THE LINEAR DREAM

DO LEYS EXIST? An unnecessary question one might think, considering the current flood of words on the subject. In fact, though, the existence of leys is, to say the least, 'not proven'. Robert Forrest, one of the new breed of tough-minded mathematical leyhunters, has been running his slide rule over some of the classic leys. He is not impressed by what he's found.

Leys are alignments of ancient sites. To prove that they 'exist' the leyhunter must show that there are more alignments between the set of sites he is considering than would occur by chance. Each case must be compared with its own chance score, as the number of chance alignments to be expected depends on the number of sites, the width allowed and the size and shape of the area considered.

There is no agreement among leyhunters as to what counts as a ley point. Some only include *bona fide* ancient sites and standing stones but others accept crossroads, milestones, treeclumps, moats and placenames that have 'leigh' or 'dod' or 'cole' in them. Most only count churches that were built on pagan sites but if a modern church is found to lie on a ley some leyhunters will talk of 'subconscious siting' and include it.

Nor is there agreement about the width to be allowed. Clearly, for the purpose of statistical comparison, it cannot be less than the width of the largest site considered. Some sites, such as camps and moats, are several hundred yards across, so that they are much more likely to align by chance than the single standing stones of Land's End described in *Undercurrents 17.*

The cases that follow are selected from fifteen that I have studied.

Mysterious Britain

On page 192 of their book *Mysterious Britain* (Paladin) Janet and Colin Bord describe four leys, of orders 9, 8, 7 and 5, in the Bedford area. A survey of the relevant map (sheet 147 of the 1'' edition) yielded 600 sites (468 churches, 97 moats and 35 earthworks). Taking a width of 35 yards the ley parameter k (see the box **Statistical Theory** for the formula for k) is 0.52. This means that every other line drawn between two sites will have at least one other site on it by chance! The expected scores are: 0.1 9-pointers, 1 8-pointer, 15 7-pointers and 1144 5-pointers.

The 9-pointer includes two large sites: Drays Ditches and a moat. Both are skirted. Also, Chicksands Priory is in none too good alignment with the other sites. If we limit the width to 35 yards this ley is probably only a 6 or 7-pointer. The 8-pointer is rather better: it is a good 7-pointer and the doubtful eighth point (Arlesey Church) may just lie within the limit. The 7-pointer contains two large points (Drays Ditches and Waulud's Bank). Lastly the 5-pointer is a good alignment but it also includes a large site and two hills (not counted in my analysis). The 5-pointer is a good line but it also includes a large site (a moat). The kindest thing one can say about these 'leys' is that they are less significant than the Bords think they are.

STATISTICAL LEYHUNTING

If the sites are scattered at random over the map, then the number of alignments with three, four, five, etc. sites on them will (approximately) follow a Poisson Distribution with parameter k, where k is the expected number of sites on a line drawn between any two sites.

Definitions

n	total number of sites
x	width of ley
L	average length of ley (see below)
A	area of map
k	Ley parameter
$P(r)$	probability that a ley is of order r
W	total number of leys
$N(r)$	number of leys of order r

Formulae

$$k = n.x.L/A$$

$$P(r) = k^{r-2}.exp(-k)/(r-2)!$$
$$W = \tfrac{1}{2}n(n-1)/(1+2k+\tfrac{1}{2}k^2)$$
$$N(r) = W.P(r)$$

NOTE ON *L*. THE AVERAGE LENGTH OF A LEY

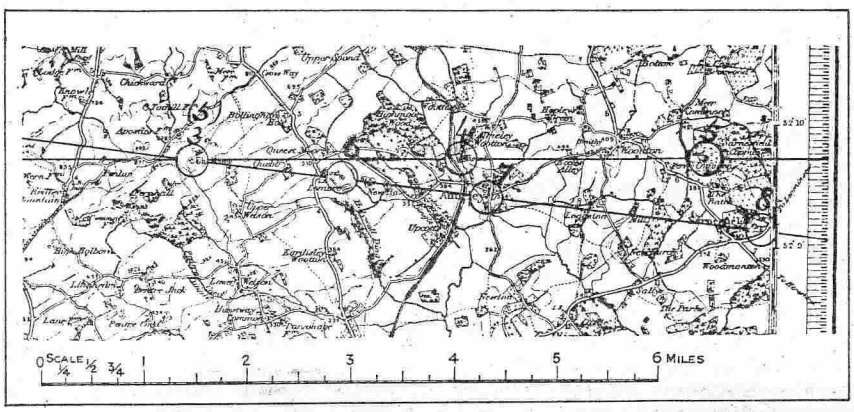
The length used in these studies is an estimate of the average length of a line joining two random points, extended to the edges of the map. This length is proportional to the width of the map in a ratio which depends on its shape. The simplest case is a square sheet like the 1:50,000 O.S. maps. L is then about 1.08 times the width of the map. Obviously the more rectangular a sheet is a map is the more necessary it is to make a good estimate of L by simulation.

View over Atlantis

On page xxi of John Michell's *View Over Atlantis* (Abacus) there is a map of alignments between moats in East Anglia, two allegedly of order 6. The map (an extract from sheet 155) contains 38 sites; their mean width is about 80 yards, giving k a value of 0.27.

The expected number of 6-pointers is only 0.08 and the odds against two 6-pointers occurring by chance are 300 to 1, so *prima facie* this is good evidence of leys. Looking at the map, however, we see that though line A is a good alignment, line B includes a large site (Hessett Moat) and to this level of accuracy can only be counted a 'possible'. If it is only a 5-pointer then this map is not 'significant' in the statistical sense as we would expect to find one 6-pointer by chance in twelve such maps.

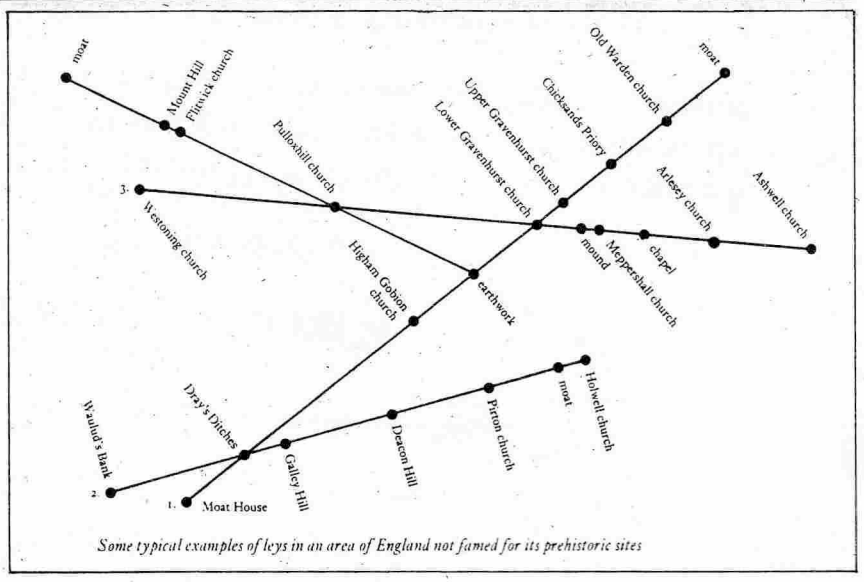
Sheet 155 contains a total of 126 moats; if we take a width of 70 yards the number of 6-pointers expected is 0.4 and the odds against finding two fall to 20 to 1.



The Old Straight Track

Alfred Watkins describes a 7-point (A) and an 8-point ley (B) in South Radnor (*The Old Straight Track*, Garnstone, pp 7-10). The relevant map is the bottom half of sheet 148; on it I counted 115 churches, 50 tumuli and 13 moats, making a total of 178. Allowing a width of 35 yards gives us a k of 0.23. The number of 7 and 8-pointers expected are 0.04 and 0.001 respectively. Once again we appear to have good evidence for leys but inspection of the map reveals the following details: line A includes two hill peaks (Wylfie and Glascwm Hill), both of which should be classed as 'large sites', and only skirts the moat (labelled 'the Camp' in the diagram); at best, therefore, it is a 5-pointer; line B includes another camp, which again is a large site, and only skirts 'the Camp'; worse, it misses one of the mounds at Hundred House by 50 yards which is more than the 35 yards we have assumed; so it is no more than a 6-pointer.

By chance we would expect 16 15-pointers and 0.9 6-pointers so these two lines are not significant.



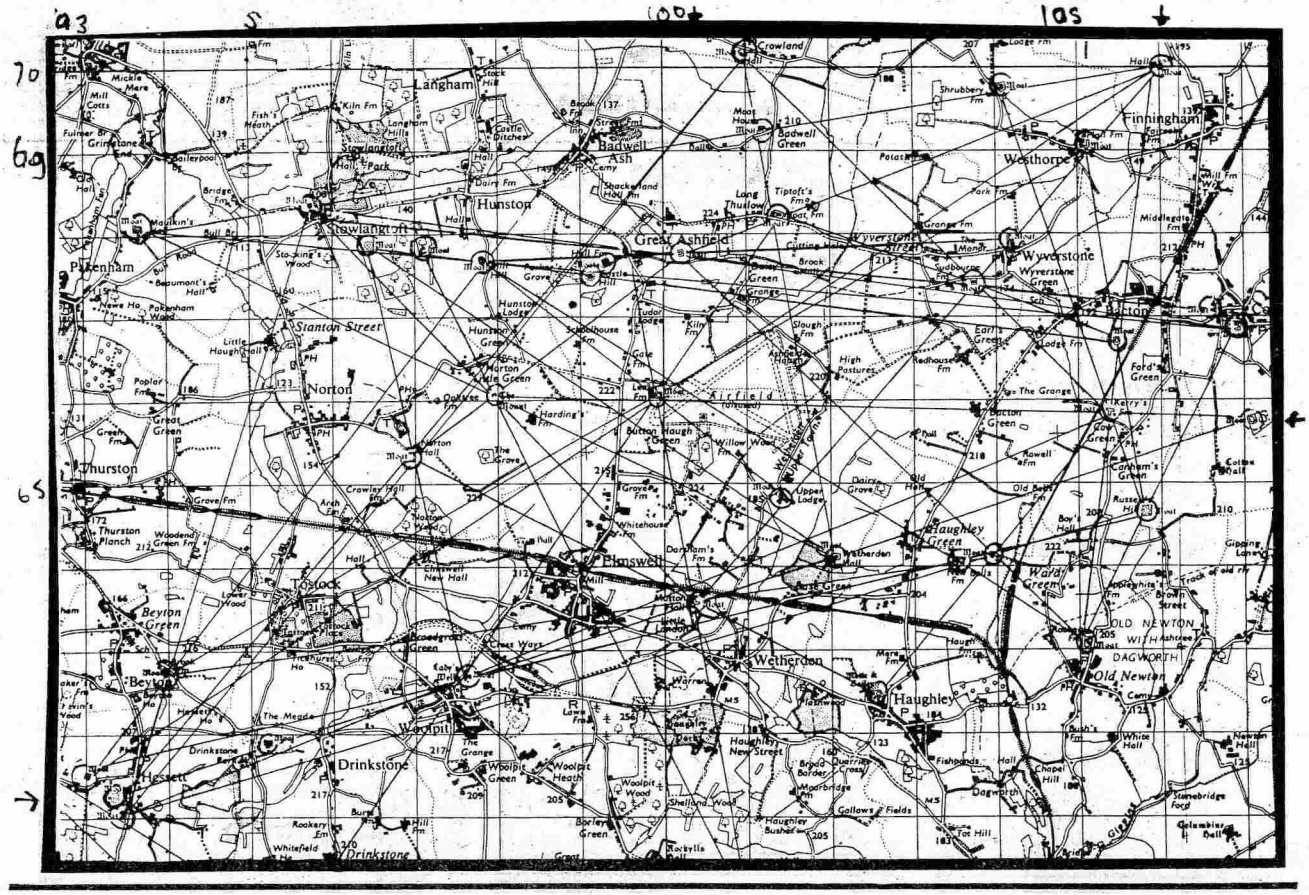
Some typical examples of leys in an area of England not famed for its prehistoric sites

The UFO Connection

Among the phenomena which imaginative leyhunters have linked to their lines are ghosts, UFOs, crimes of violence, and car accidents. The 'chance' explanation of these links is that in many areas there are enough ley lines about to make it likely that more or less any phenomenon we study will occur on or close to a ley line.

To test this hypothesis I did two experiments. First, I scattered 50 random points on a sheet of paper and drew in all the 'leys' between them I could find. Then I plotted a further 20 random 'UFO sightings' and counted the number that fell on or close to a 'ley'. I repeated this experiment three times; the average score was 50%. Second, I scattered 50 random points on a sheet of graph paper and joined up all the pairs, continuing the line to the edges of the paper. About 1100 distinct lines are obtained, splicing the paper into minute regions. Only a few of these regions are large enough for a random 'phenomenon' to avoid being attached to a line. It is true that most of the lines are of order 2 or 3 and do not count as leys. But a map containing 330 ley points would yield about 1100 leys (i.e. lines of order 4 or more), taking a width of 35 yards. So it would look quite like my piece of graph paper if they were all drawn in.

Of course the UFO leyhunter looks at things rather differently; he is more likely to plot his sightings first and then look for a ley for them to fall on. So I did another experiment: I took the 1" map of the Chilterns and ringed



all the sites on it (560 in all). Then I used random numbers to fix six 'UFOs' on the map; each was represented by a circle 0.1" in diameter, corresponding to an uncertainty in the sighting in 200 yards. Taking this as the ley width I found that all six 'UFOs' could be placed on at least three leys!

The Bournemouth Pumas

One of the chief proponents of the UFO link is Phil Grant of Bournemouth, who uses the six maps of his area in conjunction. He does not seem to have realised the arithmetical consequences of this. If we assume 500 sites per map and a width of 35 yards as before, we can expect no less than 352,000 leys, including 20 of order 10 or more. How many of these leys has he checked out, I wonder? Calculation also shows that any UFO sighting on this composite map will be at the junction of 126 200 yard wide leys!

Grant has claimed (*The Ley Hunter,* No 50) that 90% of ghosts and UFOs in this region occur on leys; that all the local 'puma' sightings occur on leys; and that 'schools, cemeteries and public buildings of all kinds (including, crazy as it may sound, post offices) fall on leys too often for pure coincidence'.

I, for one, am not surprised.

Other Case Studies

Space does not permit me to detail all the studies I have done. They include:

1. four others from Michell's *View Over Atlantis:* the Dorchester area (p.40); the Gare Hill leys (p.145); the Norfolk castle and moats on p. xvi; and the moat alignments on p.xx.
2. the South Durham leys described by Paul Screeton in his standard work on leyhunting *Quicksilver Heritage* (p.43) (Turnstone).
3. Salisbury Plain and Warminister.
4. The leys and circles in *Geometrical Arrangement of Ancient Sites* by Major T.C. Tyler (out of print).
5. The right-angled triangles described by F.W. Holiday in his book *The Dragon and the Disc.*
6. The equilateral triangles described by Sir Norman Lockyer in his book *Stonehenge and Other British Stone Monuments Astronomically Considered* (Chapter XL).

I will be pleased to provide details of these studies to serious students writing to me c/o *Undercurrents.*

It should be clear from this, I hope even to the most dedicated leyhunter, that I have taken as wide and fair a sample of the published literature as I could. If anyone knows of other sets of alignments that they consider to be good evidence I will be interested to hear from them.

Not Proven

There are two ways in which the ley hypothesis might be proved. The leyhunter must either find a profusion of medium order leys or a smaller number of high order ones.

None of the cases described here have come near to doing either. Nor have the others I have looked at. It must be remembered that one 'significant' result is not enough, if it is obtained by inspecting and rejecting a larger number of maps. Just as a gambler does not refute the laws of statistics by winning against the odds from time to time, so a leyhunter must do more than find a ley significant at the 5% level on one out of twenty maps he studies. What we need are several '1000 to 1 against' maps if we want the scientific world to take notice. Have such maps been found? If so, their discoverers are keeping very quiet about them.

My own view, on the basis of the studies presented here, and the ten others I have done, is that the ley hypothesis is false. Leys are no more than a chance effect.

Robert Forrest