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## The Lismullin Enclosure: a Designed Ritual Space

Frank Prendergast

*Technological University Dublin*, [frank.prendergast@tudublin.ie](mailto:frank.prendergast@tudublin.ie)

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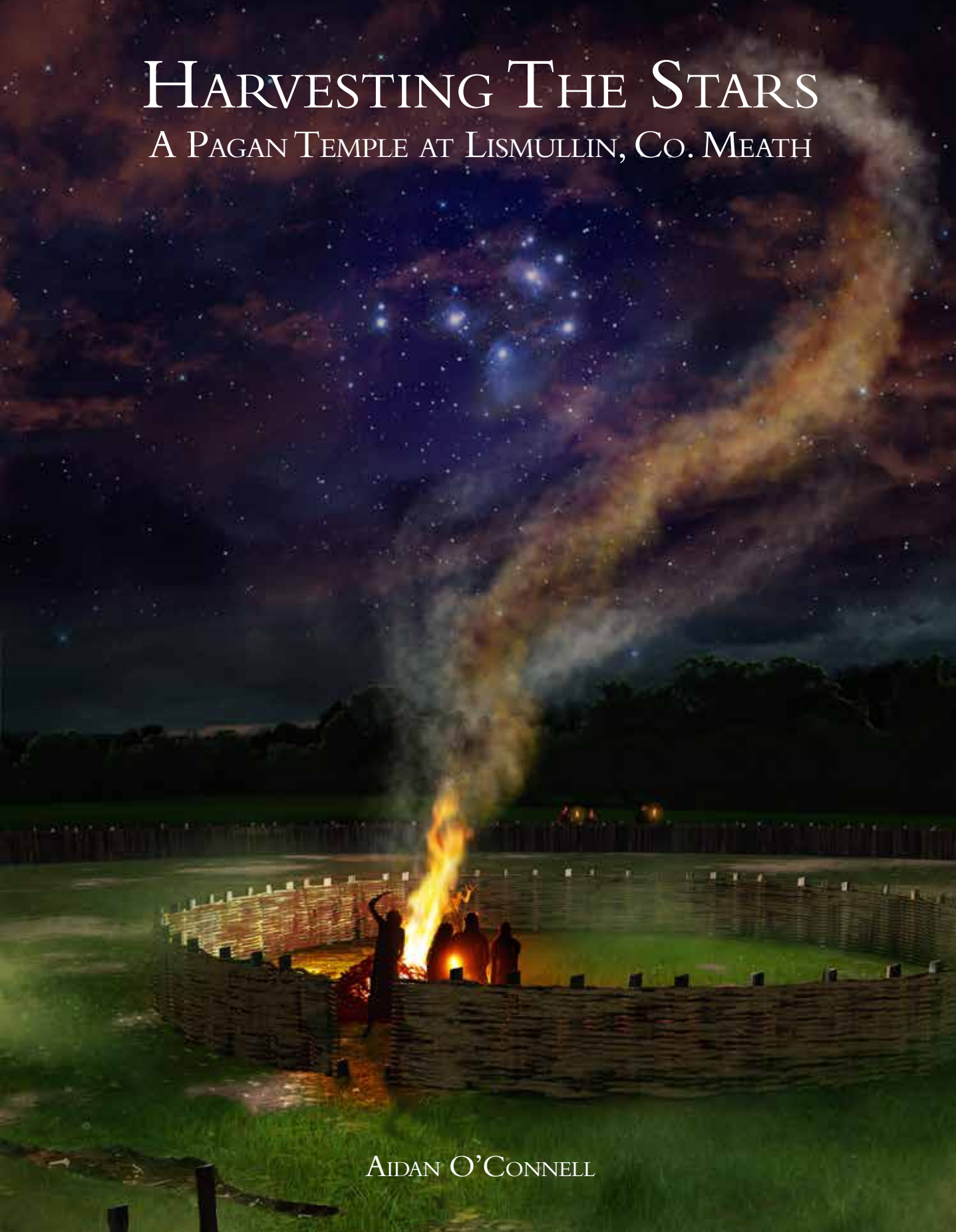
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# HARVESTING THE STARS

A PAGAN TEMPLE AT LISMULLIN, CO. MEATH



AIDAN O'CONNELL

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Aidan O'Connell

with contributions by

Chris Burbidge, Anwen Caffell, Anne Connon, Gordon Cook, Mary Deevy, Lorne Elliott,  
Louisa Gidney, Eoin Grogan, Charlotte Henderson, Tim C Kinnaird, Peter D Marshall,  
Charlotte O'Brien, Rob O'Hara, Muiris O'Sullivan, Frank Prendergast, Christine Prior,  
Helen Roche, David C W Sanderson, Órla Scully and Farina Sternke.

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Front cover—An imaginative reconstruction of the Lismullin 'temple' with the Pleiades star cluster overhead, by the artist Phil McDarby.

Back cover—Copper-alloy ring-headed pin found at Lismullin, with post-excavation plan of post-enclosure in background (Photo: John Sunderland).

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## APPENDIX 3

### The Lismullin enclosure—a designed ritual space

*Frank Prendergast*

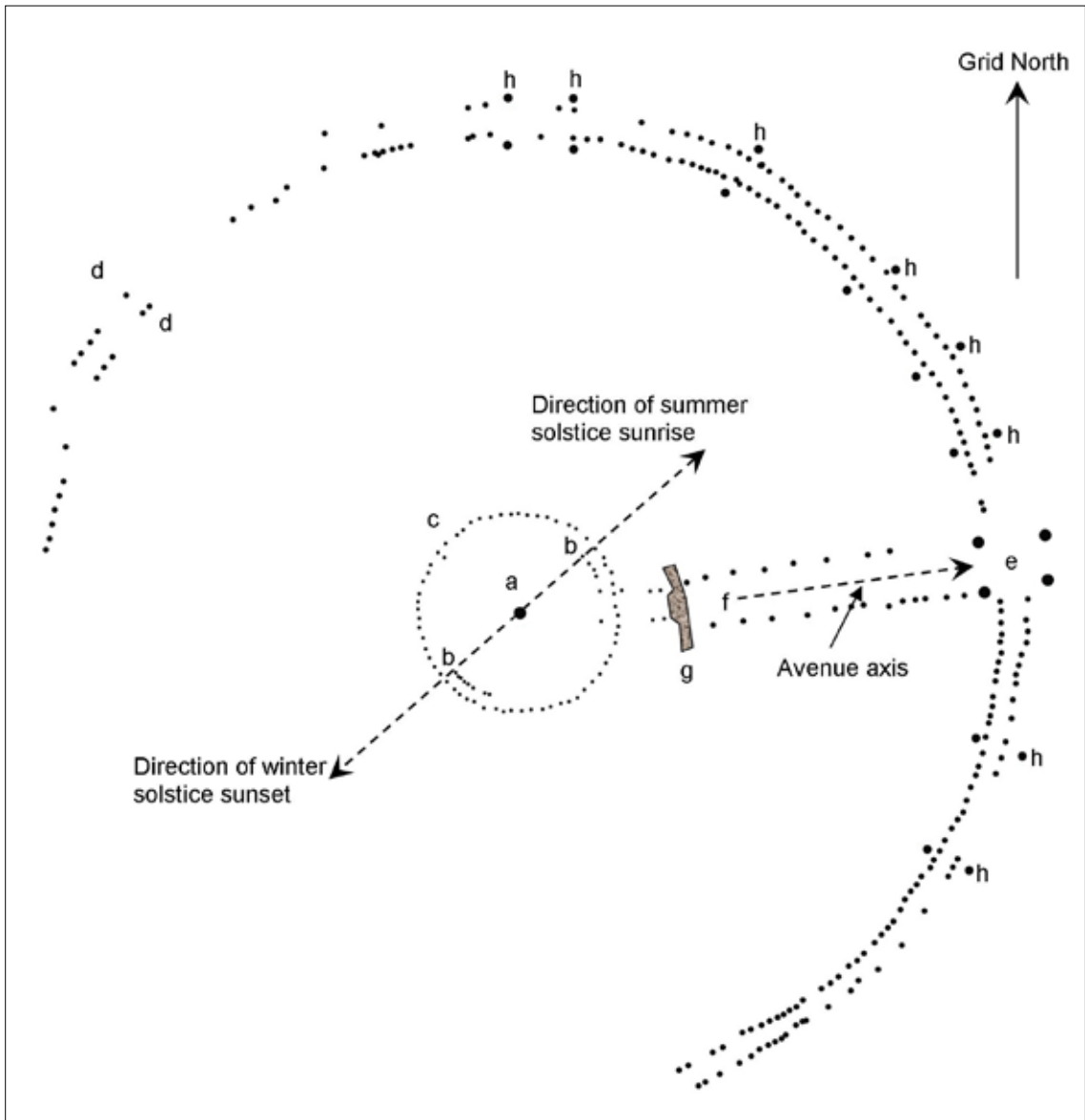
The discovery in 2007 of a prehistoric post-built enclosure at Lismullin, Co. Meath, during archaeological investigations in advance of the construction of the M3 motorway is, arguably, the most significant Irish archaeological discovery of recent times. This appendix summarises a commissioned specialist report on the spatial and archaeoastronomical features of the enclosure (hereinafter Lismullin; see Prendergast 2009; CD-ROM, LER Vol. 2).

#### Enclosure description and chronology—a summary

In its overall form the enclosure can be described as consisting of two concentric inner and outer circular spaces connected by an avenue. This was easterly facing and entered through a larger and more formal four-post entrance feature located at the perimeter (Illus. App. 3.1). Towards the inner end of the avenue, a transverse pit containing charcoal and burnt and unburnt bone ash was discovered 4 m outside the inner enclosure. In addition, eight pairs of pits radially and symmetrically spaced in relation to the outer enclosure complete the corpus of structural elements.

Radiocarbon dating of the charcoal deposits retrieved from enclosure post-holes indicate that it dates to the Early–Middle Iron Age. Whether all elements of the enclosure were contemporary i.e. built concurrently as a single phase, is a matter of debate (Chapter 4). The current archaeological hypothesis is for a multi-phase development of the post-enclosure based on dating and other excavation evidence. When the design is viewed and appraised in its totality, however, the argument for an initial single phase of construction followed by recurring and/or cyclical replacement/refurbishment of the elements or their components may be equally valid.

When the site plan for Lismullin is examined and the residual errors or deviations from the ‘perfect or best-fit’ circles and straight lines are assessed, apparent irregularities in the morphology of the enclosures and the avenue can be readily explained. Minor deviations from any ‘design plan’ incurred during construction using a rope and peg method of setting out, may have been due to impenetrable ground or buried stones. Where posts had degraded and were replaced, small deviations may have been tolerated, especially if the enclosure was wattled. Either way, minor departures from what was perceived as ‘exact’ may not have held any significance or consequence in terms of how the complex was used, nor detracted from the overall design aesthetic.



*Illus. App. 3.1—Site plan of the post-enclosure showing the principal structural elements: a) ‘central’ post-hole; b) solstitial alignment; c) inner enclosure; d) outer enclosure rings; e) entrance structure; f) entrance avenue; g) elongated pit; and h) pit pairs.*

## Research questions

To those who made the initial archaeological discovery, it was immediately apparent that the post-enclosure exhibited clearly visible attributes in terms of regularity and symmetry. Moreover, the lack of recorded artefacts at Lismullin and the dimensional and structural characteristics of the enclosure strongly supported a ritual and ceremonial use. While comparative timber structures



can be identified in late prehistoric Ireland (Chapter 5), none has been subject to the same degree of spatial analysis as Lismullin. Furthermore, comparative studies of timber circles and enclosures across Ireland, Britain and Europe by Gibson (1994, 193; 2005, 81–98) assert to all such structures possessing similar architectural motifs consistent with their use as sacred/ceremonial spaces linked with prevailing ritual and religious beliefs.

When confronted with the challenge to interpret the role and meaning of the Lismullin enclosure, the excavators were quick to realise the opportunities provided by this rare site type, and from a period of Irish prehistory until recently perceived as hidden and poorly understood. There was the suspicion that because of the easterly orientation of the avenue, the complex may have been linked with sunrise at the equinoxes. Following consultation with the writer, however, the spatial investigation was considerably broadened so as to examine the possibility of the post-hole locations harbouring evidence of a construction method as well as a link with celestial events in the day/night sky. Accordingly, three investigative themes were pursued:

- 1) analysis of the enclosures and avenue geometries (morphology)
- 2) dimensional analysis to detect any evidence for the use of a unit of measure (metrology)
- 3) astronomical orientation analysis to detect the existence of any significant alignments towards seasonally prominent celestial bodies and their potential ceremonial role/meaning (archaeoastronomy).

### **Morphology**

From the excavations and surveys of the site, archaeologists were able to produce accurate plans and digital models of the enclosure based on high-accuracy co-ordinates (eastings and northings) of each post-hole. Not all had been found and there were many discontinuities in the data. Nonetheless, the exceptionally large number of data points allowed for a mathematical analysis (after data cleaning to remove obvious discontinuities) to locate the geometric centres of the three circular arrays. For ease of description here, each circle is termed Enclosure 1, 2 and 3 with respect to the centre of the complex (1 being the innermost). The analysis (using least-squares) provides strong statistical support (confidence levels of 0.03–0.06 m) for the conclusion that the post-holes in each circle were set out from a common centre (Table App. 3.1).

*Table App. 3.1—Morphology of the enclosure*

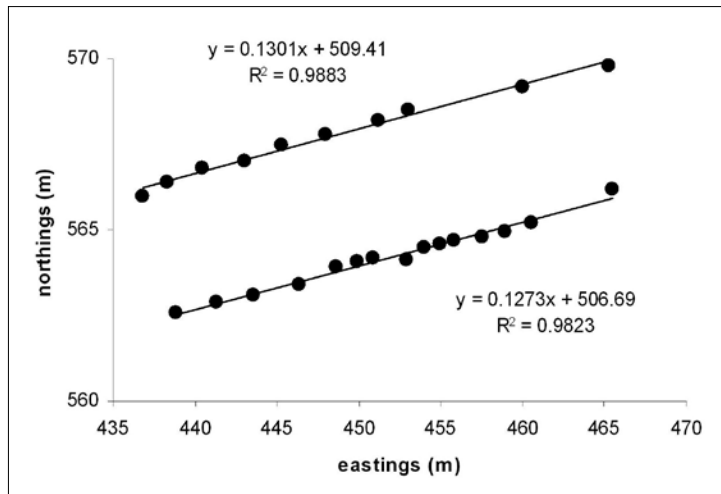
<b>Element</b>	<b>Easting (m)</b>	<b>Northing (m)</b>	<b>Radius (m)</b>	<b>Std. dev. (m)</b>
Enclosure 1	423.4	563.6	8.0	0.11
Enclosure 2	423.4	563.4	38.3	0.28
Enclosure 3	423.2	563.7	40.3	0.28
F4078 (central post-hole)	423.9	563.7	—	—

The data in Table App. 3.1 also reveal that the spread in the co-ordinates of the best-fit circle for each enclosure is minimal (<0.3 m) and the conclusion reached is that each was probably set out from a common centre. Interestingly, when the excavation plan was examined, a post-hole (F4078) was found to closely coincide (<0.5 m) with these points. As such, it is regarded as a discretely

different point and was not the geometric/setting-out centre. However, it could have marked the symbolic/ceremonial centre of the complex.

The avenue between the slot-trench and the four-post entrance was similarly investigated for statistical evidence of regularity/linearity. Regression analysis of their co-ordinates clearly indicated that each side was set out with a very high goodness-of-fit ( $R^2$ ) to the theoretical straight line (Illus. App. 3.2).

In addition, the north and south post-holes of the entrance feature coincide with the north and south sides of the avenue and this advocates that the sides of the avenue and the sides of the entrance feature have a shared alignment. The avenue sides were also found to be parallel to within 0.2 of a degree. Overall, the evidence here is that the avenue was carefully constructed, and that this was simply achieved with the aid of a rope for linearity and by using a constant offset to achieve parallelism.



*Illus. App. 3.2—Regression analysis of the avenue post-holes.*

An analysis of the gaps between adjacent post-holes (pitch) in the enclosures was undertaken to determine if these were set out with a repeated or standard spacing. This would equate to a radial method of construction referenced to the centre of the circle. For this analysis, every pitch distance and subtended cone angle were calculated and then analysed. Using the method of analysis of variance (ANOVA) on these data, there is evidence that the spacing of the post-holes in the outer enclosures (2 and 3) were radially set out from a common centre and that a standard pitch (c. 1 m) was used to space the post-holes of the outermost circle (Enclosure 3). Significantly, the pitch between the posts in the inner enclosure does not reflect use of the same radial method as used to construct the two outer enclosures. This could indicate a different imperative for the construction of this element consistent, perhaps, with a ceremonial role in how the complex was used.

### **Metrology and construction**

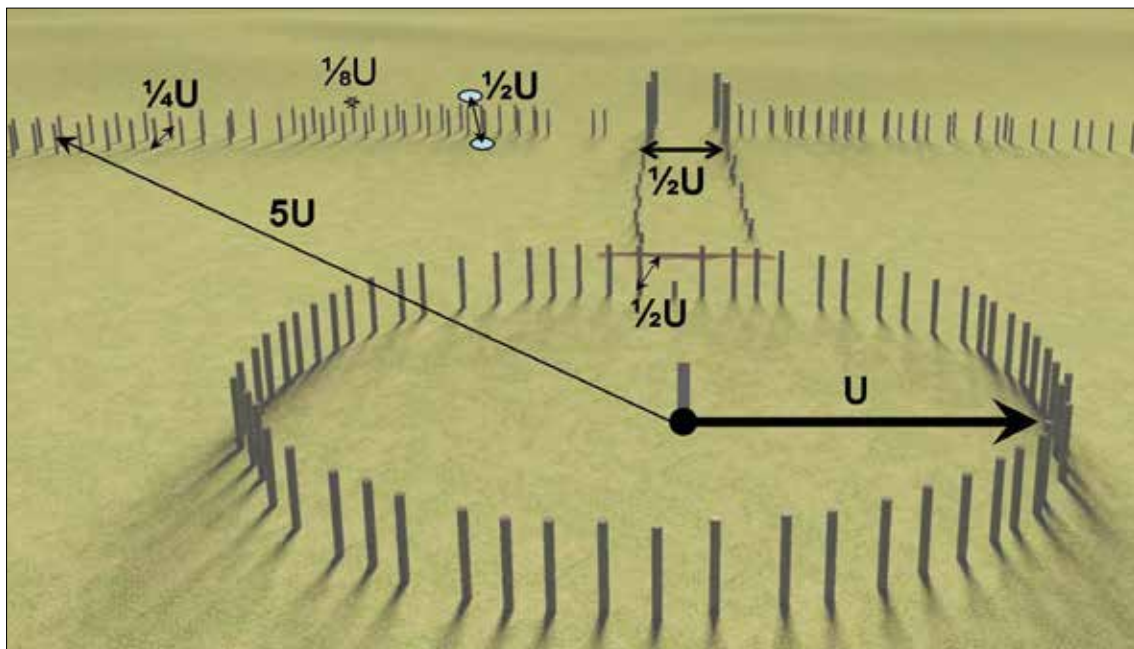
The evident degree of dimensional regularity in the avenue, and in the pitch between post-holes in the two outer enclosures, suggested that a unit of measure (or 'yard stick') may have been adopted to achieve and maintain proportionality and symmetry during the construction phase. Arguably, and if present, these qualities would imply design intent consistent with the use and function of the complex for ceremonial or religious purposes. Support for this claim can be found in a number of early structures, especially Roman temples (Manley 2000, 104) and in some of the ecclesiastical architecture of medieval Ireland (Behan & Moss 2008, 181). Detection and proof is another matter and this can be challenging and reliant on the quantity and quality of the data (Esquivel & Navas 2005, 1580; Hartwell 2002, 527; Waterman 1997, 160). At Lismullin, however, the high quality

and large volume of post-hole data greatly facilitated numerical analysis for evidence of a unit of measure being used at the site. The results are given in Table App. 3.2.

*Table App. 3.2—Morphological measurements*

Element	Length m	Length scaled to U		Remarks
Inner enclosure radius (U)	8.00	—	—	Unit of measure (U) <sup>1</sup>
Avenue and entrance width	3.94	0.49	$x^{1/2}$	Half U
Outer enclosure radius	40.30	5.05	x5	Five U
Outer gap width	1.90	0.24	$x^{1/4}$	Quarter U
Internal arcs: inner enclosure gap	1.00	0.13	$x^{1/8}$	Eighth U
Pit pairs gap	4.00	0.50	$x^{1/2}$	Half U
Outer enclosure pitch	1.00	0.13	$x^{1/8}$	Eighth U
Gap between inner enclosure and elongated pit	4.10	0.51	$x^{1/2}$	Half U

Examination of the data in Table App. 3.2 provides very strong evidence that the whole complex could have been constructed using a unit of measure (U) based on the radius of the inner enclosure (8 m). The other elements of the complex were then probably scaled by simple and repeated subdivision of this same unit. To set out the larger radius of the outer enclosure (40 m), U could have been scaled by a factor of five. This hypothesis is visualised in Illus. App. 3.3 and has statistical backing i.e. the null hypothesis  $H_0$  is not rejected ( $p$ -value = 0.67,  $F_{crit} = 2.03$ ,  $n = 368$ , 95 % confidence level).



*Illus. App. 3.3—Hypothetical construction method at Lismullin.*

Overall, the proportionality and symmetry that is evident in the complex can be readily explained by the use of an 8 m unit of measure either subdivided or positively scaled for construction purposes. When the local topography is examined, the entire complex is seen to be symmetrically positioned inside the topographical hollow identified by O'Connell (2009b, 25). This could suggest that the primary unit of measure both dictated and dimensionally controlled the overall scale of the complex so as to fit discretely and proportionately within this elevated yet discrete section of the local landscape.

### Archaeoastronomy

There is now little doubt among archaeologists that early societies were acutely aware of the diurnal and seasonal movements of heavenly bodies and incorporated this knowledge into their cosmology. That can be reflected in the deliberate orientation of some prehistoric structures, especially towards the extreme solstitial rising/setting directions of the sun. An interest in the night sky would have played a similar cultural role but, with the exception of the moon, is much more difficult to prove because of the very large number of observable stars. Regardless, the orientation of the avenue, and a unique diameter in the inner enclosure were investigated for astronomical alignment. The avenue alignment is self-evident. The unique diameter in the inner enclosure is defined by the line joining the terminal post-holes of the two inner arcs and which passes through the centre post-hole (Illus. App. 3.1).

The method of analysis required the calculation of astronomical declination ( $\delta^\circ$ ; the celestial equivalent of latitude on the earth) based on values of azimuth (true bearing and horizon altitude), horizon altitude (corrected for refraction) and geographical location. By knowing the date of construction, sky modelling could also be adjusted for the small changes in the tilt of the earth's axis (obliquity) since the Iron Age. From these calculations, the alignment of the avenue was found to be towards sunrise ( $\delta^\circ = c. +5^\circ$ ), but not at the equinoxes. The dates of sunrise indicated by the alignment of the central axis of the avenue coincide with sunrise on or about 1 April and again on 10 September in the modern Gregorian calendar. Moreover, the entrance portals would have framed the rising disc of the sun for a period of up to 10 days, and depending on where the observer was positioned within the inner enclosure. Any significant lunar alignment (towards the major or minor limits of that body) can also be discounted. More significantly, the orientation of the unique diameter (as previously defined) within the inner enclosure was similarly examined and found to have a solstitial alignment (Illus. App. 3.1).

Analysis of the orientation of the avenue for any evidence of alignment towards a prominent celestial object in the night sky was also carried out. This reveals that in the Iron Age, the uniquely obvious star cluster (not a constellation) now known as the Pleiades would have transited over the avenue when its altitude was about  $12^\circ$  (the cluster cannot be seen with the human eye rising on the horizon due to its low brightness magnitude and the light absorbing effect of the atmosphere). The phenomenon would have lasted about 20 minutes each evening and occurred from late summer until the onset of winter. This is visualised in Illus. 4.11 (Chapter 4).

The astronomical analyses of the Lismullin data provide indicative dates/date ranges that suggest a ceremonial use around the periods of either summer or winter solstices, or both. Furthermore, the orientation of the avenue could suggest that assembly and procession may have been triggered and culturally timed to coincide with the transit of the Pleiades over the avenue. Significantly, this is

identified here as a phenomenon beginning at the end of the harvest and ending prior to the onset of winter around the end of October. After that date, the cluster would not have been visible until the same period in the following year. In addition, a celebration of the sunrise phenomenon when it appeared within the avenue portals at the indicated times of year may also have held ritual meaning to the users of the complex.

## **Conclusions**

The results of this investigation were dependent on the procurement of carefully excavated and recorded archaeological data in the first instance. No comparisons have been made by the writer with other similar sites to date. Nonetheless, the outcomes reveal a wealth of new information on the design and construction method employed at Lismullin over 2,000 years ago. These corroborate the empirical observations of the excavation's archaeologists, and perhaps this analysis takes the interpretation and meaning of the site to a deeper and more informative level. Aside from just providing new knowledge about the culture at that time, these data bring us very close to the actions of individuals at one specific but important site.

The challenge here has been to transform spatial data into new knowledge and, arguably, that has been achieved. In so doing, perhaps a new archaeological layer or chapter, even, has been added to the story of Lismullin. With further comparative analysis using similar data from other such sites, then, perhaps, the late Prof. Barry Raftery's view of Iron Age people as 'invisible' may be partly redressed.