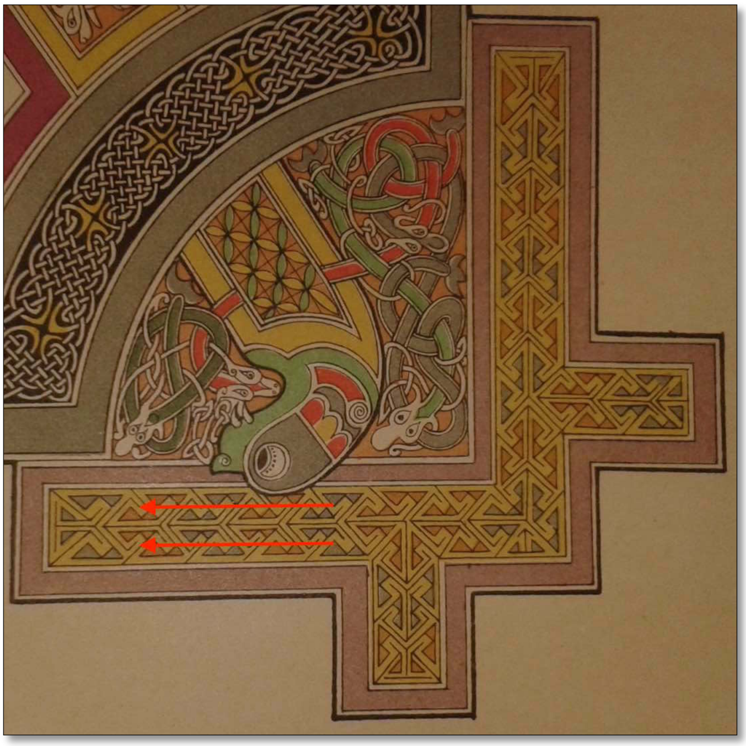
(e) 

(f) **Image has been removed due to copyright restrictions**

Fig. 4.3

(e) Westwood’s bottom right finial (identical to Westwood’s bottom left finial (c), mirrored across vertical axis), compared to original (f). Facsimile and original are not identical

(e: details, Westwood 1868, plate 9; f: detail, B. Meehan 1994, 38)



(g)

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(h)

Fig. 4.3

(g) Westwood’s bottom right finial, compared to original (h). Red arrows indicate areas of key pattern in the facsimile versus the original that are facing in opposite directions.

(g: details, Westwood 1868, plate 9; h: details, based on B. Meehan 1994, 38)

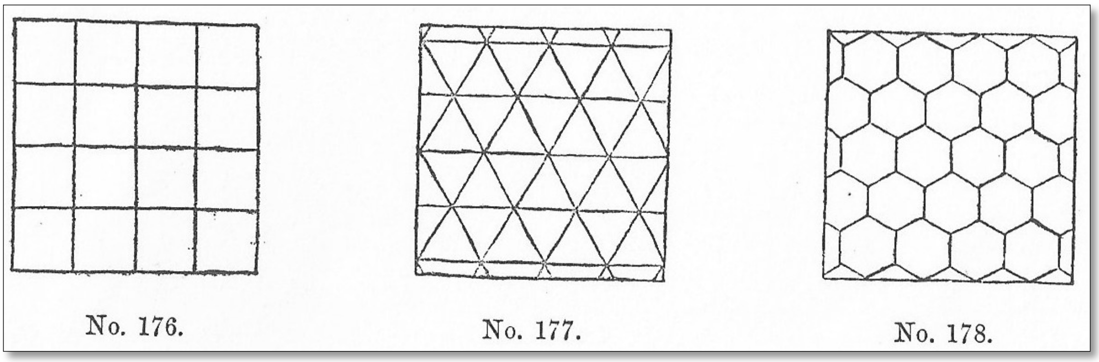

Fig. 4.4

Allen's square, triangular, and hexagonal grids (Allen and Anderson 1903, vol. 1, part 2, p. 131, no. 176-78)

Fig. 4.5

Allen's key pattern grids developed from the square grid (square, diagonal, and diagonal with additional lines added) (Allen 1885, p. 265, plate 1)

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Fig. 4.6

Allen’s classification of key pattern spiral structures (Allen 1885, pp. 265-69, plates 2-3)

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Fig. 4.7

Allen's classification of 'connecting lines' (Allen 1885, pp. 270, 272, plates 4-5)

(a) 

(b) 

Fig. 4.8

(a) Black-and-white detail of key pattern in the St Gall Gospel Book, p. 266. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

(b) If the pattern-maker were to have created the spirals first as Allen suggested, without 'connecting lines' they would have had to create something similar to the composition illustrated here (© Author)

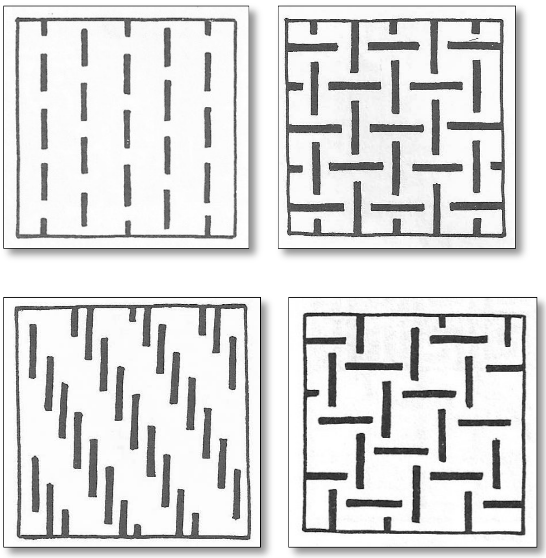


Fig. 4.9

Allen's 'isolated straight lines' set out in parallel or parallel/perpendicular formation (top), then further offset from each other (bottom) (Allen and Anderson 1903, vol. 1, part 2, pp. 314-16, nos. 827, 828, 829, 830)

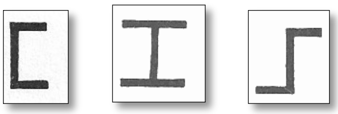
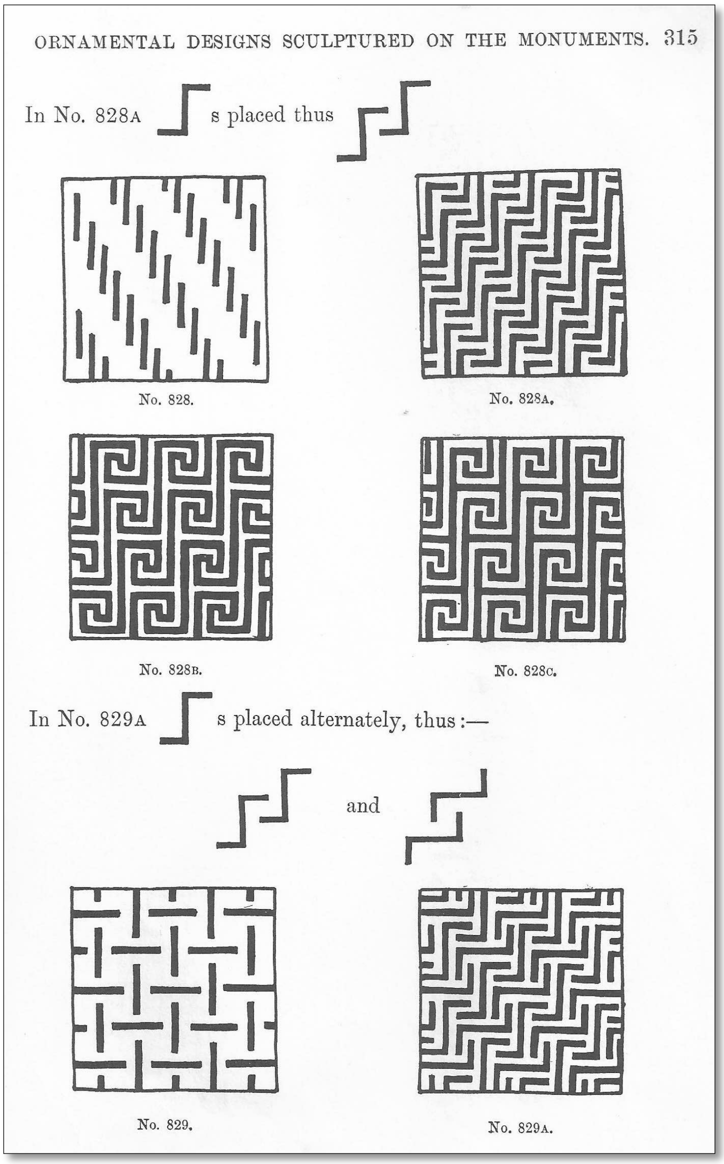


Fig. 4.10

Allen: ‘isolated lines’ (trunks) with added lines (branches) placed to either end (of the trunk) (details, Allen and Anderson 1903, vol. 1, part 2, p. 314)



ORNAMENTAL DESIGNS SCULPTURED ON THE MONUMENTS. 315

In No. 828A s placed thus

No. 828.

No. 828A.

No. 828B.

No. 828C.

In No. 829A s placed alternately, thus:—

and

No. 829.

No. 829A.

Fig. 4.11

Allen’s all-over arrangements of isolated lines (trunks) with their added angled lines (branches) (Allen and Anderson 1903, vol. 1, part 2, p. 315).

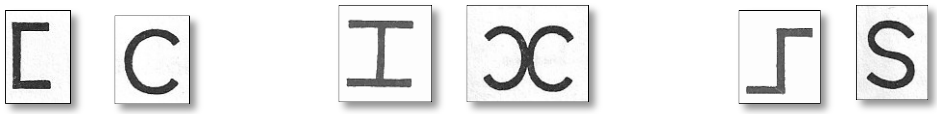


Fig. 4.12

Allen’s isolated straight lines with added angled lines (i.e. trunks and branches), and corresponding curvilinear spiral forms (C-spiral far left, S-spiral far right) (details, Allen and Anderson 1903, vol. 1, part 2, p. 313)

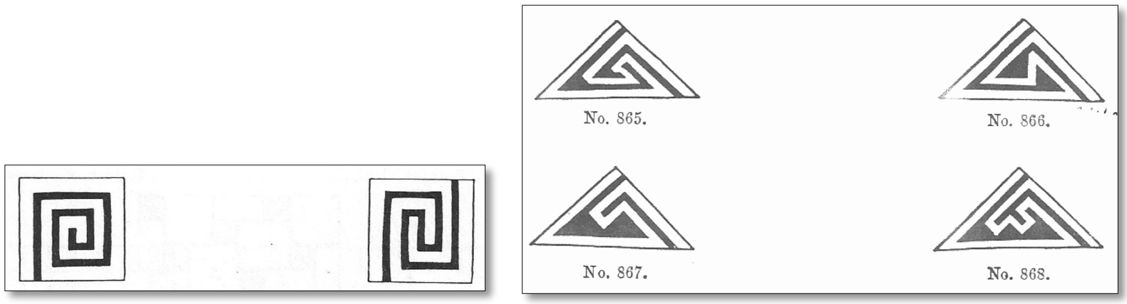


Fig. 4.13

Extensions that elaborate the spiral shapes in key pattern (i.e. embellishments, added to branches) (details, Allen and Anderson 1903, vol. 1, part 2, pp. 312, 327, no. 823-24, 865-68)

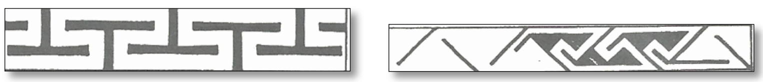


Fig. 4.14

Key patterns in ‘square’ and diagonal orientation (Allen and Anderson 1903, vol. 1, part 2, pp. 334, 341, no. 899, 928)

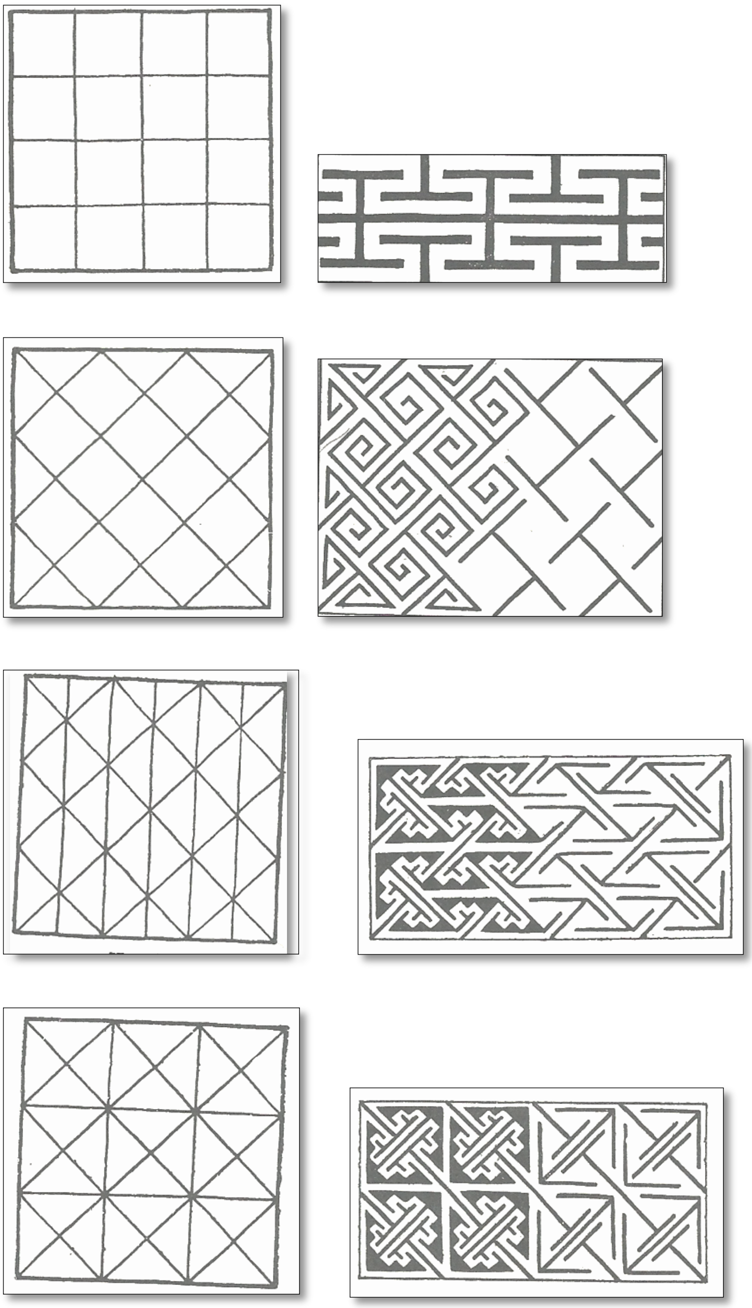
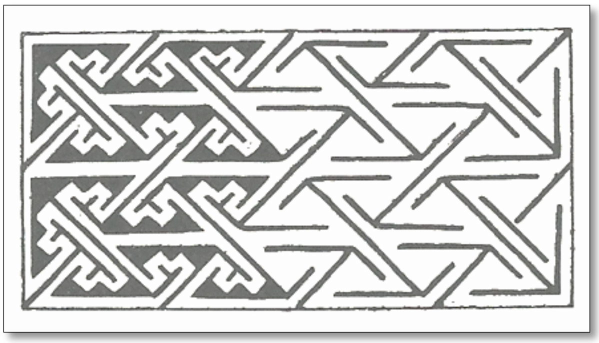


Fig. 4.15

Allen’s grids for ‘square’, diagonal, and ‘diaper’ patterns (Allen and Anderson 1903, vol. 1, part 2, pp. 325, 335, 328, 351, 353, 357, no. 859, 860, 872-73, 906, 949 975, 994)

(a)



(b)

Fig. 4.16

Allen's illustration of key pattern in a single row (a) versus in a larger field (with four stacked rows) (b) (Allen and Anderson 1903, vol. 1, part 2, pp. 341, 353, no. 929, 975)

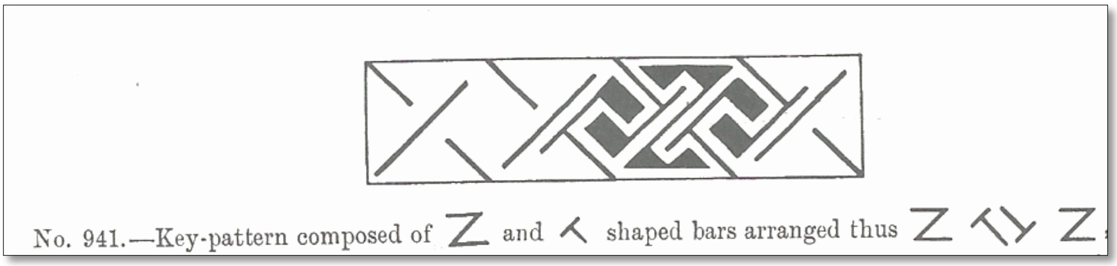
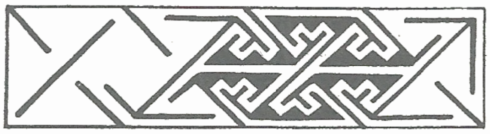


Fig 4.17

Allen: two patterns with different 'bars' (trunks and branches) (details, Allen and Anderson 1903, vol. 1, part 2, pp. 341, no. 941, 944)

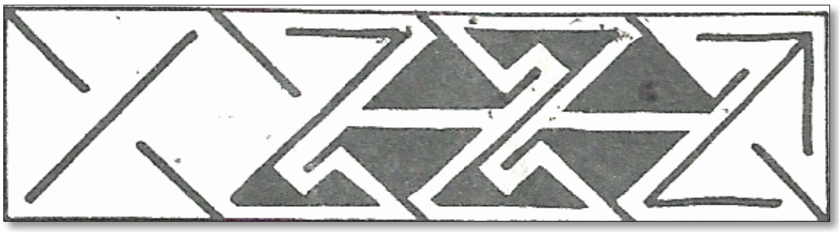


No. 933.—The same as No. 932, but finished off with three small black triangles to each bay (No. 869).

Fig. 4.18

Allen cross-references a similar pattern with different decoration (Allen and Anderson 1903, vol. 1, part 2, pp. 342, no. 933)

(a)

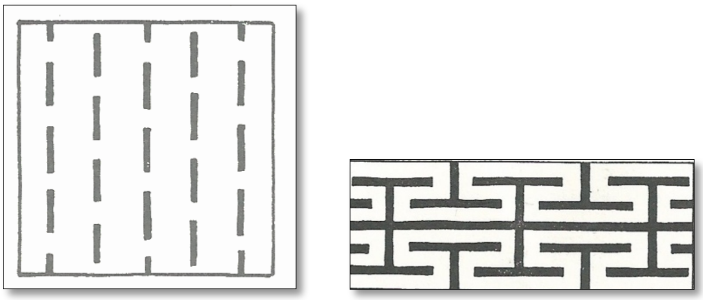


(b)

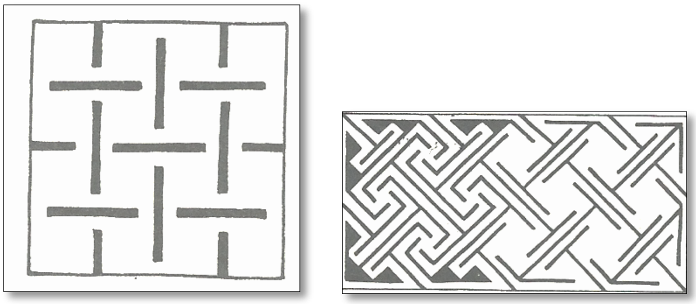
Fig. 4.19

(a) Black-and-white detail of key pattern drawn in black and coloured ink in the St Gall Gospels, p. 266. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

(b) Allen's regularised reproduction of this key pattern (Allen and Anderson 1903, vol. 1, part 2, p. 342, no. 934)



(a)



(b)

Fig. 4.20

Allen’s different all-over arrangements of isolated lines for two key patterns that actually have a deep structural relationship (Allen and Anderson 1903, vol. 1, part 2, pp. 317, 335, 349, no. 831, 832, 906, 963)

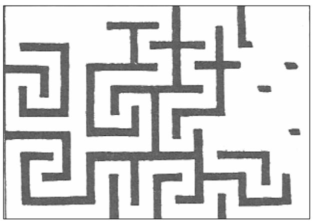


Fig. 4.21

Allen: an ‘irregular pattern’ (Allen and Anderson 1903, vol. 1, part 2, p. 340, no. 923)

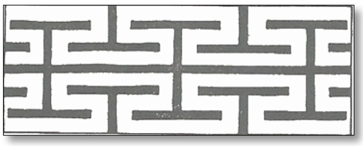
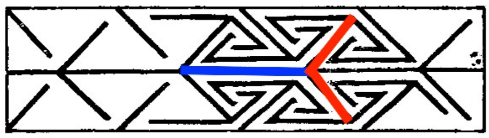


Fig. 4.22

Allen: a ‘square’ pattern in two rows that are ‘symmetrical opposite[s]’ (Allen and Anderson 1903, vol. 1, part 2, p. 335, no. 906)



No. 935.—Key-pattern composed of and shaped bars arranged thus and the triangles filled in with double straight-line spirals (No. 862A).

Fig. 4.23

Allen mistook the adjacent border between two mirror reflected rows of diagonal key pattern (partially highlighted in blue) as part of its ‘bar’ or trunk-with-branches. In truth, the two red lines are two separate trunks emanating from this internal border (based on Allen and Anderson 1903, vol. 1, part 2, p. 342, no. 935).

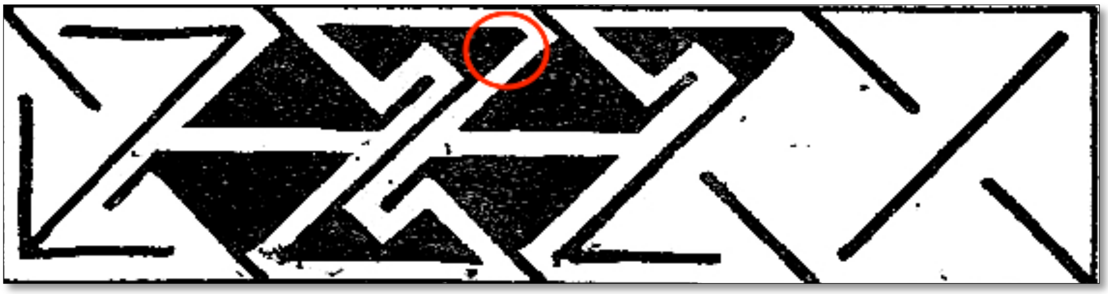
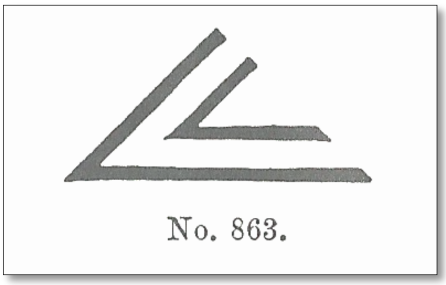
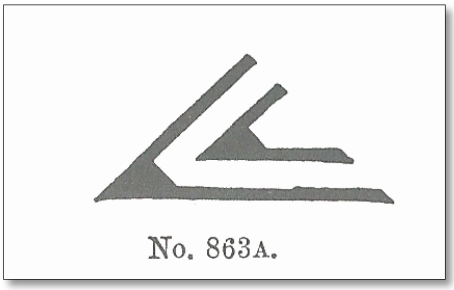

(a)

(b)

Fig. 4.24

The removal of a negative line element (a branch) permitted the St Gall Gospel book illuminator to create unusually large triangle-shaped embellishments. The branch in question is indicated by circles (present in the pattern illustrated in (a), removed in St Gall Gospels pattern, as illustrated in (b) (based on Allen and Anderson 1903, vol. 1, part 2, pp. 341-42, no. 928, 934)



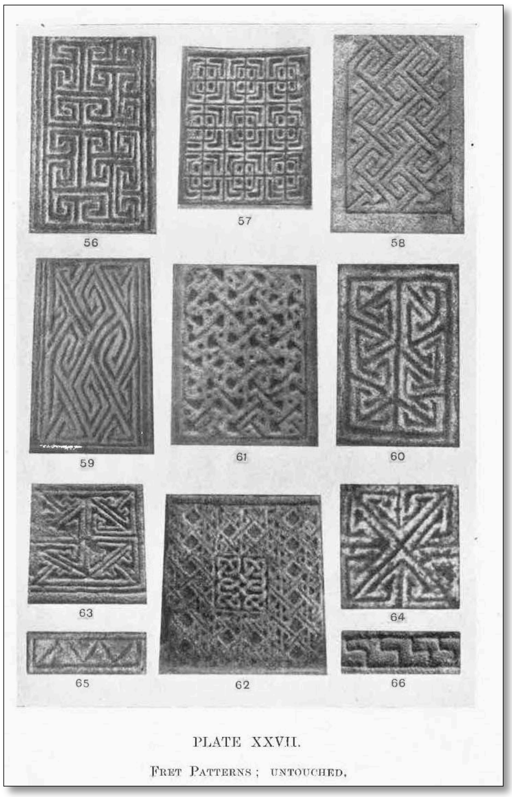
(a)


(b)

Fig. 4.25

Allen illustrates the widening of intersections of (negative) lines. The widened negative lines occur in (b) (Allen and Anderson 1903, vol. 1, part 2, pp. 326-27, no. 863, 863a)

5. Chapter 5: The History of Studies of Key Pattern, Part II

(a) 

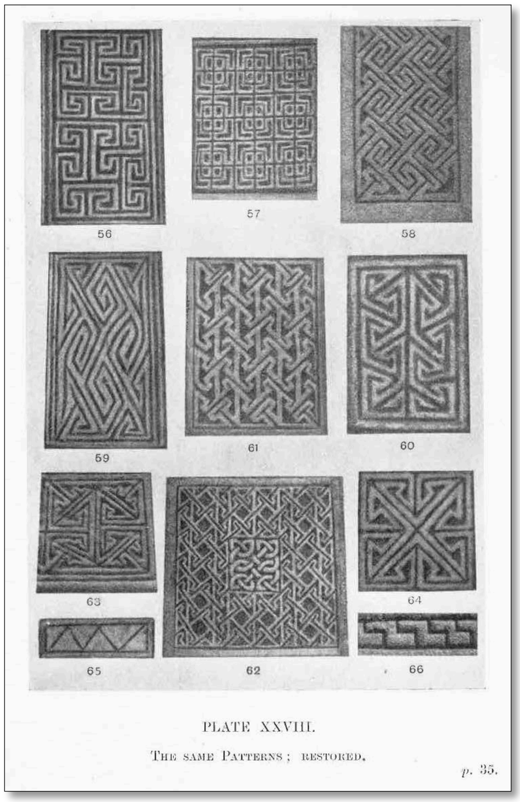
(b) 

Fig. 5.1

Crawford’s photographs (a) and ‘restored’ versions (b) (Crawford 1926, p. 35, plates xxvii-xxviii)

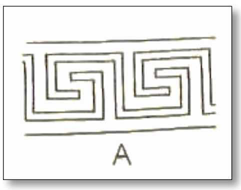


Fig. 5.2

Crawford’s line drawing of key pattern from Clonmacnoise. The outlined, discontinuous shapes are meant to represent the path. The negative line elements are joined together so that they are continuous, which on rare occasions, Insular artists chose to do (detail, Crawford 1926, p. 38 no. A, p. 39 fig. 7a)

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Fig. 5.3

Rosemary Cramp's pattern templates (detail, Cramp 1984b, p. xlvi, fig. 27)

(a) **Image has been removed due to copyright restrictions**

(b) **Image has been removed due to copyright restrictions**

Fig. 5.4

Edwards' charts of 'fret elements' (a) and 'terminals' (b) (details, Edwards 1987, pp. 114-15, fig. 3, 4h)

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Fig. 5.5

Wales corpus, classification charts (Edwards 2007, vol. 2, p. 78, fig. 7.14)

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Fig. 5.6

Merne's basic symbols (Merne 1931, p. 11, plate 1)

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Fig. 5.7

Merne's theory for the development of interlace from spirals (detail, Merne 1931, p. 21, plate 6)

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(a)

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(b)

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(c)

Fig. 5.8

(a) Merne's drawings of prehistoric patterns he believed were ancestral to key pattern (detail, Merne 1931, p. 69, Plate 30)

(b) Merne's correct visual identification of individual spiral units in key pattern (not described as such, however, in his text) (detail, Merne 1931, p. 70-71, plate 31)

(c) Merne's structurally incorrect attempt at Insular key pattern (detail, Merne 1931, p. 73, plates 32)

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Fig. 5.9

George Bain's 'stages' for drawing key pattern, instructions for grid measurements, and discussion and measurements of units (detail, G. Bain 1951, p. 75, plate 1)

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restrictions

Fig. 5.10

G. Bain bolds structures in dark ink that are similar to Allen's 'bars' and gives method for counting their length by grid squares ('Order 1.8.1') (detail, G. Bain 1951, p. 75, plate 1)

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Fig. 5.11

G. Bain’s experimental pattern (detail, G. Bain 1951, p. 81, plate 13)

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Fig. 5.12

G. Bain: A drawing displaying the same key pattern, with two different types of symmetry: on the right, two rows in mirror reflection, while on the left, the same two rows but with 2-fold rotation (detail, G. Bain 1951, p. 80, plate 12).

(a) Image has been removed due to copyright restrictions

(b) Image has been removed due to copyright restrictions

Fig. 5.13

Meehan highlights similar structures as Allen's 'bars' (trunks and branches) and draws separate diagrams of single rows (a) and of spiral units (b) (A. Meehan 1993b, p. 110-11, fig. 60-61)

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Fig. 5.14

The ‘path’ in a prehistoric maze pattern (A. Meehan 1993b, p. 78, fig. 38)

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Fig. 5.15

Meehan: A pattern diagram with a grid (A. Meehan 1993b, p. 140, fig. 88)

(a)

(b)

Fig. 5.16

The St Gall Gospel book key pattern: Meehan's regularized version (b) versus original, from p. 266 of the manuscript (black-and-white reproduction) (a). By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (a: St. Gallen [accessed 3 November 2017]; b: detail, A. Meehan 1993b, p. 124, fig. 72)

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Fig. 5.17

I. Bain demonstrates implicitly in a diagram: when one negative line segment is altered (here a branch is made shorter, circled in the far right pattern), an adjacent negative line segment or space must be altered by enlarging or lengthening it to keep the path even (triangular shaped embellishment, far right pattern). If the same branch is longer (circled in the far left pattern), expansion of neighboring negative line elements (embellishments) into triangular shapes is not an option, because the path would become discontinuous (annotated, detail, I. Bain 1994, p. 2)

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Fig. 5.18

Detail from I. Bain's reproduction of key pattern from Lindisfarne Gospels, indicating area of artist's alteration of a C-spiral to an S-spiral (detail, I. Bain 1994, 38).

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Fig. 5.19

Iain Bain: a 'widened' key pattern (detail, I. Bain 1994, p. 3)

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Fig. 5.20

Sturrock's instructional diagram for a key pattern that does not exist in the Insular corpus. The units do not interlock to form a continuous series of spiral units, and they process along each row in a two-fold symmetrical relationship to each other. This symmetrical relationship between units was never used within individual rows of Insular diagonal key pattern (Sturrock 203, 112).

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Fig. 5.21

Tetlow's illustration of the symmetry of spiral units in a single row of key pattern (vertical reflection, units highlighted in grey), and illustrations of other arrangements of the same spiral units (in square compositions, on the right) (Tetlow 2013, 27, fig. a-b)

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Fig. 5.22

Tetlow demonstrates his theory that when individual base units are enlarged (highlighted in grey), artists had to create more complex ‘foot’ shapes (embellishments) (Tetlow 2013, 27 fig. a-d).

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Fig. 5.23

Lynch’s ‘step’ patterns in small, square fields (A, C, D, and E are key pattern) (Lynch 2000, p. 13, fig. 1)

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Fig. 5.24

Lynch’s generating units (Lynch 2000, p. 14, fig. 3)

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Fig. 5.25

Lynch’s demonstration of two out of the three generating procedures (Lynch 2000, p. 14, fig. 2)

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Fig. 5.26

Lynch mistook a full key pattern containing four spiral units as a basic, generating unit ((a) above), and bisected two of the spiral units in another key pattern ((e) above) (Lynch 2000, p. 14, fig. 3)

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Fig. 5.27

Hull's reconstruction of a detail from Book of Durrow folio 1v (left) compared the original (right). Rotational symmetry occurs throughout individual patterns and the entire composition (Hull 2003, p. 196, 199, fig. 6.21, 6.25)

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Fig. 5.28

Hull used lattice theory to identify two possible unit cells (left) for an interlace pattern (right) (detail, Hull 2003, p. 96, fig. 4.3)

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Fig. 5.29

Hull’s ‘unit’ for a key pattern (outlined in red) and demonstration of its translation over a larger field. The red lines outlining his ‘unit’ (original to Hull) bisect the pattern’s branches (Hull 2003, p. 74, fig. 3.8).

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Fig. 5.30

Hull's diagram for creation of the path (in light grey) in key pattern (Hull 2003, p. 79, fig. 3.14)

Comparison of Scholarly Terminology for Select Key Pattern Structures

	Standard term for key pattern structure as advocated here:	**Trunk (negative line element)**	**Branch (negative line element)**	**Embellishment (negative line element)**	**Path (positive space)**
Author/ Publication					
Allen		Isolated straight line Bar (with branches attached)	Additional line Bar (with trunk attached)	Straight-line spirals, etc. (no fixed term)	White line
Edwards (1987)		Fret element (with branches attached)	Fret element (with trunk attached)	Terminals	None
Wales Corpus		Straight line elements (with branches attached)	Straight line elements (with trunks attached)	Elaborations (treated as an integral part of the 'straight line elements')	None
Meehan		Diagonals	Arrow heads	Branches/arms of the spiral/locks	Path
Iain Bain		Diagonals	None	None	Path

Fig. 5.31

A table outlining terms for key pattern structures, comparing those used in this thesis to those previous key pattern studies (© Author)

6. Chapter 6: The Origin of Key Pattern: Prehistoric Basketry and Textile Weaving

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Fig. 6.1

Ivory armband, Mezin, Ukraine, c. 22,000-20,000 B.C (key pattern in centre and at outer edges). This drawing artificially flattens the armband, which survives in its original rounded shape (detail, E. Wilson 1994, p. 28, fig. 1:1)

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Fig. 6.2

Peleus and Thetis with key pattern-shaped grip. Greek red figure cup by Peithinos (Boardman 1975, repr. 1997, p. 141, fig. 214.1)

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Fig. 6.3

Libation table, Egypt, AD 100-400 (E. Wilson 1994, p. 44, fig. 1:41)

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Fig. 6.4

Theseus and the Minotaur, Attic red figure cup by the Codrus painter, from Vulci, 5th century BC. The maze is indicated by vertical row of swastika-shaped key pattern (Boardman 2006, p. 206-207, fig. 222)

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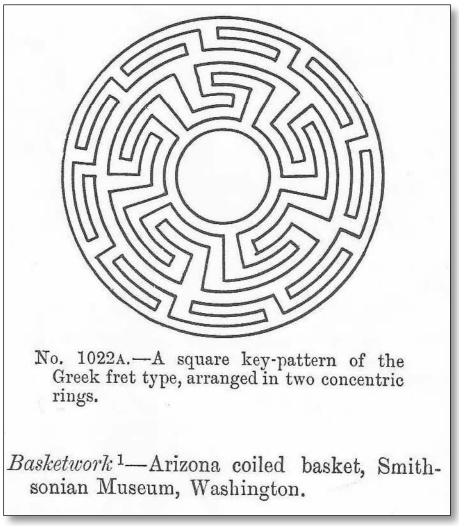
(a)



(b)

Fig. 6.5

(a) Attic dish, Geometric period, from grave 66 in the Kerameikos, Athens, late 8th century BC. Possible imitation of woven basket (Boardman 2006, pp. 17, 255, fig. 281.2)

(b) Line drawing of Native American basket with key pattern, Arizona, USA, undated (Allen and Anderson 1903, vol. 1, part 2, p. 362, no. 1022a)

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(a)

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(b)

Fig. 6.6

(a) Drawing of a fragment of a plaster model house, impressed with key pattern, fourth millennium BC, Hungary (E. Wilson 1994, pp. 33-34, fig. 1:16)

(b) Eva Wilson’s general reproduction of key pattern on wall-paintings from Egyptian tombs, Middle Kingdom, ‘c. 1842-1797 B.C.’ (detail, E. Wilson 1994, pp. 39-40, fig. 1:33)

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Fig. 6.7

Orthogonal key pattern on clothing in a painting from Egypt, Middle Kingdom, early second millennium BC (detail, Schoeser 2003, p. 35, fig. 27)

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Fig. 6.8

Neolithic pot from Ludanice, Moravia, fifth or fourth millennium BC (detail, E. Wilson 1994, p. 34, fig. 1:17)

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Fig. 6.9

Trousers with key pattern at knees, western China, approximately 1000 BC (Bower 2014)

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Fig. 6.10

Hallstatt Textile 123A from Hallstatt, Austria (c. 800-400 BC). A single row of orthogonal key pattern with two-stranded spirals is located in the central portion of the band, rotated at 45 degrees from the horizontal (detail, Grömer 2016, p. 181, fig. 102. See also Grömer and Rösel-Mautendorfer 2013, 451-52)

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(a)

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(c)

Fig. 6.11

The mechanism of tablet weaving, here with a rectilinear pattern (not key pattern). In (a), the weaver indicates how the passing of the warp threads through the holes in the cards creates a gap, or shed. In (b), the weaver then passes the weft thread from the left side of the band, through the shed, to the right side of the band (this final moment is pictured here). In (c), the weaver turns the cards along the direction of the warp (different groups of cards may be selected and turned different numbers of times, forwards or backwards, during this step). The whole process is then repeated (Screenshots from Pasanen 2014)

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Fig. 6.12

Detail of woven key pattern with single-stranded spirals from a pair of trousers found in a grave in western China, approximately 1000 BC (detail, Bower 2014)

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(a)

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(b)

Fig. 6.13

(a) ‘Kivrim’ or ‘running dog’ tablet-woven pattern (key pattern with double-stranded spirals) (detail, Collingwood 1982, p. 150, fig. 97)

(b) ‘Ram’s horn’ tablet-woven pattern (two ‘running dog’ or key pattern compositions with double-stranded spirals, mirrored across the length of the band) (detail, Collingwood 1982, p. 149, plate 72)

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Fig. 6.14

‘Running dog’ patterns on Egyptian Middle Kingdom tomb painting reconstruction, mirror symmetric to each other. Added red vertical lines indicate axes of symmetry. Each branch has two embellishments intersecting it, instead of one as illustrated in Collingwood’s diagram in Fig. 6.13b (based on detail, E. Wilson 1994, pp. 39-40, fig. 1:33)

(a) 

(b) 

Fig. 6.15

(a) The structure of a ‘running dog’ or tablet-woven key pattern with double-stranded spirals: The trunk (red) intersects with the outer border on one end (blue dot) and its branch (green line) at its other end (purple dot) (based on detail, Collingwood 1982, p. 150, fig. 97)

(b) One trunk and its intersected branch (light blue) and embellishments (light blue with dashes) is two-fold rotationally symmetric with the other trunk emerging from the opposite side of the pattern border and its branch (purple) and embellishments (purple with dashes). The embellishments of each trunk interlock to form a double-stranded spiral base unit (based on detail, Collingwood 1982, p. 150, fig. 97)

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(c)

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(d)

Fig. 6.16

(c) The structure of the trunks and branches of the ‘running dog’, option 1: The trunk (dotted black line) is expanded into triangle shape (yellow) at the point where it meets the outer border, and has only one branch at its other end (red) (based on detail, Collingwood 1982, p. 150, fig. 97)

(d) The structure of the trunks and branches of the ‘running dog’, option 2: The trunk (yellow) has two branches. One branch (red) and its embellishments create the spiral unit in the centre of the band. A second branch (blue arrow) intersects with outer border, leaving a triangular field at the border between it and the trunk (yellow shading). That blue branch could conceptually form a single-stranded spiral base unit instead, if embellishments were added to it and the triangular space was not filled in with yellow (based on detail, Collingwood 1982, p. 150, fig. 97)

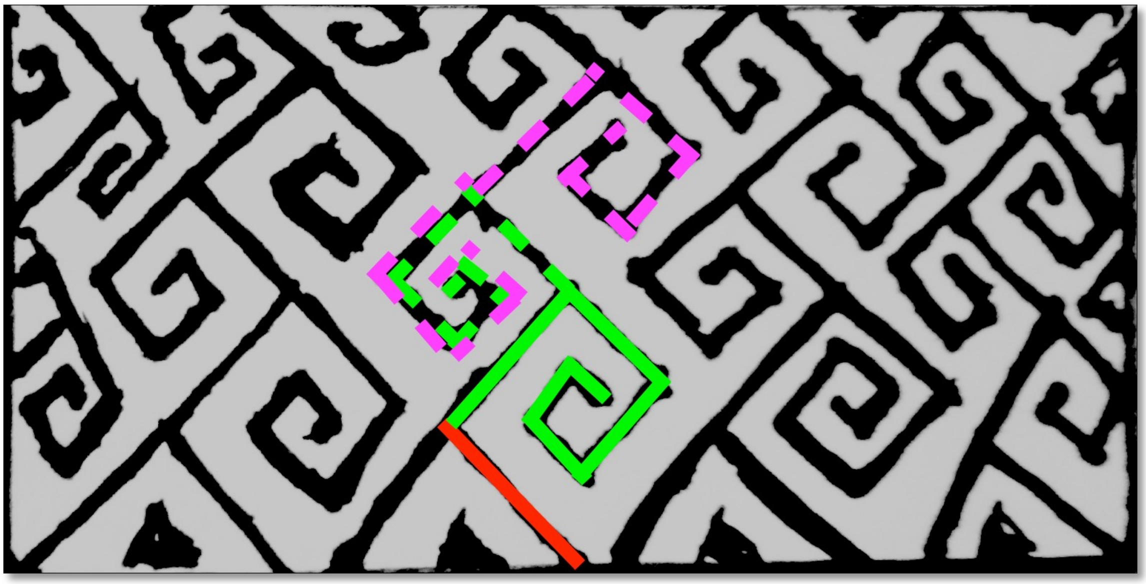

Fig. 6.17

The structure of a woven key pattern with single-stranded spirals: the first branch and its embellishments (solid green) intersect with an outer trunk (red). The green branch, however, is given second embellishment at its other end (dotted green). This entire embellishment (solid and dotted green) is successively iterated (purple). Each iteration has a one-fold rotationally symmetric relationship to the one before and after it. In addition, each branch and its next iteration (all green, or all pink) form two mirror-symmetric single-stranded spirals (Drawing by author, based on photograph of ancient Chinese trousers (Fig. 6.12, detail, Bower 2014) and Allen and Anderson 1903, vol. 1, part 2, p. 350, no. 967)

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Fig. 6.18

The colouring of a ‘running dog’ pattern: two-fold rotationally symmetric pairs of trunks, with their branches and embellishments (blue and purple), versus the continuous path (yellow) (based on detail, Collingwood 1982, p. 150, fig. 97)

(a)

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(b)

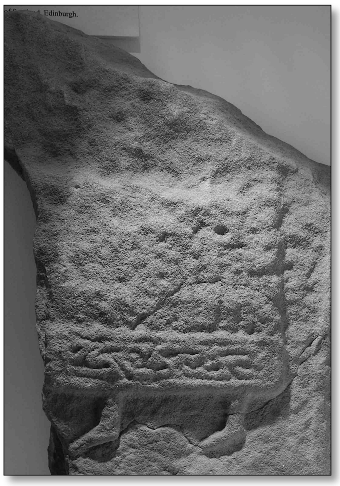

Fig. 6.19

The crucifixion plaque from St John's at Rinnagan (Co. Roscommon, Ireland) and Pictish stone panel fragment depicting a cleric (Groam House Museum, Rosemarkie, Easter Ross, Scotland (NMS X.IB.119)) (Plaque: Megaw and Megaw 2001, p. 243, fig 413; Rosemarkie panel fragment: © Author)

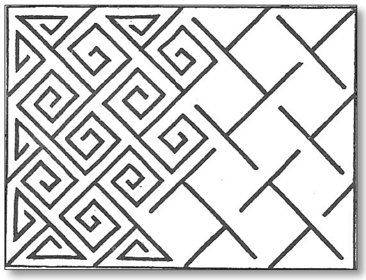

Fig. 6.20

Allen's line drawing of an Insular key pattern with single-stranded spirals, similar in structure to woven analogues (Allen and Anderson 1903, vol. 1, part 2, p. 354, no. 969)

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(b) **Image has been removed due to copyright restrictions**

Fig. 6.21

(a) The single-stranded key pattern from folio 85r of the MacRegol Gospels (detail, Bodleian Library [accessed 15 December 2017])

(b) Equivalent key pattern from modern instructional tablet weaving diagram from Pinterest (detail, Dominguez [accessed 15 December 2017]).

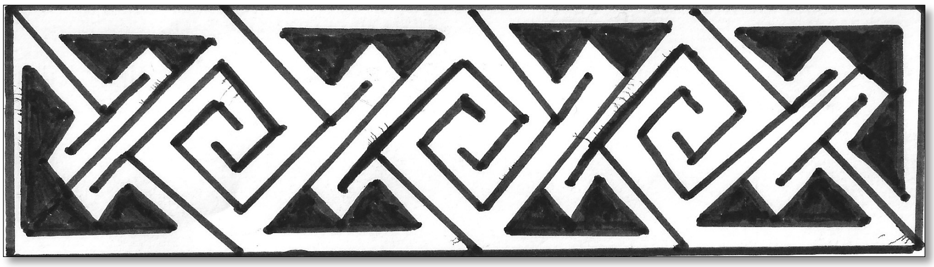

Fig. 6.22

Insular key pattern that is visually and structurally similar to the tablet-woven ‘running dog’ pattern (© Author)

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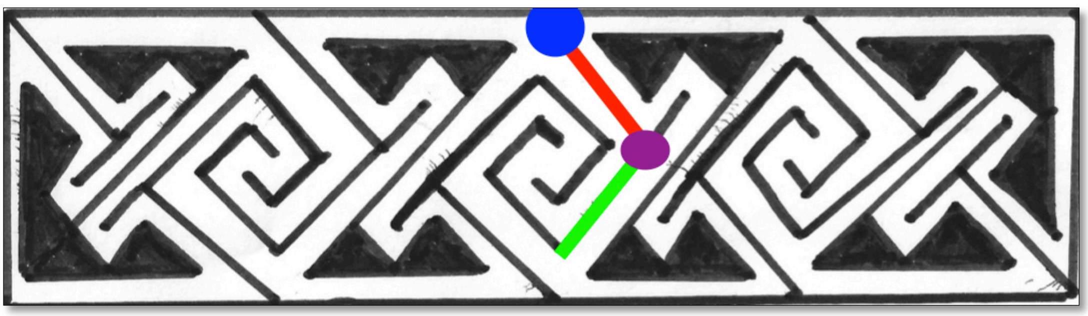
(a)



(b)

Fig. 6.23

In this Insular key pattern (b) and the tablet-woven ‘running dog’ key pattern (a), the spiral units in the centre of the compositions are both created by a trunk (red line) that intersects the outer border (at the blue dot), and its branch (green, intersecting the trunk at the purple dot) (a: based on detail, Collingwood 1982, p. 150, fig. 97; b: © Author)

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(a)

(b)

Fig. 6.24

The second branch intersects with the outer border in the running dog (a, yellow), but does not in Insular key pattern (b, yellow). Insular key patterns possess inner trunks (with branches) that do not intersect with the border (orange), which are absent in the running dog (a: based on detail, Collingwood 1982, p. 150, fig. 97; b: © Author)

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(a)

(b)

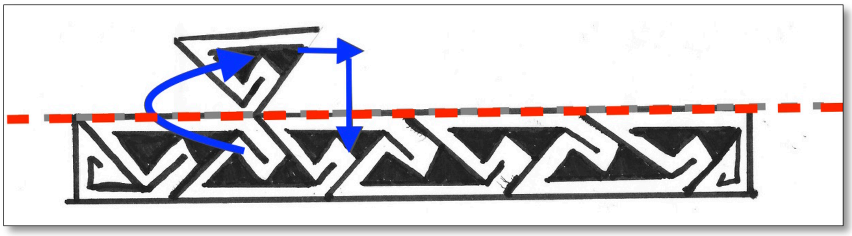
Fig. 6.25

(a) In running dog, the outer trunk (red) and its second branch (yellow) create a solid triangular area of negative space (light blue) (based on detail, Collingwood 1982, p. 150, fig. 97)

(b) In Insular diagonal key pattern, the second branch (yellow) of the outer trunk (red) and the branch of the inner trunk (orange) interlock to form a spiraliform base unit (encircled by dotted light blue line and exaggerated by added curved black lines). This spiral unit occurs in the same area as the solid triangle of negative space in running dog (© Author)

Fig. 6.26

A diagonal Insular key pattern composition whose central spiral units are created by the second branch (purple) and its embellishments (purple) of the inner trunk (orange). The outer trunk's (red) first branch, used to create the central spiral units in running dog, is omitted. Only its second branch remains (red) (© Author)



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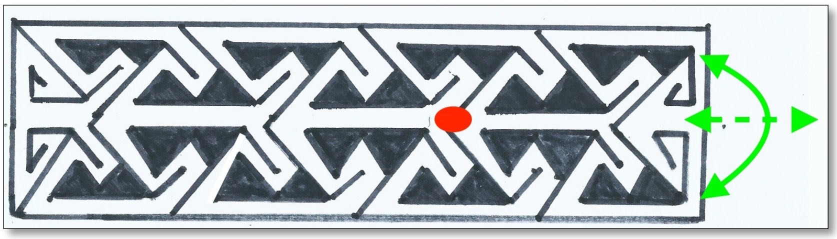

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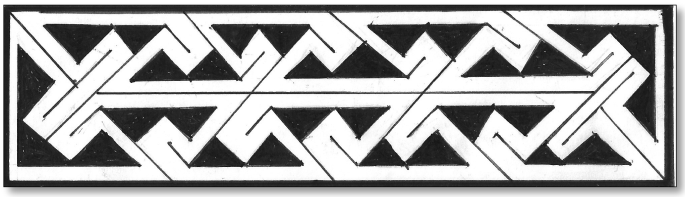

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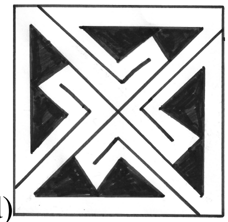

(d)

Fig. 6.27

(a) Spiral base units multiplied by mirror symmetry and then translation to create diagonal row: first vertical mirroring of spiral base unit across the horizontal axis (dotted red), and then translation along the direction of that axis (© Author)

(b) A diagonal key pattern row multiplied with vertical mirror symmetry (across the horizontal axis, green dotted line). Red dot shows where the two rows meet (based on Allen and Anderson 1903, vol. 1, part 2, p. 330, no. 885b)

(c) Two, two-fold rotationally symmetric rows of diagonal key pattern adjacent to each other, together forming a larger composition (© Author)

(d) A diagonal key pattern composition of four spiraliform base units, each a 90-degree rotation of the other (© Author)

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Fig. 6.28

A demonstration of a ‘row’ in tablet weaving, running across the narrow waist (in the direction of the weft thread) rather than the length of the cloth band (direction of the warp, as well as the direction of Insular key pattern rows) (Screenshot from Niles 2009)

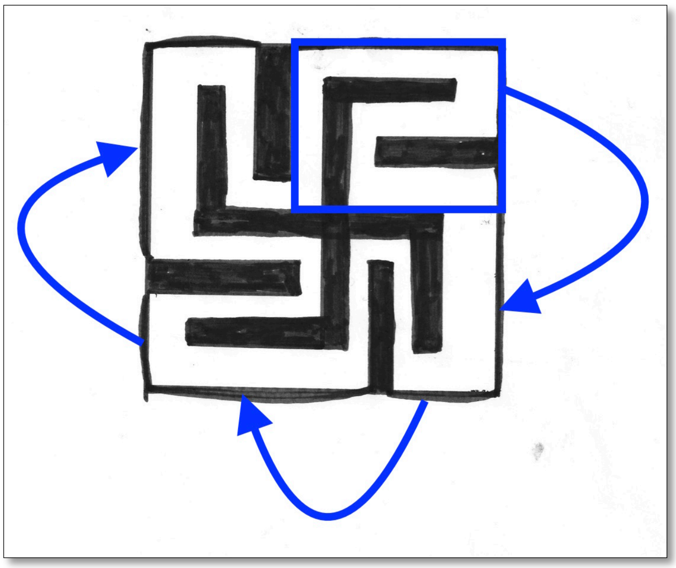
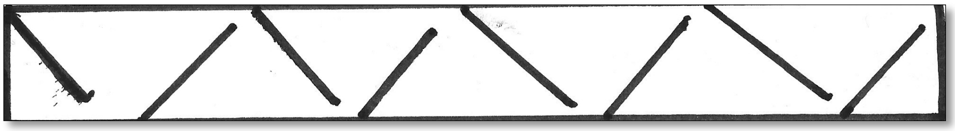


Fig. 6.29

An orthogonal key pattern composition with four spiral base units, each a 90-degree rotation of the other. Blue square indicates base unit, and blue arrows indicate rotation. Equivalent of Fig. 6.27d (© Author)

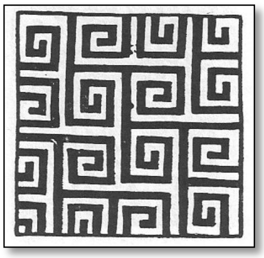
(a) 

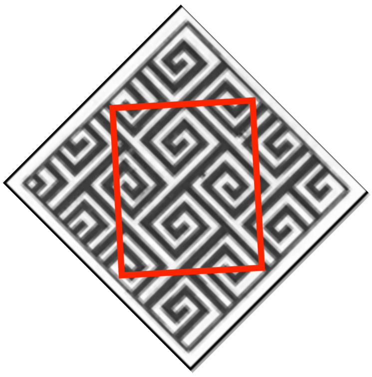
(b) 

Fig. 6.30

(a) Diagonal lines (here: trunks) in diagonal key pattern leave large voids of positive space (© Author)

(b) Detail of the St Gall Gospels, page 79. Negative line elements (black) are expanded into curvilinear shapes (yellow). By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 79 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 4 December 2017])


(a)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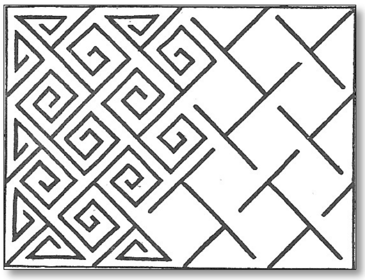

(c)

Fig. 6.31

(a) An orthogonal key pattern (Allen and Anderson, vol. 1, part 2, p. 322, no. 873b)

(b) The orthogonal key pattern, rotated 45 degrees and with a new outer border (red) around a section of the pattern, which cuts the outermost spiraliform units in half (based on Allen and Anderson, vol. 1, part 2, p. 322, no. 873b)

(c) A diagonal key pattern supposedly based on the 45-degree rotation of the above orthogonal pattern, with the angles between the outermost trunks and branches altered from 90 to 45 degrees to fit within the outer border (Allen and Anderson 1903, vol. 1, part 2, p. 354, no. 969)

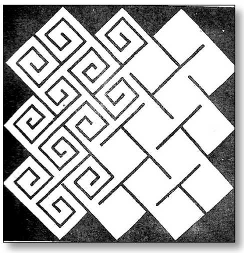
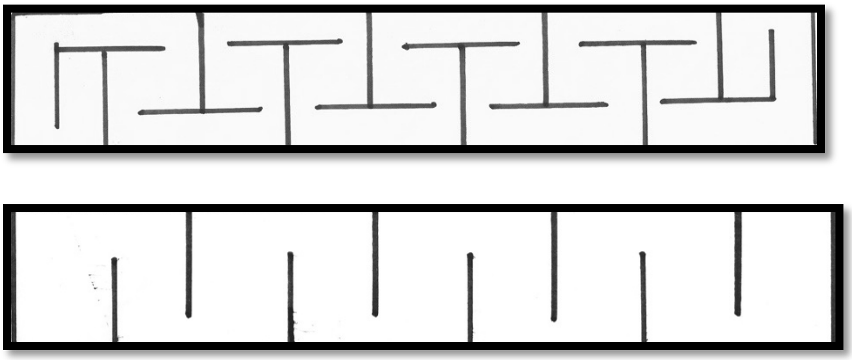


Fig. 6.32

Allen's line drawing of a key pattern from the Lindisfarne Gospels, showing solid outer base units (Allen and Anderson 1903, vol. 1, part 2, p. 351, no. 970)



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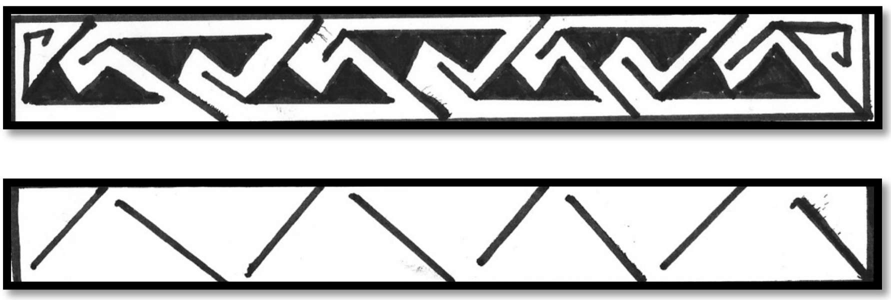

(b)

Fig. 6.33

An Insular diagonal key pattern in which the negative lines are skewed at 135°/45° angles to the pattern border from the beginning of the working process (b), compared to an orthogonal key pattern (a) in which the trunks are parallel and perpendicular to the outer border (with all other negative lines following suit) (© Author)

7. Chapter 7: Key Pattern in a Global Context

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Fig. 7.1

(a) Geometric Greek, orthogonal, additive, branchless key pattern (trunks only). Decorating an Attic amphora by the Dipylon Painter, 8th century BC, Athens (detail, Boardman 2006, pp. 20-21, fig. 13).

(b) Geometric orthogonal, additive key pattern with single branches per trunk and double-stranded spirals. Decorating an Attic amphora by the Dipylon Painter, 8th century BC, Athens (detail, Boardman 2006, pp. 20-21, fig. 13).

(c) Geometric orthogonal key pattern with single branches per trunk and single-stranded spirals. Drawing of a pyxis, Samos, 8th century BC (Schweitzer 1969, p. 106, fig. 75)

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Fig. 7.2

Geometric orthogonal, reductive key pattern with single branches per trunk and double-stranded spirals. From Nauplion, Argos. C.f. Fig. 5.27b (Coldstream 2008, plate 31d)

(a) 

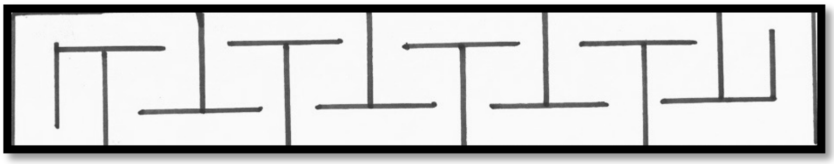
(b) 

Fig. 7.3

(a) Attic amphora with a key pattern composition that is cut off at the borders. The path (dark shading) cul-de-sacs at the border at each end to the row. Geometric period, early 9th century BC, Athens (Boardman 2006, pp. 18-19, fig. 7)

(b) An orthogonal Insular key pattern, in which the artist has prevented the path (white) from cul-de-sacing at the outer border by manipulating the negative lines (black) so that it appears to turn in on itself in single-stranded spirals at either end of the row (© Author).

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Fig. 7.4

A drawn reproduction of Geometric, additive key pattern in two rows that are two-fold rotationally symmetric to each other. From a kantharos from Samos (detail, Schweitzer 1969, p. 114, fig. 88)

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Fig. 7.5

An Attic amphora by the Dipylon Painter, 8th century BC, Athens. With detail of additive key pattern on neck with elongated trunks (two trunks highlighted in blue and green, respectively). Blue trunks have additional embellishments (red) in addition to the original branch (blue) (c.f. Fig. 7.1b). Green trunks are manipulated to appear angled (Boardman 2006, pp. 20-21, fig. 13).

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Fig. 7.6

(a) Reductive (top) and additive (bottom) key pattern on a black figure hydria, the Hunt Painter, Rhodes, dated to the mid-6th century BC-on (Boardman 2006, p. 68, fig. 90)

(b) Detail of additive key pattern from (a). Negative lines (embellishments) touch in the centre of the spiraliform base units, making the path (black) discontinuous (detail, Boardman 2006, p. 68, fig. 90)

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Fig. 7.7

Additive key patterns scratched into black glaze on hems of figures from a 6th-century Attic crater from Chiusi, Italy, by the vase painters Kleitias and Ergotimos. With detail (detail, Boardman 2006, p. 52-53, fig. 64)

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Fig. 7.8

A key pattern composition runs into itself (near the bottom of the image, below the standing figure's rear foot) inside a cup, by the painter Douris. This causes one spiral unit to overlap another, which causes the path in the spiral unit lying 'underneath' to cut off or be prematurely terminated (Arias 1962, p. 341, plate 145)

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Fig. 7.9

Additive key pattern on a red figure kylix, early 5th century BC, Panaitios Painter (Richter 1987, pp. 340-341, fig. 456)

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Fig. 7.10

A reductive key pattern on a red figure stamnos, with two branches per trunk and a decorative black line following the continuous path (detail, Boardman 1975, repr. 1997, p. 173, fig. 304.1)

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Fig. 7.11

Additive key pattern with swastika-shaped spiral units on a late 5th-century red figure amphora, Kleophrades painter (Arias 1962, plate 122)

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Fig. 7.12

A white-ground lekythos, mid-5th century BC (Richter 1987, p. 348, fig. 466)

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Fig. 7.13

Two korai from the Acropolis Museum (Kore 594 and Kore 680) with the same swastika-shaped key pattern. On Kore 594 (a), the key pattern is reductive. On Kore 680 (b), the key pattern is additive (Payne and Young 1936, pp. 69-70, plates 48, 54)

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Fig. 7.14

Ivory goddess figurine with reductive key pattern on the ‘polos’ (cap) (Schweitzer 1969, Plate 147)

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Fig. 7.15

Schweitzer's chart: the disarticulation and symmetrical rearrangement of 'meander hooks' and 'lozenges' (i.e. structures in the 'running dog' key pattern) on Geometric vessels from Rhodes (Schweitzer 1969, p. 94, fig. 63)

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Fig. 7.16

Attic amphora with additive diagonal key pattern with single-stranded spirals, inspired by a woven composition, late 7th century BC, the Piraeus painter (Richter 1987, p. 300, fig. 415)

Fig. 7.17

A reconstruction of the Persian Rider sculpture, demonstrating the original paint colours. With detail of key pattern (By permission of Helayna Thickpenny)

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Fig. 7.18

Black figure amphora depicting Achilles and Ajax, with running dog on clothing, by Exekias, 6th century BC. With detail (detail, Witcombe [accessed 23 March 2017])
(For date and artist, see Boardman 1991, repr. 1997, 52; Boardman 2006, p. 62-63, fig. 80-81)

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Fig. 7.19

(a) Reconstruction of a tablet-woven band from the Hochdorf burial, Germany. Branchless, orthogonal key pattern compositions (with a yellow path) are located at the edges of the band and are rotated at 45-degree angles. Tile-shaped, orthogonal key pattern compositions (with red and blue negative lines, and yellow paths), formed by 90-degree (1-fold) rotation of spiral units, run down the centre of the band. These are also rotated at 45 degrees to the edges of the cloth (detail, Grömer 2016a, p. 185, fig. 105)

(b) Reconstruction of a tablet-woven band from the Hochdorf burial, Germany, with tile-shaped, orthogonal key pattern compositions, formed by 90-degree rotation of spiral units. These are also rotated at 45 degrees to the edges of the cloth (detail, Grömer 2016a, p. 185, fig. 105)

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Fig. 7.20

Bronze hand from a 7^{th}-century grave at Kleinklein, Austria (detail, Megaw and Megaw 1989, repr. 2001, pp. 24-25, fig. 4)

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Fig. 7.21

Stela from Kermaria en Pont-L'Abbe, Brittany, 4th century BC (Cunliffe 1999, p. 158, fig. 129)

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Fig. 7.22

Bronze belt hook with stippled key pattern (top row), 4th century BC, Zelkovice, Czech Republic (Megaw and Megaw 1989, p. 258, fig. 429b)

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Fig. 7.23

Key pattern compositions with four distinct structures engraved on an iron and bronze scabbard from a La Tène grave, Hallstatt, Austria, 4th century BC (detail, Megaw and Megaw 1989, pp. 80-81, fig. 92)

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Fig. 7.24

Embroidered La Tène running dog with reconstructions, from Nové Zamky, Slovakia. The blue line annotation is added to the black-and-white line drawing and indicates where the two adjacent rows of running dog are divided (annotated, detail, Grömer 2016, p. 204, fig. 120)

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Fig. 7.25

Roman floor mosaic from Woodchester, Gloucester, England, early 4th century AD. Additive, swastika-shaped key pattern compositions located in outer border and in square fields around central circular motif. With detail of key pattern from the border and from a square field (Neal 1981, plate 87)

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Fig. 7.26

Additive key pattern with swastika-shaped spiral units from a fragment of a Coptic shroud, purple wool and undyed linen, Egypt, 4th- or 5th-century AD. Roundel diameter 30.2 cm (detail, Trilling 2008, p. 90, no. 99)

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Fig. 7.27

Neal’s reconstructive drawing of a mosaic fragment at Chichester, West Sussex, England, with added colour annotation. The mosaicist arranged individual swastika-shaped spiral units using mirror symmetry (the red spiral is mirror symmetric to the dark blue, the dark blue to the green, the green to the purple, and the purple to the red. Light blue lines indicate where the artist connected the spiral units to create a continuous path (based on Neal 1981, p. 54-55, fig. 15).

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Fig. 7.28

Neal's reconstructive drawings of key patterns with swastika-shaped spiral units from Roman mosaics from Combe St Nicholas, Somerset, and Aldborough, Yorkshire (detail, Neal 1981, p. 28, fig. 7c-d)

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Fig. 7.29

Detail of mosaic with reductive key pattern with swastika-shaped spiral units, Antioch-on-the-Orontes, Turkey, AD 50-115 (Henig 1983, plate 9)

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Fig. 7.30

(a) Key pattern in three-dimensional, reductive illusion from the Mausoleum of Galla Placidia, AD 430 (detail, Henig 1983, plate 15)

(b) Key pattern in three-dimensional, reductive illusion from a fresco, Villa of Mysteries, Pompeii, 1st century BC (detail, Henig 1983, plate 2)

(a) 

(b) 

Fig. 7.31

(a) Roman frieze fragment with reductive key pattern with swastika-shaped spiral units, from the Great Baths in Bath, England (detail, Cunliffe and Fulford 1982, pp. 16-17, no. 57, plate 15).

(b) Detail of engraved, reductive key pattern with swastika-shaped spiral units, from the Anastasius Dish, Sutton Hoo treasure, silver, AD 491-518 (By permission of Emilia K. Thickpenny)

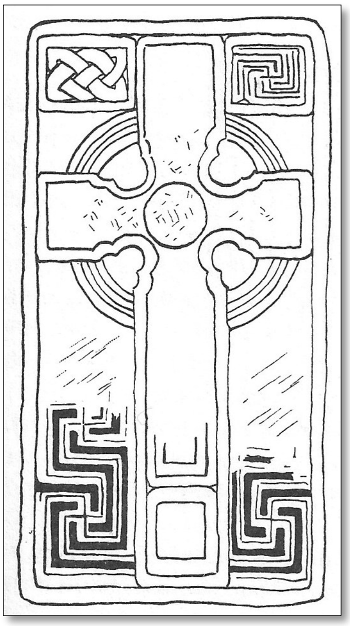


Fig. 7.32

Allen's line-drawing reproduction of key pattern with swastika-shaped units from the Abercromby no. 2 cross-slab, Fife, Scotland (Allen and Anderson 1903, vol. 2, part 3, pp. 348-349, fig 362)

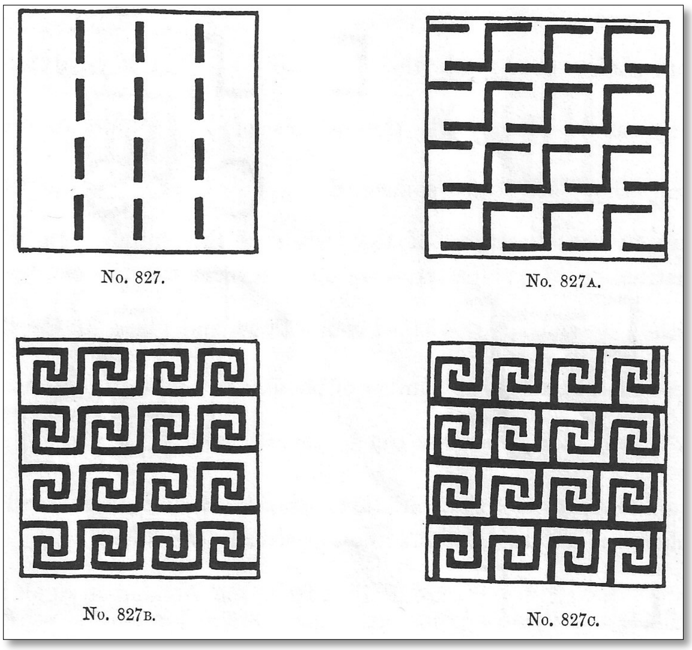


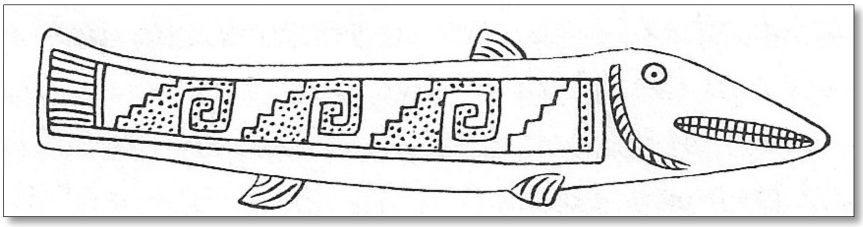
Fig. 7.33

Allen misidentifies the path in an additive Greek key pattern as negative lines (nos. 827a), recognizing the reductive version and actual negative lines (no. 827c) only as a reciprocal (Allen and Anderson 1903, vol. 1, part 2, p. 314)

Fig. 7.34

Additive key pattern mosaic, with swastika-shaped spiral units, at the Great Mosque at Cordoba, Spain. The date refers to the year of discovery (By permission of Katherine Forsyth)

(a)



(b)

Fig. 7.35

(a) Running dog pattern around the border of a cloth and feather panel. Nazca culture, Peru, 200 BC-200 AD, cotton and feathers (Schoeser 2003, pp. 42-43, fig. 34)

(b) Allen's line drawing of a fish-shaped vessel with running dog, Peru. No date, provenance, or background information provided (Allen and Anderson 1903, vol. 1, part 2, p. 309)

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(c)

Fig. 7.36

(a) Key pattern composition of two mirrored running dog compositions (ram's horn), with unique treatment of negative lines. Architectural mosaic, inner patio in the Hall of Columns, Mitla, Mexico, c. 1200-1521 AD (detail, Blomster 2012, p. 339, fig. 24.2)

(b) Orthogonal and diagonal architectural key pattern mosaics, in the same inner patio in the Hall of Columns (detail, Blomster 2012, p. 339, fig. 24.2)

(c) A single-stranded 'running dog' key pattern, with unusual blending of creative approaches. Outer trunks and branches (negative space) and path (inner section of pattern, between raised lines) are both recessed. Architectural mosaic, the same inner patio, Hall of Columns (detail, Blomster 2012, p. 339, fig. 24.2)

Fig. 7.37

A depiction of architectural running dog in the 14th-century Mixtec Codex Zouche-Nuttall, with negative trunks and branches rendered in two colours (red and white). The British Museum (© Author)

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Fig. 7.38

Map of the ancient North American Southwest, including the Ancient Puebloan (here Anasazi) and Mogollon cultures (Hurst 1999, 90)

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Fig. 7.39

Two rows of single-branched, double-stranded orthogonal key pattern, black-on-white bowl, Ancient Puebloan, Sikyatki, Arizona (Martin and Willis 1940, pp. 22-23, plate 6, fig. 2)

(a) 

(b) 

(c) 

Fig. 7.40

(a) Running dog key pattern compositions, black-on-white bowl, Ancient Puebloan, possibly found at Lower Little Colorado River, Arizona (Martin and Willis 1940, pp. 30-31, plate 10, fig. 5)

(b) The ceramicist fit one key pattern composition within the border (red circle). At the end of this row, the white path turns inward and dead-ends on itself as a single-stranded spiral (c.f. Fig, 7.40c). In another composition on the bowl, the ceramicist allowed the pattern to be cut off at the border (blue circle). At the end of this row, the white path cul-de-sacs at the outer border (based on Martin and Willis 1940, pp. 30-31, plate 10, fig. 5)

(c) An Insular key pattern fitted within the outer border. At the end of the row, the path turns in on itself and dead ends inside the single-stranded spiral unit (red circle) (© Author)

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Fig. 7.41

A rare additive Ancient Puebloan key pattern, with single-stranded spirals, negative lines in orange. Black-on-orange jar from ‘Homolovi (No. 1)’, Arizona (Martin and Willis 1940, pp. 58-59, plate 24, fig. 4)

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Fig. 7.42

A black-on-white pitcher with two different embellishments, expanded in different ways: the left spiraliform, and the right a jagged rectilinear shape. Ojo Caliente, New Mexico (Martin and Willis 1940, pp. 266-267, plate 124, no. 9)

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Fig. 7.43

(a) Four units of diagonal key pattern, one-fold (90-degree) rotationally symmetric to each other. Black-on-white bowl, thought to be found at the Lower Little Colorado River, Arizona (Martin and Willis 1940, pp. 30-31, plate 10, fig. 6)

(b) Square-shaped key pattern compositions, separated from each other by three vertical black lines that intersect both sides of the border. Each square field of key pattern is composed of two truncated running dog patterns, two-fold rotationally symmetric to each other (one truncated portion of running dog is circled in red). Black-on-orange jar, Bidahochi, Arizona (Martin and Willis 1940, pp. 64-65, plate 27, no. 4)

8. Chapter 8: Insular Key Pattern in Action: Additional Structural Analysis and Case Studies

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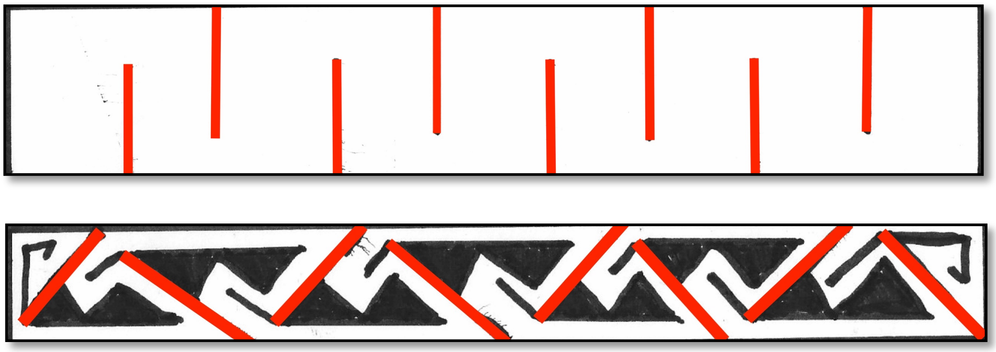


Fig. 8.1

(a) In this key pattern, the trunks (red) are the only negative line segments present, and lie parallel to each other (© Author)

(b) In this key pattern, other negative lines and shapes are present in addition to the trunks. The trunks (red) lie alternately parallel and perpendicular to each other (© Author)

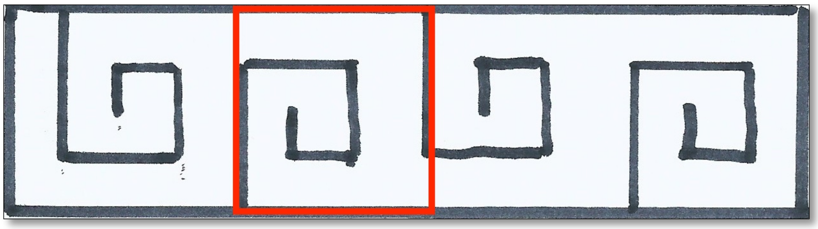


Fig 8.2

An orthogonal row with single-stranded spirals. In all key patterns, a spiral base unit occurs between two trunks that contain a spiral structure in both positive and negative space between them (outlined red). Each unit shares a trunk with the units directly before and after it (© Author)

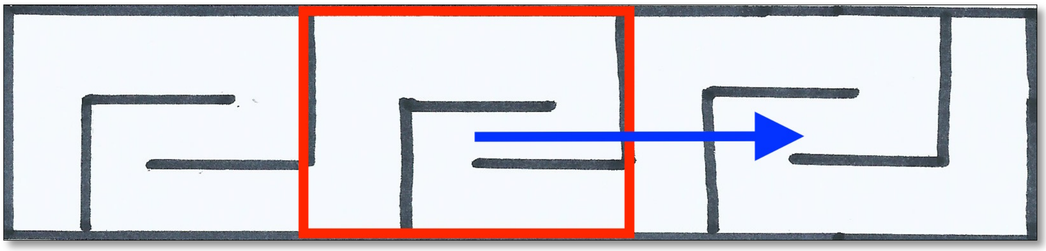


Fig. 8.3

An orthogonal row with double-stranded spiral base units (red outline) repeated using only translation (blue arrow) (© Author)

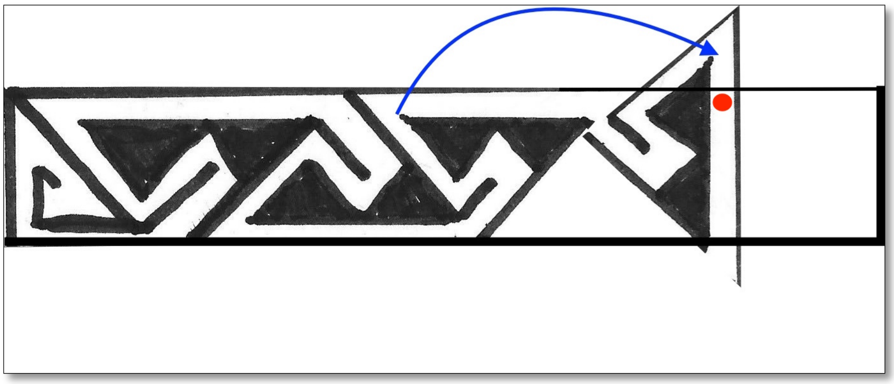
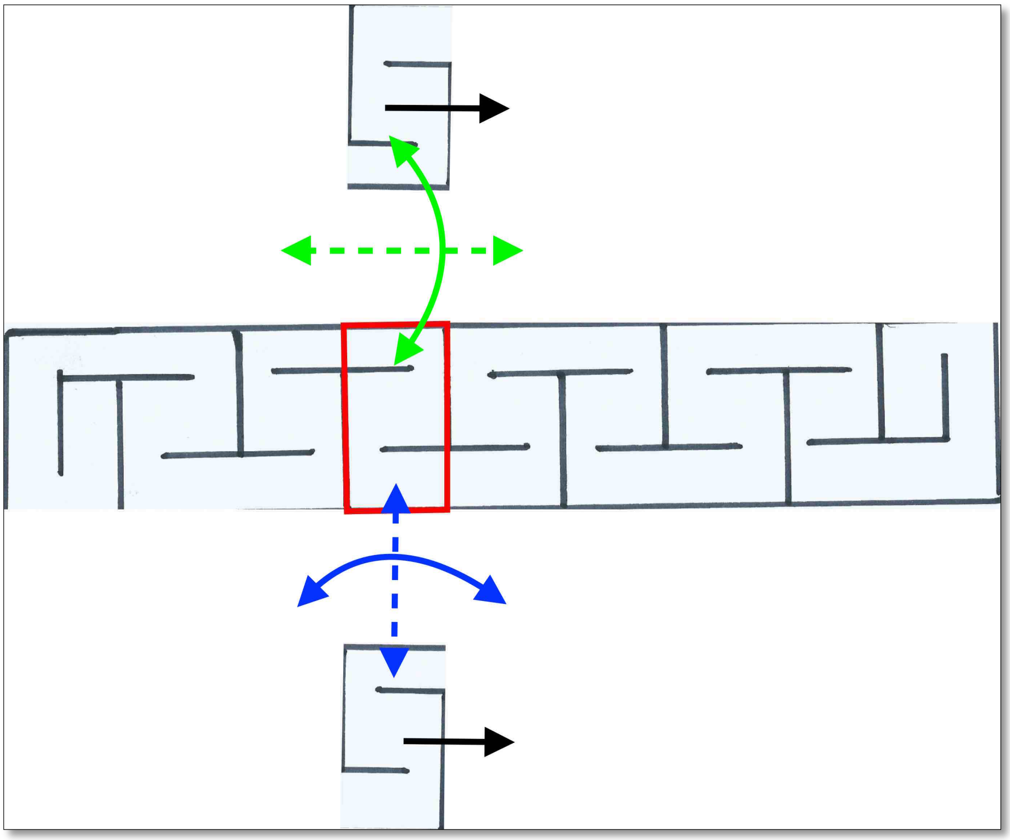


Fig. 8.4

A diagonal row. The final spiral base unit is rotated at 90 degrees, causing it to run off the edge of the composition. As a result, the path cul-de-sacs at the outer border (red dot). Insular artists therefore did not use this symmetry operation for repeating diagonal units to form rows (© Author)



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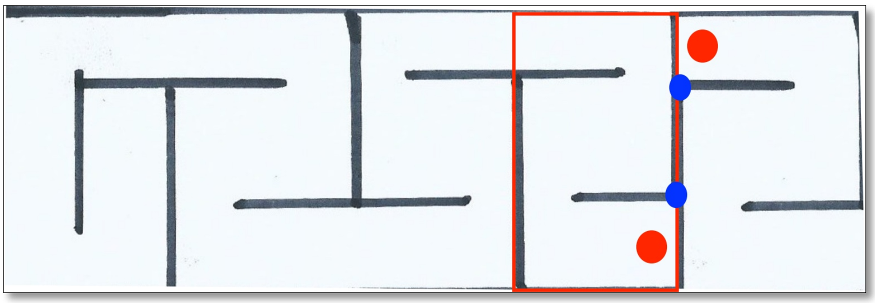
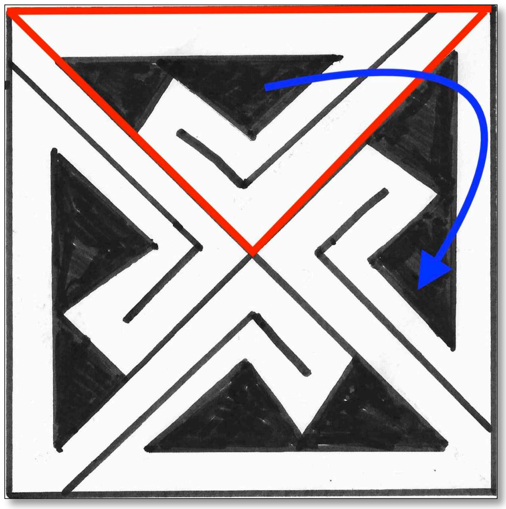


(b)

Fig. 8.5

(a) Orthogonal row with two branches per trunk. The spiral base unit (red) can be either mirrored vertically across horizontal axis (green), as if flipped up, and then translated down the row, or mirrored horizontally across vertical axis (blue), as if flipped across, and then translated down the row (black arrows) (© Author)

(b) An orthogonal row, with a spiral base unit (red outline) translated to the right to create the final unit (far right). Translation causes the branches to intersect the middle of their shared trunk (blue dots) and the path to cul-de-sac (red dots), both which Insular makers avoided. With this spiral unit, rotation also results in the same problem (© Author)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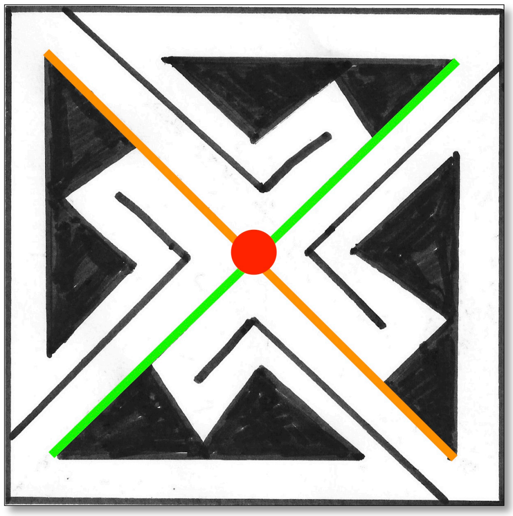

(b)

Fig. 8.6

(a) A diagonal rotated unit composition, with unit highlighted (© Author)

(b) Pairs of intersected trunks highlighted in colour, with their point of intersection indicated (red dot) (© Author)

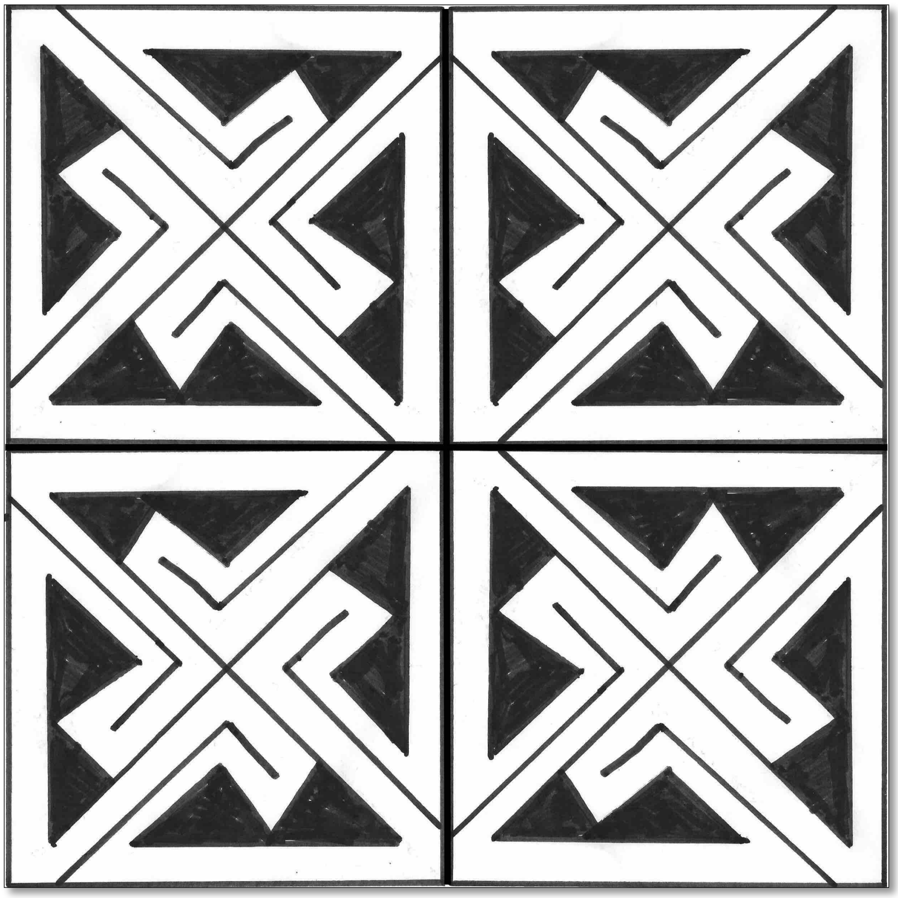
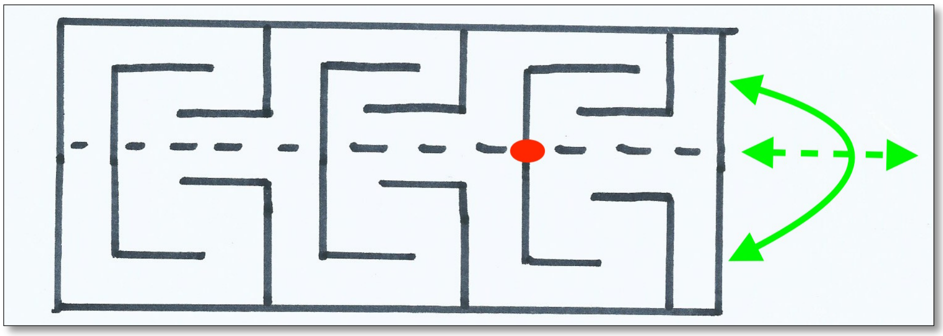


Fig. 8.7

Four rotated unit compositions multiplied by mirror symmetry (each composition is mirror symmetric to the ones adjacent to it). Although the adjacent borders between the four rotated unit compositions are retained in this drawing, readers will note that the trunks intersecting these adjacent borders now also intersect each other, forming V-like shapes in the central area of this larger composition (© Author)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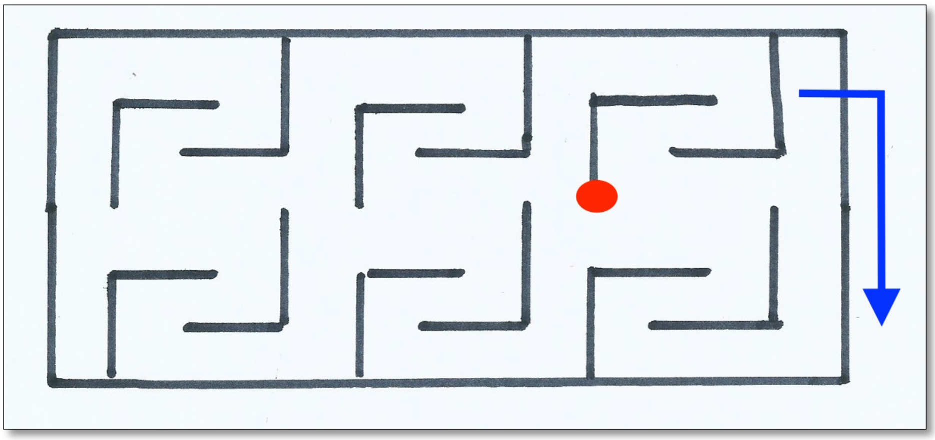
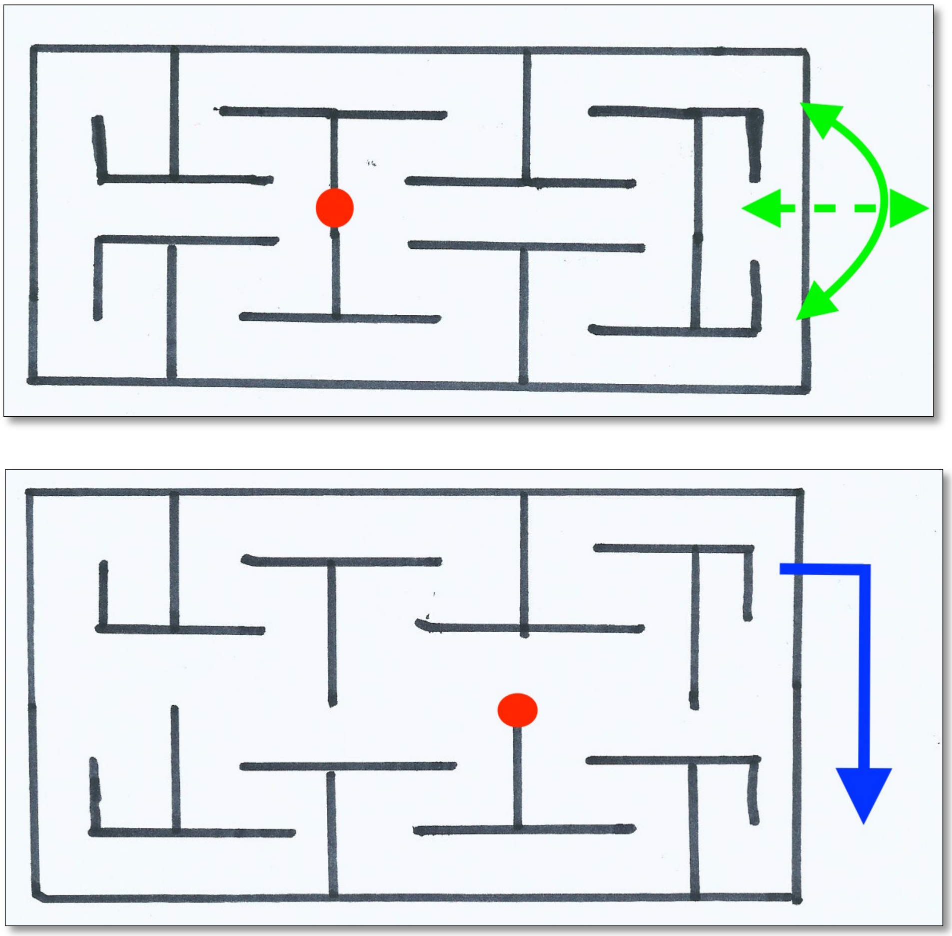

(b)

Fig. 8.8

(a) A multiple formed of two rows (i.e. the row depicted in Fig. 8.3). The two rows are vertically mirror-symmetric to each other (across the green horizontal axis). The border between the two rows is removed (indicated by a dotted line). The trunks from each row, which originally intersected this adjacent border, also meet each other (red dot) (© Author)

(b) A multiple formed of two rows (again, the row depicted in Fig. 8.3), multiplied with translation (blue arrow). Translation does not allow the trunks from each row to meet each other. Instead, they float freely (red dot). Two-fold rotation also causes this result. Insular makers therefore never used translation or rotation to multiply such a single row, as the resulting multiple loses its structural integrity (© Author)



(a)

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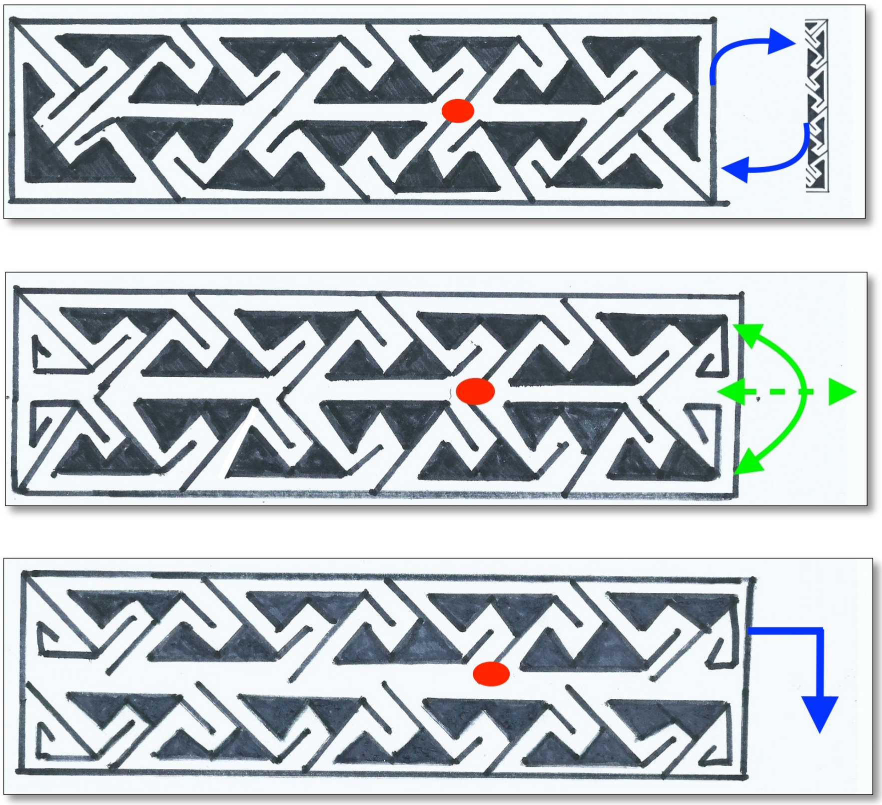
Fig. 8.9

(a) A multiple formed of two rows (i.e. the row depicted in Fig. 8.5a). The two rows are vertically mirror-symmetric to each other (across the green horizontal axis). The border between the two rows is omitted. The trunks from each row, which originally intersected their outer border in this adjacent area, also meet each other (red dot) (© Author)

(b) A multiple formed of two rows (again, the row depicted in Fig. 8.5a), multiplied with translation (blue arrow). Translation does not allow the trunks from each row to meet each other. Instead, they float freely (red dot). Two-fold rotation also causes an identical result. Insular makers therefore would never have used translation or rotation to multiply such a single row, as the resulting multiple loses its structural integrity (© Author)



(a)

(b)

(c)

Fig. 8.10

(a) A multiple formed of two rows (i.e. the row depicted in Fig. 8.1b), multiplied with two-fold rotation (blue arrow). The border between the two rows is omitted. The trunks from each row, which originally intersected their outer border in this adjacent area, also meet each other (red dot) (© Author)

(b) A multiple formed of two rows (again, the row depicted in Fig. 8.1b). The two rows are vertically mirror-symmetric to each other (across the green horizontal axis). The trunks from each row, which originally intersected their outer border in this adjacent area, also meet each other (red dot) (© Author)

(c) A multiple formed of two rows (again, the row depicted in Fig. 8.1b), multiplied with translation (blue arrow). Translation does not allow the trunks from each row to meet each other. Instead, they float freely (red dot). Insular makers never used translation to multiply such a single row, as the resulting multiple loses its structural integrity (© Author)

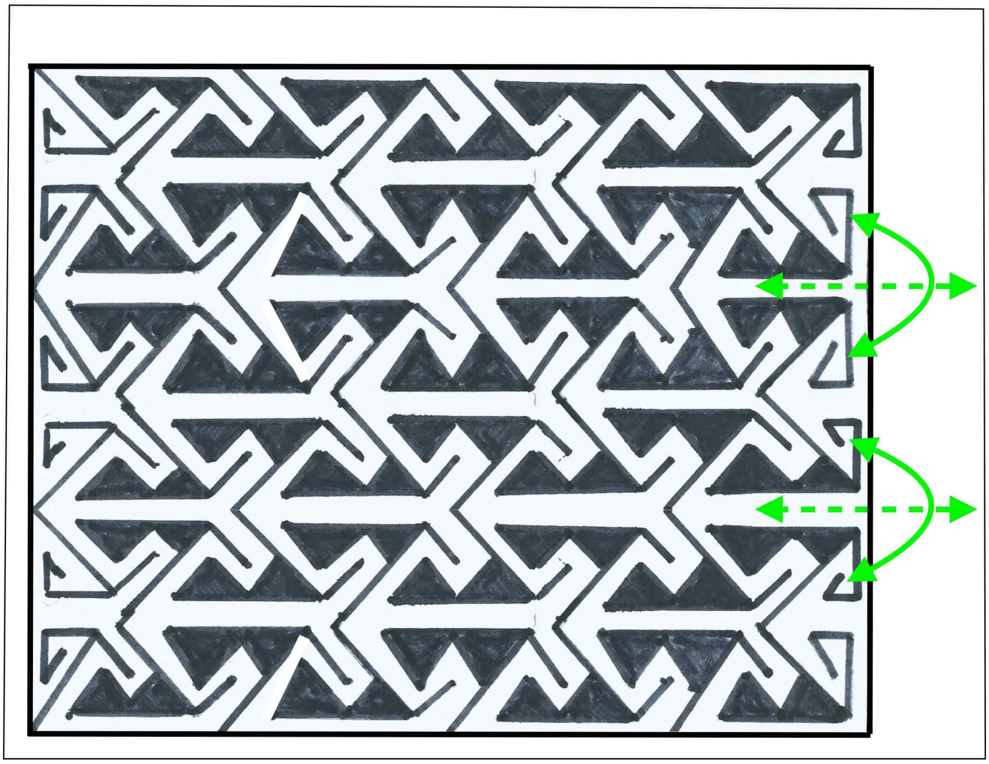


Fig. 8.11

A larger key pattern composition formed of three pairs of row multiples. Within each pair, the multiplied rows are vertically mirror symmetric to each other (across the green horizontal axis illustrated Fig. 8.10b). Each pair is then multiplied by mirroring again across the horizontal axis (green here), to form this larger composition, which contains six individual rows and therefore three pairs of rows. The trunks meet each other in the adjacent border areas (© Author)

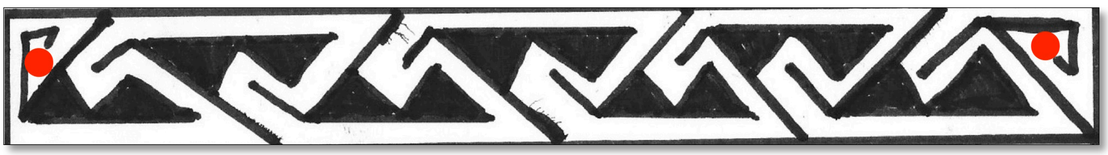
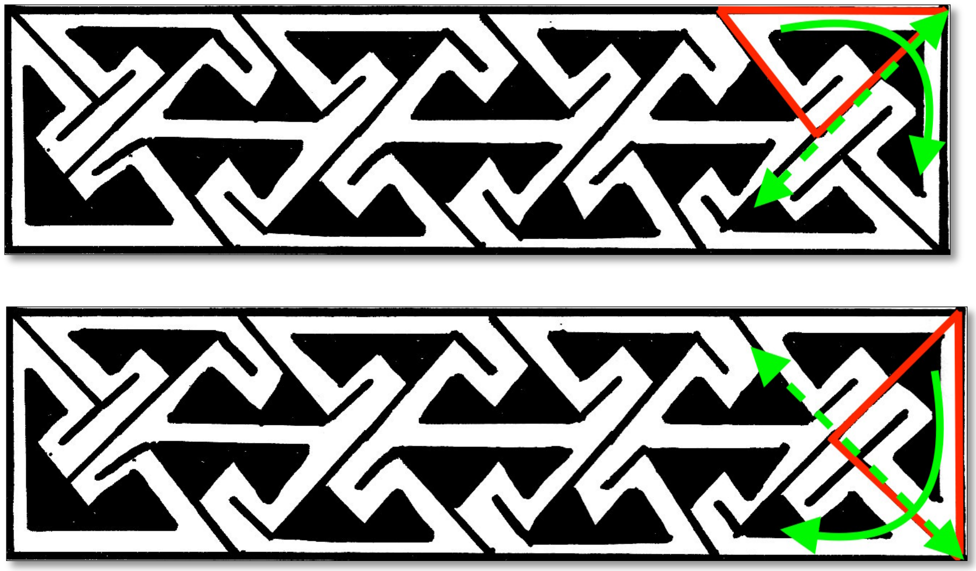


Fig. 8.12

Terminals at either ends of a diagonal row. The path cul-de-sacs at the centre of the single-stranded spirals in each terminal (red dot) (© Author)

Fig. 8.13

A field of key pattern with three sets of diagonal, two-fold rotationally symmetric row pairs, with mitres. St Gall Gospel Book page 208, with an annotated detail of the three pairs of rows. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 208 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

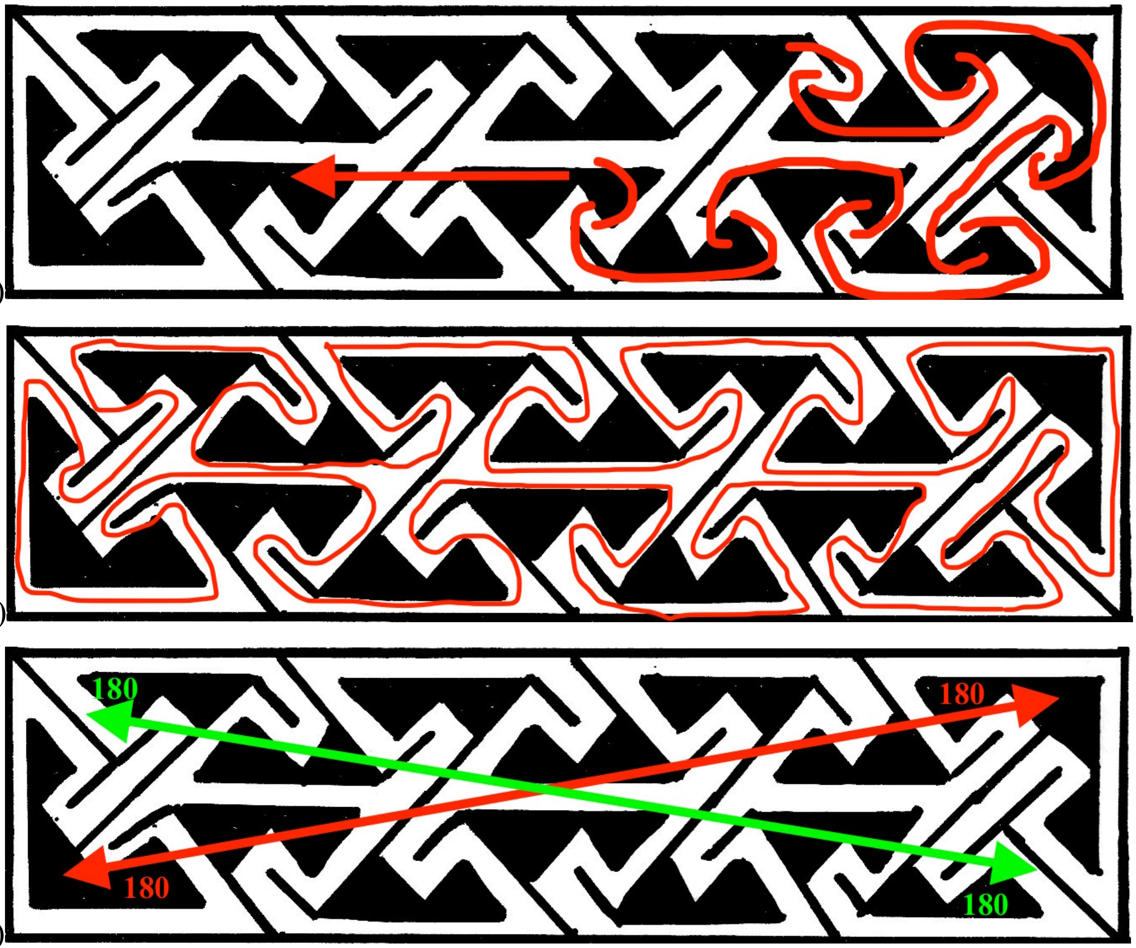


(a)

(b)

Fig. 8.14

Sequential repetition of the spiral base unit (red), with mirror reflection across 45-degree axes (green), to form the top and bottom mitres of a diagonal, two-fold rotationally symmetric pair of rows (© Author)



(a)
(b)
(c)

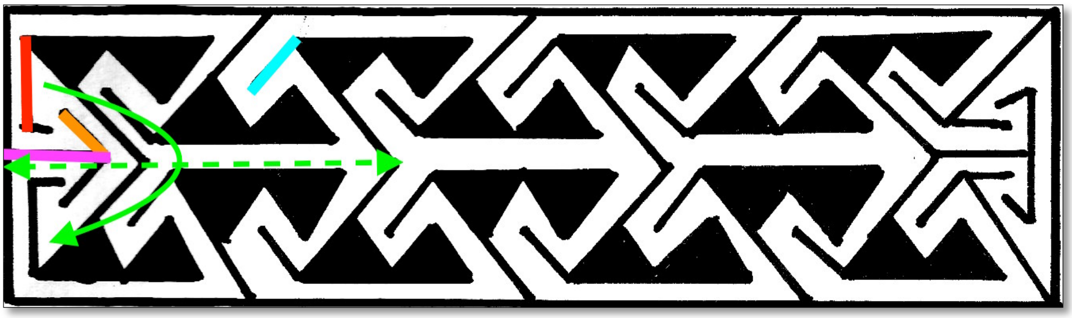
Fig. 8.15

(a) Two-stranded spiral base units linking continuously through the mitres (© Author)

(b) Path (red) traveling continuously throughout pattern, through the mitres (© Author)

(c) Opposite mitres are two-fold rotationally symmetric to each other (at 180 degrees) and identical in structure (© Author)

(a)

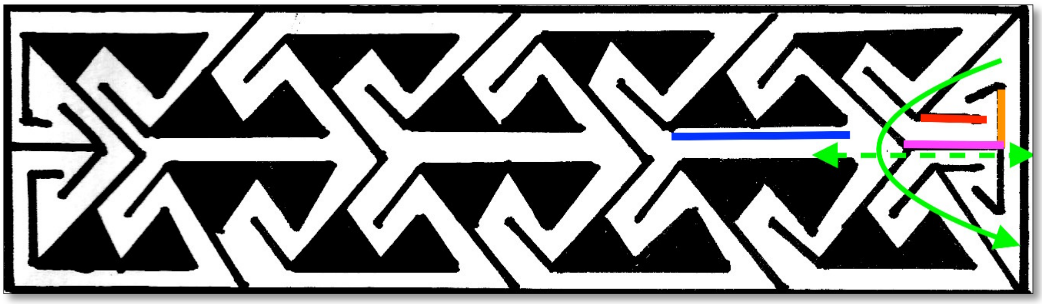


(b)

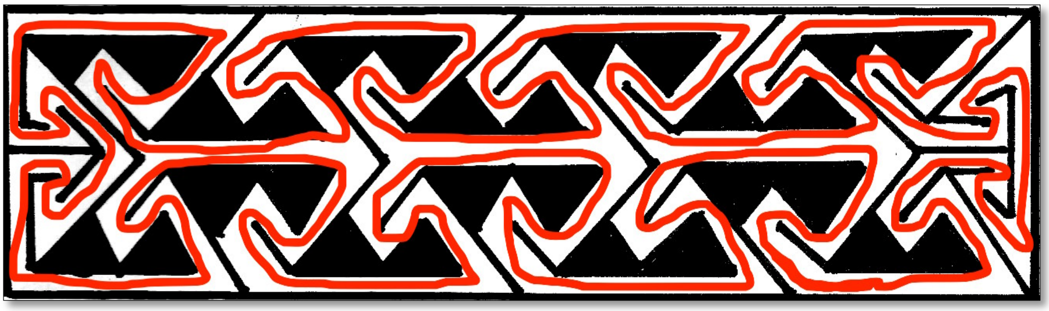
Fig. 8.16

(a) A mirror-symmetric pair of rows with mitres near the base of the Cross of St Patrick and St Columba, Kells, Ireland (partly weathered) (© Author)

(b) A mitre in a mirror-symmetric pair of rows, occurring where the last trunks in the rows (left side) intersect the adjacent border area between the two rows. Insular artists altered final branch (red) to lie at an angle of 45 degrees instead of 90 degrees to the trunk (compare with blue branch, which is at 90 degrees to the trunk) and parallel to the outer border. An additional, short negative line element is added (orange) to replace the missing branch from the next unit and create a two-stranded spiral in the final, leftmost unit. The adjacent border between the rows is partially retained (pink) to keep that path even. The whole mitre unit in the top row is mirrored over the x-axis/adjacent border (green) to create the mitre unit in the bottom row (© Author)



(c)

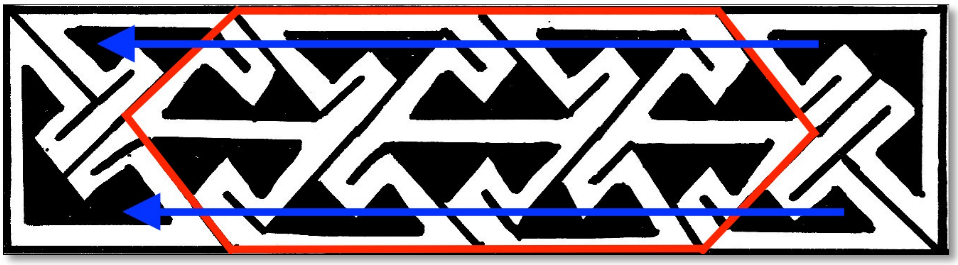


(d)

Fig. 8.16

(c) A mitre in a mirror-symmetric pair of rows, where the last trunks in the rows (right side) intersect the outer borders. Insular artists shortened the final branch (red; compare with previous branch in the row, underlined in blue). Additional, short negative line element are added (orange) to replace the missing branch from the next unit and create a two-stranded spiral. The adjacent border between the rows is partially retained (pink) to keep the path even. The whole mitre unit in the top row is mirrored over the x-axis/adjacent border (green) to create the mitre unit in the bottom row (© Author)

(d) The mitres keep the path (red) traveling continuously in an oval through the top and bottom rows (© Author)

(a) 

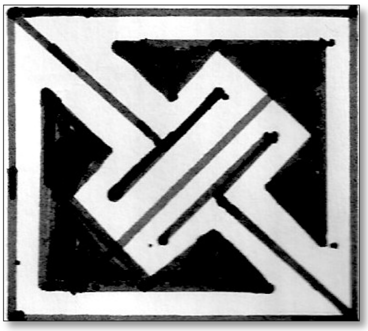
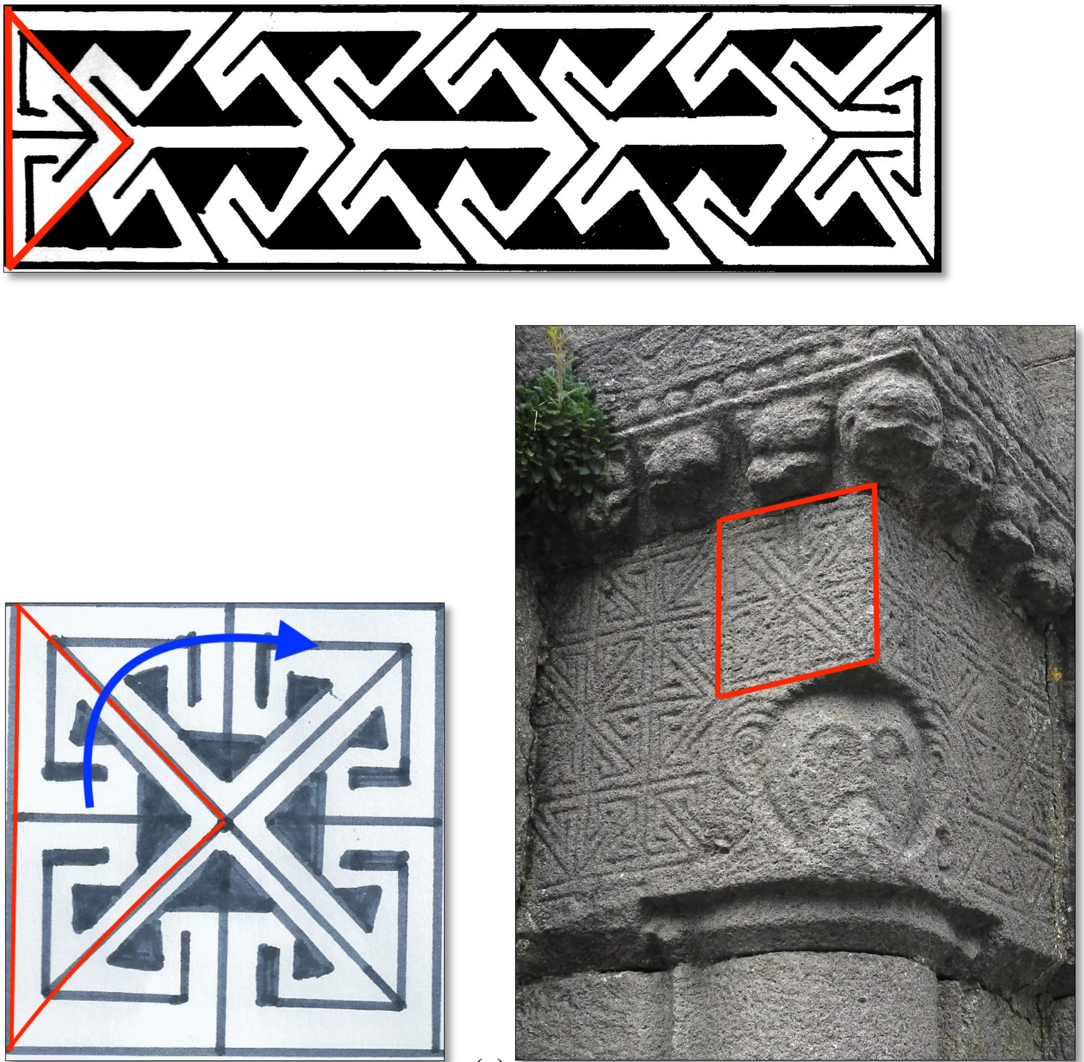
(b) 

Fig. 8.17

(a) A composition formed of a pair of two-fold rotationally symmetric rows. To create a mitre pattern (b), Insular makers omitted the spiral base units within the rows themselves (outlined in red) and made the mitre structures contiguous, as if pulling them together (blue arrows). Each end of the composition containing paired rows (right and left) contains three spiral base units in its mitres (as shown in Fig. 8.14a-b). However, the resulting mitre pattern (b) has four rather than six spiral base units because, when artists conceptually ‘pulled’ these mitre units together from either side of the composition containing a pair of rows, some mitre units overlapped each other, as indicated by blue arrows (© Author)

(b) A mitre pattern derived from a pair of two-fold rotationally symmetric, diagonal rows (© Author)



(a)

(b) (c)

Fig. 8.18

(a) The two, mirror-symmetric mitre units (red) at the end of a composition formed from a pair of mirror-symmetric diagonal rows, where the final trunks emerge from the adjacent border between those two rows (as explained in Fig. 8.16b) (© Author)

(b) Those two, mirror-symmetric mitre units (red), repeated with rotation at 90 degrees four times (blue arrow). Negative line elements widened into shapes to maintain path evenness (© Author)

(c) A series of mitre patterns derived from mirror-symmetric pairs of rows, located above a column at the apse of the Nun's Church, Clonmacnoise, Ireland. A mitre pattern with the structure of diagram (b) is outlined in red (© Author)

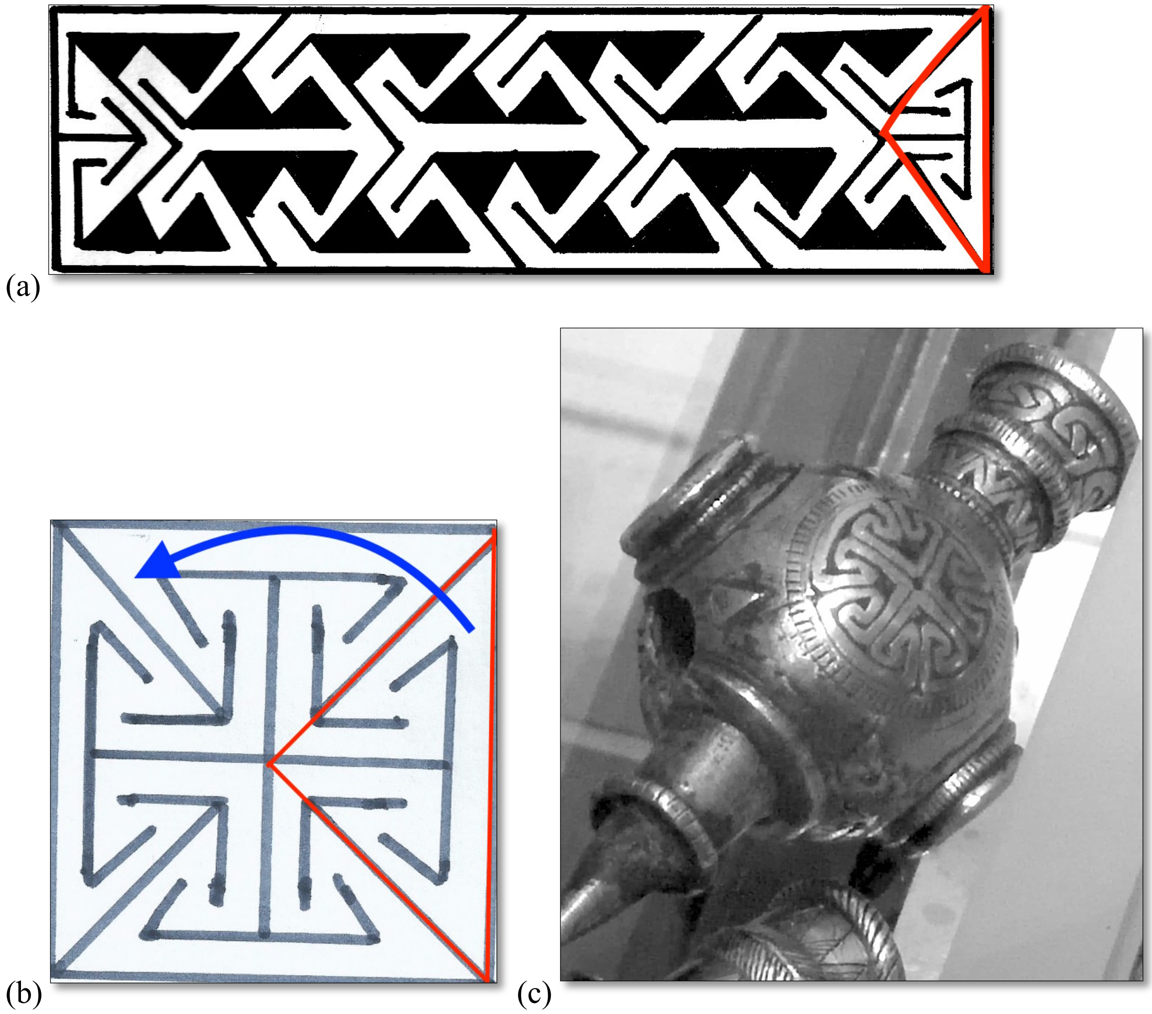
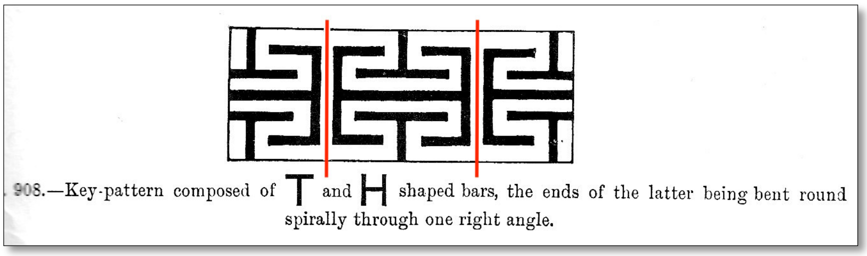


Fig. 8.19

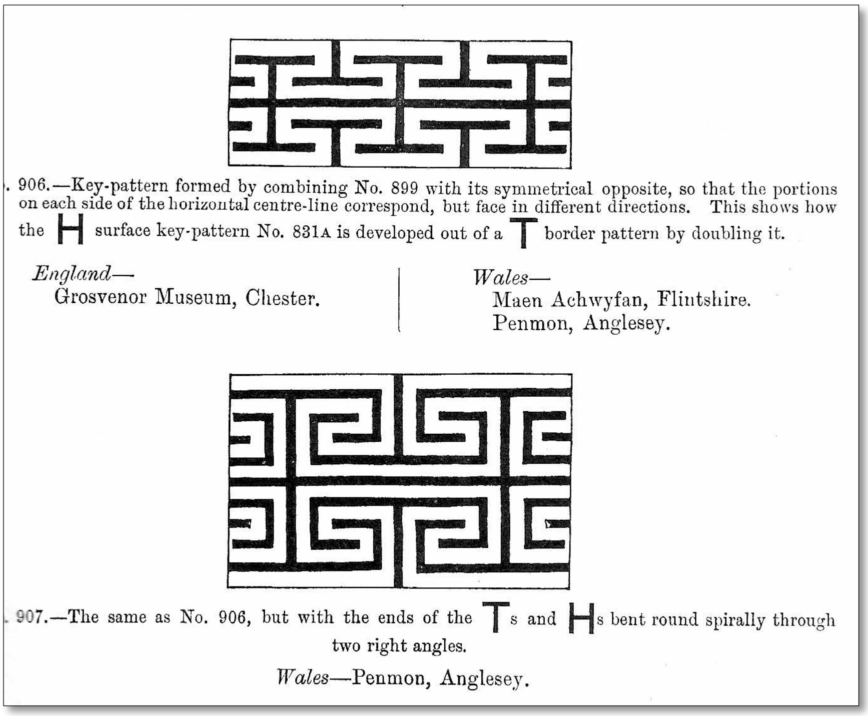
(a) The two, mirror-symmetric mitre units (red) located at the end of a composition formed from a pair of mirror-symmetric diagonal rows, where the final trunks emerge from the outer borders of the rows (as explained in Fig. 8.16c) (© Author)

(b) Those two, mirror-symmetric mitre units (red), repeated with rotation at 90 degrees four times (blue arrow) (© Author)

(c) A mitre pattern with the structure of diagram (b) on the terminal of a silver thistle brooch from the Viking-Age Skaill Hoard, Sandwick Parish, Orkney. Now held in National Museums Scotland (© Author)



(a)



(b)

Fig. 8.20

(a) Allen's diagram of the orthogonal key pattern from the Harley Golden Gospels and its 'T' and 'H' bars. Added red lines indicate spaces between the negative line elements that allow the path to travel continuously through these areas (Allen and Anderson 1903, vol. 1, part 2, p. 335, no. 908)

(b) Allen's diagrams of compositions formed from pairs of orthogonal rows, and their 'T' and 'H' bars. Each row is separated from its pair by a horizontal border. There are no open spaces between the negative line elements to allow the path to travel between the two rows (Allen and Anderson 1903, vol. 1, part 2, p. 335, no. 906-907)

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(a)

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(b)

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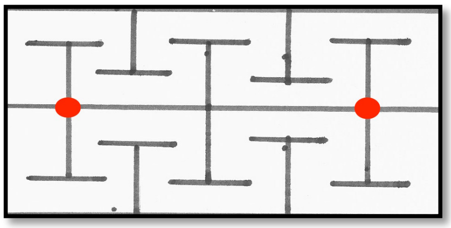
(c)

Fig. 8.21

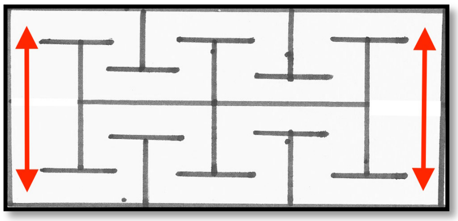
(a) The Harley Golden Gospels (British Library Harley MS 2788), folio 14v (British Library [accessed 23 July 2018])

(b) Detail of orthogonal mitre pattern. The illuminator drew the negative line elements in green and filled the path in with orange ink (British Library [accessed 23 July 2018])

(c) Detail of diagonal mitre pattern. The illuminator drew the negative line elements in green and filled the path in with blue ink (British Library [accessed 23 July 2018])



(a)



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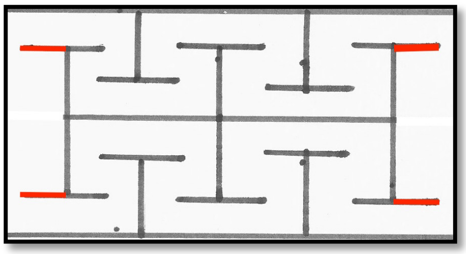

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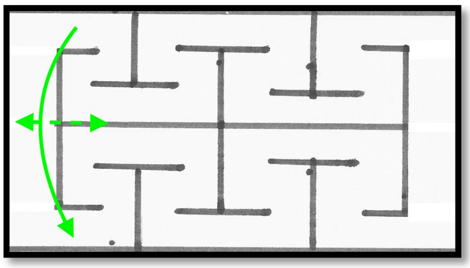

(d)

Fig. 8.22

(a) A composition of orthogonal, mirror-symmetric, paired rows, in which the final trunks at either end of the rows intersect the adjacent border between those rows (red dots) (© Author)

(b) The adjacent border between the two rows is omitted at either end of the composition, so the path can travel continuously between the two rows (red arrows) (© Author)

(c) The branches from the final spiral base units at either end of each row (highlighted in red) are omitted, to keep the path even in this area (© Author)

(d) A finished composition with mitres. The mitre unit from each row is mirror-symmetric to the one in the adjacent row (green) (© Author)

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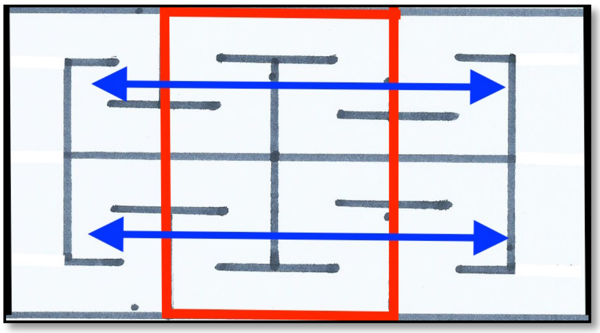
Fig. 8.23

Mitres in vertically arranged pairs of orthogonal rows on a 10th-century stone font from Penmon, Wales (two of these mitres are easily visible in the top right and bottom left corner areas of the composition). The whole composition in fact contains an odd number of individual rows, so one row contains a terminal rather than a mitre (bottom right corner) (Edwards 2013, p. 233, fig. AN54.2)

(a)



(b)

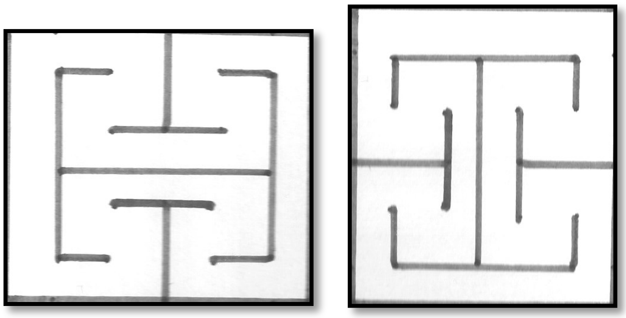


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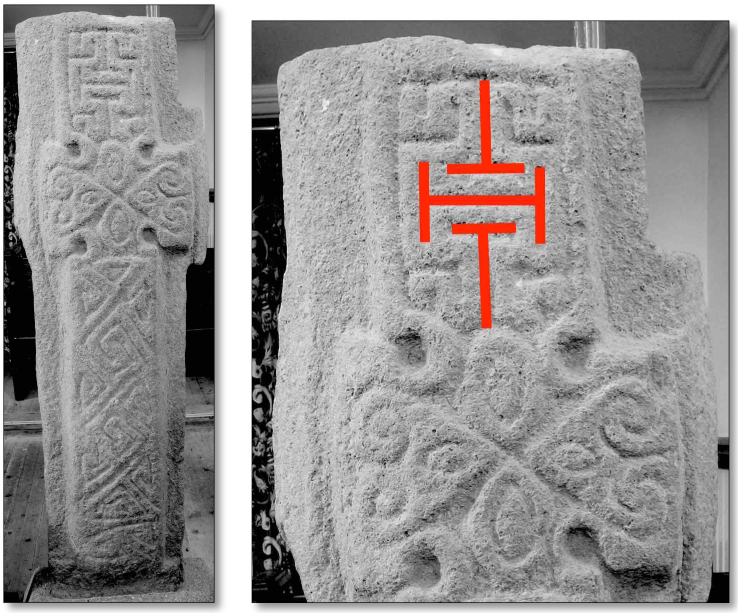
Fig. 8.24

(a) A composition of orthogonal, mirror-symmetric paired rows. To create a mitre pattern (b), Insular makers omitted the spiral units in the centre of the paired rows (outlined in red) and made the mitre structures contiguous (blue arrows), as if pulling the left and right side of the composition together (© Author)

(b) A mitre pattern derived from orthogonal, mirror-symmetric paired rows (far left), identical to that from the Harley Golden Gospels (far right), after it has been rotated 90 degrees (middle), with some additional embellishments also added to the branches (© Author; British Library [accessed 23 July 2018])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(b)

Fig. 8.25

(a) Orthogonal mitre pattern on the Kilmartin cross, with annotated detail (© Author)

(b) Curvilinear spiral pattern with negative space imitating orthogonal mitre pattern on the other side of the cross, with annotated detail (Historic Environment Scotland [accessed 23 July 2018])

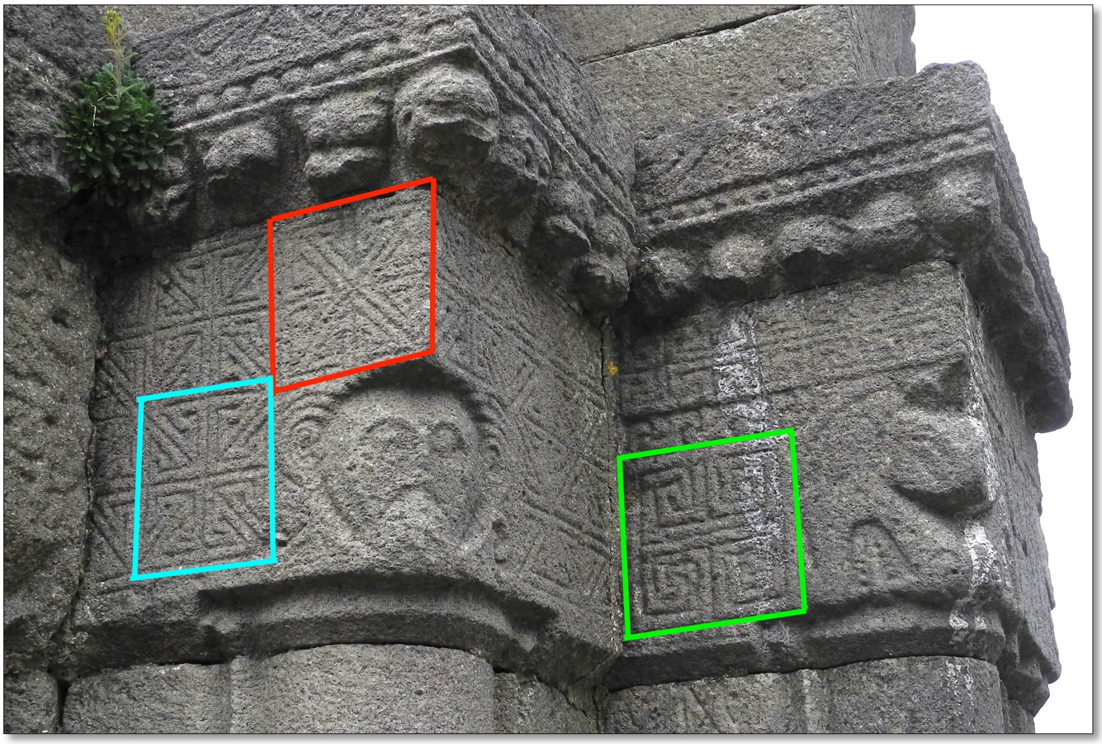
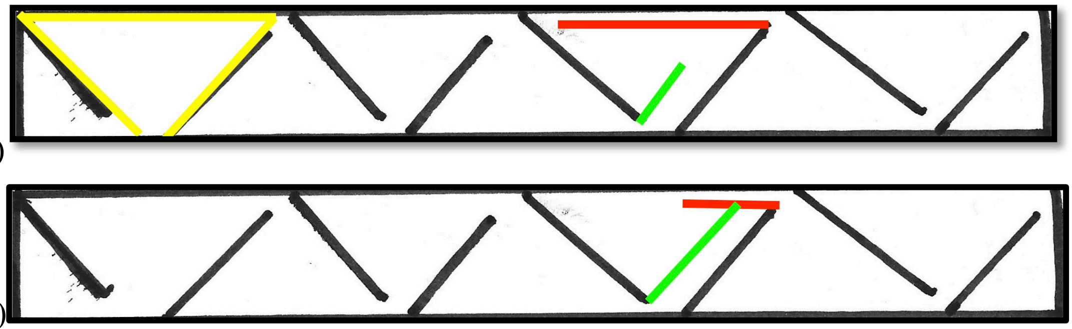


Fig. 8.26

Three different mitre patterns (one orthogonal as in the Harley Golden Gospels (green), and two derived from the two different mitre structures found in diagonal, mirror-symmetric pairs of rows (blue and red)) above the columns at the apse of the Nun's Church, Clonmacnoise, Ireland (© Author)

(a)



(b)

Fig. 8.27

(a) Trunks (black) in a partially-finished diagonal row, with the triangular space containing a spiral base unit between two trunks outlined in yellow. The longer branch in a spiral unit (red) lies along the longest side of this triangular-shaped unit. The shorter branch in the unit is highlighted in green (© Author)

(b) The same diagonal row, with the longer branch within a unit drawn too short (red), making the path too wide, and the shorter branch (green) drawn too long, so it runs into the longer branch and inappropriately cuts off the path (© Author)

(a)
(b)

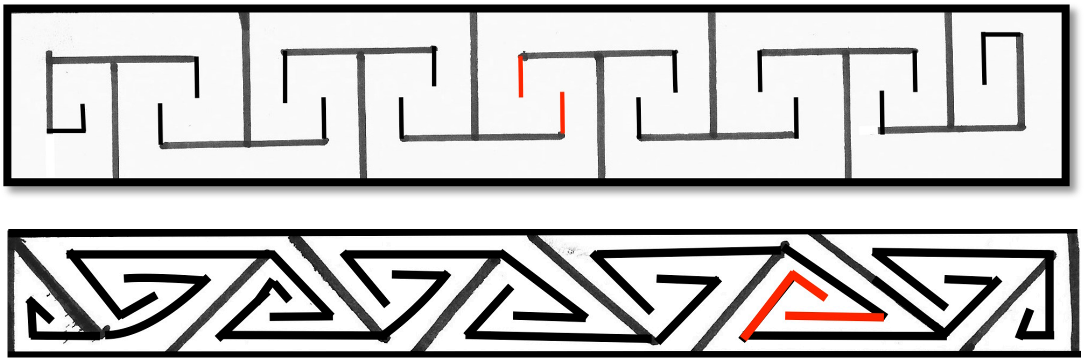


Fig. 8.28

(a) An orthogonal row composition with embellishments (examples highlighted in red) included as single line segments distal to the branches (© Author)

(b) A diagonal row composition with embellishments (examples highlighted in red) added as a single negative line element or series of intersected negative line segments distal to the branches (© Author)

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(b)

Fig. 8.29

The Hilton of Cadboll cross-base. Pictish, Hilton of Cadboll, Easter Ross, Scotland. Embellishments altered to be curvilinear and raised into bosses (green), triangular embellishments with line segments placed at 45 degrees to the branches rather than 90 degrees (red), rectangular embellishments (yellow) (Annotated, Henderson and Henderson 2004, p. 187, fig. 273)

(a) 

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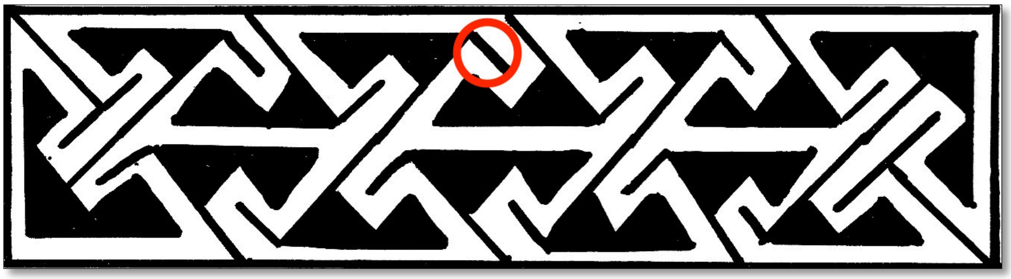
(b)

Fig. 8.30

(a) A diagonal row, with triangular embellishments on the longer branch in each unit (red). The shorter branch (green) approaches these triangular embellishments, forming a two-stranded spiral and keeping the path even (© Author)

(b) Detail of key pattern from the Book of Kells folio 183r, with rectangular embellishments (only some finished with dark colour) (Annotated, Trinity College Dublin 2012)



(a)

(b)

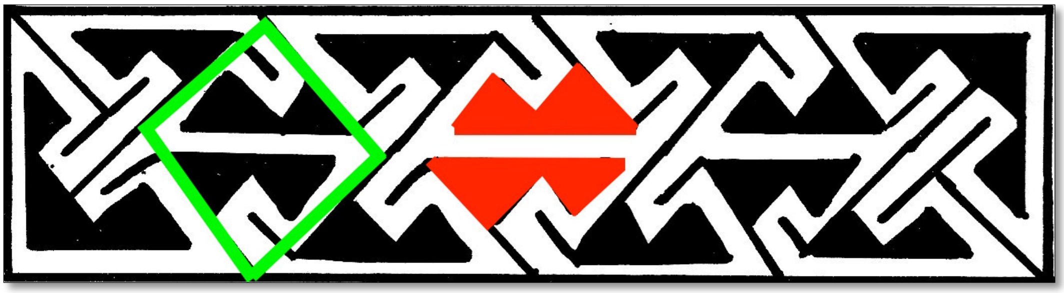
(c)

Fig. 8.31

(a) A pair of diagonal, two-fold rotationally symmetric rows. The shorter branch in the spiral base unit is circled in red (© Author)

(b) Annotated detail of key pattern in the St Gall Gospel Book, p. 266. Red arrow indicates embellishment expanded into a single large triangle shape (which the illuminator coloured in with yellow ink). By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

(c) Annotated detail of key pattern in the St Gall Gospel Book, p. 266. Area circled (red) where the shorter branch within the unit was omitted. By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 266 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

(a)


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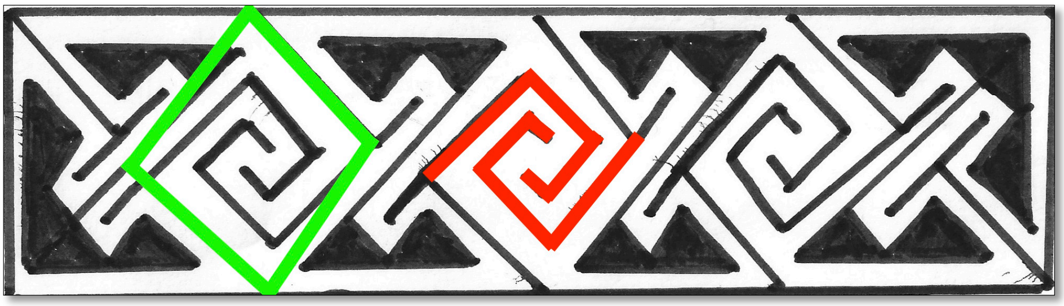

Fig. 8.32

(a) Adjacent pairs of long branches (red) in a diagonal, two-fold rotationally symmetric, pair of rows. The area comprising the two adjacent spiral base units that contain these branches is outlined in green (© Author)

(b) Altered diagonal (running-dog-like) row multiples, with the same branches and embellishments (red) as those in (a), altered so that they are no longer adjacent but interlocking to form a two-stranded spiral (as if the branches and embellishments bent around each other, with the triangular shaped expansions omitted). These two interlocked branches now become a base unit, twice the size of the original individual units. The same area once comprising the two adjacent units is outlined in green (© Author)

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(a)

(b)

Fig. 8.33

(a) A Pictish stone fragment from Drainie (Moray, Scotland) with a mix of altered diagonal row multiples (red) and a diagonal, two-fold rotationally-symmetric pair of rows (green) (Annotated, Historic Environment Scotland 2002)

(b) An intact mitre in an altered diagonal row multiple (the other corners are broken). Invermay cross fragment, Pictish, Perth and Kinross, Scotland (© Author)

(a)

(b)

(c)

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Fig. 8.34

(a) One branch omitted on each end of every pair of intersected trunks, forming C-spirals. Each spiral base unit has two strands. Pictish sandstone panel from Rosemarkie (1992.2), Easter Ross, Scotland. Now held in Groam House Museum. 136x30cm (© Author)

(b) One branch omitted on each end of every pair of intersected trunks, forming S-spirals. Each spiral base unit has two strands. Cross shaft from Abercorn, West Lothian, Scotland (© Author)

(c) Both branches retained at the end of every pair of intersected trunks. Each spiral base unit has four strands. Cross shaft: St Andrews 14, St Andrews, Fife, Scotland. With detail (Annotated, Historic Environment Scotland, 1990)

Fig. 8.35

Annotated detail of an altered diagonal row multiple in the St Gall Gospels, p 209. Different omission or retention of branches at the ends of intersected pairs of trunks are highlighted in red (S-spiral, C-spiral, and another instance in which three branches are retained). By permission of: St. Gallen, Stiftsbibliothek, Cod. Sang. 51, p. 209 – Irish Evangelary from St. Gall – Quatuor evangelia (St. Gallen [accessed 3 November 2017])

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Fig. 8.36

A single-stranded diagonal composition from the Lindisfarne Gospels folio 210v, with the outer units filled in with blocks of green colour (British Library [accessed 8 June 2018])

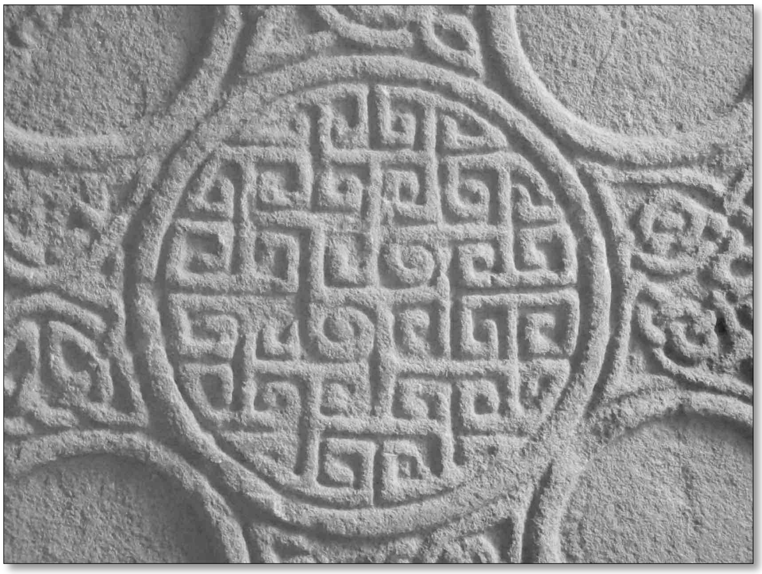

Fig. 8.37

A single-stranded orthogonal composition in the centre of the cross head of the Pictish Rossie Priory cross-slab, Perth and Kinross, Scotland (© Author)

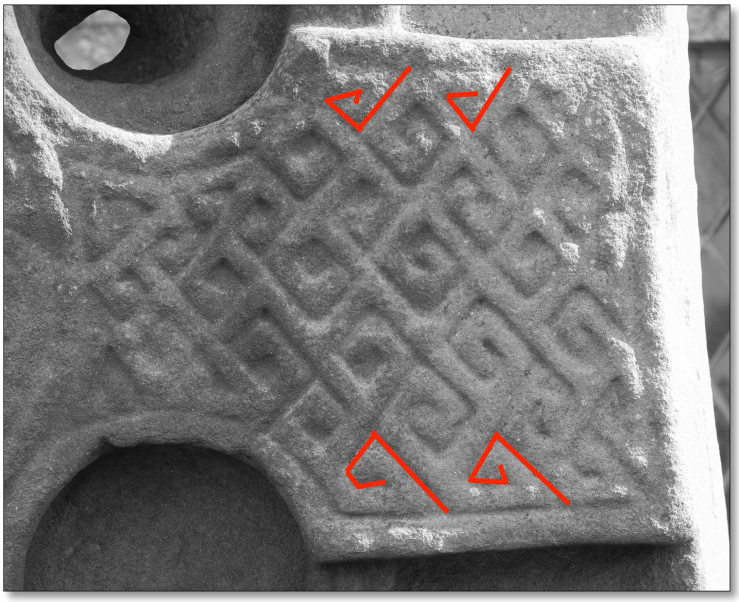

Fig. 8.38

Triangular-shaped spiral units (red, attached to trunks that intersect the outer border) around the edges of a single-stranded diagonal composition on the right arm of the Aberlemno churchyard cross-slab, Angus, Scotland (© Author)

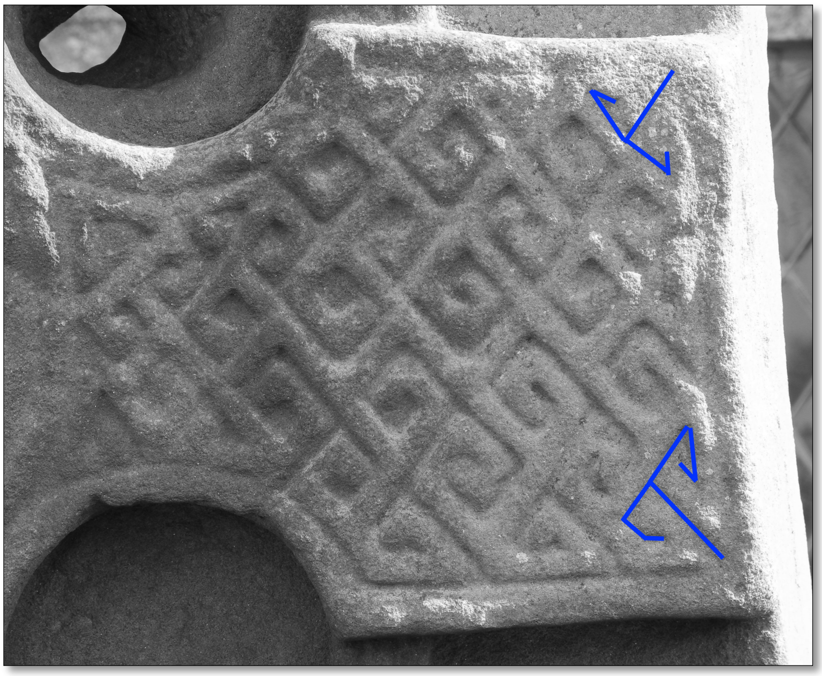

Fig. 8.39

Mitre structures (blue) in the corners of the Aberlemno Churchyard cross-slab's single-stranded diagonal composition (© Author)

Fig. 8.40

Individual spiral base units (red) from the outer edges of a single-stranded diagonal composition, disarticulated and symmetrically rearranged in single rows that form the two vertical borders of the Pictish Meigle 6 cross-slab, Perth and Kinross, Scotland (© Author)

Fig. 8.41

A key pattern composition on the Kilmartin cross containing both units from the outer edges of single-stranded diagonal compositions (blue) and units joined to form double-stranded S-spirals from an altered diagonal row multiple (red) (© Author)

Fig. 8.42

Details of spiral units on the left versus right side of the panel. On the left, embellishments are formed of three negative line segments (red) (before reaching the branch) and are thinly carved. On the right, embellishments are formed of two negative line segments (red) (before reaching the branch). The embellishment line segments at the centre of the spiral unit are carved very wide (© Author)

Fig. 8.43

It is possible to create 'loose' units on the left side of the panel (black annotations, left) and still maintain the key pattern's structural integrity, but it is not possible to create 'tight' units on the right side of the panel (black annotations, right and inset) without compromising the path (Annotated, © Jon Bailey and Susan Seright)

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Fig. 8.44

Total lengths of pairs of intersected trunks, measured in centimetres, with expanded details. Blue and black text simply helps the reader read the different measurements (Annotated, © Jon Bailey and Susan Seright)

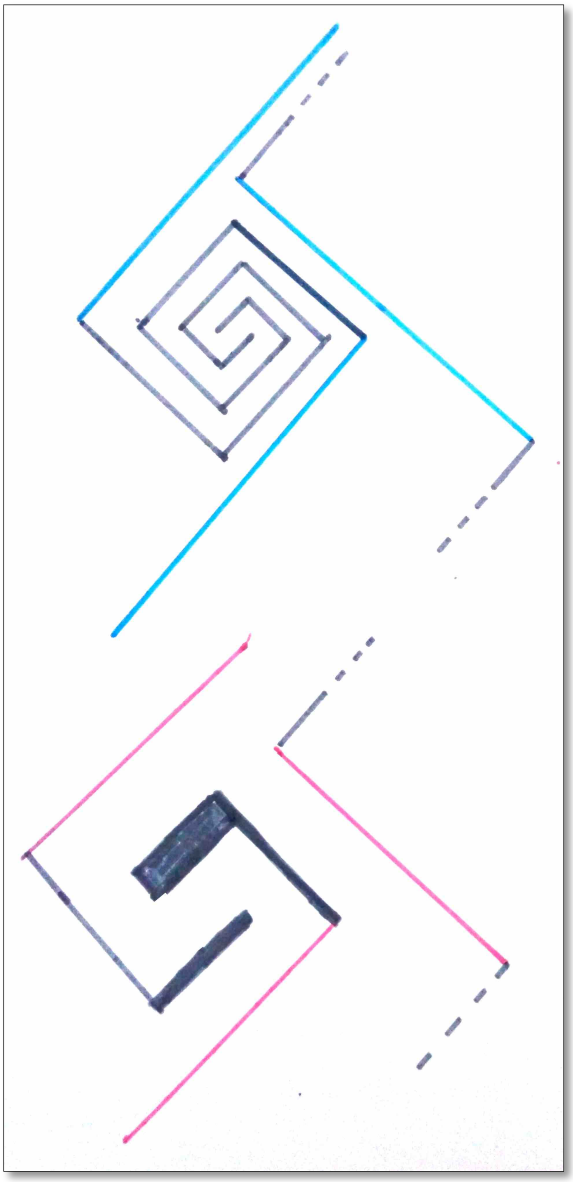

Fig. 8.45

If intersected pairs of trunks are lengthened (blue) within a closed composition, they must lie parallel and perpendicular to each other in a more tightly-packed fashion. As a result, the path between them, and their branches and embellishments (black), is narrower too, leaving more room for extra negative line segments or 'turns' within each spiral unit.

If paired trunks are then shortened in the same composition (pink), they must be spread out slightly to fill the available space. As a result, the path between them, their branches, and embellishments (black) is wider, leaving less room for extra line segments or 'turns' inside the spiral units (and often requiring the widening of these negative lines) (© Author)

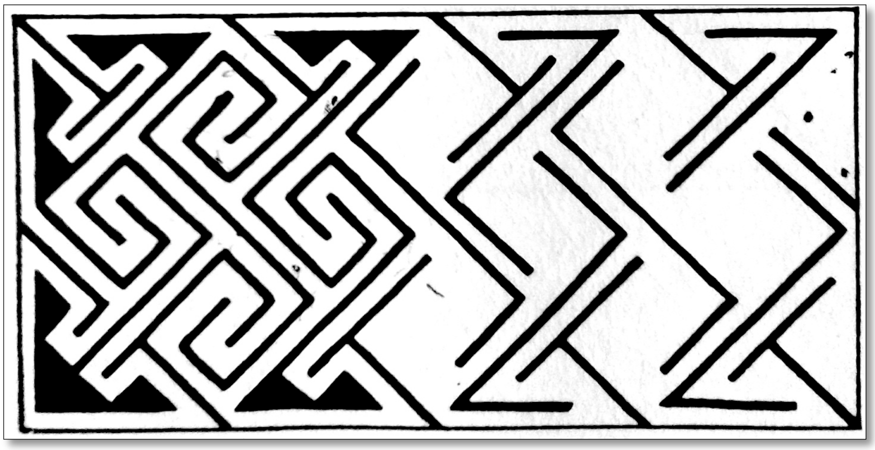

Fig. 8.46

Allen’s template (Allen and Anderson 1903, vol. 1, part 2, p. 348, no. 958)

Fig. 8.47

The Glenmorangie Pictish throne reconstruction in National Museums Scotland storage, with detail (© Author)

9. Conclusion

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Fig. 9.1

The altered key pattern composition on the Llangyfelach cross-base. The mitre units on the left side of the composition are in a form commonly found in mirror-symmetric, diagonal pairs of rows throughout the Insular world. The trunks in the leftmost spiral units before the mitres in these two rows each intersect the outer border. The mitre structures are illustrated in Fig. 8.19a.

Typically, in such compositions, the mitres at the other end of the rows contain trunks that intersect the adjacent border between the two rows (Fig. 8.18a). On this cross-base, however, the maker created mitre units on the right side of the composition by carving additional, unusual, trunk-like negative lines (highlighted in red, intersecting the outer border at the top and bottom corners of the composition) in order to make the right-side mitres look similar to the left-side mitres. This created the impression that the whole composition is mirror-symmetric from right to left, and not just from top to bottom (Annotated, from W.G. Thomas 1976, plate 25b)

Fig. 9.2

A museum display at the Clonmacnoise visitor centre, which depicts an early medieval abbot of Clonmacnoise providing a stone carver and his apprentice with a diagram containing instructions for the design of a high cross. With a detail of the abbot’s blueprint. This display represents the common, modern assumption that the Insular designer, as an informed artist, was a separate person from the craftsperson or manual labourer who executed the designer’s plans (By permission of Dr Katherine Forsyth)