

## THOM - RIGHT ABOUT THE MEASURE, WRONG ABOUT THE UNIT?

*In this article Peter Sain ley Berry, from the Vale of Glamorgan, argues in favour of a common Neolithic unit of linear and area measurement. In this respect Thom was right, he says, but the pole and acre make better units than the megalithic yard.*

Alexander Thom (1894-1985) is known in archeology for his hypothesis that the Neolithic peoples laid out their sites using a single prehistoric unit of measurement which he called the 'megalithic yard'.

Specifically, Thom's analysis of 46 Neolithic stone circles found that their sizes fell predominantly into three groups with diameters respectively of 6.7 metres; 13.4 metres and 16.8 metres. Working back from these measurements Thom suggested that the Neolithic builders had been using a single unit of 1.65 metres, which he termed the 'megalithic fathom.' Half of this measure gave him the 'megalithic yard.' (1) And indeed the diameters of Thom's circles are approximately 4, 8, and 10 megalithic fathoms respectively (or 8, 16 and 20 megalithic yards).

Thom's work has attracted both admirers and detractors. The admirers have concentrated upon showing how the Neolithic peoples could have reproduced the measure (2). These solutions needn't detain us here; none is particularly elegant and all seem contrived. This has led Thom's detractors to debunk the whole idea of a common standard of Neolithic measurement - calling it pseudo-scientific and asserting that the megalithic 'yard' is no more than a variable megalithic 'pace'.

My own work has concentrated on the spatial relationships between Neolithic sites in the Vale of Glamorgan and specifically on the location of the Tinkinswood burial cairn. I have thus been looking at measurement over distance rather than measuring the diameters of circles. Nevertheless, my work supports Thom's hypothesis of a common Neolithic unit. (3).

However, my data suggest that Thom was incorrect in focusing on the megalithic yard. For there is another unit which better fits both his data and the observed distances between Neolithic sites. In addition, it is an easier unit for which to find a provenance. I have called this the Neolithic pole as it is very close to the Imperial pole of 5.03 metres. At 5 metres exactly this Neolithic pole is approximately six of Thom's megalithic yards.

The Imperial Pole is 198 inches or 5.03 metres. Now the Imperial system of measurement was derived from measures that already existed. Poles and acres, which seem to have derived at least from very early times, had to be fitted together with feet (from the classical world) and yards which, in their current guise, are medieval. This process would inevitably have involved some adjustment of the various measures, so we are not stretching credulity to suppose the pole itself might have been shortened by just over half a per cent in this way.

Many distances between Neolithic sites in the Vale of Glamorgan (and elsewhere) can be measured in round numbers of kilometres. 7.5, 15, 25, 40 and so on. For instance, to take a single example, the distance between the site of the town cross at Cowbridge and the headland at Penarth near Cardiff is exactly 20 kilometres.

Neither site is ostensibly Neolithic of course, but on a line passing through these points lies the undoubtedly Neolithic Tinkinswood burial cairn which divides this line precisely into two lengths of 10 kilometres. This can be verified from the Ordnance Survey map.

This line is far from unique. There are many imaginary lines in the Vale of Glamorgan that can be expressed in round numbers of kilometres connecting Neolithic sites with each other or with prominent geographical features. This could be chance, of course, but for the fact that where a Neolithic site bisects such a line it does so in such a way as to give a simple ratio. In the above example this is 1:1; I have found other simple ratios as well.

Now the Neolithic people clearly did not measure in kilometres. But if we take the Neolithic pole as 5 metres then these distances of 7.5, 15, 25 and 40 kilometres become 1,500, 3,000, 5,000 and 8,000 poles, there being 200 5 metre poles to the kilometre. The distance between Penarth Head and Cowbridge then becomes 4,000 poles with Tinkinswood 2,000 poles equidistant from each.

I believe that Alexander Thom's megalithic fathom of 1.65 metres and his megalithic yard of 0.83 metres are no more than the third and sixth fractions of this Neolithic pole. The diameters of his circles given above therefore become  $4/3$ ;  $8/3$  and  $10/3$  Neolithic poles.

These figures may seem inelegant. But if you picture the stone circle lying within an equilateral triangle so that its circumference just touches the sides of the triangle - then the height of the triangle can be measured exactly in whole numbers of poles - 2, 4 and 5 Neolithic poles.

### **Provenance of the Neolithic Pole**

One of the problems with Thom's measures is their provenance. Why would the Neolithic engineers have chosen a measure of 1.65 metres? It seems arbitrary. Why not 1.5 metres or 1.89 metres or 2.3 metres? Another problem is that there doesn't appear to be any area measure associated with his units.

This is not the case with the Neolithic pole.

I have said that what impressed me when I first started to look at Neolithic measurement was the correspondence with the kilometre. This could only occur if Neolithic and modern measures were derived from the same base, however unlikely that might seem at first. The kilometre is related to the circumference of the earth. Is it conceivable that the Neolithic pole is similarly derived?

I believe so. The first piece of evidence that this could indeed be the case comes not from any observed measurement, or even any theory, but from the mathematical formulae for the surface area of a sphere -  $4\pi r^2$  - and the circumference of a circle  $2\pi r$ ; from the number of poles in the earth's circumference (8 million if we take the Neolithic pole as being 5 metres and the earth's circumference as 40,000 kilometres) and from the number of square poles in an acre (160).

The surprising result, which turns on the numbers 2, 4, 8, and 16, and which anyone with elementary mathematics can easily check for themselves, is that the number of acres in the earth's surface area is exactly 100,000 times the number of poles in the earth's radius. This calculation does not depend on the value of  $\pi$  - or even a precise value for the pole, it simply falls out of the formulae.

But why should there be 160 square poles in an acre - why should the acre be defined in this way? The only reason to define thus is so as to tie the acre to the pole where the pole is defined as one 8 millionth of the earth's circumference. There is no logical reason other than to tie units of linear and area measure together and relate them mathematically to the sphere.

In actual fact there is evidence for thinking that the Neolithic unit of area measure was 16 rather than 160 square poles. One (though not crucial) reason is that we should then have a multiplier of a million in the above paragraph rather than 100,000. Being a perfect square, a million is a more satisfactory number.

But by far the best evidence that the Neolithic people measured in units of 16 square poles rather than 160 comes from observation of the ratios of the areas of the circles at Stonehenge.

There are four principal concentric circles at Stonehenge. The outer circle - what might be called the Heel Stone circle - has a radius of some 80 metres. Inside this is the so-called Aubrey circle of post-holes; this has a radius of some 43 metres. Inside this again is the famous Sarsen circle, which has a radius of some 15 metres. Inside this again is the circle of bluestones with a radius of approximately 11.5 metres.

The area in acres (160 square poles) of these four circles are, respectively, 5; 1; 0.5 and 0.1 acres. A regular pattern so typical of Neolithic building is apparent. But the figures are unsatisfactory. Using tenths of an acre (16 square poles) the figures become 50; 10; 5 and 1 - which seems more likely and precisely the elegant patterning of a structure in terms of size and ratio that Neolithic engineers seem to have tried to achieve.

So the answer as to why the length of the Pole should be set at 5 metres seems to be that our Neolithic ancestors went through a similar thought process to the French revolutionary engineers who fixed the kilometre by defining it as 1/10,000 of a quadrant of the earth's circumference. Rather than having a unit defined by a part of the body or some arbitrary length Neolithic engineers defined their pole as one eight millionth of the earth's circumference.

There are plenty of people ready to deny the possibility that stone age people could have developed skills of geometry and measurement. But humans then were then no less intelligent than now. Moreover, Neolithic society lasted far longer than ours has done.

Because no record of their geometry or metrics survives (apart from the record of the structures themselves) they say it could not have existed. But this assertion assumes that technology develops in linear fashion ever onward and upward. But is this correct? When a civilisation collapses then much of its knowledge and technology is lost too. A better model may therefore be the saw-tooth rather than the linear with knowledge increasing and collapsing at different points in time.

Could the Neolithic people have measured the earth's circumference - why not? The care with which the Tinkinswood burial cairn was positioned shows them to have been exceptional surveyors. What would have stopped them? It is easy enough to conclude that the earth is round and not flat. The mathematics of measurement are not exceptionally complicated.

Indeed, looking at the evidence it is easier to argue that the Neolithic people did develop the necessary technical and mathematical skills - and then to argue that that knowledge was subsequently lost with the collapse of the Neolithic civilisation - than it is to argue that such knowledge never existed before modern times. Even in our own modern civilisation, with all the resources we have to protect our knowledge and skill base, knowledge is being lost all the time. If humanity survived a nuclear holocaust how much knowledge would be retained? Or would the survivors have to start again to rebuild the knowledge base over several thousand years?

So on the basis of the evidence I will credit the Neolithic people with measuring the earth and inventing a system of linear and area measurement based upon it. It is a legacy as great as any of their more tangible artefacts.

1. Thom, Alexander (1955). "[A Statistical Examination of the Megalithic Sites in Britain](#)". Journal of the Royal Statistical Society. Series A (General) **118 part III**: 275 – 295.
2. C. Knight & R. Lomas. *Uriel's Machine*. Century. 1999.
3. Sain ley Berry, P 'The Location of the Tinkinswood Burial Cairn'. Published in <http://www.ansari.org.uk/Tinkinswood>. 2001

### **Biographical Note:**

Peter Sain ley Berry holds an MA in Natural Sciences from Cambridge University. He is Vice-Chair of the UK National Commission for UNESCO Cymru-Wales Committee. He has been researching Neolithic building and measurement since 1985. He lives in the Vale of Glamorgan, Wales.

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