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Shapes of Early Sculptured Crosses of Ireland

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Abstract

This paper proposes the hypothesis that the shapes of early sculptured crosses of Ireland were devised by constructive geometry employing concepts and procedures like those used to devise the shapes of full-page illuminations in the early Insular Gospel manuscripts. Both kinds of design exhibit the same aesthetic rules: parsimony of ratios and commodulation of measures. That is to say, relations among the principal dimensions are linked by one or two elementary ratios inherent in simple geometrical figures, the circle and the cross. The hypothesis is developed by showing that stone cross shapes, similar to cross-page designs, can be replicated time and again by straightforward, catenulate construction with compass and straight-edge. There is no attempt to identify the source of the designs, or their possible symbolism, or their developmental sequence, for reasons that will be given. The focus, rather, is on the nature of the individual shapes—something never before articulated—and on how they can all be alike without any two being the same.

The Irish high crosses give up their mysteries one at a time. Some of them have receded now beyond recovery, such are the erosions of time and weather and cultural evolution. But the painstaking researches of scholars, archaeologists, art historians, and amateurs are gradually restoring understanding of many aspects of these striking monuments from early Irish Christianity. We now have some idea of when those sculptured crosses were made, of their iconography, their materials, their distribution, and their purpose. The decoration, too, is beginning to become clear, at least in art historical terms; motifs can be traced to other works often in other media, in interlace, in specific biblical scenes, in the bosses that often appear at the intersection of circle and cross, or elsewhere.

Yet the individual cross-shapes which bear the decoration have never been explained.[1] They vary in endless ways. The crosses are large or small, with rings perforated or not, surfaces decorated or not, the decoration sometimes pictorial sometimes abstract, rings thick or thin, curves at the armpits deep or shallow, and so on. All this variation presents us with a seeming paradox: all are recognizable as "Irish high crosses" by design as well as by geography and history, yet no two have the same shape. Every one that we know must be in some respect a copy of some of its predecessors, even as it is not a copy of any one of them. This paradox disappears when we draw the distinction between following the same methods of design, and following the same steps. Following the same steps produces the same form again—the goal of copying procedures. Following the same methods, but *not* the same steps, produces another form, which is like the others, without being a copy. That is the goal of creative procedures tied to a tradition.

How to generate these shapes, how to understand them, how to copy them, what other things they are like—these will be the topics addressed in the following pages. If the hypothesis presented here is right, it can yield a new dimension to understanding the tradition of the sculptured crosses of early Christian Ireland.

Replicating Shapes of Stone Crosses

The ringed crosses will be examined here; they are the most numerous,[2] and their designs encompass those of the unringed crosses. All require the construction of right angles (for the cross) and circles (for the ring). These two elements will also initiate the designing of any of the shapes of the early sculptured ringed crosses. Fig. 1 shows time-honored steps for constructing right angles of a cross (Fig. 1, a) and concentric circle (Fig. 1, b).

> (a) Begin by drawing a single line H on a flat surface. Next, set the fixed point of a compass at one end of that line, the opening at more than half the line's length, and sketch the path of the other point as it moves above and below the given line; repeat this operation beginning from the other end of the given line. The two paths intersect above and below the given line. Finally, connect the two intersections with a straight line V. There is the cross shape. This procedure also locates the midpoint of a line of given length, which becomes the center of a circle whose diameter is equal to that of the given line (b).
>
> (b) Fix one point of the compass at the midpoint of the line, set the other point at one end of the line, and guide it around the center to describe a circle.

If the artisan is working in book illumination or stonecutting or woodworking, a square of identical extension will also be needed. Construct it as in Fig. 1, c. Latent within this last figure lie all the ratios and proportions needed for devising shapes for standing crosses cut from stone, the same ones needed to devise forms for nearly every one of the carpet-page illuminations of the early Insular Gospel manuscripts.[3]

> (c) Keeping the same radial measure of Fig. 1, b, locate corners of an enclosing square, which will be divided by the cross into quadrants.

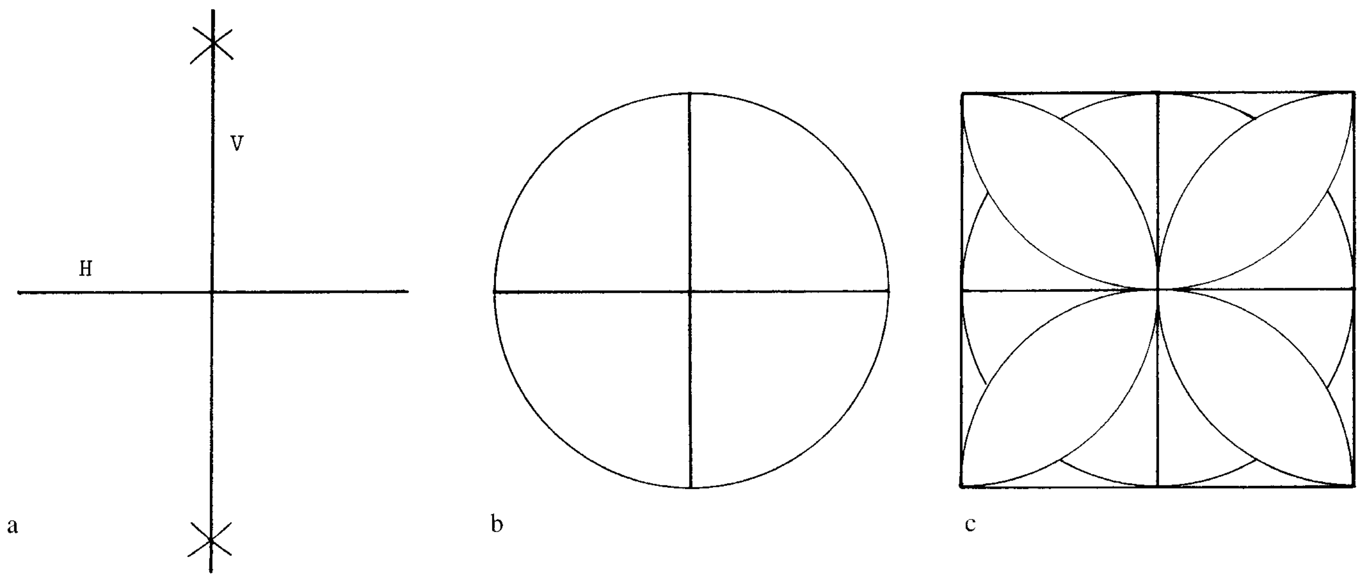


FIGURE 1. *A practical method of constructing cross, circle and square.*

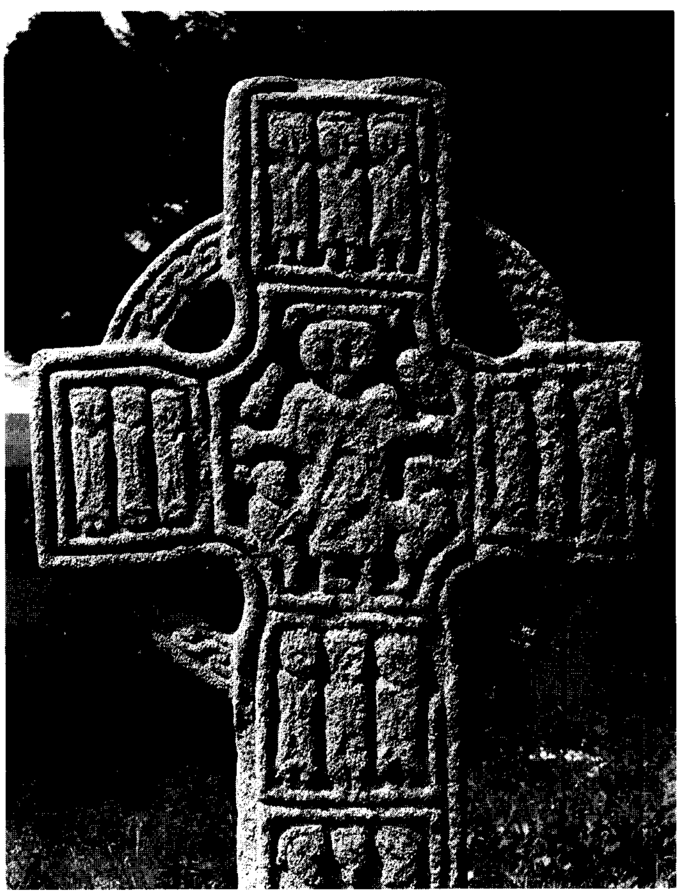


FIGURE 2. *North Cross, Castledermot, Co. Kildare (photo: Dúchas, The Heritage Service, Ireland).*

The point here is not that artisans would have used compass (or string) and straight-edge in laying out cross designs. That they did seems to be self-evident. Rather, it is that the designs will not be understood aright without recognition that fundamental proportionings of these crosses proceed from the use of these simple tools. The shape of a stone cross, it will be shown, answers to constructive geometry, with all the basic dimensions accounted for by their commodular relations. Only one dimension needs to be known, as "given," and it is beside the point what that dimension is according to any standard scale of measure. In fact, centimeter or foot-inch measures of the separate components of a design are generally unrevealing: to find, say, that a ring has its outer circle 71 cm in diameter, its inner circle 52 cm in diameter, does not point the way to understanding anything more about the cross's shape. The geometrical ratio approximated in pairs of measures like these *is* revealing, though, when expressed in terms of constructional methods. That ratio is the key to the shapes of two of the crosses analyzed below (Figs. 5, a, and 18, a).

The procedure of the demonstration here will be one of replicating the shapes of a number of crosses and comparing the models to the artifacts. The models must be accurate; the best test of accuracy, I believe, is congruence of photograph and drawing, taking into account the effects of erosion and breakage. Equally, the models must be simple; the best test of simplicity is that every primary dimension shall be related to all others by *direct* derivation using the simple tools of the geometer.

The initial replication will be that of the basic contour of the North Cross of Castledermot, Co. Kildare (Fig. 2). Its central shape emerges immediately from dimensions inher-

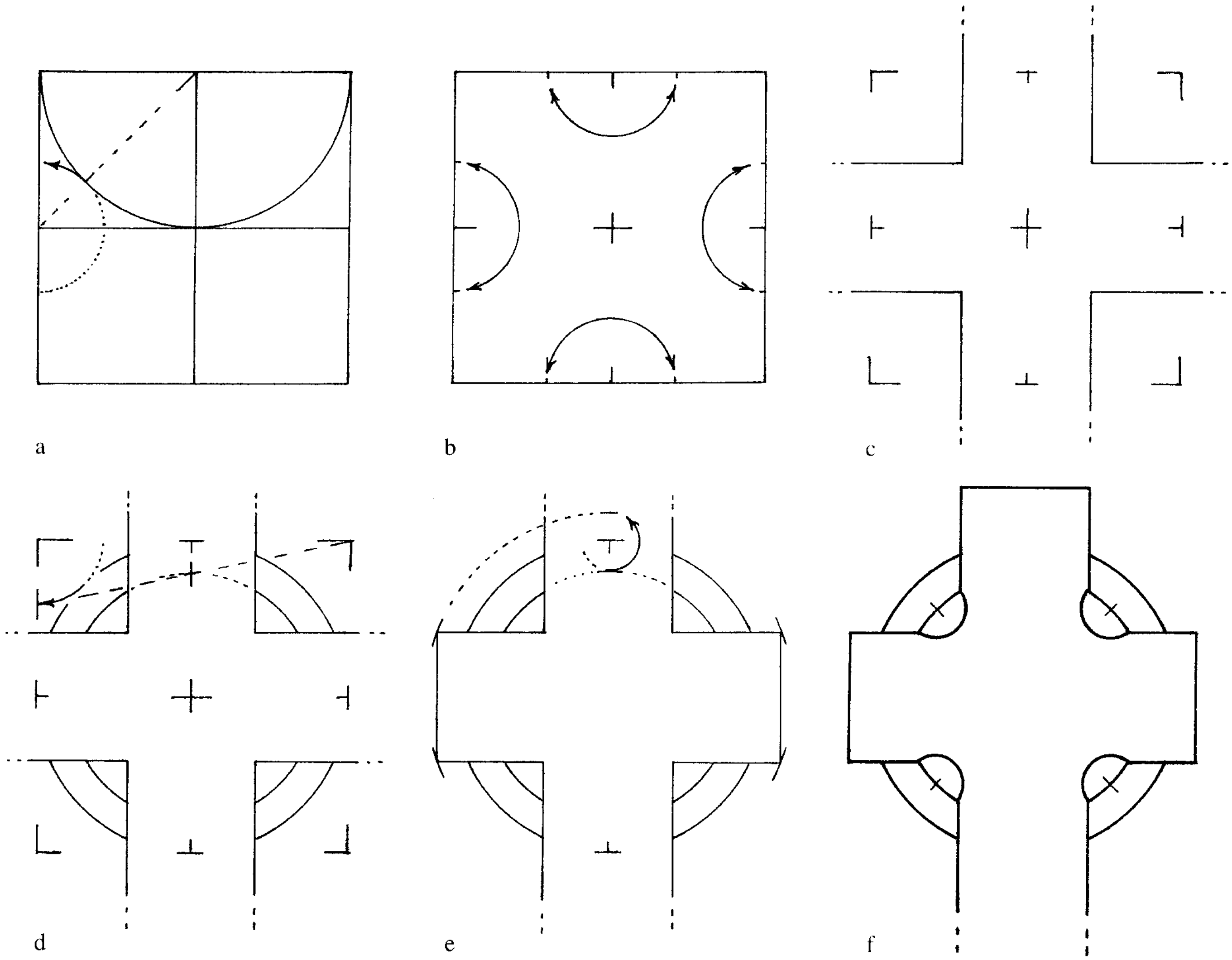


FIGURE 3. *Steps to replicate the shape of North Cross, Castledermot, Co. Kildare.*

ent in Fig. 1, c, as soon as diagonals are added. Only two additional measures are needed. One measure is used for the transverse dimension of the arms and the shaft of the cross (Fig. 3, a), and the other for the thickness of the ring (Fig. 3, d). The first of these measures is the length of the diagonal of a quadrant minus the radius of a semicircle (radius same as that of the whole circle). It needs to be derived only once, though it can be derived separately in each of the eight places it will be used.

(a) In Fig. 3, a, it is derived once, by placing the fixed point of a compass or pair of dividers at the midpoint of a side of the square, the moving point at the nearest intersection of the diagonal of a quadrant and a semicircle.

(b) This measure is then copied with dividers to mark points on either side of the midpoints of all four sides of the square.

(c) Connecting these points in pairs by parallel lines outlines the arms and shaft of the cross.

The second measure is derived directly from the first measure, and is used to set the thickness of the ring.

(d) Copy—or derive—the first measure this time from any corner of the square to mark a point along one of its sides. Derive half of that to be the second measure, and mark it along a segment of the enclosed cross—a straight line to the next corner will do this. From center to this new mark is the radius of an inner circle, completing the outline of the ring.

Finally, cross-arm length and curves at the armpits are set.

(e) Use the compass to copy the difference in radius length between outer (original) circle and the inner circle of the ring to mark a point along an extension of the cross; this derives the radius of a still larger circle, which is used to set the length of the cross-arms.

(f) The curves at the armpits of the cross are plotted from markings already in place: their centers are where diagonals of the quadrants intersect the inner circle of the ring, and their radii reach to where the inner circle intersects the nearest outline of the cross.

The North Cross at Ahenny, Co. Tipperary (Fig. 4), will provide the second illustration of how the cross-shapes can be derived by straightforward construction with compass and straight-edge. Replication of its shape in Fig. 5 begins from the same source, illustrated in Fig. 1, c, that underlies the Castledermot North Cross. This time the ring will be plotted first.

(a) Fix one compass point at a corner of the square and the other at an adjoining corner; that measure is copied from the corner to the nearest segment of an underlying cross (1).

Alternatively, fix one compass point at a corner of the square and the other at the center of the square; copy the diagonal measure to mark a point along the side of the square (2), and then take the measure shown, from the farther midpoint of a side to the point just marked, and copy it to mark a point along the cross (3).

Either method will set the radius of the inner circle of the ring.

(b) Breadth of the cross arms is set by copying to the sides of the square the measure from each corner to the inner circle of the ring, then connecting the points located thus by pairs of parallel lines. (Length of the arms is not explicated in this illustration.)

(c) To plot the radii of the armpits, sketch a circle at the center with diameter equal to the breadth of the cross-arms. Centers of the arcs are the intersections of the lines set in b.

Once again the design has required only two measures to be derived from the underlying circle, cross, and square—one for the thickness of the ring, the other for the transverse dimension of the cross-arms.[4] All others are entailed.

St. Kevin's Cross, Glendalough, Co. Wicklow (Fig. 6), will provide a third example. Its shape is typologically among the simplest: the shaft is untapered, shaft and cross-arms are of equal breadth, and an unperforated disc encloses the intersecting members of the cross. Unusual simplicity lies in the lack of re-entrant curves at the junction of the arms and the upright of the cross (the armpits). Stages of the development of the shape are illustrated in Fig. 7.

FIGURE 4. *North Cross, Ahenny, Co. Tipperary (photo: Dúchas, The Heritage Service, Ireland).*

(a) In the underlying square, sketch diagonals of pairs of quadrants (1). Then sketch circles centered where the diagonals intersect, diameters equal to the side of a quadrant (2). The shortest measure from a corner of the

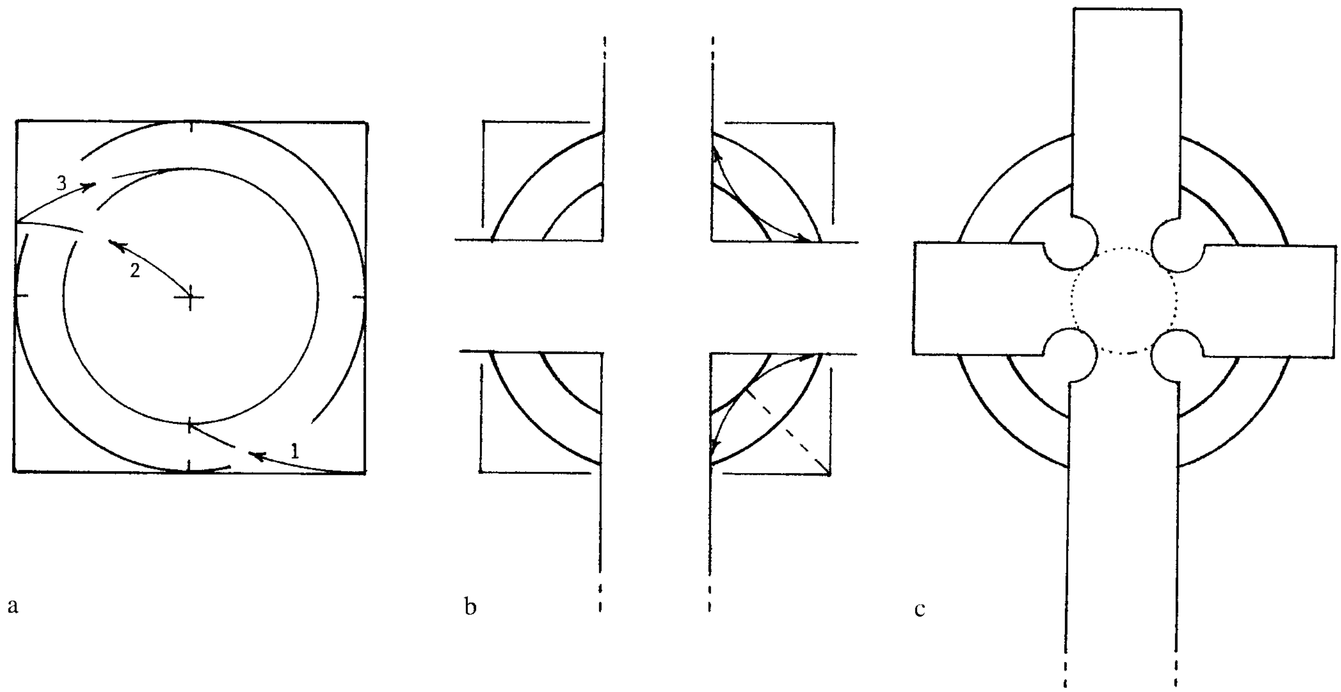


FIGURE 5. *Steps to replicate the shape of North Cross, Ahenny, Co. Tipperary.*

square to one of these circles is copied then from each corner to mark eight points along the sides of the square (3). This divides a side of each quadrant into two segments; call the shorter segment α, the longer segment β.[5]

(b) Connect these points, as usual, with pairs of parallel lines to set the outline of a solid cross where arms and upright join.

(c) The circle enclosing the center of the cross has as its radius the distance from the center of the figure to where the diagonals and small circles intersected in a.

This is the central plan for the circle and cross of St. Kevin's Cross.

The lengths of the cross-arms are already set by the sides of the underlying square. Next, the vertical dimensions of the shaft.

The height of the shaft above the center of the cross-arm is equal to the measure $\alpha + 1$ (where any quadrant side equals 1). Easiest plotting is to extend by length α above the underlying square (Fig. 7, b). The length of the shaft below the center of the cross-arm is equal to the measure $\beta + 3$. Easiest is to extend by length β below the underlying square, as in Fig. 7, b, and then (not shown) add the measure of the square below that. The cross thus has width and height in the ratio 2 : 5 (since α and β together are equal to 1).

Commodulation

The initial purpose of these first three examples has been to show that the cross shapes are conformable with shapes derived by elementary maneuvers of constructive geometry. A second purpose now is to articulate the commodulation of measures that is inherent in these shapes.

"Commodulation" is a technical term. In everyday sense, it signifies a linking of measures. The illustrations given thus far show that measures in these cross shapes clearly are linked. Their commodulation can be traced in the three replications above by noting the dependency of each step of the construction on a preceding step. To understand the shapes, however, calls for grasping the relations among the measures—the ratios, that is—which do the linking in a static form.

These commodular designs are not those of step-patterns, or grids, or any other patterns that follow a numerical scheme of layout. They are quite different from these in employing two kinds of measure. One is the kind expressed in small rational numbers such as 1 or 2 or 4 or 7. This kind is found in the dimensions of the underlying cross, circle, and square of Fig. 1. Thus, unity is the value of the first line laid down in Fig. 1, a (the "given" measure), from which the three concentric shapes in Fig. 1, c, were derived. This unity is divided by two when the given line is bisected to locate the center of the circle. With the construction of the square, each of the square's four sides is already divided by two. The result is four quadrants of the square and four quadrants of the circle.

From that point on, the measures are of the second kind, found in the diagonal measure of a square (or of a quadrant of a square), the diagonal of two adjacent squares, and the like, or in direct derivations from them. These measures cannot be expressed in ordinary numerals, or for that matter in fractions. In modern notation they incorporate quantities such as $\sqrt{2}$ or $\sqrt{5}$ or $\sqrt{3}$, which represent irrational numbers. Any such notation is a shorthand expression of a relationship among measures, that is, a ratio: thus $\sqrt{2}$ is a short way of expressing $\sqrt{2} : 1$. In that sense, the linking of measures is already implicit: everything proceeds from 1 (unity) and is expressed in terms of it.

The commodular network of the measures can be understood to begin with those having arithmetical relations, but usually only so far as the underlying cross, circle, and square are developed; then it develops with measures involving geometrical relations, in working out the measure for the ring, the transverse measure of the cross-arms, the concave curves at the armpits, and any other basic dimensions that inform the shapes of the individual crosses.

Replicating Shapes of Related Objects

The sculptured stone crosses are not innovative in having commodular outlines. The same principles of form can be recovered from a bookshrine and from full-page manuscript illuminations also from early Christian Ireland and Northumbria (not to mention manuscript *mise-en-page*[6]). Soiscél Molaise is a specially good illustration (Fig. 8). Here is another circle-and-cross design, similar to the designs of ringed stone crosses: it has a central cross with a concentric circle enclosing the intersection of its four members; concave curvatures resemble the armpit shapes typical of sculptured crosses; there is a smaller central circle with a decorative pattern (now lost). These are similarities that one can inventory by inspection.

The formal principles in its proportions need replication, however, if they are to be understood. In this instance, the commodulation of basic measures proceeds through two simple ratios already illustrated—the one which pervades the plan of the North Cross of Castledermot (Fig. 3), and another, which initiates the derivation of the shape of the North Cross of Ahenny (Fig. 5). They are deployed differently here, of course: the cross shape is different, and the design is radically different for the cross being enclosed within a rectangular frame.[7] Even so, the derivation of the initial ratios for Soiscél Molaise is only a simple variation of the derivation of the shape of the Ahenny North Cross (Fig. 5, a). How simple this variation is will be obvious if both procedures are recognized as beginning with the diagonal measure of quadrants of the underlying square. See Fig. 9.

(a) Fix one compass point at the end of a cross-arm within the underlying square and the other at one end of the intersecting cross upright; copy the diagonal measure to mark a point along the cross-arm (1); then take the measure from a farther corner of the square to the point just marked and copy it to mark a point along the side of the square (2). (This is the alternate method used in Fig. 5, a.)

(b) The frame extends the square vertically by the measure from the nearest corner to the point just marked. The outer circle of the ring is drawn with a radius set by

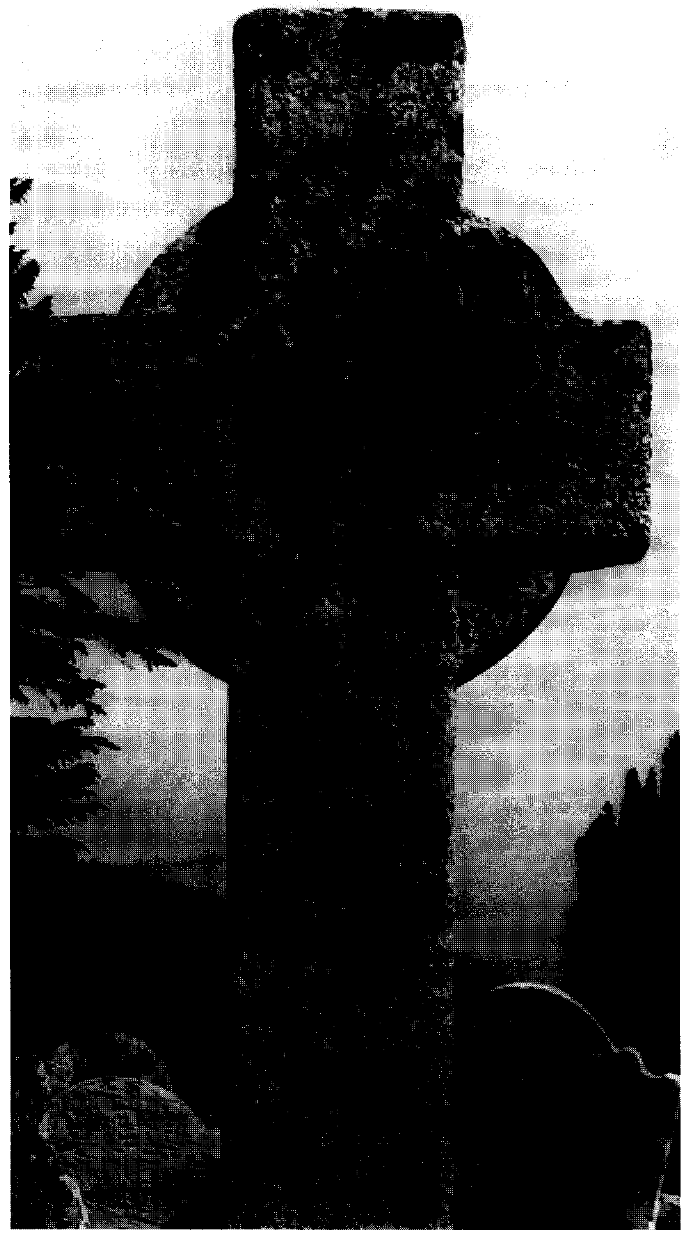


FIGURE 6. *St. Kevin's Cross, Glendalough, Co. Wicklow (photo: author).*

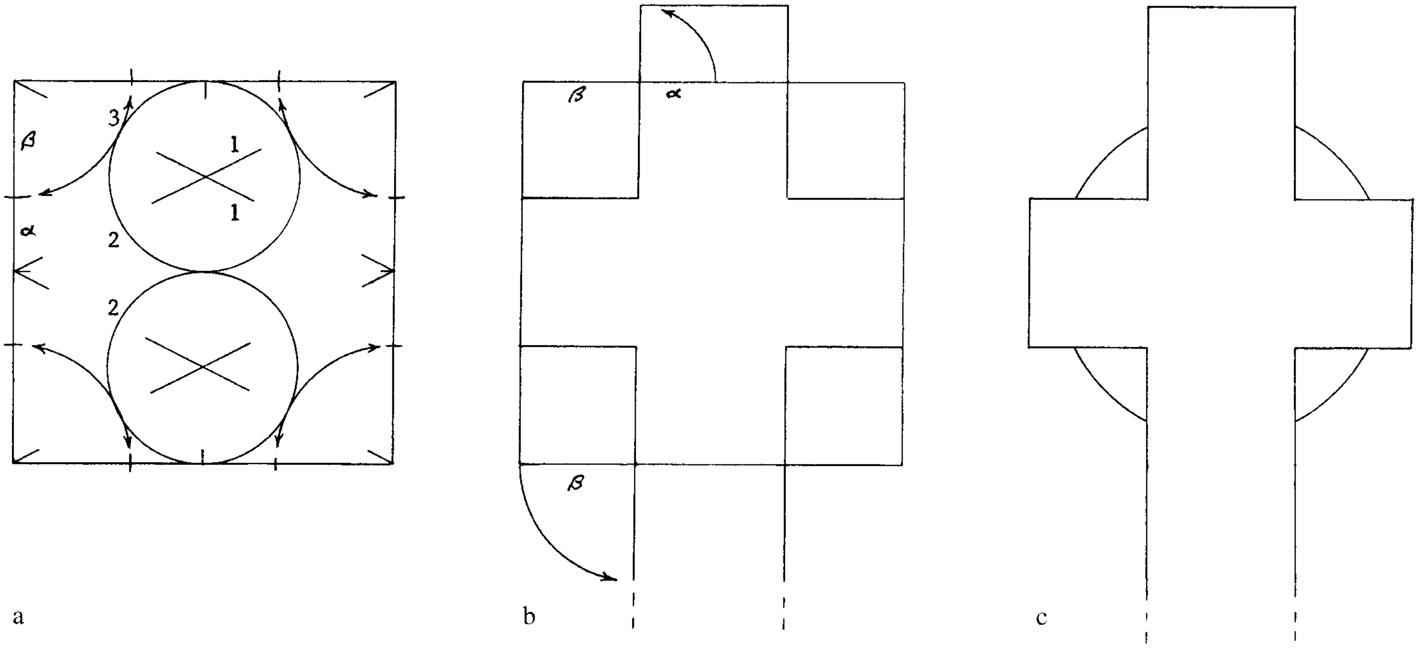
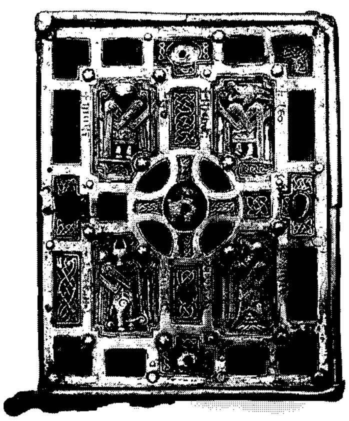


FIGURE 7. *Steps to replicate the shape of St. Kevin's Cross, Co. Wicklow.*



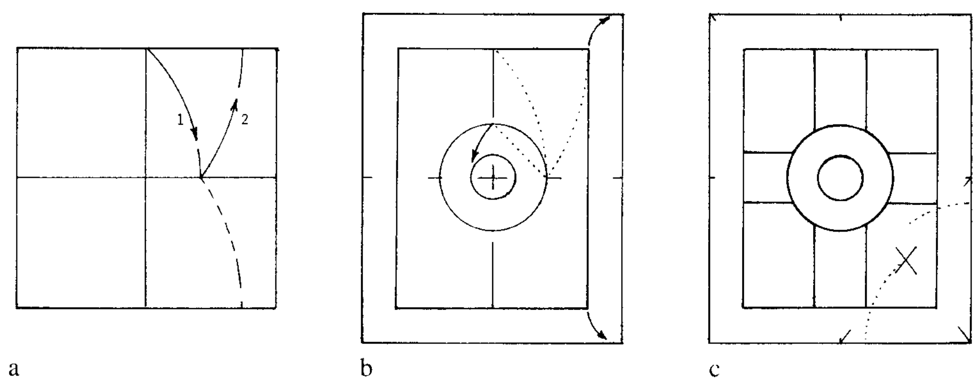


FIGURE 8. (left) *Soiscél Molaise Book Shrine, Dublin, National Museum of Ireland (photo: National Museum of Ireland).*
FIGURE 9. (right) *Steps to replicate the shape of Soiscél Molaise cross and circle.*

the point marked above as (1). The inner circle radius is set by repeating the procedure that produced (1) in step a.

(c) The cross is outlined by using half the diagonal measure of the quadrants of the outer rectangle of the frame (half being set by the intersection of the diagonals).

There is a parallel and contemporaneous tradition of design in the full-page illuminations of the Insular manuscripts of the Christian Gospels—the Book of Kells, the Lindisfarne Gospels, the Macdurnan Gospels, the St. Gall Gospels, and others. That tradition will only be alluded to here. It, too, develops the forms of cross and frame (and other representations such as the evangelists and their symbols) by constructive geometry. It employs the same few ratios in various schemes. It produces many framed crosses (and other objects), no two being the same, while they are all alike.

The cross-page illuminations preserve a kind of evidence of construction methods that inevitably will never be found on the crosses of sculptured stone. That evidence lies in minute punctures in the parchment, where the compass point was planted sometimes to construct arcs or circles, sometimes to plot dimensions, in the same ways illustrated in the figures presented above. There are also lines impressed in the surface but not drawn with ink, participating in the derivation of the structure of the design. One example will have to serve. The carpet page preceding St. Mark's Gospel (fol. 94v) in the Lindisfarne Gospels (Fig. 10) is appropriate, for having as its center another cross-and-circle design. It will illustrate again the governing function of the ratio already shown to inform the shape of St. Kevin's Cross (Fig. 7). (It need not be claimed as a source for stone cross shapes!)

Replication of the shapes of the principal elements is illustrated in Fig. 11. It begins with a derivation similar to the one that began the St. Kevin's Cross design, but reverses the ratios that divide the quadrant sides: now the longer segment (β) begins at midpoint of the sides of the square, rather than from corners of the square.

(a) Begin as in Fig. 7, a, through (1) and (2). This time, though, the shortest measure from the *midpoint* of a side of the square to one of these circles is copied from each *midpoint* to mark four points along the sides of the square (3).

(b) Copy the shorter measure (α) in each corner of the square to mark another set of four points. Connecting

FIGURE 10. *Lindisfarne Gospels, London, British Library, MS Cotton Nero D.IV, fol. 94v (photo: The British Library).*

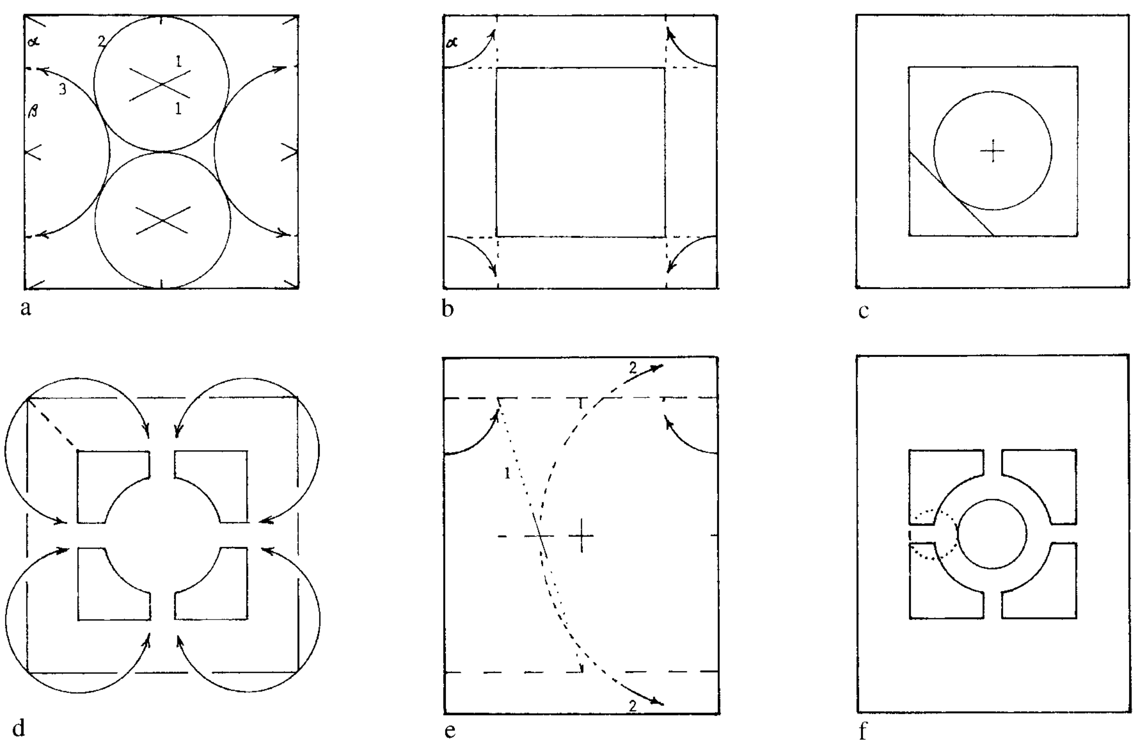


FIGURE 11. *Steps to replicate the primary shapes of Lindisfarne Gospels, fol. 94v.*

Table 1. Some inverse ratios embodied in cross-rings and page frames			
	STANDING CROSSES		CARPET PAGES
0.732	Ahenny, North Cross	1.366	Book of Kells, fol. 291v, St. John
	Duleek, North Cross		——— fol. 32v, Christ
	Tynan, Island Cross		——— fol. 7v, Virgin and Child
			St. Gall Gospels, p. 266, Crucifixion
			——— p. 267, Last Judgment
0.764	Castledermot, South Cross	1.309	Lindisfarne Gospels, fol. 94v, cross
	Killamery, cross		Lichfield Gospels, *Quoniam* page
			Echternach Gospels, fol. 176v, eagle
			——— fol. 75v, lion
0.809	Ahenny, South Cross	1.236	Lindisfarne Gospels, text area
	Monasterboice, West Cross		——— fol. 2v, cross
			——— fol. 138v, cross
0.750	Termofeckin, cross	1.333	Book of Kells, fol. 33, cross
			Lichfield Gospels, p. 220, cross
			St. Gall Gospels, p. 78, St. Mark
			——— p. 208, St. John

the two sets of points with pairs of parallel lines sets the outline of an inner square.

(c) Plot a circle within the inner square by setting a radius of half the diagonal measure of each quadrant.

(d) Plot a cross within the inner square by copying to its sides the measure from corresponding corners of the inner and outer squares, as shown.

(e) Sketch a line (1) from the midpoint of the lower side of the original square to one of the points marked in b along the upper side of the square; it divides the horizontal line of the underlying cross into uneven segments. Copy now (2) the measure of the longer segment from the midpoint of the side to mark points on extensions of each side in turn, both above and below. Connecting these points in pairs yields the outer measure of the rectangular frame.

(f) The main structural outlines. (The dotted circle is used to set equal measures between the inner and outer circles and the outer circle and the square.)

The parallel between the shapes of stone crosses and carpet-page illuminations appears in another light when the commodular ratios of both are compared. Here it is essential to grasp the fundamental difference in the typology of the two types of design. They are opposites. The illuminations have enclosing frames, which are rectangular, while the standing crosses lack a frame. The disposition of structural dimensions within a rectangular frame is in terms of that frame, hence developing the ratio of its dimensions. The frame's dimensions are derived as an *extension* (on one axis) from the underlying square. For the sculptured cross, the disposition of structural dimensions seems to be in terms of the ring. Its outer measure nearly always is commensurate with the underlying square, with the key ratio developed as a *reduction* of that measure. The frame develops a measure of the square externally, while the cross develops a measure internally with respect to the given measure.

The opposition just described discursively can be expressed as well in modern mathematical notation, which may be more familiar. If, say, the Ahenny North Cross (Fig. 5) has a ring whose circles are related outer to inner as $1 : (\sqrt{3} - 1)$—developed *within* the square—what would be the corresponding ratio developed *beyond* the measures of the square? It would be the inverse, in modern terminology. In algebraic notation, the relation can be expressed by reversing the terms of the ratio, *i.e.*, $(\sqrt{3} - 1) : 1$. In decimal notation, these are approximated by 1 : 0.732 for the first, and 1.366 : 1 for the second. This aspect of the common principles that inform carpet-page shapes and stone cross designs is illustrated in Table 1.

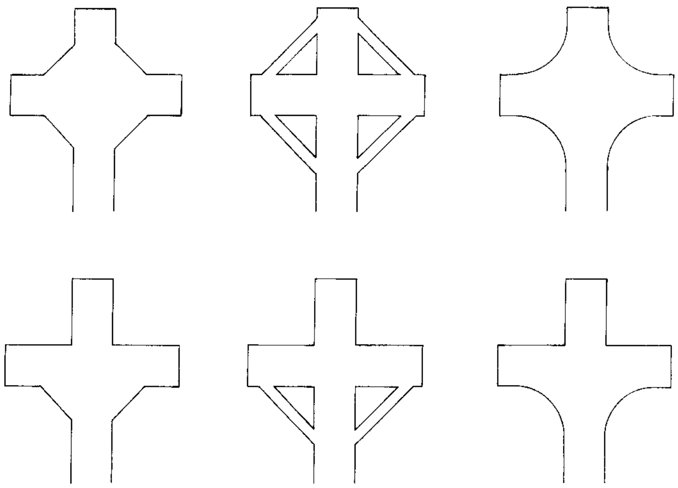


FIGURE 12. *Some cross-arm support shapes seldom or never used.*

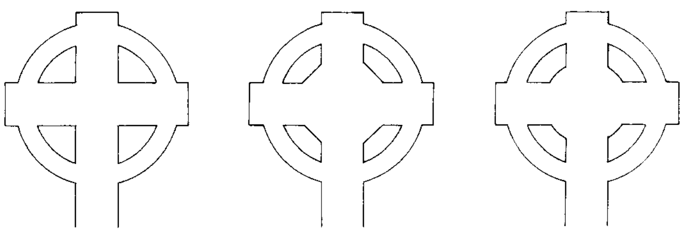


FIGURE 13. *Configurations of cross and circle not normally used.*

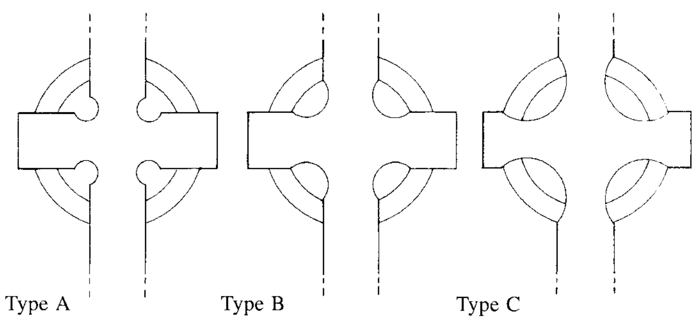


FIGURE 14. *The three basic variants in armpit design.*

The Ring and the Armpits

Let us examine next the ring that is a distinctive part of the commodular design of a large number of crosses. Peter Harbison says of this ring that it

> must be considered as having had an important structural function. . . . Where the arms had constrictions, they were all the more easily liable to break at the narrowest part, and . . . a support was needed to ensure that they would not snap off. . . . It could be argued that an almost straight line—rather than a semi-circle—would have been more natural. . . . [T]he rounded form may have been chosen for aesthetic reasons, and . . . even though the upper half of the ring was not necessary for structural support, it was added for aesthetic reasons.[8]

That is, the ring makes sense for crosses carved from stone, because of the protection which the ring gives to the extensions of brittle material which are susceptible to fracture from impact or from changing stress (temperature, moisture, and such). Such protection is a benefit of the form; it may not be its origin, much less its full explanation. If the ring is explained by its protective function, there still must be found an explanation why other configurations, equally protective, were not chosen. Fig. 12 illustrates some of these unchosen shapes. "Aesthetic reasons" may be invoked, and indeed they may well have guided the choice of a circle to surround the juncture of a cross, though this leaves the explanation troublesomely vague.

Once again let us look to the cross carpet pages for potential help in understanding stone cross design. On all these pages a cross is contained by its frame, which provides the ground for the cross as subject. A large cross standing fixed in place and in the open will have no ground, no containing or complementing element. Along with its protective function, then, the ring establishes containment and complementation for the figure which it otherwise would lack.[9] Further, the head, shaft, and arms of the cross normally extend beyond the circle. Thus the ring encloses without encompassing, enabling the cross to dominate the design, as its figure, or subject. This will be the case whether the cross-and-circle design is perforated—as it is in more than half the instances—or not.[10]

Such identification of the aesthetic function of the ring has to remain speculative, though no less to be considered for that reason. On the other hand, its function within the commodular scheme of the cross shapes is analytically accessible. The two circles of the ring are fundamental elements in the simple web of ratios informing the outlines of crosses, as we have seen, and in a way that angle-brackets like those in Fig. 12 cannot be. The outer circle in particular seems in instance after instance to embody the measure from which all the others derive, in a configuration essential to their direct derivation.

Next, the armpits. The ring as protector against breakage of the cross arms would be less needed if it were not for the characteristic constrictions where the arms join the upright of the cross.[11] These constrictions make the arms the more frangible and therefore the more in need of protection by a ring or other supporting shape. In any case the ring occurs very seldom without the constrictions in the configuration of the cross: that is, designs seldom include forms like those illustrated in Fig. 13. Instead, the normal configurations are of the kinds illustrated in Fig. 14.[12]

How are these scoops out of the structural solidity to be accounted for?[13] Probably part of the answer lies again in aesthetic reasons. None of the shapes typified in Fig. 13—or any of those in Fig. 12, for that matter—has the aesthetic strength of the shapes typified in Fig. 14. (Our only available vocabulary for such assertions is impressionistic, but it will have to do.) The shapes chosen for most ringed crosses have a balance, a tension, a counterpoint of two oppositions. One opposition is in the contraposed curvatures of the ring and the armpits; and besides their contrary movement, there is the contrast of four smaller curvatures symmetrically opposed to one larger (encompassing) circle. The other opposition is between solidity or sturdiness, on the one hand, openness or fragility, on the other.

But another part of the answer to why the constrictions are the norm may lie in the forces of the design methods and concepts, which are inseparable. The design is nothing if it is not a conceptual unity. In addition, it is trivial if it is too brief. In this case, good design needs more than a plain ring and plain cross. Further development can take place at either the structural outline of the cross, or the structural outline of the ring. The ring remains undeveloped in this regard. (The small "rolls," such as those found on the inside of the rings of the cross at Durrow, Co. Offaly, and the Cross of the Scriptures, Clonmacnoise, Co. Offaly, are attachments rather than developments, even as they are no more than attachments to the armpit curvatures in the cross at Drumcliff, Co. Sligo, and the Market Cross of Kells, Co. Meath.) In every instance development of the design appears at the armpits of the cross, in the form of so-called constrictions formed as re-entrant arcs.

Integration of the plan was demonstrated in Figs. 3 and 5 for the Castledermot North Cross and the Ahenny North Cross. Another illustration can be found in the South Cross of Ahenny (Fig. 15). Its scheme, explicated in Fig. 16, is a little more elaborate than the ones described earlier. Here is a set of operations that will lay out the plan of this cross.

(a) Divide the radial measure of circle C_1 in half (a diagonal of two adjacent quadrants of the square will do this), and use that measure to divide sides of the large square into four equal measures. Then sketch circle C_3 with radius half that of C_1.

(b) Sketch a larger circle with radius OA.

(c) Copy the measure AO from A to mark a point along a side of the square (1); find half the complementary measure (again a diagonal [2] will do this), and mark it on a segment of the underlying cross. (That complementary measure is the same as α in Fig. 11, a.)

(d) Draw an inner circle C_2 with the newest radial measure.

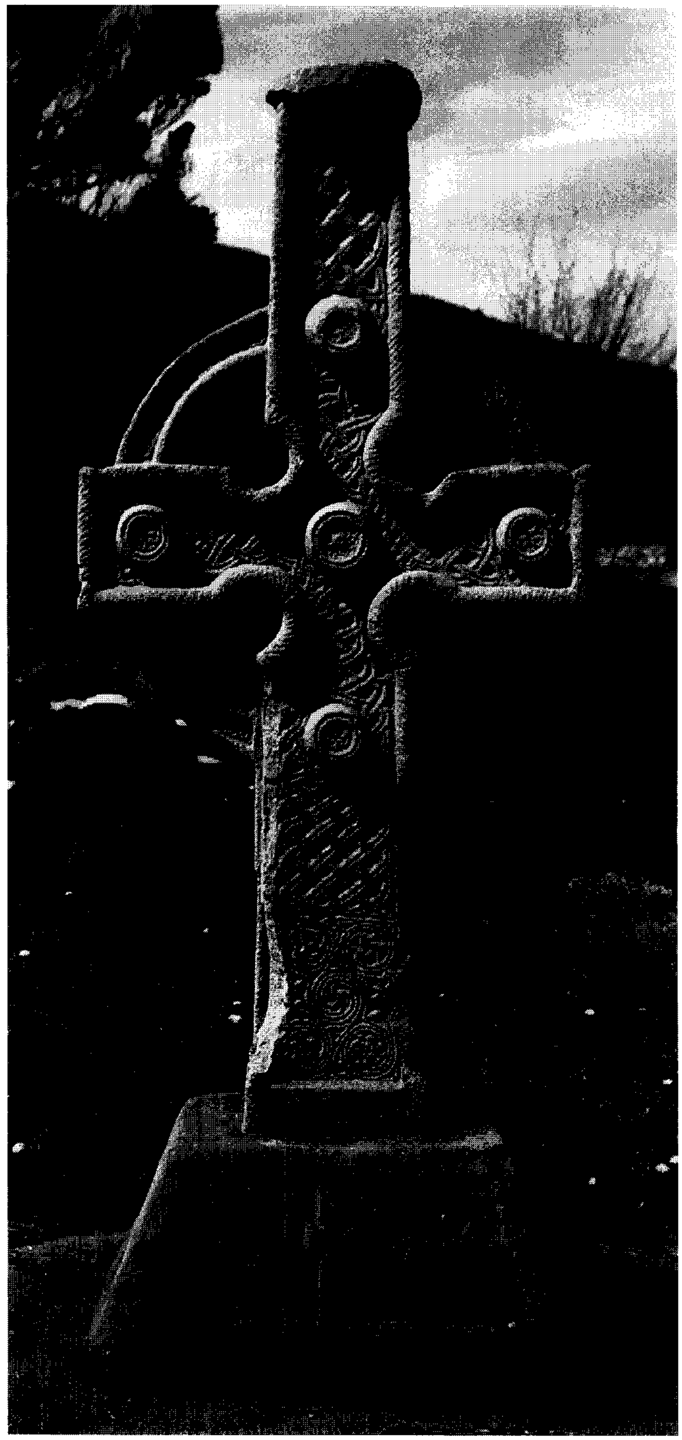


FIGURE 15. *South Cross, Ahenny, Co. Tipperary (photo: Dúchas, The Heritage Service, Ireland).*

(e) Mark all the midpoints of the enclosed cross (a circle C_3 with the half-measure of the original square and circle will do it), and copy the difference between radii of C_2 and C_3 on either side of the cross-lines.

(f) With guidelines just plotted, draw the outline of a solid cross; the arms terminate at the outer limits of the circle sketched in step b.

(g) Sketch a semicircle (1) centered at one side of the square, radius equal to that of C_1; plot the diagonal of two adjacent quadrants to intersect that semicircle (2); copy the length of the longer segment of that diagonal to mark a point along the nearest side of the square (3); plot the path of a line from this point to the farthest corner of the square (4). Mark the point of its intersection with the cross to define the radius OB for circle C_4.

(h) Sketch diagonals of the large square to intersect C_3. The points of intersection will be the centers of the arcs forming the curvatures of the armpits of the cross; the length of the radii will be the distance from the center to C_4.

(i) The shape plotted by the preceding steps.

That is an operational accounting for the shape of this cross (except for tapering the shaft). It is no better than connect-the-numbered-dots in drawing a face, or a maze, or a house, if one only follows the mechanical operations without comprehending the commodulation that the plan embodies. Carrying out the instructions is a way to begin, but it is no guarantee of understanding, any more than reading about the form of a sonnet or a fugue will guarantee a grasp of the form. Any understanding of its commodulation ultimately has to be conceptual.[14]

Both the North Cross and the South Cross of Ahenny belong to the variant Type A in Fig. 14. Type B constrictions may be represented by the North Cross of Castledermot, already illustrated in Fig. 3. The integration of shapes and extensions is relatively straightforward when the curved constrictions at the armpits lie well within the ring, as in Type A. It is less direct or simple for the other armpit types, because the armpit curves must interact with the ring—with its inner circle in Type B, its outer circle in Type C. With the latter two types the design often requires adjustment to a tapered shaft, as well.

More than the others, Type C constrictions tend to be complicated by having to accommodate the larger (*i.e.*, outer) circle of the ring or a tapered shaft, or both. The Cross of SS. Patrick and Columba, Kells, Co. Meath, is one example; the North Cross, Duleek, Co. Meath, is another. The simplest scheme and the clearest lines of Type C design are found in the Island Cross of Tynan, Co. Armagh (Fig. 17). This design is spun from another single ratio—the one developed initially in Fig. 5. Its derivatives, all involving this "subject ratio" or motif, set the rest of the relations among the key parts of the design: the depth of the constrictions and their radius; and also, because Type C has the terminations of the constriction arcs at the outer circle of the ring, it is this conjunction that sets the thickness of the arms and upper part of the shaft.

Here are some of the links. The "scoop" of the armpits reaches to half the outer radial measure of the ring. The radius of each scoop is half the radius of the inner measure of the ring. The thickness of the cross arms (*i.e.*, the vertical measure) is equal to the radius of the scoop, and so is the thickness (*i.e.*, horizontal measure) of the top segment of the cross. And so along the outer circle of the ring—where the circle and the constriction arcs join—the segments of the outer circle of the ring which are covered by the cross are equal in measure to the segments of that circle that we see. (Adjustment for the widened base of the shaft alters the pattern only slightly.) On the west face, the circular device at the center of the cross has a diameter with the same measure as do the arcs of constriction. And finally, the centers of the scoop arcs are along diagonals of the underlying square, at a measure of half the outer ring radius plus half the inner ring radius.

Fig. 18 illustrates one practical sequence that will generate its shape.

(a) Plot ring circles having radii related as shown (cf. Fig. 5 and Table 1).

(b) Plot the path of a circle with a radius ending halfway between the radii of the outer and the inner circles of the ring (cf. Fig. 3, d and Fig. 16, c); where this circle intersects the diagonals of the square will be the centers of the armpits.

(c) Plot the path of a circle with half the radius of the outer circle (cf. Fig. 16, a).

(d) Draw outlines of the armpits with centers plotted in b, radii extending to the circle plotted in c.

(e) Draw the arm and top extensions with thickness marked by intersections of the "scoop" arcs and the outer circle (the central circular device on the west face has a diameter equal to the arm thickness); the bottom of the shaft is slightly wider, tapering outward as it descends.

(f) The extension of the arms is φ ("golden ratio") in relation to the inner circle of the ring (not detailed in the drawing). Probably the extension was the same for the top of the shaft, originally, to judge from the incised bordering lines paralleling its outline.

Making and Copying Forms

The shapes of ringed crosses thus can be devised, and replicated accurately, by methods of constructive geometry. That is one reason for inferring that they were made this way. Another reason lies in the procedures that will most naturally and readily aid in copying these shapes from model to stone. This is parallel, of course, to copying the design of a cross page from a model to fine parchment. If copying a cross design meant copying its dimensions one at a time, as equal measures on the model and on the copy, all designs would have to have been devised on the scale of the completed stone cross. Copying a motif, a scene, a decorative pattern, or a proportion from model to stone would have required transferring dimensions one at a time, presumably by way of

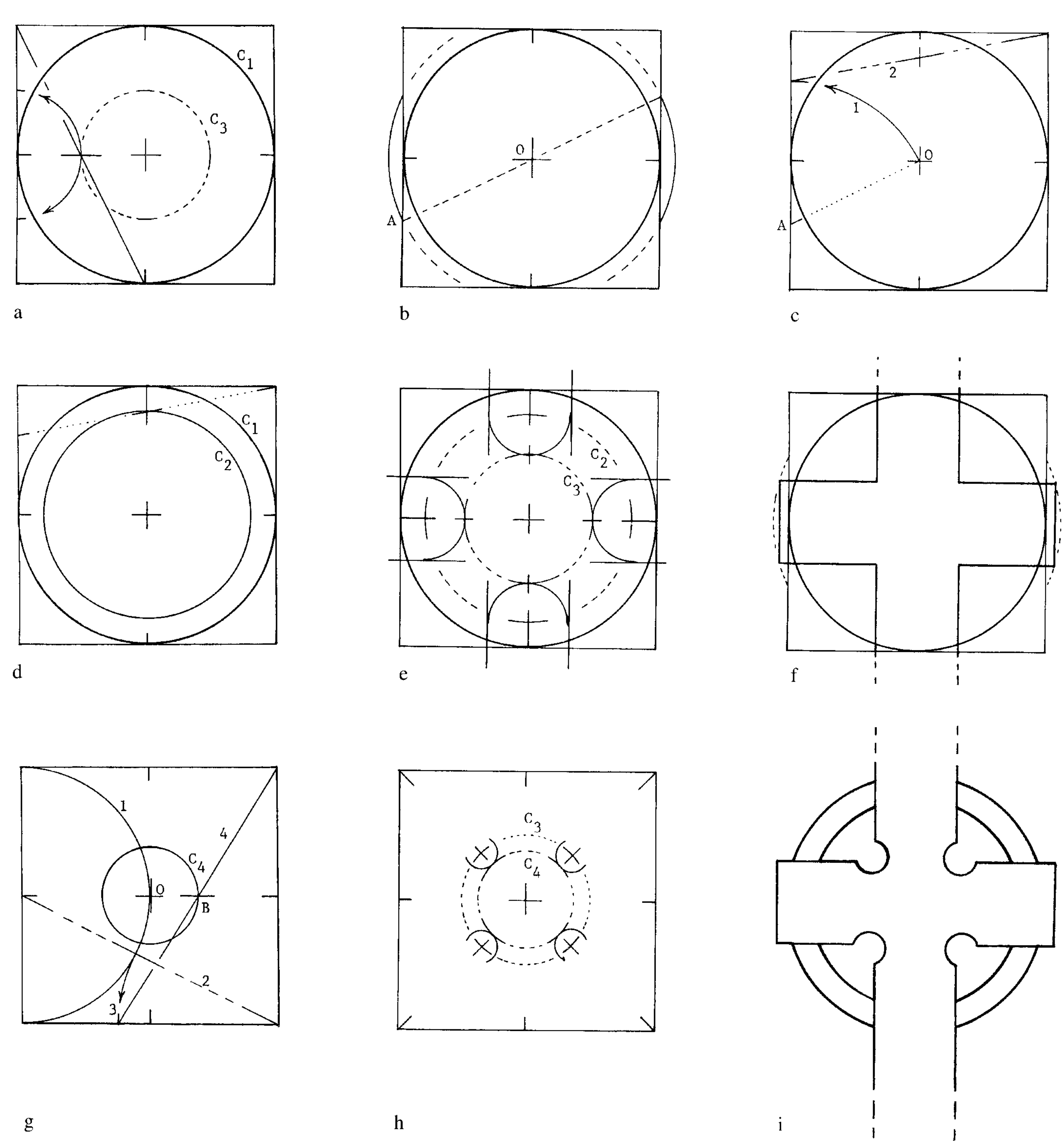


FIGURE 16. *Steps to replicate the shape of South Cross, Ahenny, Co. Tipperary.*

an intermediary copy on a portable material (such as woven fabric).

On the other hand, if the model were smaller than the planned sculpture, the process of copying from the small model to the large artifact may have employed grids as a practical procedure, at least for some kinds of forms. A grid marks square, rectangular, or triangular areas, or any other kind that may be practical. So long as the grids are identical in form, their size can vary as much as will ever be needed; if all the lines of the grid are spaced by equal proportioning on model and artifact, the artisan copies by locating elements of the design by their relations to the grid lines.

For some kinds of design, a grid method of copying may be the most practical.[15] Depictions of human and animal forms, or of trees or vines, for example, especially when two or more such figures belong to a single image, probably are done best by such a method.[16] For animate forms, there is no inherent structural scheme that lends itself to copying by deriving one element of the form from another, in a sequence from a given dimension to the fully executed representation. A grid provides reference points for copying; the copy is in effect a collection of mimetic representations guided by the grid. But the grid itself, an abstract, regular form, has no intrinsic relation whatsoever to the form being copied. In that lies its value.

For designs that consist of repetitive patterns, such as chains of interlace or areas of grille-pattern, the use of grids for copying may also be the most practical. For these the grid is a regular and repeating pattern of reference lines to guide the reconstruction of the repeated elements on a different surface, and probably on a different scale.

It is a different matter altogether when the design being copied (at whatever scale) represents such basic geometrical shapes as circles and crosses of the kinds described in the preceding pages.[17] Obviously, it takes no grid to copy a cross design, any more than it does to copy a ring. It is easier and more accurate to draw them directly to a given scale. Then if all the main lines of a design are related by ordinary constructional geometry, the easiest and most accurate way to copy them on any scale is to repeat the constructional procedure. The scale is set by a given dimension (as at the outset of Fig. 1).

Uncertainties

Up to this point a case has been made that the shapes of the early sculptured crosses of Ireland were devised by constructive geometry, just as were the cross-pages and other full-page illuminations in early Irish and Northumbrian Gospel manuscripts. Now it will be in order to consider some uncertainties that accompany the hypothesis. There would not be any uncertainties, of course, if we had direct testimony by their creators concerning these cross designs—how they worked, where their ideas came from, what they meant by them (if anything), how they developed these ideas over time. (We should also need reason not to doubt the truthful intention of that testimony, on the one hand, and its accuracy, on the other.)

Some uncertainties grow from practical or empirical considerations, chiefly the results of weathering, human damage, and asymmetry of execution.[18] Others may stem from an expectation of finding meaning in the commodular geometrical designs. What might such mathematical patterning symbolize? What does a slender ring such as that in the cross at Kilfenora mean, in contrast to a heavy ring such as that in the cross at Drumcliff? How does the meaning of armpit Type A differ from those of Types B or C? To pursue such questions is to pursue phantoms, most likely. The numerous manuscript illuminations that were designed similarly show no correlation of one ratio or another with a particular evangelist or cross type or topic that the illumination accompanies.[19] None of the governing ratios in the illuminations can

FIGURE 17. *Island Cross, Tynan, Co. Armagh (photo: Public Record Office of Northern Ireland).*

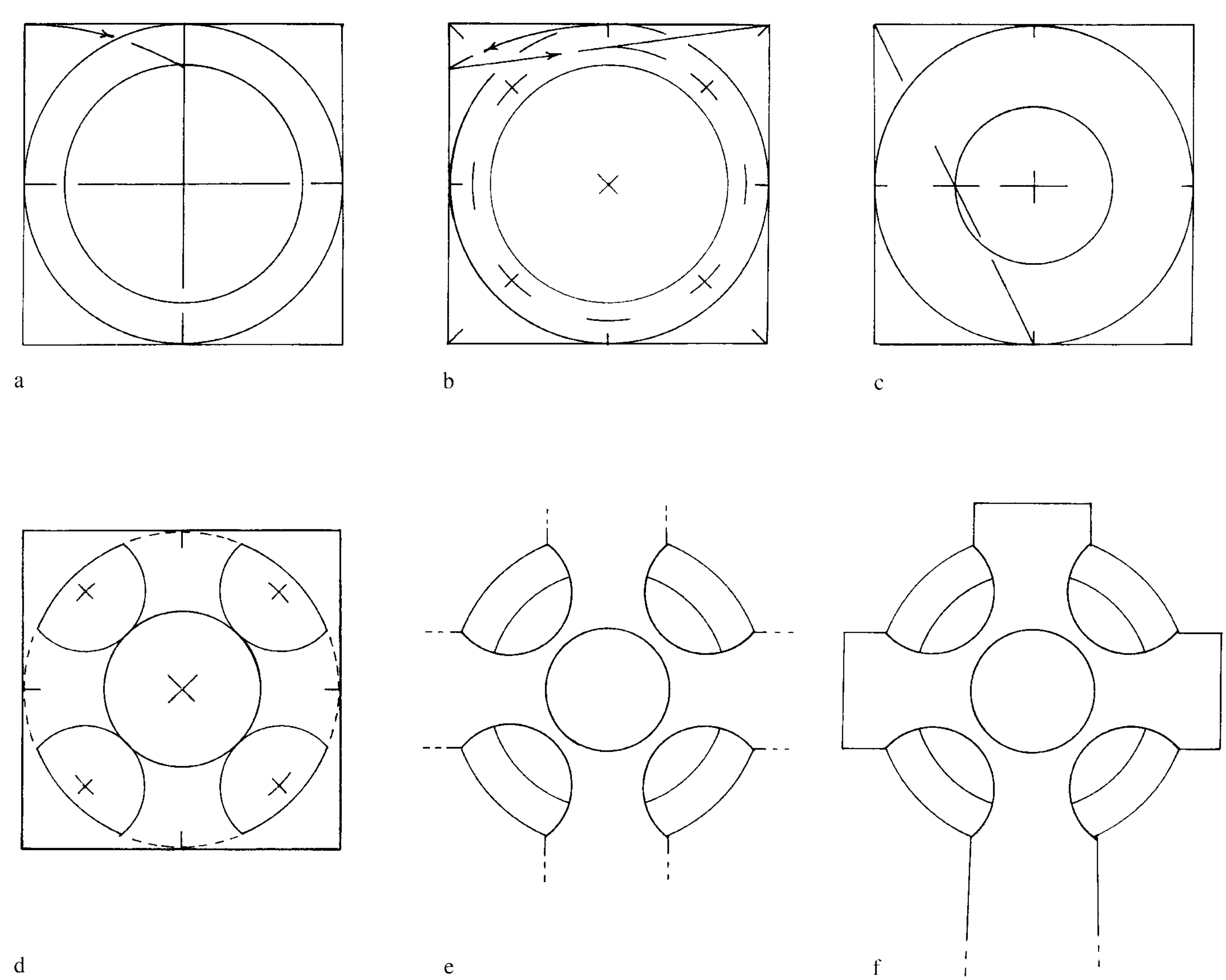


FIGURE 18. *Steps to replicate the shape of Island Cross, Tynan, Co. Armagh.*

be linked to the same ratio occurring among the lengths of sections of English vernacular verse of the same period.[20] There is nothing like the correspondence patterns that support the symbolism of numbers, or the symbolism of objects such as vines or trees. In short, there seems to be no basis for thinking that relations among dimensions were assigned meanings.

Another uncertainty is analytical, rather than empirical. In its simplest manifestation, the common geometrical ratios uniting the shapes do not have unique derivations. In many cases two or even three methods of deriving a ratio are available and about equally practical. Which one an artisan used is often impossible to determine, and probably does not matter. In Fig. 16 the inner circle of the ring was derived from the outer one. It is no more difficult to derive the outer from the inner. The results are equivalent, even if the ratios of their radii are reciprocals rather than identical (cf. Table 1). Common sense might say that a design would have begun with the larger measure, with the smaller one derived from it. For one thing, that would result in setting the proportions more accurately, as any draftsman knows. For another, if a designer derived larger measures from smaller ones, there would always have been the possibility that a derivation would yield outer dimensions too large to fit a stone slab already prepared. A way around that problem is to scale down the size of the cross progressively until none of its dimensions exceeds the size of the quarried stone. Such trial-and-error procedure would never have been needed if the cross-shape was a product of constructive geometry, made and copied as described above. The design of page illuminations

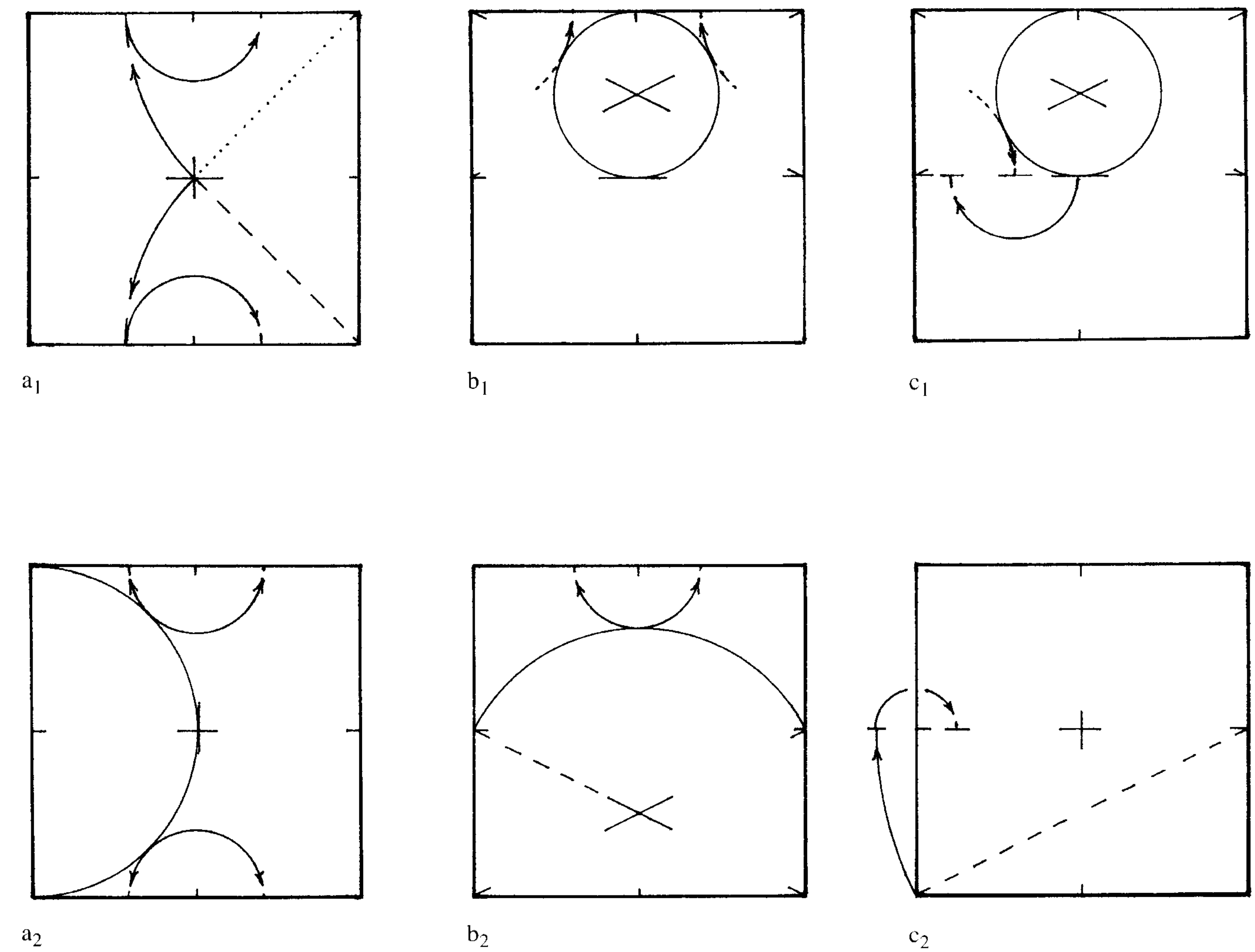


FIGURE 19. *Alternative methods of setting three basic ratios for cross plans.*

posed similar problems, though probably ones easier of solution. For page designs the starting point nearly always is the width of the frame enclosing the image. This can be inferred from sets of coordinate illuminations which have uniform widths and varying heights, best illustrated by the Lindisfarne Gospels cross pages and the evangelist pages in the Book of Mulling.[21] It is also affirmed in some instances by relations among clear construction marks.

Another example of alternative methods of setting the radius of the inner circle for the ring can be seen in Fig. 5, a. Figs. 11, a, and 16, a–c, set equal divisions of a quadrant. Fig. 19 shows still other alternative methods of setting equal proportional measures: a_1 and a_2 set equivalent ratios, as do b_1 and b_2, and c_1 and c_2. Because so many elements of the plans are so simply constructed from circle, cross, and square, one cannot hope to know the exact steps followed in devising the plan of many of the crosses. Still, while one may not be able to trace the footsteps, the path is unmistakable.

Conclusion

Practical shapes and artful forms lie a long way from the center of interest of geometers. They organize their knowledge from the top down, beginning with axioms and postulates, then proceeding through logical proofs. For craftsmen in metalwork, manuscript illumination, and stone sculpture, on the other hand, the useful shapes and valued forms must be the first concern. To understand their knowledge we have to begin from the bottom and work up, so to speak. As in the deciphering of remote writing systems, recognition of the elements being manipulated must come first. In languages they are the separate sounds, syllables, words, or ideas, but normally only one of these elements. In visual (and tactile) arts whose forms are built from circles and cross shapes, the elements are extensions and their ratios, first and foremost. It is for this reason that the key used here for decoding the high cross designs has been constructive geometry. With it these designs turn out to be neither arcane nor mysterious.

Related to this are two important questions: what is the source of commodular shaping for the crosses, and can the chronology of their shapes be recovered from their formulas? It is easy, but hazardous, to infer a chronology from a typology. Maybe, in broadest terms, greater complexity of geometrical design does go with later creation; this would put Muirdach's Cross at Monasterboice later than St. Kevin's Cross (Fig. 6), for example. But when most shapes evolve from ratios as elementary as those developed in Figs. 3, a, 5, a, and 7, a, it is hard to distinguish among degrees of complexity surely enough to establish chronology.

Then the source. I think woodworking can be ruled out as the source for commodular shaping.[22] Wooden crosses are assembled from parts, while stone crosses are carved from a single mass, or have at least the central cross and ring commonly cut from a single slab. The method of making is entirely different in each case, and for this reason a difference in design might be both natural and expected. One process is that of assembling, *i.e.*, fabricating a cross from elements cut to the grain. The other is that of cutting away those materials that do not make up the design. So it is only in a limited sense that we "must visualise . . . stone crosses [being] monumentalised copies in stone" of smaller wooden crosses "which had plaques of bronze and other materials attached to them."[23] As between metalwork and manuscript illumination, there is no firm basis for the exclusive designation of either one as source. In any case, once stone sculpture joined the tradition, it is hard to imagine that ideas flowed in only one direction—say, from scriptorium to stoneyard—over the course of several generations. But if they did, we shall have to have chronologies and typologies more exact than any in hand in order to know.

These crosses ask for absolute understanding of commodular form (as distinct from formularies). Fail to understand the rules of measure and their binding, and the crosses look samey. Understand them, and the shapes generate fascination that is in no way dependent upon mystery—fascination that we may suppose was shared by those who fashioned them.

NOTES

1. Well discussed is the generic form of the ringed crosses, as distinct from the forms of individual crosses. P. Harbison, *The High Crosses of Ireland*, 3 vols. (Bonn, 1992), surveys the various views of what constituted the prototypes of these crosses and their typical features, I, 345–349. The rôle of Christian iconography in its development was reviewed and endorsed by M. Werner, "On the Origin of the Form of the Irish High Cross," *Gesta*, XXIX (1990), 98–110, who also discusses the question of when and where ring and cross—"the constituent elements of the Irish high cross"—were combined.

2. D. Kelly reckons that 72% of the Irish population of crosses have (or had) rings, either pierced or unpierced (*i.e.*, solid): "The Relationships of the Crosses of Argyll: The Evidence of Form," in *The Age of Migrating Ideas*, ed. R. M. Spearman and J. Higgitt (Edinburgh, 1993), 223. A full discussion of the morphology of the crosses is published in her "Irish High Crosses: Some Evidence from the Plainer Examples," *Journal of the Royal Society of Antiquaries of Ireland*, CLXVI (1986), 51–67, where it is pointed out that the ringed crosses (72% of the whole population) divide almost evenly into those with solid rings (34%) and those with open-work rings (38%). This census is an important reminder that Irish stone crosses will not be understood by looking at only the more famous and striking examples. The present study, though limited to ringed crosses, deals with their design in a way that should be testable independently of the remaining (unringed) crosses.

3. I have treated the construction of the illuminations in *The Earliest Irish and English Bookarts: Visual and Poetic Forms before* A.D. *1000* (Philadelphia, 1994).

4. D. Kelly provides measurements of several elements of this cross, in her lengthy paper on "A Sense of Proportion: The Metrical and Design Characteristics of Some Columban High Crosses," *Journal of the Royal Society of Antiquaries of Ireland*, CXXVI (1996), 108–146 (published 1998). Because her interest is in discovering the "design structure" within the "architecture" of Scottish and Irish crosses, she provides in fact two sets of measures. One set is "Actual," based on fieldwork, and the other "Ideal," inferred from "blueprint" drawings proposed to illustrate the design features of this cross (measures given in centimeters). Both sets of measures for the Ahenny North Cross are given below, alongside another labeled "Commodular": this third set is computed by the ratios represented in Fig. 5 when the diameter of the outer circle of the ring is stipulated as 126. Both the commodular and the ideal measures approximate the actual measures so closely that each must be close to the designer's model (see Kelly's Fig. 12 b). Only the commodular set, though, is calculated as a chain of derivations: it uses the outer ring size as the given measure. As a set, it is closer to the actual measures than are the ideal measures inferred from an eclectic mix of measures of the basic shape and measures of areas of decoration.

FEATURE	ACTUAL	IDEAL	COMMODULAR
Diameter of ring, outer	126	126	126
Diameter of ring, inner	91.5	91	92.2
Transom height max. (= arm thickness)	40.5	41.36	40.0
Diagonal across head	40/41.2	41.36	40.0
Hollowed angles (= armpit diameter)	16.75–19.5*	17.4	16.6

*The larger number is exceptional because this portion of the cross is "very worn."

5. The segments α and β are in the relation known as the "golden ratio," or the "golden section" of a line, in which the length of α is to the length of β as the length of β is to their combined length; that is, $\alpha : \beta :: \beta : \alpha + \beta$. This special relation was known, discussed, and used

widely in design since antiquity, and for a long time has had its own symbol φ. It will be referred to subsequently in this paper; cf. n. 14.

6. L. Gilissen, *Prolégomènes à la Codicologie. Recherches sur la construction des cahiers et la mise en page des manuscrits médiévaux* (Ghent, 1977).

7. I have used the Soiscél Molaise bookshrine before as an example of another kind of object designed by geometrical construction (see n. 3). Probably the Lough Kinale bookshrine shares with the Lindisfarne Gospels text area and carpet pages on fols. 2v and 138v the outline ratio listed in Table 1. "When intact, the shrine was 34.5 cm long, 28.0 cm wide," according to E. P. Kelly, "The Lough Kinale Book Shrine," in *The Age of Migrating Ideas*, 168.

8. Harbison, *The High Crosses of Ireland*, I, 350–351.

9. F. Henry, *Irish Art in the Early Christian Period* (London, 1940), 103, observes that "the great crosses . . . are no longer the outline of a cross raised against the sky. There is a sense of architecture about them. . . . But architectural as they may look, they are first and foremost enlargements into stone of metal crosses—bronze crosses made monuments"; similarly in *Irish Art in the Early Christian Period (to 800 A.D.)* (Ithaca, 1965), 140. What Henry calls here the "architectural" aspect, I believe, is at least in part the effect of adding the ring to the design.

10. D. Kelly's discussion of the morphology of the crosses catalogs similarities and differences between the solid and pierced ring crosses, and then observes: "The difference in the treatment of the ring is largely confined to the lack of piercing; in other respects the rings on solid-ringed crosses differ little from those on crosses with pierced rings" ("Irish High Crosses," 59). She also notes that "If the reason for the use of the pierced ring is obscure . . . the preference for a solid disc may be regarded as even more puzzling" (58). In either case the aesthetics are different from those of relief carving.

11. Of course there can be a cross shape with constrictions of this kind but without a ring—as at Kilbroney, Co. Down. There are also cross-slabs with constrictions but no ring, such as those typed by I. Henderson, "The Shape and Decoration of the Cross on Pictish Cross-Slabs Carved in Relief," in *The Age of Migrating Ideas*, 210.

12. To Type A belong: Ahenny, Co. Tipperary, North Cross and South Cross; Kilkieran, Co. Kilkenny, West Cross and South Cross. To Type B belong: Castledermot, Co. Kildare, North Cross and South Cross; Drumcliff, Co. Sligo; Finglas, Co. Dublin; Killamerry, Co. Kilkenny; Kilcree, Co. Kilkenny; Moone, Co. Kildare; Termonfechin, Co. Louth. To Type C belong: Duleek, Co. Meath; Gallen, Co. Meath; Kells, Co. Meath, Cross of SS. Patrick and Columba, Market Cross, and Unfinished Cross; Kilfenora, Co. Clare, West Cross; Monasterboice, Co. Louth, North Cross, Muirdach's Cross, and Tall (West) Cross; Tynan, Co. Armagh, Island Cross and Terrace Cross. The crosses in Durrow, Co. Offaly and Arboe, Co. Tyrone are unusual in falling between Types B and C. Clonmacnoise, Co. Offaly, Cross of Scriptures is unusual for the armpits not joining to the arms or shaft of the cross.

13. To R. B. K. Stevenson's question, "Could indeed the purely Insular indented armpits be skeuomorphs of holds for tying beams together?" ("Further Thoughts on Some Well Known Problems," in *The Age of Migrating Ideas*, 16), the answer may be "yes." Yet this concerns inferred prototypes and sources, and is again a matter of the generic form, rather than of the individual forms with which this paper deals.

14. An accounting in terms of the plan's commodulation requires a grasp of the "golden section," or "golden ratio" (cf. n. 5). The whole plan proceeds from effects of a diagonal of two squares sharing one side—explicitly marked in Fig. 16, a and g—which are then developed in all the other steps. In step a that diagonal halves the measure of a quadrant. In step c the golden ratio is set (1) and then its shorter segment α is halved, setting the radii of the circles of the ring at $\frac{\varphi}{2}$. The width of the cross arms and shaft (steps e, f) is $\frac{\varphi}{2} - \frac{1}{2}$. The two steps plotting the curves at the armpits are g and h. The latter calls for these arcs to be disposed symmetrically around the junctures of the arms and the shaft of the cross, at a measure already set. The two steps together set that measure. The first (g) uses operations 1, 2, 3 to divide the given measure (one side of the underlying square = diameter of ring) by the golden ratio (φ), and then in operation 4 marks half the length of the longer segment β along one member of the cross-lines. The shorter segment of the half measure golden ratio (OB) sets the radius of the circle sketched as C_4. The other step (h) uses the distance between radii of circles C_3 and C_4 to define the radii of the armpits. The radii of the inner circle of the ring and those of the armpits are all functions of the golden ratio in relation to the given measure of the design.

15. One of the three desiderata in the study of early Irish art mentioned by Nancy Edwards is the examination of individual objects "more closely from a technical point of view," including the use of "templates and grids" (*The Archaeology of Ireland* [London, 1990], 171). The beginnings of this work, as she notes, date from about 1960, with R. L. S. Bruce-Mitford's work on the Lindisfarne Gospels (*Evangeliorum Quattuor Codex Lindisfarnensis* [Olten, 1956, 1960]), the methods developed there having been transferred to items such as stone carvings.

16. Mary Ann Gelly has analyzed the composition of several picture panels on stone crosses in terms of their layout on a grid, in "The Irish High Cross: Methods of Design," in *From the Isles of the North*, ed. C. Bourke (Belfast, 1996), 157–165. The depiction of Adam and Eve on the cross at Durrow, Co. Offaly, for example, is analyzed in terms of a grid of inch and half-inch square units (her Fig. 5). Gelly also importantly calls attention to the re-use of a scene "type," sometimes on the same scale but with alteration to accommodate different areas (162–163 and Fig. 14), sometimes with an image "scaled up" (163).

17. J. Lang, "Some Units of Linear Measure in Insular Art," in *KEIMELIA: Studies in Mediaeval Archaeology and History in Memory of Tom Delaney*, ed. G. Mac Noicaill and P. Wallace (Galway, 1988), 95–101, sees much of the design of high crosses as based on grids, whose fine measurements are often the imperial inch, or a close approximation to it. The North and South crosses at Castledermot "have the inch module underlying their designs" (96), for example. Lang's analyses are concerned principally with decorative patterns. His citation of parallels in Bruce-Mitford's analyses of construction marks for illuminated pages in the Lindisfarne Gospels (cf. n. 15) also refers to decorative designs, not the overall shapes on which the decoration is wrought.

18. Some of the original dimensions can be reconstructed, especially when the erosion can be gauged by patterns wrought on the face of a cross when it was made. A ring whose faces have symmetrical geometric decoration is the best example: there is no problem in deducing the original dimensions, if it is granted that full symmetry would represent the pattern to which the stone was intended to conform. Some crosses have enough asymmetries to put any original plan beyond certainty. In the smaller cross-head, west face, of Ardane, Co. Tipperary, the horizontal and vertical cross members are unbalanced. The ringed cross cut in relief at Gallen, Co. Offaly, has numerous asymmetries. Muirdach's Cross, Monasterboice, Co. Louth, is another example. The asymmetries of the arm extensions and the armpits obscure parts of its plan, and the spans of the constrictions of the cross arms are conspicuously unequal. Striking elements of this plan and aspects of its asymmetry as well are found in the North Cross of Duleek, Co. Meath.

19. For example, the portrait of St. John in the St. Gall Gospels is governed by an arithmetical ratio 4 : 3, but the St. John portrait in the Book of Kells has a geometrical governing ratio, the inverse of the one governing the Ahenny North Cross. See Table 1 and the Index of Proportions in *The Earliest Irish and English Bookarts*, 281–282.

20. The opening one-third of the tenth-century English vernacular poem *Andreas*, a verse narration of the legend of St. Andrew, is divided in the manuscript into segments governed by the ratio set in Fig. 3, a, and the one set in Fig. 5, a, in the first instance; the whole formal plan is explained in *The Earliest Irish and English Bookarts*, 33–37. Another verse narrative, *Elene*, concerning the mother of Constantine, builds its sectional divisions from the golden ratio division of 1000. I discuss the question of the meaning and the form of this poem in some detail, *ibid.*, 127–131.

21. Bruce-Mitford, *Evangeliorum Quattuor Codex Lindisfarnensis*, II, 232, and Stevick, *The Earliest Irish and English Bookarts*, 19–21, 55–57.

22. D. Kelly, "The Heart of the Matter: Models for Irish High Crosses," *Journal of the Royal Society of Antiquaries of Ireland*, CXXI (1991), 105–145, develops in detail the inference of wooden crosses alongside metalwork crosses; particularly valuable is the discussion of the parts and the joinings of those parts. More on this matter is discussed by D. Mac Lean, "Technique and Contact: Carpentry-constructed Insular Stone Crosses," in *From the Isles of the North*, 167–175. The rôle of the "chief master wright" is distinguished here, and the point is made that the "Ahenny crosses . . . mark the final stage in the accommodation Gaelic master craftsmen reached between their experience of wood and the understanding of stone" (172). Still, without extant wooden crosses that may have been prototypes, without bosses covering nail-heads of fasteners of those crosses (with one possible exception), without stucco or bronze plaques of figural sculpture attached somehow to those crosses—without instances of unmistakable models, any inferences based upon them can never be more than speculative.

23. Harbison, *High Crosses of Ireland*, I, 348.

De coloribus: The Meanings of Color in Beatus Manuscripts*

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Abstract

This study is premised on the idea that human responses to color are historically and culturally specific. Illuminations of the Apocalypse in mid-tenth- through early twelfth-century Beatus manuscripts are analyzed for patterns of color use. These patterns suggest that color functioned differently than twentieth-century viewers might expect. Links between the text of Revelation and the colors chosen by the illuminators may be evidence that the illuminations were used mnemonically. Although they appear to us as the antithesis of illusionism, some of the colors in these manuscripts were chosen with reference to the natural world. Colors could carry symbolic meanings which varied according to context, and they could be tied to ideas about light and darkness, not only to hue. An aesthetic system which prized complex and systematized chromatic variety informed the painting of these illuminations. These and other patterns show that color provides a significant point of access for historical readings of Beatus illuminations.

When asked by Fernand Léger what single work of art he should see in New York, Meyer Schapiro chose a tenth-century illuminated copy of Beatus of Liébana's *Commentarius in Apocalypsin*, housed in the Pierpont Morgan Library (Color Pls. 1–2).[1] Schapiro has described mozarabic painting, of which Beatus manuscripts are a large part, as "an art of color."[2] Mireille Mentré has pointed out that most twentieth-century viewers enthusiastically describe the colors in the illuminations of these manuscripts as beautiful, passionate and powerful, but that nineteenth-century viewers usually said they were ugly.[3] As this dichotomy illustrates, responses to color can change over time. Recent scholarship has also shown that people in different parts of the world, and at different times in history, have had varying ideas about the nature and meanings of color.[4]

Despite the salience of color as one of the determining characteristics of Beatus manuscripts, it has not been the subject of rigorous historical analysis.[5] The purpose of this study is to demonstrate that a series of historically-specific ideas about color affected the choices made by the illuminators of Beatus manuscripts. My principal method is to examine repeating patterns of color use in these densely illustrated codices. Some of these patterns will help to test proposals by John Gage and Liz James concerning medieval ideas about color. In some ways Beatus manuscripts provide a more fruitful ground for analysis of color patterns than the geographically disparate, and principally monumental examples used by Gage and James. The density of illustration in each manuscript, and the comparatively large number of codices from the same region and time period, provide ample material for study. The data derived from them permit me to propose additional motivations for the selection and reception of color, thereby broadening our understanding of medieval ideas about color.

Beatus manuscripts are named after the eighth-century Spanish monk Beatus of Liébana, who assembled a commentary on the book of Revelation which became very popular. The text came to include a remarkably elaborate group of images.[6] A complete set of paintings numbers one hundred and eight, of which sixty-eight illustrate the Apocalypse.[7] It is from the latter group that I draw my examples. Beatus arranged his *Commentary* in sections, each beginning with several verses from the book of Revelation followed by the relevant exegesis. In the mid-tenth- through early twelfth-century manuscripts considered in this study, the illuminations illustrate the biblical text and are placed adjacent or very close to it, before the bulk of the exegesis. Most of these images are full-page, and depict the same basic subjects in what is often a startling array of colors.

Illustrated copies of this work survive from the early tenth century on, and follow two main *stemmata*, or branches (Fig. 1). The second *stemma* has two major sub-branches (IIa and IIb). The divisions into these groupings were made on the basis of textual and iconographical differences. While their basic assignment into three divisions has not been changed, the relationship of elements within these recensions continues to be revised.[8] Analysis of these issues is outside the scope of this project. I will therefore use as a working model Peter Klein's *stemma* I, onto which I have grafted John Williams's recently published revision of *stemma* II.[9]

I studied eight manuscripts for patterns of color use.[10] All were copied and illuminated in a small, relatively isolated area of northern Spain, between *ca.* 940 and 1109 C.E. Two are ascribed to *stemma* I, five to *stemma* IIa, and one is from *stemma* IIb. Their selection was informed by several factors, the most important of which are their close temporal and geographical relationships. An attempt to build an understanding of historically specific ideas about color can most profitably be undertaken within restricted parameters. Because textual and iconographic elements tend to be transmitted through copying, a study of patterns of color use must consider this factor as well. Finally, the pragmatic reality of access to manuscripts and to color reproductions of them has also informed my selection.[11]

