Section 34 Spatial analysis of individual buildings, part 1

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Cross-references to Digital Supplement in red
Cross-references to Printed Synthesis in brown

This introduction applies to Sections [34–35].

The method of laying out individual buildings in relation to each other

There were two basic factors operating in the design of buildings. One was whether they were built on 'green' sites away from other structures, where the dimensions laid out were the internal ones; the other whether they were built in close association with extant buildings and the design was based on external measurements. With the latter, sight lines were taken from existing buildings and projected; this produced the external dimensions of the structure [34.01].

In trying to see how the plans were constructed, the method that worked consistently well was to commence with taking the measurement of the internal dimensions of the buildings, using one width and examining the proportions of the building in relationship to it. The width then represented the measurement of the basic square that could be subdivided in a number of ways. For most of the buildings, the layout appears to have begun with the eastern and northern ends; the starting point always contains a complete square. In some cases there is only one good end surviving; here the dimensions are roughed out starting from measuring the width of the better end and using that to estimate the dimensions of the building. If this seemed a fruitful avenue of research, the same process was attempted from the missing or poor end of the building. In several cases this system provided a far more convincing result, with more coinciding points and lines; these also usually turned out to be the buildings where practicality would dictate starting at a particular end and working out from it. This was the case with S14 where the west end was damaged, the east end survived well, but the edge of the fishpond lying to the west originally dictated the limit of the building. The same measurement that dictated the form of the original building was used to design both extensions and external open spaces between buildings.

S	Method	Description	External or internal origination
6	Simple square	Built from two buildings S6 + S87; single square of 5.20m	External virgin build
7	Simple square + rotated square	Two squares of 4.00m + two parts of rotated squares within the drainage ditch; posts coincide	Mostly internal
8	Simple square	Built from two buildings S8 and S88; based on three squares of 3.50m, posts and slots coinciding	Mostly internal, virgin build
9	Simple square	2 squares of 3.00m with posts coinciding and outshot or fence of ½ square	Internal virgin build
10	Simple square	8 squares and 2 half squares of 6.40m outside floor area; posts coincide	External virgin build
11	Simple square	2 squares and 2 halves of 1.60m + porch; coincides with posts	Internal
13	Simple square	Built from 11 squares of 3.70m side, coinciding with posts; porch the same size	Internal

S	Method	Description	External or internal origination
14	Simple square	8 squares of 4.30m with posts at intervals; ½ square marks door	External virgin build
16	Simple square	8 squares of 3.40m coinciding with posts and reconstructing the wall lines. Squares of 2.30m used for modifications 2, 3, 6, 7[1]	External
17	Simple square Rotated square	8 squares of 3.20m; coincidence of partition and door Rotation for north extension	Internal
18	Simple square	Extracted from two buildings, S18 and S86, 4 squares of 3.00m 2 half squares; posts at intervals	Internal External
19	Simple square	3 squares of 5.20m; 2 in main chamber, 1 in north stone yard[2] 1 south annexe	Internal External
21	Simple square	One square of 4.80m + fractions	Mainly internal
22	Simple square	One square of 3.35m	
23	Simple square + circle	Based on 8 squares of 4.00m; surveying error at south end led to abandonment of rectangular annexe, replaced by circle of 3.50m diameter	Mainly internal
24	Simple square	Based on squares of 2.60m perpendicular to main original grid	
25	Simple square	Based on squares of 2.60m, at 45° to S24	
27	Simple square	Based on 8 squares and 4 half squares of 2.50m; designed to fit S19	External
28	Simple square	6 squares of 3.80m	Internal
29	Simple square + Rotated square	6 squares of 3.30m + 2 half squares + rotated square for external stair base	Mainly internal
30	Simple square	9 squares of 3.50m, ignoring partition walls[3]	External
31B	Simple square	Reconstructed as 3 squares	
35	Simple square	Based on multiple use of a square of 5.80m extended through the building's life. Coincided with walls and post pads	
36	Simple square	4 squares of 4.75m	
37	Simple square	4 squares[4] of 6.20m	
38	Simple square	4 squares and 2 quarter squares of 6.60m	Internal
39	Simple square	One square of 4.50m	External
40	Simple square	4½ squares of 8.50m coinciding with post pads[5]	
41A	Simple square	Squares of 2.75m forming building and paddock	
41B	Simple square	2½ squares of 4.60m coinciding with padstones and walls[6]	Mainly internal
42	Simple square	4½ squares of 5.00m	Internal
43	Simple square + Rotated square	3½ squares of 7.40m + rotated square for south extension	Internal
50	Simple square	Square of 2.50m	
51	Circle	Diameter 7.00m or 8.90m	External
52	Simple square	1½ squares of 7.00m	Mostly external
53	Simple square	Squares of 3.00m continuing from S3. Mostly internal [?]	

[1] Editor's note: This seems different from what is described below and shown in 34.08, which shows equal size squares and half squares in the revised plan.
[2] Editor's note: described differently below. Not quite as shown on plan 34.09.
[3] Editor's note: not as shown on plan 35.01=7.16.
[4] Editor's note: described as three squares in [35].
[5] Editor's note: the reconstruction of this building was revised in 2011, see illustrations 10.06=23.01a and 10.07=23.01b, and text in [4] and [10].
[6] Editor's note: described as two squares in [35].

S	Method	Description	External or internal origination
54	Simple square	North square of 6.20m + S of 7.00m divided by a corridor + a square of 6.20m. The southern square was misaligned to the west giving a poor south-east corner to the building. The partition walls were not joined to the squares. The middle square confirmed the width of the wall of the chapel S16.[7]	Internal
55	Simple square	6 squares of 4.30m coinciding with walls and partitions	External
56	Simple square	8 squares of 6.00m	External
57	Simple square	4 squares of 3.60m coinciding with walls and post pads	Mainly internal
59	Simple square	2 squares of 5.00m	Internal
60	Simple square	2 squares of 5.75m with error in alignment in internal partition apparently corrected	External
61	Simple square	1 square of 5.50m coinciding with pads and earthwork	Mainly internal
62	Simple square	6 squares of 3.00m	Internal
63	Simple square	Based on 6 squares of 4.80m divided by a corridor of ¼ square width. The analysis showed a laying out fault by the masons. Erected within frame of medieval [?] to same pattern	Internal
65	Simple square	Based on 14 squares of 2.30m including external features; coincides with post pads and partition lines	Internal
66	Simple square	8 squares of 2.75m designed with 41A	External
69	Simple square	2 squares of 2.70m	Internal
71	Simple square	2 squares of 3.60m marking floor level. Matched Extent buildings F and G	Internal
73	Simple square	2 squares of 4.50m, half square marking door. Matched Extent building C	Mostly external
74	Simple square	2 squares of 2.50m	Internal
75	Simple square	2 squares of 1.90m	External
80	Simple square	2 squares of 3.00m	Internal
81	Simple square	One square of 7.60m + 1/8 square	Internal
85	Simple square	One square of 6.75m	External
86	Simple square	Single square of 6.20m, 1 square 4.60m posts at intervals.	External Replacing S18
87	Simple square	Built from 2 squares of 4.50m	Internal, replacing S6
88	Simple square	Built from 8 squares of 2.70m on the outside of S8	Mostly internal replacing S8
96	Simple square Rotated square	One square of 4.40m	Rebuild of S21
103	Simple square	2 squares of 3.00m	External

34.01 Table giving the probable geometry and internal or external origin when planning buildings

The simple square

Three methods have been identified, though occasionally more than one was employed in planning a single building. The most commonly used construction technique was the simple square, used whole, halved, or quartered.

[7] Editor's note: this differs from the explanation given in [35].

The rotating square

Fewer buildings used the rotating square, the technique seemingly in common use, and which probably goes back to antiquity; it was illustrated as early as the 15th century by Mathes Roriczer in his *Booklet on Pinnacles* (Roriczer 1486). With the width-of-room square as the basic module, the square could be rotated[8], expanded and reduced, halved and quartered, to give a large range of reliable and repeatable measurements for constructing buildings and locating the principal construction features such as the position of doors, partitions and hearths. Apparently random constructions have an underlying symmetry and purpose. This has proved to be a method used on high status structures, domestic, and agricultural buildings.

Masons' techniques

The medieval mason was well versed in geometry, his badge of office being his compasses and square; together with a measuring rod and plumb line this simple equipment was all that was needed to lay out and design complex structures (Coppack 2004). He had two sorts of compasses: a large set made of wood, several feet long, and generally with points and hinge; precision compasses for designing or to measure complicated profiles, with a moveable hinge. He had a rigid measuring rod of up to six to eight feet long; one drawing from Brussels in Binding (2004, fig 120) of a mason in 1376 shows him with his long plumb line, square, and measuring staff; both staff and plumb line appear to be graduated. Both entries 122 and 266 indicate the use of a staff in the Anglo-Saxon period. Figure 514, dated to 1151–56 shows a mason with a measuring staff and a coil of rope; there are no illustrations showing the actual translation of a drawing onto the ground, but it may be that lengths of rope were used to form the initial outline of a building, to guide accurate excavation of footings or slots.

Ecclesiastic parallels

Coldstream (1989) cites the 14th century choir at Howden Minster where the bay length of 17ft 3ins equals both the height of the arcade and the east window arch; the arch springs 24ft from the floor. At Ely the *triforium* plus clerestory measures 17ft 6ins and the distance from the *triforium* floor to the spring of the inner arch is 12ft 3ins. Unfortunately at La Grava superstructures do not survive to measure, but they might be reconstructable to an extent using these principles, at least in theory.

To appreciate the extremely close correlation between the basic geometrical theory and its application to the La Grava buildings it was essential to present the structural evidence with sufficient building detail to demonstrate the relationships with the geometrical design. This is described in the report, although the simpler buildings are allowed to speak for themselves with the measurements and method given. The more complex relationships are explained, as are the impacts upon the interpretation or reconstruction arising from this analysis. The analysis has been applied throughout to see whether it applies to buildings of all ages on the site. Correlation of measurements to see whether the measurements are usually medieval and related to the rod, pole, or perch remains to be explored. The buildings detailed in the 1155 Extent [7.03] have been subjected to the same analysis; plans and elevations have been reconstructed. They have been compared with the excavated structures to see whether there is a correlation.

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[8] Editor's note: the square is rotated by 45°, and measurements based on diagonals are used in addition to measurements based on the square itself.

Spatial analysis of buildings by illustration, part 1[9]

34.02
S6 Simple square reconstructed; external
S87 Double square; internal

34.03
S7 Two squares at the east; rotated square to the west

34.04
S10 Eight equal squares plus two half squares; external

34.05
S13 Ten equal squares plus one equal square external for the south annexe; mainly internal

34.06
S14 Eight equal squares designed internally[10]
S18 One square to the east; plus four quarter-length squares[11]. Designed along building lines
S86 Two squares of different sizes; designed along building lines

34.07
S16 Main chamber, eight equal squares; externally designed
S16 North annexe based on one and one half squares of equal size to the main chamber, measured internally
S16 South annexe based on one square equal to the main chamber, measured internally

34.08
S17 Original build; based on six squares of equal size measured externally[12]
S17 Extended; three and one half squares of the same size measured externally

34.09
S19 Relationship with S27, S58, S17; based on nine equal squares formulated from the outside of the main block S19, coinciding with building lines[13]

34.10
S21 Simple square[14]
S96 Two squares[15]

[9] Editor's note: the descriptions of buildings given here and in [35] are very similar to those found in 34.01, although in some instances the information in each conflicts, as noted below and in [35].
[10] Editor's note: the plan shown on 34.06 shows these squares as designed externally.
[11] Editor's note: shown differently on 34.06.
[12] Editor's note: described differently above, 34.01. Not as shown on plan 34.08.
[13] Editor's note: described differently above, 34.01. Not quite as shown on plan 34.09.
[14] Editor's note: not as shown on plan 34.10.
[15] Editor's note: described differently above, 34.01. Not as shown on plan 34.10.