Archaeoastronomy, no. 21 (*JHA*, xxvii (1996))

STONE ROWS OF THREE OR MORE STONES IN SOUTH-WEST IRELAND

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1. INTRODUCTION

A previous paper[1] has described the motivation for, the methodology of data acquisition in, and the initial data obtained from, a new archaeoastronomical investigation of prehistoric stone rows in south-western Ireland. The survey programme commenced in 1991 with a study of the four- to six-stone rows in the region, chosen because at these sites the orientation we measure today is most likely to be an accurate reflection of that originally intended. During two subsequent seasons of fieldwork attention was focused upon three-stone rows where all three stones remain standing, another sample of sites at which orientation evidence is likely to be relatively well preserved. In this paper we present the data from these sites and examine them in conjunction with the earlier data in order to draw some tentative conclusions about whether the trends apparent in the latter appear to be strengthened within the broader sample. Statistical analysis of the data will be attempted elsewhere.

2. METHODOLOGY OF DATA ACQUISITION

The methodology of data acquisition during the second and third seasons was similar to that employed during the first.[2] The starting point was those sites with exactly three stones in Counties Cork and Kerry in the list of stone rows published by Ó Nualláin,[3] supplemented by that of Burl.[4] The 48 sites concerned[5] are listed in Table 1, ordered from grid north to grid south. A map showing the distribution of the sites, together with the longer stone rows covered in the earlier paper, is given in Figure 1.

Priority for inspection and survey was given to those sites at which, according to Ó Nualláin's description, all three stones remain standing. All 27 such sites were visited, with the exception of Garryduff, which was omitted because it appears only in a supplementary list, and Derrynagree and Monavaddra, which were searched for but not found. At one site, Kippagh, it was found that only one stone now remains upright.

The remaining 21 sites include eleven (Ballygarret, Gortnagulla, Carrigagulla E, Canrooska, Coomleagh East, Eyeries, Turnaspidogy, Knockatlowig, Lissacraig West, Murrahin North, and Comillane) where one stone has fallen but the other two remain standing. Three of these (Ballygarret, Gortnagulla, and Canrooska) were also visited because time and logistics happened to permit. No data reduction

0142-7273/96/0021-0055/$2.50

TABLE 1. Three-stone rows in Counties Cork and Kerry.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Co	3	Tooreenglanahee	R174207	1	1	3								a			
Ke	59	Ballygarret	Q685101	2	3	3		SW	d	D	N		C	Y		930526	bq
Ke	60	Ardamore	Q521000	3	3	3		NE		D	Y	x	B	N		930526	
Co	4	Gneeves	W469928	3	3	3		NE		A	N		B	N		920408	i
Co	6	Kippagh	W225883	1	3	3	h	SW		D	N		A	N		920411	c
Co	7	Cloghboola More	W277872	3	3	3		SW		A	N		A	N		920411	
Co	174	Garryduff	W904854	3	3	3											o
Ke	61	Gortnagulla	V568836	2	3	3		SW		B	Y		D	Y		930522	b
Co	173	Knocknagappul	W346831	1	3	3											a
Co	9	Glantane East	W277830	3	3	3		SW		B	N		B	N		920411	
Co	10	Carrigagulla W	W371829	3	3	3		U	r	C	N		D	N		920408	
Co	11	Carrigagulla E	W384828	2	3	3											a
Ke	62	Curragh More	V801819	3	3	3		NE		C	Y		A	N		930524	
Co	14	Ballideenisk	W723819	1	3	3											a
Co	19	Dooneens	W382815	1	3	3											a
Ke	63	Dromteewakeen	V761808	3	3	3		NE		B	N		D	N		930524	
Co	18	Coolacoosane	W323789	3	3	3		U	s	D	N		A	N		920411	
Co	15	Derrynasaggart	W183780	3	3	3		NE		C	N		A	N		920409	i
Co	21	Coolavoher	W191753	3	3	3		N	t	A	N		C	Y		920409	
Co	24	Bealick	W351727	2	2	3											a
Ke	176	Fermoyle	V453724	2	2	3											a
Co	23	Gortyleahy	W319717	3	3	3		SW		A	N		D	Y		920412	
Ke	66	Dromatouk	V952711	3	3	3		U	u	D	N		C	N		930524	
Co	27	Cloonshear Beg	W264682	3	3	3		SW		D	N		D	Y		910415	
Co	26	Turnaspidogy	W189666	2	3	3											ak
Co	29	Rossnakilla	W324658	3	3	3		N	v	A	N		B	N		920412	
Co	32	Derrynagree	W140627	3	3	3											f
Co	34	Monavaddra	W195623	3	3	3											g
Co	30	Canrooska	V936583	2	3	3		SW		B	N		D	N		930520	b
Co	31	Currakeal	V937582	3	3	3		SW		B	N		D	N		930520	
Ke	69	Cashelkeelty	V747575	3	3	4	p	NE		D	Y		A	N		930522	j
Co	39	Coomleagh East	W119536	2	3	3											a
Co	38	Kilcaskan	V817523	3	3	3		U	u	A	Y		D	Y		930522	
Co	42	Cullenagh	W152522	3	3	3		SW		D	N		A	N		920413	
Co	43	Eyeries	V645505	2	3	3											a
Co	49	Leitry Lower	W138488	3	3	3		SW		B	N		D	Y		930520	
Co	46	Foildarrig	V684467	1	3	3											a
Co	47	Scartbaun	W003461	3	3	3		SW		A	N		D	Y		920413	
Co	50	Knockawaddra	W269460	3	3	3		NE		D	Y	e	B	N		930520	
Co	48	Keilnascarta	V993453	3	3	3		SW		A	N		A	N		920413	
Co	44	Fanahy	V651448	1	3	3											a
Co	45	Clonglaskan	V644446	1	3	3											a
Co	51	Knockatlowig	W320443	2	3	3											a
Co	52	Maulinward	V975438	3	3	3		N	w	B	Y		B	N		930520	
Co	175	Farranmanagh	V825385	1	3	3											a
Co	53	Lissacraig West	W039367	2	3	3											a
Co	54	Murrahin North	W029365	2	3	3											a
Co	56	Comillane	V977229	2	3	3											a

COLUMN HEADINGS:

1 County (Co=Cork/Ke=Kerry)
2 Catalogue no. in Ó Nualláin, "Stone rows in the south of Ireland"
3 Site Name
4 Irish National Grid Reference
5 No. of stones still standing
6 No. of stones remaining (standing or prostrate)
7 Estimate of original no. of stones in row
8 Notes on number of stones
9 Probable direction of stone height gradation, if any (tallest at NE end / SW end / N(neither) / U(unknown))
10 Notes on stone height gradation
11 (Most distant) horizon distance category to NE
12 Highest point exists within the horizon profile indicated to the NE? (Y/N)
13 Notes on horizon to NE
14 (Most distant) horizon distance category to SW
15 Highest point exists within the horizon profile indicated to the SW? (Y/N)
16 Notes on horizon to SW
17 Date of survey or visit
18 General notes

KEY TO NOTES ON NO. OF STONES (Column 8)

h Only the central stone *b* now remains standing, although stone holes where the other stones had stood were still visible at the time of the author's visit in 1992. The author was informed at the time that stones *a* and *c* had been thrown over by someone taking silage about five years previously. The south-westerly height gradation (accentuated by the slope of the ground) is deduced from Ó Nualláin's plan and drawing.[35]
p Although listed as a three-stone row by Burl,[36] the alignment is known to have consisted originally of four stones following excavations in 1977,[37] as noted by Ó Nualláin[38] and more recently by Burl.[39]

KEY TO NOTES ON STONE HEIGHT GRADATION (Column 10)

d Prostrate stone *a* would have been the tallest,[40] but the other stones are also substantial.
r Stones *a* and *c* both appear to have been broken off.
s Stone *a* has been reduced to a stump.
t Stone *b* appears to have been the smallest.
u All three stones appear to have been broken off.
v Three tall stones of roughly equal height, stone *b* being marginally the shortest.
w Three small stones of roughly equal height.

KEY TO NOTES ON HORIZON TO NE (Column 13)

e The profile is obscured a forestry plantation adjacent to the site and has been obtained by calculation.
x The left-hand end of this indication was obscured by cloud at the time of survey. The altitude here has been estimated to be less than that of the peak within the indicated profile.

KEY TO GENERAL NOTES (Column 18)

a Not visited as fewer than three stones remain or remain standing.
b One of those sites with two stones standing and one prostrate that it was possible to visit and survey in the time available.
c Visited and surveyed because it was believed prior to the visit that all three stones were standing.
f Not found. Much of the area is now under forestry plantation.
g Not found. The northern slopes of Mullaghmearogafin, where the site is located, are now under forestry plantation.
i While the nomenclature "NE/SW" is used at this site (see text), the orientation is in fact between E/W and ESE/WNW.
j The site 100m to the W, the remains of which consists of three large stones in a row, is actually the remains of a stone circle.[41]
k No grid reference is supplied by Ó Nualláin. The value quoted is that given by Burl[42] and noted as approximate.
o Omitted because it only appears in a supplementary list.[43]
q The north-point is reversed in Cuppage's plan.[44]

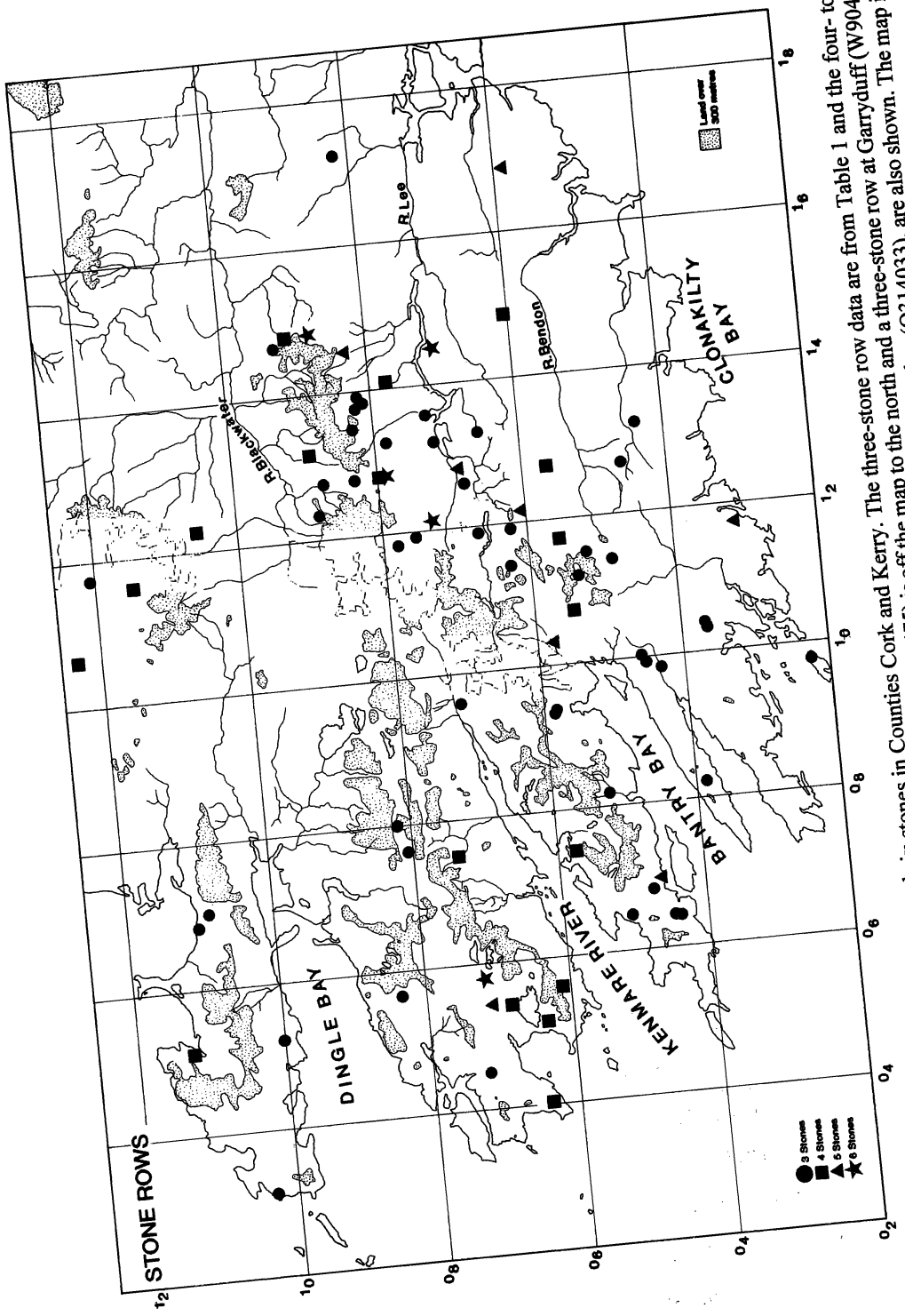

FIG. 1. Map of the stone rows of between three and six stones in Counties Cork and Kerry. The three-stone row data are from Table 1 and the four- to six-stone row data from an earlier paper.[6] A six-stone row at Beal Middle (Q885475) is off the map to the north and a three-stone row at Garryduff (W904854) is off the map to the east. Two possible three-stone rows, now destroyed, at Curraduff (Q703088) and Clogher (Q314033), are also shown. The map is based on one kindly supplied by the Archaeological Branch, Ordnance Survey, Dublin.

was attempted on site, so the inclusion of data from these sites should not bias the overall conclusions and they duly appear in the analyses that follow.

As in the previous paper, we refer for convenience to the 'NE' and 'SW' directions in the context of individual rows (e.g. "the NE-most stone"), even though the rows in question may actually be oriented NNE–SSW, ENE–WSW, or even N–S or E–W. The actual orientation data are given in Table 2. For referring to the stones within a row, we always use the label *a* for the SW-most stone (in the above sense), labelling subsequent stones towards the NE as *b*, *c*, etc.

Surveys were undertaken at all of the 27 sites visited, although in nine cases (Cloghboola More, Curragh More, Coolacoosane, Derrynasaggart, Coolavoher, Gortyleahy, Cullenagh, Scartbaun, and Keilnascarta) surveys in one direction of indication were rendered unproductive because of the close proximity of the indicated horizons (closer than, say, 500m). At Knockawaddra the NE horizon was obscured by adjacent forestry trees, but obtained instead by calculation. Kippagh was included because, despite the fact that only one stone now remains standing, a recent plan is available and the stoneholes of the removed stones are still clearly visible; thus the indicated azimuth range is considered reliable. In all, then, we have data on 45 horizon indications at 27 sites.

Procedures for (i) identifying the possible preferred direction of indication from stone height gradation, (ii) identifying prominent hills falling within the indicated azimuth ranges, and (iii) producing 'horizon scans' to determine whether there is a preference for more distant horizons in particular directions, follow those described in the earlier paper.[7] The probable direction of height gradation at each site, together with the horizon distance category of,[8] and the presence or absence of a highest point within, each indicated horizon range, are given, with detailed notes as appropriate, in Table 1.

3. THE RESULTS

3.1 *Preferred Directions of Indication*

A probable 'preferred direction' was identified from the stone height gradation at 20 of the 27 sites examined (see Table 1). Thirteen are to the SW and seven to the NE, showing an apparent preference for the SW but with many instances to the NE. This contrasts with the earlier result from the four- to six-stone rows, where the probable directions of indication were almost evenly split between SW (11 instances) and NE (9 instances),[9] and gives an overall result showing some preference for the SW (24 instances, as opposed to 16 for the NE).

Of the 20 sites where a probable preferred direction could be identified, the horizon distance category was greater in the preferred direction than in the opposite direction in 11 cases,[10] the same in 4 cases,[11] and less in the remaining 5 cases.[12] These data present a far less clear-cut case for a correlation between the apparent direction of indication and the greater horizon distance than did the data from the four- to six-stone rows,[13] and even include two sites (Kippagh and

Cullenagh) where the horizon in the apparent preferred direction is closer than 1 km (category A) whereas that in the opposite direction is over 5 km distant (category D). Nonetheless, when the two sets of data are combined the correlation between preferred direction and greater horizon distance is still strong, with the greater distance category being in the preferred direction in 26 cases out of 40 and in the opposite direction in only six.[14]

3.2 *Variation of Horizon Distance with Azimuth*

Horizon scan data have been obtained at each of the sites visited and are combined with the earlier data from the four- to six-stone rows in Figure 2.[15] Figure 2(a) shows, for each 1° azimuth interval, the percentage of horizons falling into each of four distance categories. Figure 2(b) shows similar information for azimuths relative to the preferred direction rather than absolute azimuths, at sites where the preferred direction could be identified.

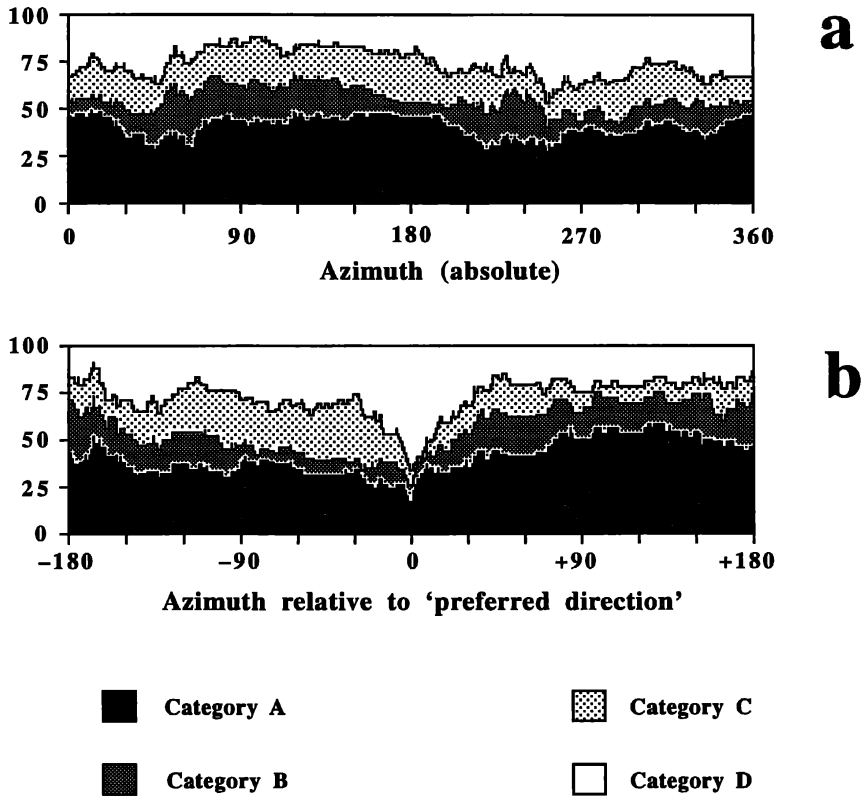

FIG. 2. (a) Horizon scans by azimuth. For each 1° interval in azimuth, we plot the percentage of horizons in category 'A' (up to 1 km, black), 'B' (1–3 km, dark shading), 'C' (3–5 km, light shading) and 'D' (over 5 km, white). The figure combines data from the three-stone rows (see Table 2) and the four- to six-stone rows considered earlier.[16] Where data could not be measured or estimated on-site, e.g. because of nearby afforestation, they have been omitted and the average taken over the remaining data for the azimuth interval in question. (b) Horizon scans relative to the 'preferred direction' where this is available. Bins now represent the azimuth relative to the preferred direction.

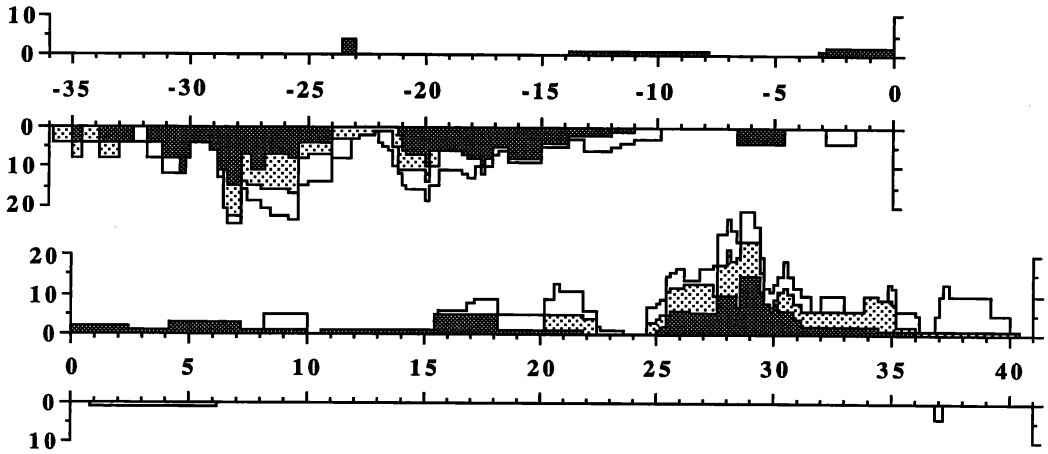

FIG. 3. Indicated declinations. As in Fig. 2, data from the three-stone rows are combined with data from the four- to six-stone rows published earlier. Easterly data (rising objects) are plotted upwards, westerly data (setting objects) downwards. Each range is plotted with equal weighting assigned to all declinations between the limits given in Table 2 and a similar table for the earlier data.[23] The weight is 4 vertical units for ranges up to 2 degrees, 3 units for ranges 2–3 degrees wide, 2 units for ranges 3–4 degrees wide, and 1 unit for ranges over 4 degrees wide. Dark shading denotes a range in the preferred direction, lighter shading a range at a site where the preferred direction is unidentified, and no shading a range in the direction opposite to the preferred one. One indication between approximately +48° and +50° (preferred direction unidentified) is off the graph.

Comparing the graph of the absolute azimuth data with that for the four- to six-stone rows only,[17] it is evident that the additional data have served generally to smooth out the graph, suggesting that the more obvious variations noted earlier[18] are not significant. A similar remark applies to a noticeable increase in the proportion of category D (distant) horizons around –140° in the earlier graph of azimuths relative to the preferred direction.[19]

On the other hand, the new graph of azimuths relative to the preferred direction serves to confirm that there is a sharp increase in the proportion of more distant horizons around 0°. In the new graph the dip is even deeper and more prominent, and centred exactly upon the 0° bin (i.e. within 1° of the preferred direction itself). It should be mentioned that this result came as a complete surprise when the graph was first plotted; the fact that the total number of sites with a category A (local) horizon in the preferred direction had increased to 6, together with the decreased correlation between the apparent direction of indication and the greater horizon distance mentioned earlier, had suggested that the earlier evidence for "a clear and sharp increase in the proportion of distant horizons at relative azimuths close to zero — i.e. close to the 'preferred direction' at individual sites"[20] might now be considerably diluted. Instead, quite the opposite is the case. It should also be emphasized that the graph (Figure 2(b)) remains as initially plotted, and the raw data obtained on site have not been retrospectively modified in any way.

TABLE 2. Table of indicated horizon ranges.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
59	54	61	0·2	+20·8	+16·8		N	234	241	4·8	−17·6	−13·8		N	58–238	238
60	42	49	2·4	+29·8	+25·0	g		222	229	0·0	−27·6	−24·0	g		46–226	46
4	89	98	2·4	+2·4	−3·2			269	278	2·0	+0·8	+6·2			94–274	94
6	354	358	−0·2	+37·2	+36·8	c	N	174	178	14·6	−23·6	−23·0	c	N	356–176	176
7	18	24	1·0	+36·2	+34·8		N	—	—	—	—	—	a		21–201	201
61	53	61	11·0	+30·6	+25·8		N	233	241	0·8	−21·2	−17·4		N	57–237	237
9	56	68	4·4	+23·6	+17·2	f	j	236	248	2·8	−18·4	−11·0		j	62–242	242
10	26	30	1·8	+35·2	+33·8		o	206	210	−0·2	−34·4	−33·0		p	28–208	—
62	79	96	3·2	+10·0	−2·8		N	—	—	—	—	—	a		87–257	87
63	45	58	10·0	+36·0	+25·2		k	225	238	3·6	−21·8	−16·8		l	52–232	52
18	11	38	2·8	+40·4	+30·4	e		—	—	—	—	—	a		24–204	—
15	102	111	−0·2	−7·8	−13·8		N	—	—	—	—	—	a		106–286	106
21	—	—	—	—	—	a		220	228	1·8	−27·0	−22·8		N	44–224	—
23	—	—	—	—	—	a		234	243	0·4	−20·8	−16·4		N	59–239	239
66	43	50	1·2	+27·4	+24·6			223	230	2·4	−25·4	−21·0			47–227	—
27	53	55	0·4	+21·8	+20·6		j	233	235	1·4	−21·0	−19·8		j	54–234	234
29	40	44	1·8	+29·6	+28·0			220	224	1·8	−26·8	−25·0			42–222	—
30	77	80	2·8	+10·0	+8·2		N	257	260	2·2	−6·6	−4·6		N	78–258	258
31	57	68	3·0	+22·6	+15·6		N	237	248	2·0	−18·2	−12·0		N	62–242	242
69	81	86	2·6	+7·2	+4·2			261	266	2·4	−2·8	−1·6			83–263	83
38	20	25	15	+50	+48	h	j	200	205	0·4	−35·8	−34·4		j	23–203	—
42	28	31	0·4	+33·0	+32·0			—	—	—	—	—	a		30–210	210
49	43	47	3·0	+29·2	+27·4		n	223	227	0·2	−27·4	−25·4		n	45–225	225
47	—	—	—	—	—	a		219	224	0·4	−28·4	−26·8		N	42–222	222
50	31	35	−0·2	+31·2	+30·0	b	m	211	215	0·4	−32·4	−30·4		m	33–213	33
48	—	—	—	—	—	a		236	241	0·8	−20·0	−17·2		N	59–239	239
52	27	48	2·2	+35·6	+26·2		j	207	228	4·6	−27·6	−22·2		j	37–217	—

Column headings:

1 Catalogue no. in Ó Nualláin, "Stone rows in the south of Ireland"
2 Minimum Azimuth (to NE), quoted to the nearest degree
3 Maximum Azimuth (to NE), quoted to the nearest degree
4 Mean altitude (NE indication), quoted to the nearest 0·2 degrees
5 Maximum Declination (NE indication), quoted to the nearest 0·2 degrees
6 Minimum Declination (NE indication), quoted to the nearest 0·2 degrees
7 General notes (horizon to NE)
8 Notes on Lynch's result where significantly different (horizon to NE)
9 Minimum Azimuth (to SW), quoted to the nearest degree
10 Maximum Azimuth (to SW), quoted to the nearest degree
11 Mean altitude (SW indication), quoted to the nearest 0·2 degrees
12 Minimum Declination (SW indication), quoted to the nearest 0·2 degrees
13 Maximum Declination (SW indication), quoted to the nearest 0·2 degrees
14 General notes (horizon to SW)
15 Notes on Lynch's result where significantly different (horizon to SW)

16 Mean axis, quoted to the nearest degree
17 'Preferred direction' estimated from stone height gradation, quoted to the nearest degree

KEY TO GENERAL NOTES ON HORIZONS (Columns 7 and 14)

a Horizon less than 500m distant, so not surveyed.
b The "fine outlook to the east and north" noted by Ó Nualláin[45] is now obscured by a forestry plantation adjacent to the site, so was not surveyed. The tabulated values have been obtained by calculation.
c The indicated azimuth range has been estimated using the positions of the stoneholes of the two stones removed in about 1987. They are consistent with Ó Nualláin's plan.[46]
e The indicated azimuth range here is very wide, owing to the sinuous nature of the alignment.
f The left-hand end of the indication is close (about 300m) and was not surveyed. The declination figure quoted is an estimate.
g Some error is possible owing to poor visibility conditions and the lack of an accurate sun-azimuth determination at this site.
h The lower accuracy is due to large extrapolations between surveyed points.

KEY TO NOTES ON LYNCH'S RESULT WHERE SIGNIFICANTLY DIFFERENT (Columns 8 and 15)

j Lynch appears to have transposed the horizon altitudes in the two directions at this site.
k Lynch quotes a much lower altitude of 3°·0.
l Lynch quotes a higher altitude of 6°·9.
m Lynch quotes an azimuth of 29°·0 / 209°·0.
n Lynch quotes an azimuth of 33°·5 / 213°·5.
o Lynch quotes an impossibly low altitude of –2°·8.
p Lynch quotes a higher altitude of +1°·4.
N Lynch does not provide data for this site.

3.3 *Indicated Declinations*

The azimuth limits of the indicated horizon range, together with mean altitudes and declination limits, are listed to an appropriate accuracy in Table 2. As with the four- to six-stone rows, discrepancies between our data and those published fifteen years ago by Lynch[21] are listed in the table. The indicated declinations obtained from the data tabulated in Table 2 have been combined with the four- to six-stone row data[22] and are presented in Figure 3. As in the earlier paper, each range is simply plotted with equal weighting assigned to all declinations between the limiting ones, a lower weighting per bin being used for wider ranges.

Because the three-stone row orientations include three sites where the indication (or part of it) is a little to the south of east / north of west and one site where the indication is a little to the west of north / east of south, it is no longer true (as was the case with the rows of at least four stones) that all southern declinations are setting declinations and all northern declinations are rising ones. Indeed, Kippagh, whose mean orientation is 356°/176°, yields a wholly anomalous orientation close to midwinter sunrise owing to an unusually high southern horizon at an altitude exceeding 14°.

How has the addition of these new data, more widely scattered in azimuth, affected the declination concentrations tentatively identified amongst the four- to six-stone rows?[24] The concentration to the right of –31° now appears to be quite strongly focused between –29° and –25°, whereas the concentration between

TABLE 3. Table of highest points in the indicated horizon ranges.

1	2	3	4	5	6	7	8	9
59	SW	Y	Hill, 656 ft, at Q656081	3·5	237·7	5·2	–14·8	
60	NE	Y	Knockmulanane	7	42·7	3·7	+29·9	a
61	NE	O	Been Hill, ridge to SE of summit	2·0	57·5	11·3	+28·6	
61	SW	Y	Benlee	11	236·9	1·3	–18·9	
62	NE	Y	Brassel Mountain	3·0	85·0	5·5	+7·3	
21	SW	N	Hill 1265 ft at W162727	3·9	227·5	2·2	–23·0	
23	SW	Y	Hill 1797 ft at W151601	20	234·6	1·0	–20·4	
27	SW	Y	Hill 1797 ft at W151601		233·7	1·7	–20·3	
69	NE	Y	Droppa	8	84·3	2·9	+5·6	
38	NE	U	Slopes of unnamed hill, 1714 ft, 1 km SW of Glenkeel Lake/Lough	1·0	22·3	15·4	+49·5	
38	SW	U	Hill 795 ft, 2·5 km from Sheep's Head	20	201·3	0·5	–35·3	
49	SW	Y	Mount Kiel	13	225·8	0·4	–25·7	
47	SW	Y	Mount Corin	9	219·6	0·9	–28·1	
50	NE	Y	Green Hill	18	34·7	0·1	+30·2	b
52	NE	N	Point on ridge, V983448	1·3	34·2	2·7	+33·1	

COLUMN HEADINGS:
1 Catalogue no. in Ó Nualláin, "Stone rows in the south of Ireland"
2 Direction (NE/SW)
3 Stone gradation in this direction? (Y/O(opposite direction)/N(neither)/U(unknown))
4 Name of peak
5 Distance (km)
6 Azimuth of summit, to the nearest 0·1 degrees
7 Altitude of summit, to the nearest 0·1 degrees
8 Declination of summit, to the nearest 0·1 degrees
9 Notes

NOTES
a Calculated owing to poor visibility at time of survey.
b Calculated owing to obstruction of the distant horizon (see Table 1).

+25° and +30° is largely unchanged in form and only slightly strengthened. A marked, though wider and weaker, concentration between about –21° and –15°, tailing off above the latter value, is now discernible.

The anomalous Kippagh line apart, this graph provides no evidence whatsoever for deliberate orientation upon the sun rising or setting close to the solstices. Indeed, the relevant declinations around ±24° seem to have been remarkably consistently avoided. It is tempting to interpret the south-western declination pattern as related to the moon. The two concentrations could have arisen if there was an interest in the most southerly position reached by the moon around

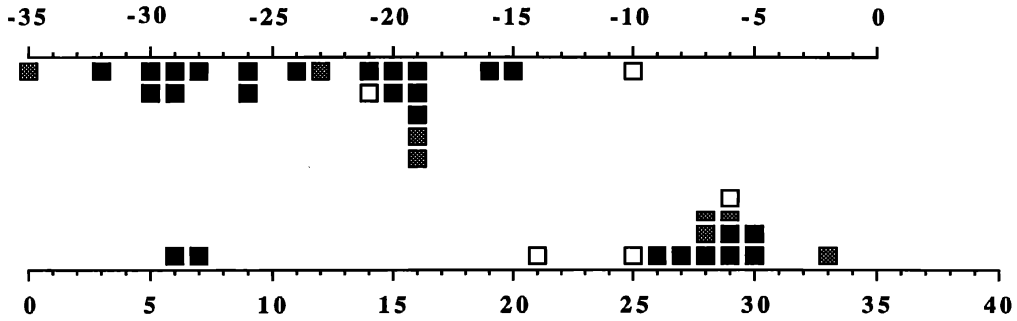

FIG. 4. Declinations of highest points in the indicated horizon ranges, combining data from Table 3 and data from the four- to six-stone rows published earlier.[30] Each square represents a single hill summit, plotted to the nearest degree. Where two summits of equal altitude occur in the same range, half squares are used. Dark shading denotes hills summits in the preferred direction; no shading denotes those in the opposite direction. Light shading is used at sites where no preferred direction has been identified. One highest point at declination +50° (preferred direction unidentified) is off the graph.

the time of major or minor standstill, but with considerable scatter owing to observations being quite casual.[25] A different possible interpretation of the concentration between –29° and –25° is that there was an interest in that part of the horizon where the moon could reach but the sun could not. On the other hand, the northerly concentration presents a problem as it is centred somewhat above +28°, further north than the moon can ever reach.

The statistical appraisal of such proposals is beyond the scope of this paper, but it is worth asking to what extent the visual effects giving rise to such interpretations might merely be a function of the particular weighting scheme chosen. The same data have been presented elsewhere in the form of a 'curvigram'[26] in which each indication is represented by a Gaussian curve of the same weight but with standard deviation equal to half the difference between the maximum and minimum declinations for the indication.[27] The general concentrations of southerly declinations are still discernible but considerably smoothed out, and only the northerly concentration around +29° remains relatively sharp.

3.4 *Prominent Hills*

In the earlier paper we suggested that high points within indicated azimuth ranges could provide an objective way of assessing whether a prominent hill is likely to be present in an indicated range of horizon.[28] The strong correlation noted there between the presence of a high point within the indicated horizon range and the directionality of a site is reinforced by the data from the 20 three-stone rows for which a preferred direction can be determined (Table 1). At nine of these a high point occurs in the preferred direction but not in the opposite direction (in five cases the preferred direction is the SW; in the other four it is the NE) and in one more case suitable high points occur in both directions. There are no cases where a high point occurs in the opposite direction but not in the preferred direction.

TABLE 4. (a) Horizon distance categories (see Figure 2) in and around the preferred direction and in and around the opposite direction along the alignment, for three- to six-stone rows where a preferred direction has been identified.

1	2	3	4	5	6	7	8	9	10	11
1	A	A	A	A	A	C	C	C	C	C
4	B	B	B	B	B	B	C	C	C	C
5	D	D	D	D	D	A	A	A	B	B
6	A	A	A	A	A	D	D	D	D	D
7	A	A	A	A	A	A	A	A	A	A
8	D	D	D	D	D	A	A	A	A	A
9	B	B	B	B	C	A	A	A	B	B
15	C	C	D	D	D	A	A	A	A	A
16	C	C	C	D	D	A	A	A	A	A
20	D	D	D	D	D	T	T	T	T	T
22	A	A	D	D	C	D	D	D	C	D
23	D	D	D	D	D	A	A	A	A	A
27	A	A	D	A	A	D	D	B	C	D
30	D	D	D	D	D	B	B	B	B	B
31	D	D	D	D	D	B	B	B	B	B
33	D	D	D	A	A	A	A	A	A	A
35	D	D	D	D	D	A	A	A	A	A
36	D	C	C	A	A	D	C	C	C	C
42	A	A	A	A	D	D	D	D	D	B
47	C	D	D	D	D	A	A	A	A	A
48	A	A	A	A	A	B	B	B	B	B
49	D	D	D	A	A	C	B	B	B	B
50	T	T	T	T	T	D	B	B	B	C
55	D	A	A	A	A	B	B	B	D	D
57	D	D	D	D	D	A	A	A	A	A
58	T	T	T	T	D	C	C	C	C	C
59	T	D	D	T	T	D	D	D	D	T
60	C	C	D	D	A	B	B	B	B	B
61	C	D	D	D	D	B	B	B	B	A
62	B	C	C	D	A	A	A	A	A	B
63	B	B	B	B	B	C	C	T	D	D
64	D	D	D	D	A	T	B	B	B	T
68	B	D	D	D	B	A	A	A	A	A
69	D	D	D	D	D	A	A	A	A	A
U2	D	D	D	D	D	A	A	A	A	A
U3	D	D	D	D	T	A	A	A	B	B
U4	A	A	D	A	D	D	D	D	D	D

Column headings:
1 Catalogue no. in Ó Nualláin, "Stone rows in the south of Ireland"
2 Horizon distance category at an azimuth 10° less than the preferred direction
3 Horizon distance category at an azimuth 5° less than the preferred direction
4 Horizon distance category in the preferred direction
5 Horizon distance category at an azimuth 5° greater than the preferred direction
6 Horizon distance category at an azimuth 10° greater than the preferred direction
7 Horizon distance category at an azimuth 10° less than the opposite direction

8 Horizon distance category at an azimuth 5° less than the opposite direction
9 Horizon distance category in the opposite direction
10 Horizon distance category at an azimuth 5° greater than the opposite direction
11 Horizon distance category at an azimuth 10° greater than the opposite direction

TABLE 4. (b) Horizon distance categories in and around the two directions along the alignment, where a preferred direction has not been identified. Four- to six-stone rows as well as three-stone rows are included, and sites are listed in order of their catalogue number. 'T' indicates that the horizon distance could not be measured or estimated on-site, e.g. because of nearby afforestation.

1	2	3	4	5	6	7	8	9	10	11
17	D	D	C	C	C	D	D	D	D	D
28	A	A	D	D	D	A	A	A	A	A
65	D	D	D	D	C	C	C	C	C	C
117	A	A	A	A	A	A	A	A	A	A
U1	C	C	C	C	C	B	B	B	B	B
10	C	C	C	C	C	D	D	D	D	D
18	D	D	D	D	D	A	A	A	A	A
21	A	A	A	A	A	D	D	D	D	D
29	A	A	A	A	A	B	B	B	B	B
38	A	A	A	A	A	D	D	D	B	B
52	C	C	C	C	B	A	A	A	A	A
66	D	D	C	C	C	C	D	C	C	D

Column headings:
1 Catalogue no. in Ó Nualláin, "Stone rows in the south of Ireland"
2 Horizon distance category at an azimuth 10° less than the NE direction
3 Horizon distance category at an azimuth 5° less than the NE direction
4 Horizon distance category in the NE direction
5 Horizon distance category at an azimuth 5° greater than the NE direction
6 Horizon distance category at an azimuth 10° greater than the NE direction
7 Horizon distance category at an azimuth 10° less than the SW direction
8 Horizon distance category at an azimuth 5° less than the SW direction
9 Horizon distance category in the SW direction
10 Horizon distance category at an azimuth 5° greater than the SW direction
11 Horizon distance category at an azimuth 10° greater than the SW direction

The main difference between the three-stone row data and those from the four- to six-stone rows is that as many as ten of the three-stone rows were placed where a high point occurs in neither direction.

The declinations of the relevant hill summits are listed in Table 3 and shown, together with the data from the four- to six-stone rows, in Figure 4.[29] With the exception of two summits in the ENE yielding declinations around +6° and +7°, the general patterns observed in the four- to six-stone row data[31] are generally enhanced by the new data, although the lunar interpretation of the northerly cluster of declinations is weakened by the addition of two indications at +30°. Of the 21 southerly hill summits in the preferred direction, twelve now fall within one degree of the major or minor lunar standstill, with another five within the range of the southerly monthly limiting moon.

4. DISCUSSION

Taking together the work on the four- to six-stone rows reported earlier and that on the three-stone rows reported here, 79 rows of three or more stones were initially considered, with data from 48 such monuments eventually being included in the analysis.

An impressive result is the clear and sharp increase in the proportion of distant horizons at relative azimuths close to zero — i.e. close to the 'preferred direction' at individual sites. In the preferred direction the proportions of category D and A (furthest and nearest) horizons are 66% and 17% respectively, as opposed to 50% and 35% respectively at an azimuth 10° greater than the preferred direction, 47% and 24% respectively at an azimuth 10° less, and an average of 26% and 40% taken around the horizon as a whole.[32] In other words, in the preferred direction we find more than twice the average proportion of category D (distant) horizons and fewer than half the average proportion of category A (local) ones.

This result certainly represents a trend rather than a universal principle that was always followed. Table 4 summarizes the relevant data for all the stone rows.[33] From this it is clear that about ten sites are responsible for the sharp dip around 0°, having horizons in a higher distance category in the preferred direction than a few degrees one side or the other. At six sites — Reananerree, Cloonshear Beg, Ardamore, Curragh More, Garrough, and Eightercua — the horizon is distant in the preferred direction but local, or at least less distant, within 10° on both sides. Yet at no fewer than six sites there is a local horizon in and around the preferred direction. Of course, it could always be argued that the preferred direction may be misidentified at some sites, but if this argument is made on the basis of the horizon distance alone then it is circular and proves nothing. In any case, there are two sites — Cloghboola More and Behagullane — where the horizon is local both ways along the row; it was clearly not crucial in these cases to have a distant horizon along the alignment, even in one direction. The Behagullane row is in a valley where the horizon is close (within 1 km) all the way around, a situation that could easily have been avoided by erecting the site a few tens of metres away.

There is a clear relationship between prominent hills and the directionality of a site as determined from the stone height gradation. In all, at 23 out of 40 three- to six-stone rows for which a preferred direction could be determined, a high point occurs in the preferred direction but not in the opposite direction; the reverse is true at only two sites. To the list of rows of four or more stones pointing directly at a single, prominent, distant summit within a wide stretch of closer horizon[34] can be added the three-stone row at Cloonshear Beg (Hill 1797ft at W151601), and there are a number of more marginal examples such as Kilcascan, Cashelkeelty, Gortnagulla, and Ballygarret.

Generally, while the evidence of an interest in orientation upon distant horizons and prominent hills has been strengthened by adding the three-stone rows

to the existing dataset, the evidence for astronomy remains more equivocal. It does seem clear, however, that the orientations of these ritual monuments generally have little or nothing to do with the sun, and that if anything the symbolism may relate to the moon. It is still difficult to be more specific. There is no evidence, either from the preferred directions, horizon distances and prominent hills, or from the astronomy, for a strong preference for SW over NE or vice versa.

If there was a general custom of incorporating astronomical symbolism in these monuments, some clues to its nature may be provided by the looking more closely at the anomalous sites. At Kippagh, for example, might the unusually high southern horizon account for the anomalous north–south orientation? Interestingly, all three east–west-oriented sites seem to have the preferred direction in the west, well away from the predominant orientation pattern towards the SW. In addition, all three sites are away from the main geographical concentrations of these monuments.

In order to progress our understanding of the symbolism incorporated in these monuments it may be crucial to consider their properties away from the direction of orientation. An idea that immediately suggests itself when the visitor sees sites such as Cloghboula More and Rossnakilla — where the horizon in both directions along the row is close but there are wide views with prominent hills across the alignment — is that the directions perpendicular to the row might have been important. Such an interpretation also seems eminently plausible at Gneeves, Kippagh and a number of other sites. The challenge is to derive from such speculations controlled sets of ideas susceptible to rigorous testing.

This and other challenges need to be met as part of the shift towards more contextual studies of the possible patterns of thought and symbolism that helped to define the location and orientation of these intriguing monuments within the Bronze Age sacred landscape and skyscape.

ACKNOWLEDGEMENTS

I am much indebted to Paul Walsh, of the Archaeological Branch of the Ordnance Survey in Dublin, for valuable background information, for the loan of large-scale maps for use in the field, and for comments on an earlier draft of the paper. Marcos Llobera assisted me in the survey work in 1992, as did Robin Harland in 1993. The Arts Budget Centre Research Committee of the University of Leicester provided financial support.

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1. C. L. N. Ruggles, "The stone rows of south-west Ireland: A first reconnaissance", *Archaeoastronomy* (supplement to *Journal for the history of astronomy*), no. 19 (1994), S1–20; hereafter: "Stone rows".
2. *Ibid.*, Section 2.
3. S. Ó Nualláin, "Stone rows in the south of Ireland", *Proceedings of the Royal Irish Academy*, lxxxviii C (1988), 179–256, pp. 231–40 and 252.

4. H. A. W. Burl, "A county concordance: The stone rows of Britain, Ireland and western Europe", in A. Thom, A. S. Thom and H. A. W. Burl, *Stone rows and standing stones* (B.A.R. International Series 560; Oxford, 1990), 421–540. Note that two entries in Burl's three-stone row list actually refer to longer rows: "Cabragh B" (p. 479), actually the four-stone row at Cabragh A (see Ruggles, "Stone rows", Table 1, note b); and Cloonsharragh (p. 482), actually a five-stone row (*ibid.*, note G). On Doory (p. 482) see *ibid.*, note O. This list has now been updated in H. A. W. Burl, *From Carnac to Callanish* (New Haven, 1993), 214–69 (for three-stone rows see pp. 250–57), but the updated list was not available at the time of site selection.
5. A site at Newcastle (W577803), listed by Ó Nualláin ("Stone rows in the south of Ireland" (ref. 3), no. 98) as a pair with a third stone 7·5m to the NE, should arguably have been included here as a three-stone row. But various conflicting accounts of the site earlier this century lead to confusion about its status. A plan is given by B. Somerville, "Instances of orientation in prehistoric monuments of the British Isles", *Archaeologia*, lxxiii (1923), 193–224, p. 220, which shows a solstitial alignment to the NE. To judge from this, the NE-most stone was *c.* 9 ft (2·7m) high and *c.* 15 ft (4·6m) to the NE of the pair. Somerville surveyed the site in March 1910, but in 1914 J. P. Conlon ("Rude stone monuments of the northern portion of Cork County", *Journal of the Royal Society of Antiquaries of Ireland*, xlvi [1916], 58–76, p. 70, no. 30) recorded only the pair. In 1933 the Ordnance Survey visited the site and recorded a third stone just 3 ft (0·9m) high and some 7·5m to the NE (Paul Walsh, priv. comm. 1996). This seems to correspond to the stone 1·05m high now present at the site (Ó Nualláin, *ibid.*, Fig. 47). Taken together, these accounts would seem to imply that the tall north-eastern stone was removed between 1910 and 1914 and a shorter one placed in the alignment, further away from the surviving pair, between 1914 and 1933. However, this is far from certain.
6. C. L. N. Ruggles, "Stone rows", Table 1. In comparing this figure with *ibid.*, Fig. 1, note (i) that the map data have been redrawn for greater accuracy; (ii) that Cashelkeelty (V747575) has been added as a four-stone row (see Table 1, note p) and (iii) that three recently discovered sites, not discussed in the earlier paper but included in *ibid.*, Fig. 1 (see *ibid.*, ref. 34), are not shown here.
7. *Ibid.*, Section 2.3.
8. The categories are 'A' (up to 1 km), 'B' (1–3 km), 'C' (3–5 km) and 'D' (over 5 km).
9. Ruggles, "Stone rows", Table 1 and S9.
10. The horizon distance categories in the direction of and opposite to the preferred direction are: D/A (3 cases), D/B (6 cases), and C/A (2 cases).
11. D/D (1 case), B/B (1 case), and A/A (2 cases).
12. C/D (1: Ballygarret), A/B (1: Gneeves), A/D (2: Kippagh, Cullenagh), and B/D (1: Dromteewakeen).
13. Ruggles, "Stone rows", Section 3.1.
14. If Ballygarret, Gortnagulla, and Canrooska are omitted this becomes 23 out of 37 and 6 out of 37 respectively.
15. In addition to the 21 four- to six-stone rows and 27 three-stone rows for which survey data have been listed in these papers, Figure 2(a) includes data from two further sites: site 41 (Dromdrasdil), where the orientation of the row could not be measured; and site 117 (Behagullane), where although the axis and preferred direction are unknown, the entire horizon is of category A. See Ruggles, "Stone rows", Table 1.
16. *Ibid.*, Table 2. The equivalent plot for the four- to six-stone row data only is *ibid.*, Fig. 2.
17. *Ibid.*, Fig. 2(a). The earlier graph also included data from Dromdrasdil and Behagullane (see ref. 15).
18. *Ibid.*, Section 3.2.
19. *Ibid.*, Fig. 2(b).
20. *Ibid.*, Section 3.2.
21. A. Lynch, "Astronomy and stone alignments in S.W. Ireland", in D. C. Heggie (ed.), *Archaeoastronomy in the Old World* (Cambridge, 1982), 205–13.
22. Ruggles, "Stone rows", Table 2.

23. *Ibid.*, Table 2. The equivalent plot for the four- to six-stone row data only is *ibid.*, Fig. 3.
24. *Ibid.*, Section 3.3.
25. In the case of the major standstill the observed declination would be higher than the theoretical limit (approximately –30°) if observations missed the actual time of the standstill in the node cycle or the limit in a given month, or both. In the case of the minor standstill (theoretical limit approximately –19°), missing the appropriate time in the node cycle by two or three years would somewhat decrease the declination, but missing the monthly limit by a few days could increase it by up to several degrees.
26. For an explanation of the term see C. L. N. Ruggles, "A critical examination of the megalithic lunar observatories", in C. L. N. Ruggles and A. W. R. Whittle (eds), *Astronomy and society in Britain during the period 4000-1500 BC* (B.A.R. British Series 88; Oxford, 1981), 153–209, p. 156.
27. C. L. N. Ruggles and H. A. W. Burl, "Astronomical influences on prehistoric ritual architecture in north-western Europe: The case of the stone rows", *Vistas in astronomy*, xxxix (1995), 517–28, Fig. 1 (four- to six-stone rows only) and Fig. 2 (all data).
28. Ruggles, "Stone rows", Section 3.4.
29. For a presentation of these data in the form of a curvigram see Ruggles and Burl, "Astronomical influences" (ref. 27), Fig. 4.
30. Ruggles, "Stone rows", Table 3. The equivalent plot for the four- to six-stone row data only is *ibid.*, Fig. 4.
31. *Ibid.*, Fig. 4.
32. This is for all sites included in the analysis. The figures are 27% and 40% excluding the 12 sites for which a preferred direction could not be identified.
33. The table includes data from Behagullane but not Dromdrasdil (see ref. 15).
34. Ruggles, "Stone rows", S15.
35. Ó Nualláin, "Stone rows in the south of Ireland", Fig. 7.
36. Burl, "A county concordance" (ref. 4), 482.
37. A. Lynch, *Man and environment in south-west Ireland, 4000 B.C. – A.D. 800* (B.A.R. British Series 85; Oxford, 1981), 66.
38. Ó Nualláin, "Stone rows in the south of Ireland", no. 69.
39. Burl, *From Carnac to Callanish*, 247.
40. J. Cuppage, *Archaeological survey of the Dingle peninsula* (Ballyferriter, 1986), 38.
41. Lynch, *op. cit.* (ref. 40), 64–67.
42. Burl, "A county concordance" (ref. 4), 481.
43. Ó Nualláin, "Stone rows in the south of Ireland", 252.
44. Cuppage, *Archaeological survey of the Dingle peninsula* (ref. 36), Fig. 23.
45. Ó Nualláin, "Stone rows in the south of Ireland", no. 50.
46. *Ibid.*, Fig. 7.