Stonehenge

An introduction to the concept of the Heavens' Hinge

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Revision 1: Graphics resolution improved

FRONT MATTER

This version published September 22, 2012 in the Megalithic Portal. This version is only available as a portable document format (pdf) and must not be offered for sale either by itself or as part of any other set of documents.

 The following discussion is intended to help explain historical coincidences relative to various new inventions. The author is not an archaeological or historical expert and it should be appreciated that the discussion is not an acknowledgment or admission that any of the material referred to was or has been part of the common general knowledge in the United Kingdom or elsewhere as at the time of writing.

Preamble

This introduction shows the mathematics and engineering behind the storyline of The Broken Stone and the secret of the Heavens' Henge. The images in the following text were produced using a three dimensional computer model which was found to replicate the stones at Stonehenge as they may have been when first constructed.

Stonehenge's plan layout is shown to be the same as an idealised geocentric description of the Universe. Its inner stone monument is demonstrated to be capable of producing a spectacular public display of solar movement. The arrangement of this system is shown to be based on a simple method of tracking celestial objects.

The contention of this paper is that Stonehenge was both a depository of knowledge about the Universe and a place of learning designed for popular interest.

Acknowledgements

Engineering concepts in The Broken Stone were expanded upon in various discussions within the Megalithic Portal Forum, whose contributors kindly offered advice and criticism. This introduction summarises the concepts behind some of those discussions.

In particular, I would like to thank George Currie and Neil Wiseman for their input.

Rather than presenting a fully referenced document, this introduction is based on a series of diagrams which, hopefully, will be easy to understand. But, despite being more than thirty pages long, it does not describe all the findings. If there is interest in seeing full references, archaeological & engineering data, other additional monuments containing similar coincidences and so on, this paper may be expanded.

Editions

If this paper is updated, newer versions can be obtained either via the Megalithic Portal or at www.stonehinge.co.uk (note spelling). Mythological references were removed from this edition: An expanded version containing additional data and the removed material will be available here.

Introduction

Stonehenge is one of the most enigmatic monuments in the world: A perfectly level ring of circular lintels set on massive upright stones, it has faces which were laboriously worked using stone tools. The worked faces look to the centre of the monument rather than outward. Inside the ring is a set of taller stones, also with worked faces and lintels, which is arranged as a horseshoe. Outside the monument, strategically placed stones are contained within a circular bank and outside that bank, a great Avenue extends to the river.

The monument was built at the dawning of a new age. In Egypt, the Pharaohs would soon start to build pyramids and in Britain, metals technology had just been introduced. A few hundred years later, tin and copper would be mixed to form bronze. With the discovery of alloys, the British Bronze Age would start and the Stone Age would become a thing of the past.

Every feature of Stonehenge is shown to be explainable using a very old and little known way of scientific thinking combined with engineering principles. This introduction describes how the search for knowledge could have resulted in an early fundamental view of the Universe and the subsequent creation of Stonehenge itself.

It has recently been discovered that metals were in use at the time Stonehenge was built. Metal has unique properties which, in addition to making good weapons, can be used in inventions. One such invention, a hinged mechanism which concentrates light, fits precisely into Stonehenge's structure. This light-concentrating system could be used to demonstrate how the Sun seems to move if the Earth is believed to be fixed at the centre of the Universe. The design requirements of this arrangement are identical to Stonehenge's enigmatic features.

The times

At the time Stonehenge was built, it is believed that life revolved around herding, farming, hunting and gathering with some communities also producing pottery, wood-crafts and other skilled work such as the management of woodland for fuel and building. Mining, smelting and metalwork were newly discovered technologies.

Although science was in its infancy, the people of the time may have felt that they were undergoing the first industrial revolution: Copper was being produced and with the invention of the saw, the size of trees cut down suddenly increased. So did the size of tree-trunks used to make structures.

Cornwall was a major source for tin ore (Cassiterite) and mines elsewhere could have produced copper and perhaps lead. But these new materials would have come at a very high cost: To make metal from ore, charcoal would have been made from a dried coppiced timber such as hazel. The ore has to be mined, smelted and then probably refined once again using a re-melting process. After smelting, metals are often re-worked again using heat.

All these processes are relatively dangerous work. At this time, metal objects would probably have taken more effort to produce than anything made of the old materials such as timber and stone: Shaping a large rock using a stone maul would be relatively easy compared to the effort and expertise required to make one saw. Whilst new technologies were being developed, storage of food would have remained critical to survival because prolonged winters could signal starvation for the community.

Long after Stonehenge, the Romans and Greeks believed that the world was at the centre of the Universe. Only recently have we come to accept that our world travels around the Sun. But on a world believed to be fixed at the centre, the Sun does not seem fixed; instead it appears to orbit the north pole in summer before gradually moving to the south, where it spends the winter.

Today, a discovery mission is in progress to send the rover, 'Curiosity', to the planet Mars. Similarly, our ancestors must have considered the whimsies of the Sun and Moon worthy of curiosity: These objects seem to move within the heavenly firmament, yet are seemingly not committed to a fixed position within it. If the Sun were thought capable of making slight changes to its own yearly cycle, the perception may have been that starvation could result from the Sun's action. If this were believed possible, inventions which could predict and understand the heavens would be borne out of necessity, not curiosity.

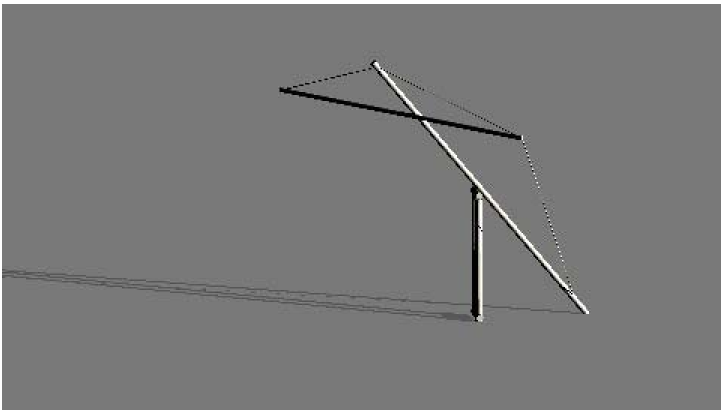
Astronomy on a fixed world

Our world appears to be solid and fixed. If you were to be placed in a new computer generated Universe, somewhere which looks exactly like Southern England, there would be no obvious way to tell if you are on a disc, a ball, a cylinder or a flat endless plain. The Universe beyond our world might also be unknown: It could be a solid sphere, it could be stars with space between, or it could be something else entirely.

Simple experiments can help to show the nature of the world and the heavens. For example, the stars above us can be seen to move over the course of a night. A diligent observer, or someone with far too much time on their hands, will soon notice that some stars seem to move less than others. By taking straight sticks and pointing them at those stars which appear to move the least, the polar axis of the world can be found: On returning a few hours later, the one stick which still points to the same unmoving star marks the most likely polar axis around which the rest of the stars rotate.

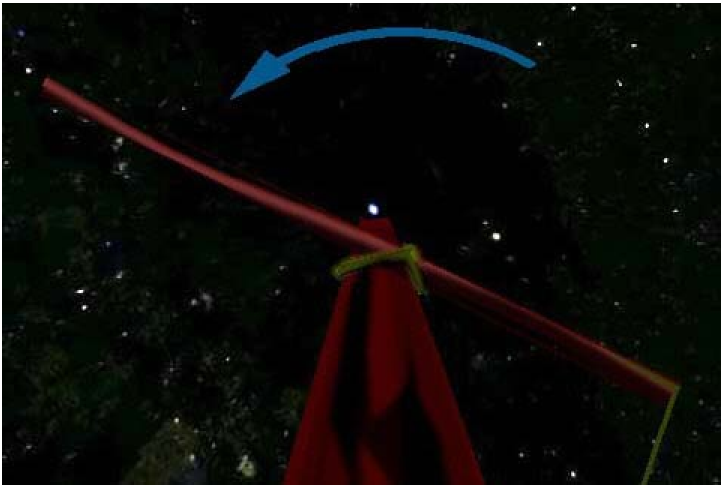
This experiment finds the fixed point of the heavens. The stick which was used to find it points along the apparent polar axis. At the time Stonehenge was built, this point was marked by a star called Thuban. But prior to Thuban there would have been no obvious marker for thousands of years.

Using the polar stick, another stick can be tied with string to make a sail which can be rotated like a hinge:



Tracing stars using the North Pole

Looking from the ground, this sail can be rotated to line up with other stars:



Following the stars

As time goes by over the course of a summer night, the sail can be rotated slowly to keep pace with one star and other stars will then remain at the same point along the length of the sail. By counting, and moving the sail in small angular steps, it is possible to show that the skies work like a 24 hour clock.

This experiment shows that the Universe revolves. It does not show what shape the Universe has; a revolving ball would look much the same as a revolving cylinder, or even stars with space between them.

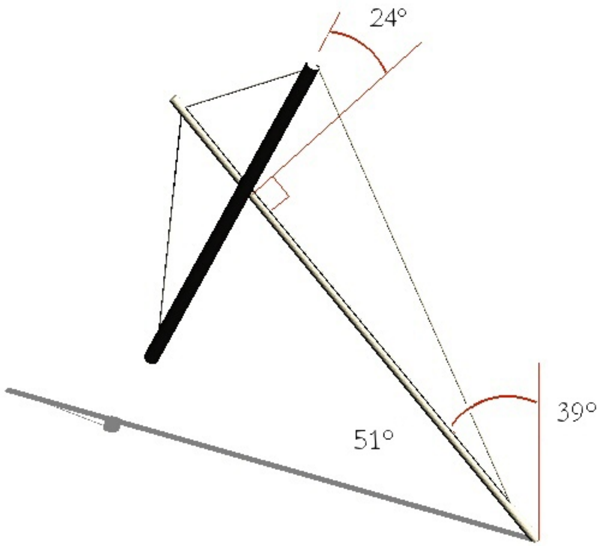
By looking down the length of the sail (rather than looking from the base of the polar stick), other stars can also be seen to be keeping pace. If the sail is at right angles to the pole, these stars will be near to the equatorial axis and are unique because they rise to the east and set to the west. The discovery of east and west stars can be very useful: By noting where equatorial stars set, from a location on high ground, the direction of something else (for instance a village) can found.

In the Northern Hemisphere, the best place to do this experiment is on a north facing slope. If the experiment is done in England over a long night of winter, the stars can be seen to rotate in almost a full circle. The most obvious explanation for this, if the Earth is fixed, is that the Universe is a sphere.

Even today, the most likely explanation for the Universe's shape is that it forms some sort of spheroid.

The sail of the stick can also be pointed towards the Sun. Using exactly the same experiment, the Sun can be shown to rotate around the same axis as the stars. In Southern England, at about 51 degrees latitude, the Sun can be seen to rotate around a stick which points up to the North Pole at about 51 degrees from the ground. Latitude, the number of degrees from the equator, can be found anywhere in the Northern Hemisphere by pointing a stick at the North Pole.

During the spring and autumn equinoxes, a sail pointing to the Sun will be at right-angles (perpendicular) to the pole-stick. To make it follow the Sun in high summer, the stick must point up from perpendicular by about 24 degrees. At winter equinox, around about the 21st of December, it must point down by about 24 degrees. Like the stars, if the rotating stick is made to follow the Sun, it also turns just like a 24 hour clock.



Summer arrangement

This experiment shows that the Sun moves just like the stars with but one major exception; the Sun appears to gradually change its position in the sphere: In high summer it is 24 degrees up from the equatorial stars and in the depths of winter it has moved to 24 degrees down.

The same experiment can be done further north. However, the angle between the ground and the stick gradually increases. To quickly check that the ground is not just sloping, the stick can be held by its end and gravity allowed to make it point down. If the angle of the polar axis changes when going north, a logical explanation is that the shape of the world must also be changing.

If the skies are probably the shape of a ball, is the Earth a ball too? The changing angle of the pole star, when travelling north, seems to indicate that it is. Although it is not possible to see the curvature of the Earth at ground level, ships disappear over the horizon; also suggesting that the Earth is curved.

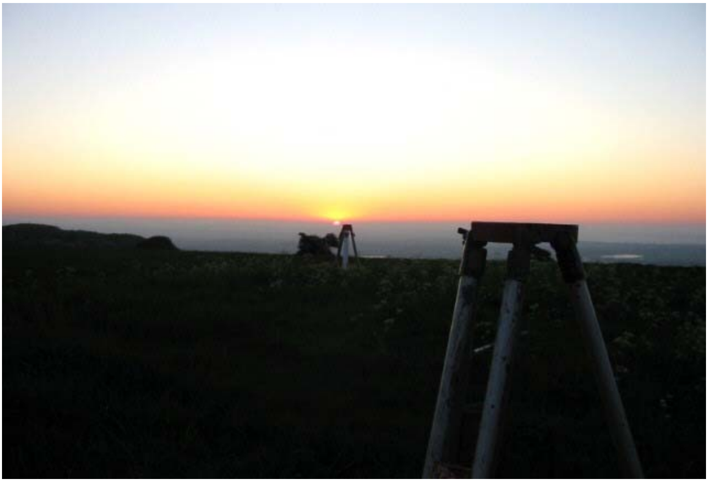
One way to test the idea is to find a high spot on an island far away from other land. The top of a stick can be aligned with another so that both tips meet with the horizon. When looking back from the other stick, if both sticks line up with the horizon the world must be flat and endless. However, if the second stick is above the horizon, the world is probably either a disc, a cylinder or a ball.

But there is a problem with this experiment: When it is tried on a hill looking over sea, the horizon measured during the day is likely to be different from the one which appears when the Sun sets (or when it rises). Haze can stop the real horizon from being seen:

Horizons: Before and at sunrise

A way around this problem is to find a location where there is both a coastline jutting out into the sea and also a tall hill within that promontory: If the two sticks are aligned over sea with the morning Sun, at the point where the horizon is in front of the Sun, an exact line to the horizon can be found. After perhaps weeks or months, the Sun will eventually set in exactly the opposite direction allowing the difference between angles to be found.

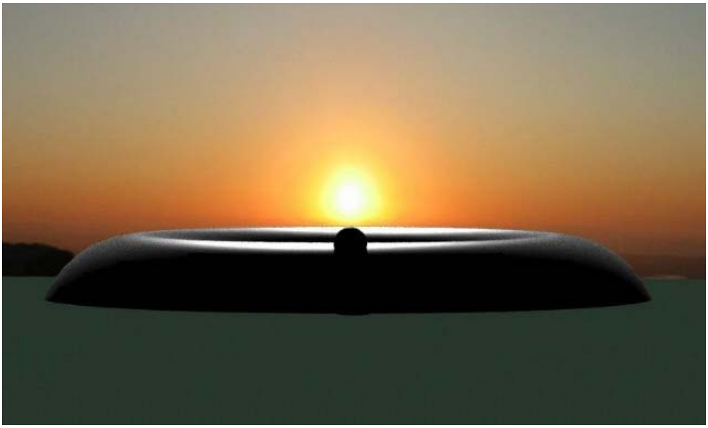
In a location which looks over sea, directly east and west, the whole experiment can be done on one day. At equinox, the Sun rises in the east and sets in the west:



Aligning to sunrise using tripods as sticks

A high spot that works for this experiment is near Beachy Head at a place called Bourne Hill (about 200 metres above sea level). By chance, there is a neolithic mound with an almost flat top in exactly the right location.

The experiment above shows that the shape of the world, looking east and west, is not flat. The experiment can be improved by making the mound into a dish with a level rim. Water will fill the dish when it rains and, if the dish is level, it will fill to the top without spilling. By making a level surface at the edge, downward angles at sunrise (in eastwards directions) can be compared to downward angles at sunset (westwards directions).



CGI image showing system

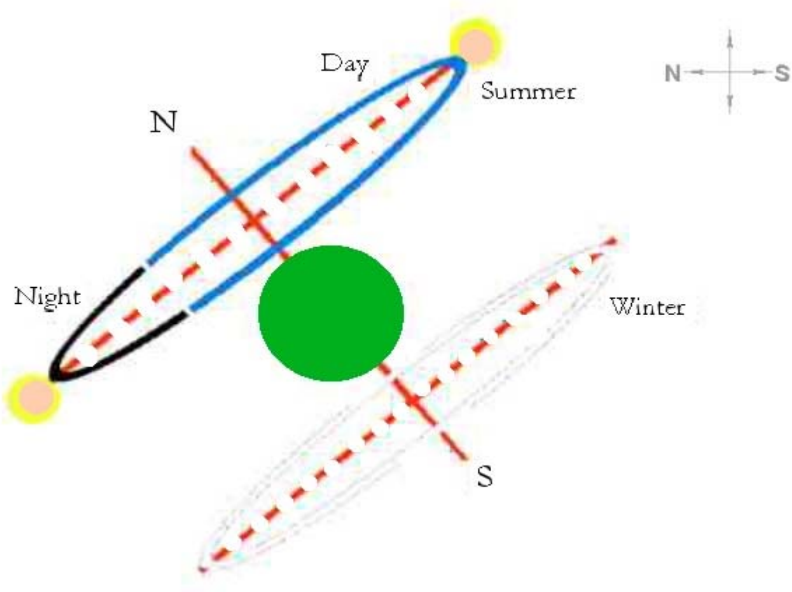
When this experiment is done, the angle down to the sea horizon in front of the Sun proves to be the same in each direction provided the Sun's rays can skim above water. The Neolithic mound at Bourne Hill, perhaps by chance, is shaped as a dish.

This last experiment only shows that the angles to the east and west are the same. It shows that the Earth is either a sphere-like object; or that the experiment itself is by chance at the centre of either a curved earth-disc or some type of cylinder (the change of angle going north shows that the world is curved from north to south). To find out which idea is right, the experiment could be done again at about the same height, but further along the coast. If the angles to the horizon start changing over these new sea views, the Earth could be a cylinder or a disc. If the angles never change (allowing for the height of each hill), the Earth is almost certainly a sphere.

There are other exceptionally good locations in Southern England for this experiment: St Catherine's (236m) is the tallest hill on the part of the Isle of Wight which juts out into the English Channel. At its summit there is also a neolithic mound which appears to be bowled or flattened on top.

By doing the experiment on both the Isle of Wight and at Bourne Hill, the world on which we live can be shown to be curved like a sphere in all directions. Further along the coast in Dorset, the experiment can be done again at a 203m high point known as Swyre Head, where the coastline also juts out. Curiously, a neolithic bowl barrow also exists at this high point.

With a few simple experiments, the world can be shown to be round, although it can not be said for certain what the other side of the world looks like. The world below appears to be solid and fixed, so if the assumption is made that the Earth is fixed, the axis of rotation of the moving heavens can be drawn relative to a picture of a fixed ball. The Sun, appearing to change its orbit from winter to summer, can also be drawn:



A drawing of a geocentric movement of the Sun

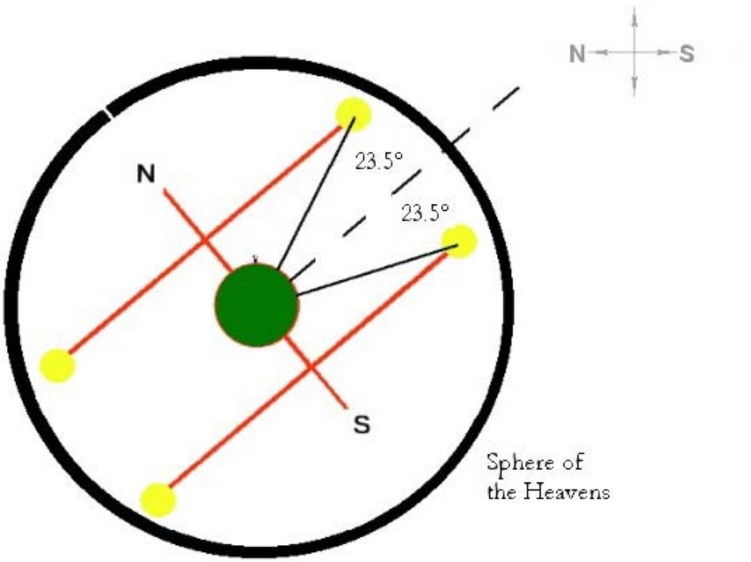
The most likely explanation for the heavens is that they too are round, but as yet no proof is available to show how big the heavens are.

The Hinge of the Heavens

The hinge of the heavens and the discovery of the world being a sphere would probably be important enough to draw out.

The angle of the hinge can be found by pointing a stick at the North Star. Looking at the world side-ways, a picture of a geocentric Universe can be drawn the most easily if east represents 'up' rather than north: The rotation of the stars around the pole can then be drawn as a big circle to indicate the rotating sphere of the heavens.

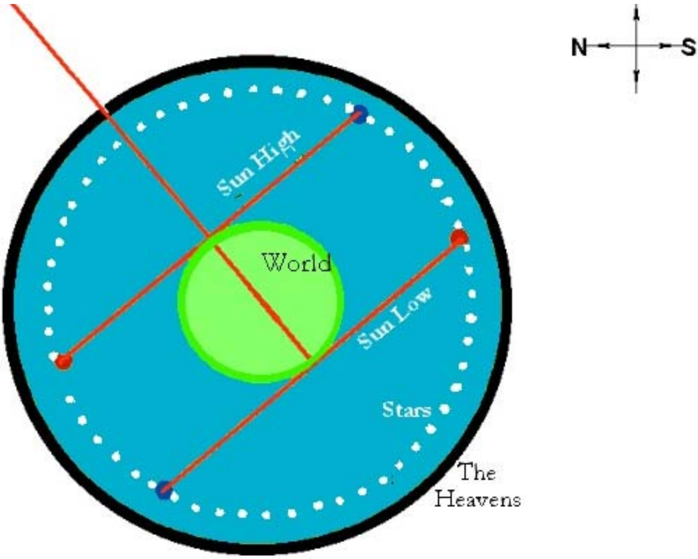
An observer at Stonehenge who is looking east (represented as a dot on the top of the ball in the picture below) can see the North Star at about 39 degrees anti-clockwise from a line drawn straight up to the skies (vertical). The equatorial band of stars rotate at about 51 degrees clockwise from vertical (the dashed line) and the Sun also seems to orbit like the stars, but is up to 24 degrees above the equator in summer and up to 24 degrees down in winter:



Drawing the Universe

The image above, an observer standing on the top of a ball, shows one of the simplest geocentric explanations of our world, the heavens and how they appear to move around us.

A vertical line drawn at Salisbury, England (a latitude of about 51 degrees), is one seventh of a circle from the equator (51°/360°) and 6/56ths from the polar axis (39°/360°). So the circle of the stars, showing the blackness of the sphere beyond, can be neatly divided into 56 parts:



The 56 divisions of the heavens in Southern England

To draw this image accurately, the direction of east or some other cardinal axis needs to be found. A very long straight pole could be pointed towards the North Star and a plumb-bob dropped to find north. However this is a lot of work, even if a straight tree trunk happens to be handy, and it only works well when a North Star is easy to find.

As described earlier, another way to find the east-west line is to go up to somewhere like Beachy Head and to find equatorial stars. Any of this band of equatorial stars, set close to what is known as the celestial equator, can subsequently be used to find an east-west line elsewhere: Providing the horizon can be seen to either the east or the west, the east-west line can be found by tracking one of these stars down to the horizon.

Stars seen rising and descending along the same set/rise line can also be used to find the days when the Sun circles above the equator. On these days (known as equinox), two sticks aligned to sunset and sunrise will be almost perfectly aligned to east-west.

However, if the horizon is behind hills, the Sun (or tracked stars) will set earlier than expected. The effect on setting out, if a west horizon is used to find east-west, is that the east-west line will appear to be rotated anti-clockwise from where it would have been had the hills not been in the way.

The path of the setting Sun

A way around this is a method known as the Indian Circle: A big circle is drawn around a stick on flat ground. When the Sun rises, the end of the stick's shadow will touch the circle. When it sets, the shadow will touch the circle again for a second time. A line drawn between the two gives the east-west direction.

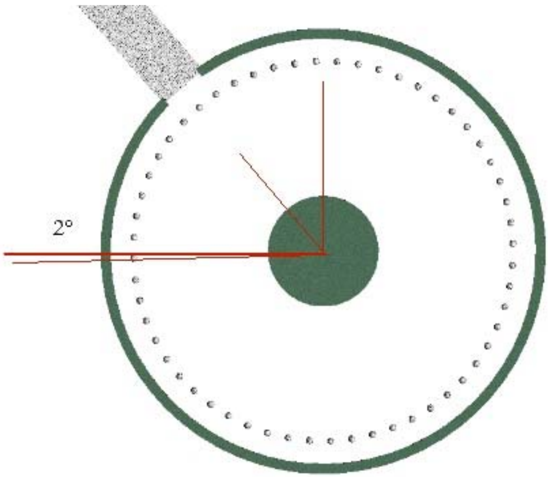
This is a useful counter-check but there is a potential problem: If the ground is not as flat as thought, and say slopes down from west to east, the shallow early morning shadow and will touch the raised edge of the circle earlier than it would had the ground been flat (because the Sun is at a lower elevation). In the evening, with the western Sun at a steeper angle, the shadow will touch the lowered eastern edge earlier than it should.

These two effects result in the same type of error which would be made when using a raised horizon of hills: If the ground slopes up to the west; the east-west line will appear to be rotated round anti-clockwise. If the ground slopes up to the east; the east-west line will appear to be rotated clockwise.

At a location like Stonehenge, where the east horizon is blocked by hills, the west, which appears to be flat to the horizon, makes an ideal setting out choice. The ground is also very flat at this particular location allowing the Indian Circle to be used for checking.

Unfortunately, these are both illusions: The horizon to the west is raised (there are hills in the far distance, particularly directly to the west). These hills raise the elevation by just under one degree above horizontal, which itself is slightly raised relative to the sea's horizon.

The ground at Stonehenge is also not as flat as it appears: It slopes down from west to east. At Stonehenge's latitude, if the sky was drawn with east representing 'up', a drawing of the heavens with 56 divisions of latitude would be rotated anti-clockwise by about two degrees or so:

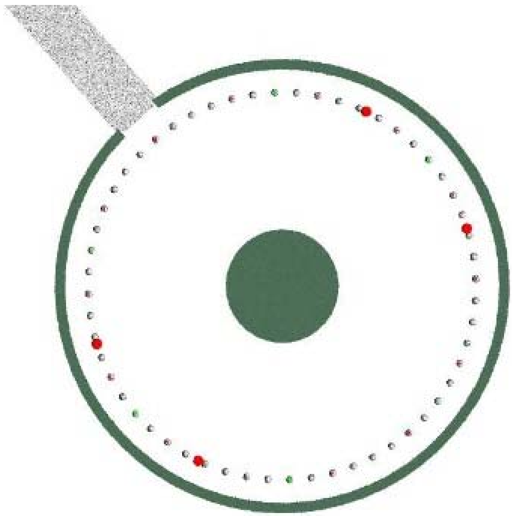


Setting out the heavens at Salisbury: East at top of picture

The original features of Stonehenge, before stone was brought onto the site, are interesting as a comparison: The 56 Aubrey holes at Stonehenge are rotated anti-clockwise from cardinals by a couple of degrees. A circular bank surrounds them. The Avenue (originally natural periglacial lines) extends out at about one degree anti-clockwise from 39 degrees (the ideal polar axis line). The southern entry also appears to be slightly out, anti-clockwise from south.

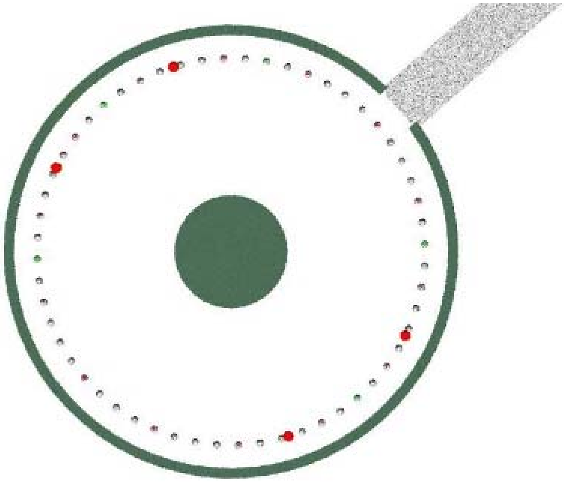
The original layout of Stonehenge therefore appears to fit a drawing of the world, and its Universe, when set out using the simplest methods available.

The Sun's apparent winter and summer orbits can be laid onto an 'east=up' drawing and stone markers used to show the extent of the Sun's movement. Four orbit points are needed to show both midday and midnight at the winter solstice and the same for the summer solstice. These four orbit points, which define the Sun's movement, are in the same place as Stonehenge's four Station Stones (the drawing below shows the arrangement viewed from the west with east at the top):



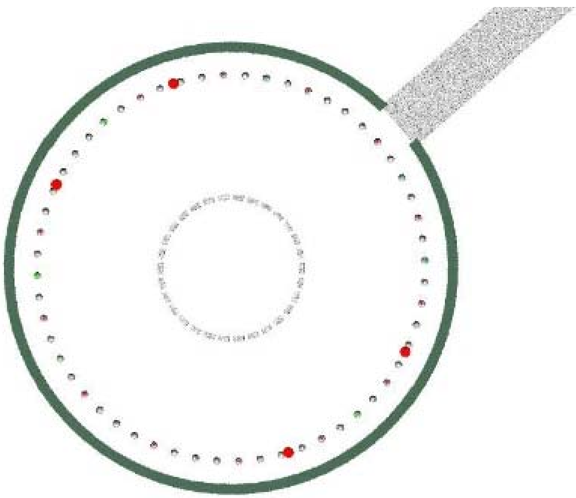
Showing the Sun's orbits in a geocentric Universe: (East at top)

If this image is turned round by 90 degrees, so that north is at the 'top', (the way we usually arrange maps today), this representation is now identical to Stonehenge's original layout:



A geocentric Universe seen to the north: North at top of picture

The Sun appears to orbit the Earth whilst slowly moving by about 24 degrees either side of the equatorial circle. This movement divides neatly into 30 parts (360/12) but not into the 56 latitudes of the heavens. A ring of 30 stones could instead be added to represent the Earth and to show the Sun's mathematical relationship to it. The layout of this description of the Universe now becomes identical to Stonehenge's final layout:



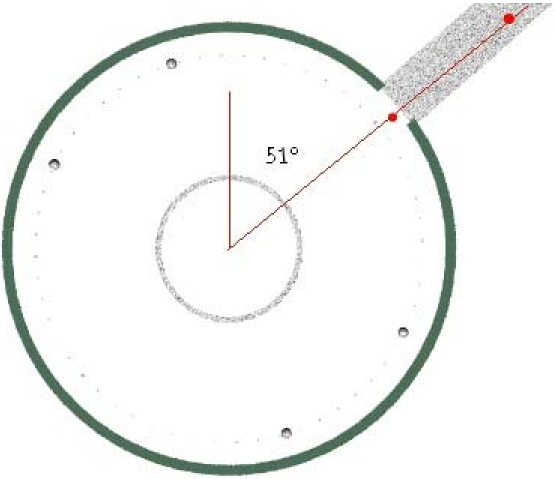
The Earth and solar markers: (North at top)

If the previous method of drawing were part of Stonehenge's original design, the layout would originally have been one or two degrees out of alignment. Other than bringing a huge tree-pole into the area, lining it up with the North Star and dropping a plumb line down to the centre of the circle, there is little or no way to see if a mistake had been made. And the idea that a tree-pole would have been brought into Stonehenge seems somewhat unlikely.

Setting out to north using a pole and plumb-bob

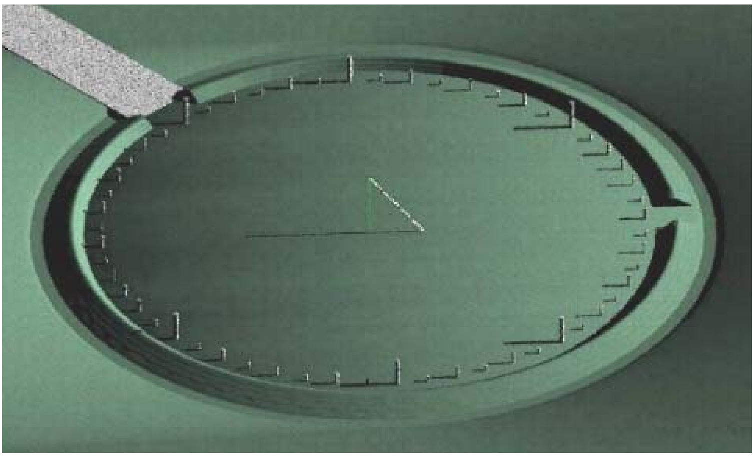
But around about the time that Stonehenge was built, some of the Avenue's Stones seem to have been removed. The ones known to have been kept are the Heel Stone and the Slaughter Stone. At about the time the sarsen ring was built, a ditch was dug around the Heel Stone (after its counter-part stone had been removed), showing that the removal of stones was intentional.

These two remaining, or possibly repositioned, stones are in exactly the correct position to represent the real position of the polar axis relative to the true cardinal directions (north, south, east and west): If these two stones might represent a sudden increase in knowledge of how to find cardinal directions, the implication is that a more advanced method would have been used to set out the stones. But when the horizon is elevated and magnets are not available, the only good method to obtain a precise cardinal layout is to trace a line to the North Star.



The Avenue stones which were kept (Heel and Slaughter Stones)

A straight tree pole aligned with the Pole Star, (Thuban at that time), could have been placed so that a plumb-bob is dropped to the centre of the circle. When the shadow from the pole aligns with the plumb-bob (which only happens at midday), a very precise setting to true north can be found. This would be sufficiently accurate to show previous misalignments:



But if a tree pole was brought to Stonehenge, why was it brought in?

A special device in a geocentric Universe

The device which could be used to find the North Star, a stick pointing to the North Pole, can also be used with a sail-stick so that the sail traces a non-equatorial star (or even our own Sun). The image below shows a stick arranged to point to the Sun at high summer from a position with a latitude of 51 degrees:

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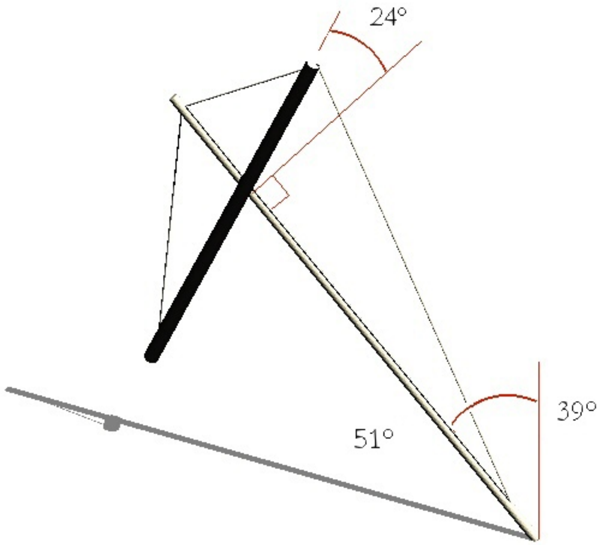


To trace the summer Sun on a geocentric world

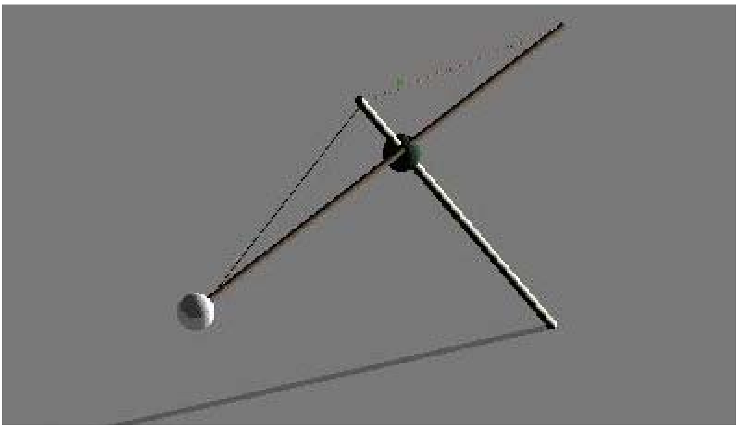
Whilst there is no evidence that a tree was brought into Stonehenge, there is a socket at the base of Stone 54 which is the right size to fit a tree. It is also the right shape. The socket on Stone 54 is also directly south of the centre of the monument and is in exactly the correct location to work.

However, this large socket seems exceptionally well-worn; almost as if it had been damaged by constant re-installation. This is inconsistent with the idea of it being used just for construction.

The principle of a polar axis at 51 degrees from horizontal, together with a rotating arm to track stars, was used at Greenwich Observatory to create what are known as the Equatorial Group of telescopes. When these telescopes are at right-angles to the support axis, they track equatorial stars:

An equatorial telescope at Herstmonceux, Sussex

The same idea can also be used to demonstrate how the Sun appears to rotate around our world: From the top of a fixed ball, with the top representing Southern England, the Sun can be shown to disappear from view at night:



How the Sun appears to rotate around a geocentric world

Before Stonehenge was conceived, it seems that tin and copper had been discovered. Tin is a material which reflects light. It can also be easily moulded to shape using an ordinary fire:

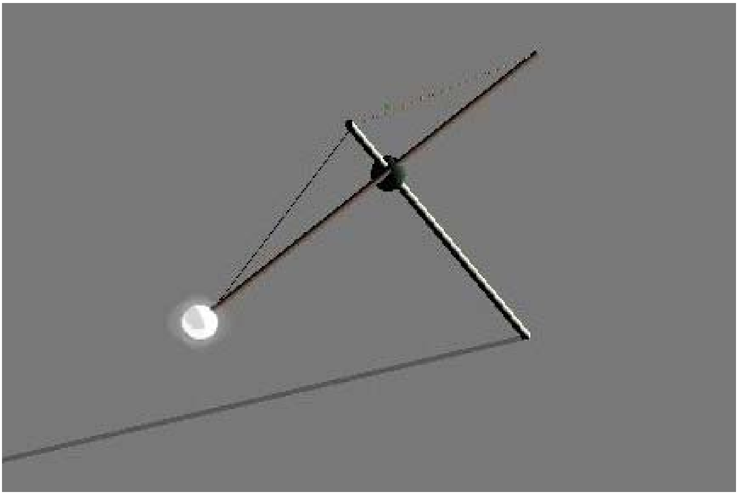
Cast tin after cooling

After casting, it can be polished using chalk paste (powder combined with water or oil) to make a mirror:

Cast tin after hand polishing using chalk paste

Tin degrades if it is kept in a cold climate. Unlike almost all other metals, it gradually turns to dust over centuries giving no evidence that it had ever been used. Unfortunately, this effect means that the discovery of tin mirrors in archaeological digs would be exceptionally unlikely.

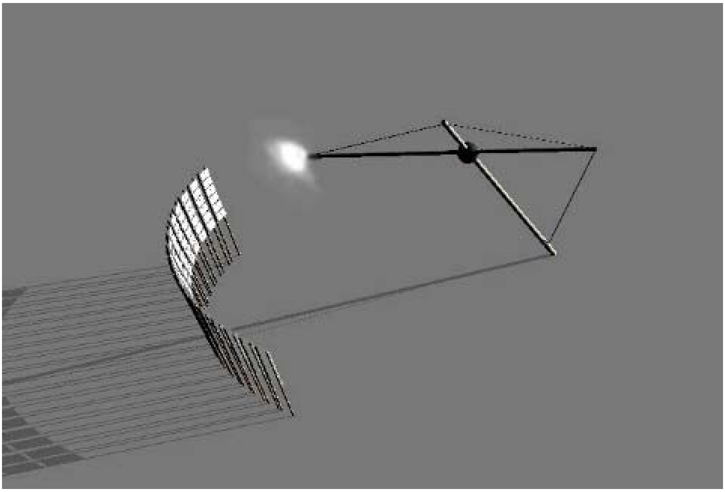
Crude tin mirrors have a reflectivity greater than 50% and can easily be used to reflect a bright light onto a ball. The idea of using reflected light could then be used to improve a demonstration which shows how the Sun seems to rotate around the Earth:



Using mirrors to light up a model of a geocentric Sun

The problem with using reflections to light up a sun-ball is that the mirrors have to be constantly re-focused to keep track of reflections as the Sun moves.

However, if the mirrors are arranged as a sphere and the sail rotated, (rather than moving the mirrors), the mirrors will remain automatically focused for several hours providing the sail is set at the correct length:

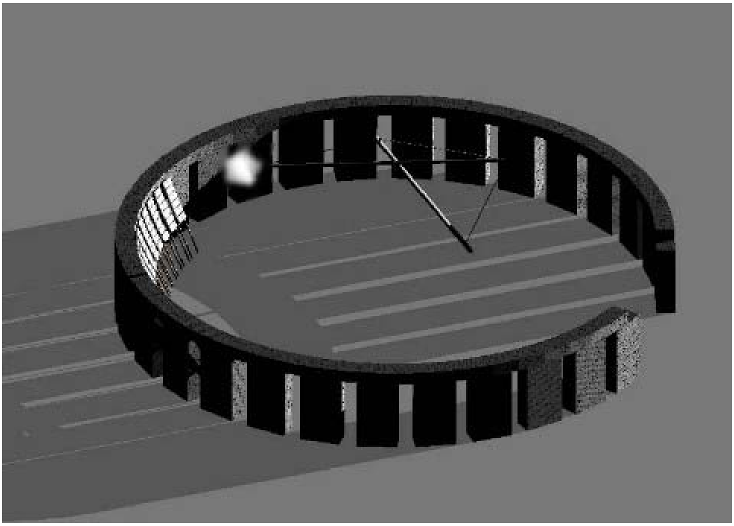


Using spherical mirrors to make a focal device

The effect of spherical concentration is used at the Aceribo Observatory where a giant spherical collector has been arranged to collect radio waves from distant galaxies.

When used in a demonstration device, sets of spherical mirrors have to be kept tightly in place so that they do not move in the wind. An inwardly facing cylinder, a circle of very strong material, is therefore required at high level together with flat faces against which the mirrors can be measured and tied.

To ensure that the mirror sets form a sphere, which has the same centre for all of the mirrors, this circle of strong material also requires a perfectly level rim:



The setting ring: To support winter mirrors

At Stonehenge there is a high level ring of inwardly facing lintels arranged as a shallow cylinder. Due south of the centre of this circle, a stone pair (stone 53 and 54) have a socket into which a tree could be inserted. If the tree were pointed at the North Star, and a second pole rotated around it, mirrors placed against the lintel rim would focus light to a ball.

As the Sun rises in its circle, the ball descends along the path of a circle. As the Sun sets, the ball rises. If a demonstration were needed of how the Sun moves in a Universe believed to be geocentric, this is the perfect arrangement.

However, tin and copper were newly discovered materials. They were probably more valuable than gold is today and would not be left out overnight. Metals would need to be stored in a safe place, moved to location in the morning, and then set up so that they focus.

This arrangement would therefore only be ideal for afternoon use when the ball appears to be rising. To reflect, mirrors need to face the Sun. In Southern England, the Sun travels from south to west over the course of an afternoon. Therefore mirrors must be placed in the north east, with their light reflecting up onto the ball; now rising to the north east of the centre.

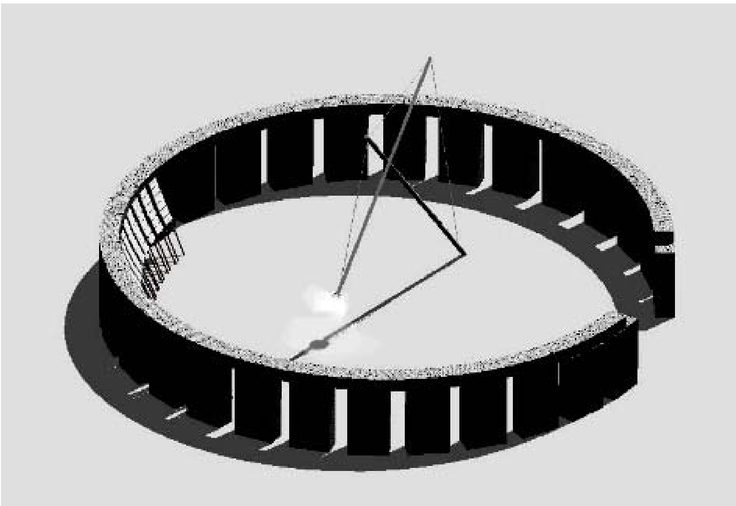
The best place to see this effect would be from the north east: A wide avenue, such as the Avenue north east of Stonehenge, would be ideal to show the effect of a bright mini-sun to a huge number of people.

The three season device (Stonehenge)

The device has a rod which points up by 24 degrees in the winter. This allows the shining ball to appear just above the top of the supports. However, the arrangement described so far is only good for winter.

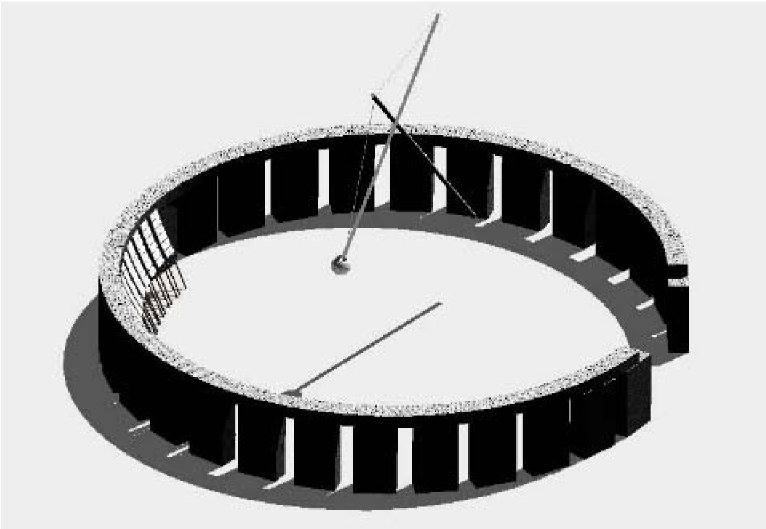
After winter passes, the Sun gets higher in the sky. The rotating rod must point to the Sun, so the end of the pole and its reflector must go down. At equinox (spring or autumn), the rod will be at right-angles to the pole. In summer, the Sun is high, so the reflector-ball will be even lower.

The effect of this, after winter passes, is that the focal point (on the ball) disappears below the top of the mirrors when viewed from the outside:



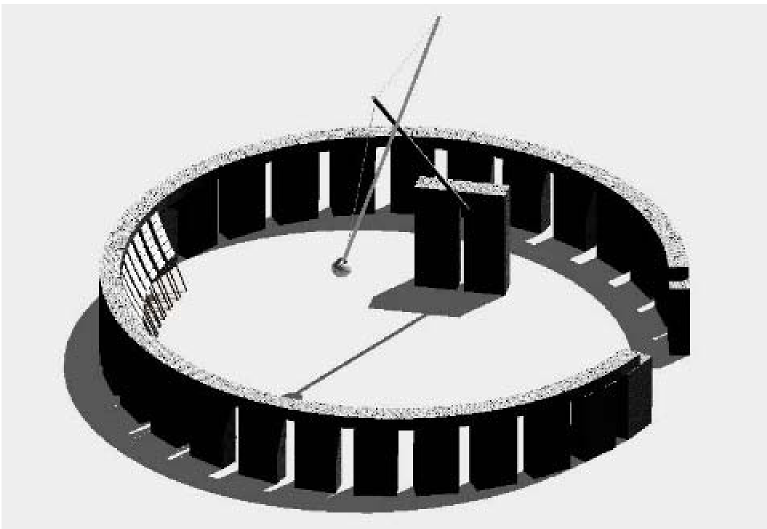
Summer: The sail pointing down

One way to improve this design is to raise the axis by just enough so that the whole assembly is again visible above the ring. As summer approaches, the whole assembly can be raised for a second time:



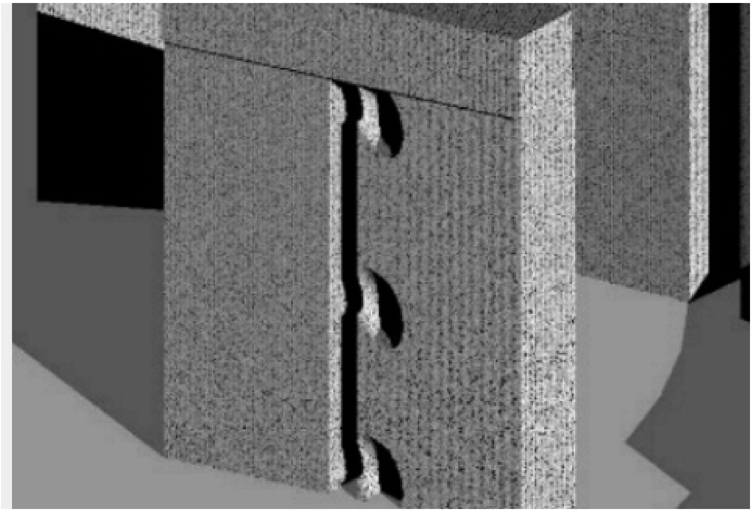
Raising the assembly above the parapet

When dimensions are calculated, it proves to be possible to position the pole so that the ball of light is always in the correct position above the rim of circular stone.



High level position of the 3-season socket arrangement

However, to make it work at Stonehenge, two extra sockets would be needed so that the assembly can be moved up:

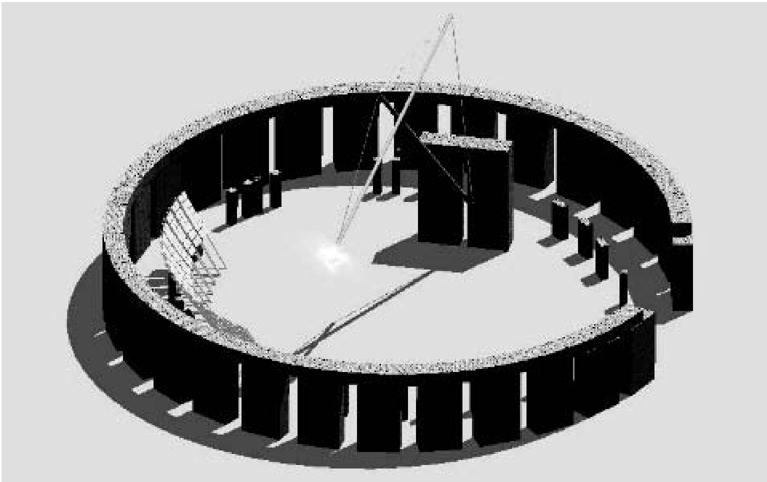


Computer model of calculated hole locations for equinox and summer

At Stonehenge, two extra sockets appear to exist on stone 54. These are in exactly the positions required to allow the shining light to rise above the lintels in any season. The holes also appear to be the right shape and orientation.

Stones 53 and 54: Stonehenge

A second consequence of moving the assembly up is that the mirrors must be moved over and then tilted so that the spherical centre moves up with the apparatus: In summer, the mirrors are highly angled so are easy to prop from the ground. But at equinox, a second set of low-level supports would be best introduced, just inside the main ring, to prop the tilted and shifted mirrors:

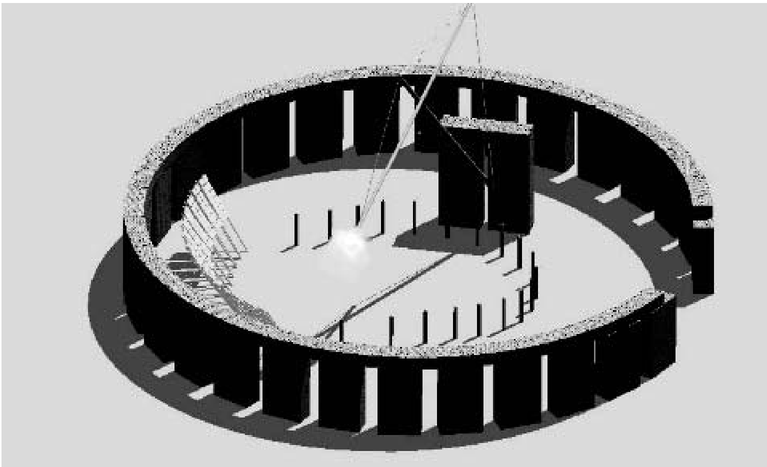


The equinox support requirement; Bowl centre raised by 2 metres

At Stonehenge, a second ring of stones, known as the outer bluestone circle, exists in just the right place to provide solid support points for mirrors which are tilted and shifted for spring or autumn:

The outer bluestone circle

The rotating collector is heavier at one end than it is the other. To improve the design, either a counterweight can be hung off the end or the end can be tied down to a series of holding down posts:

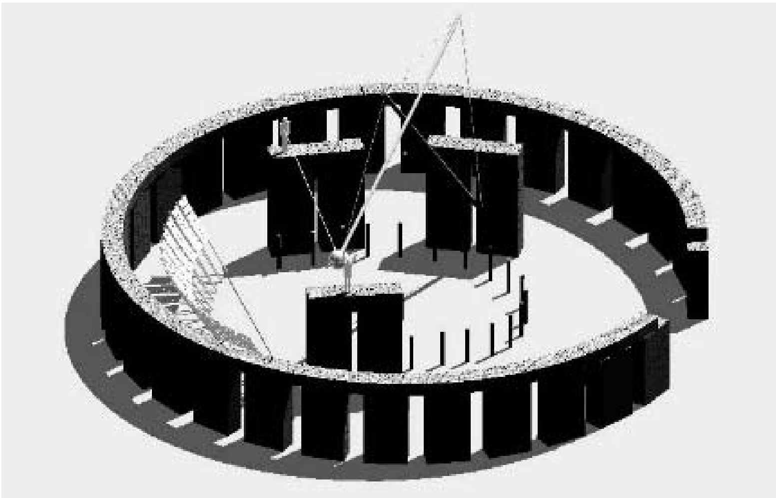


Oval or horse-shoe counterweight ring

At Stonehenge, another set of stones exists in just the right place to allow the high end of the rotating pole to have either a counterweight guide or to be tied down. These stones are known as inner bluestones:

Stonehenge's inner bluestones

To allow the rotator to be hauled around the polar axis and firmly tied against wind, tall and strong platforms are needed in the north east, arranged so that they do not cast too much shadow on the mirrors. To enable the fitting of a reflector, the end of the sail must be accessible from these platforms in winter:

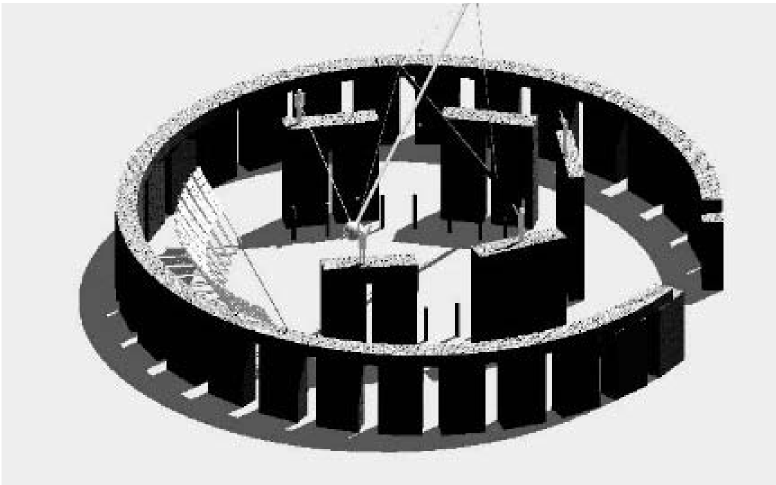


Adding the loading and rotation platforms

At Stonehenge, two sets of trilithons (Stones 51 & 52 and Stones 59 & 60) are set in just the right position to allow the sail to be rotated, be restrained against the occasional gust of wind, give access to the reflector and not cast too much shadow on the north-east mirrors.

However, when the pole is raised by one level for either the spring or autumn, the end of the sail is only just reachable (so that it can be fitted with a reflector). In summer, with the pole two levels up, the reflector is far too high to allow access to the end of the rotating arm.

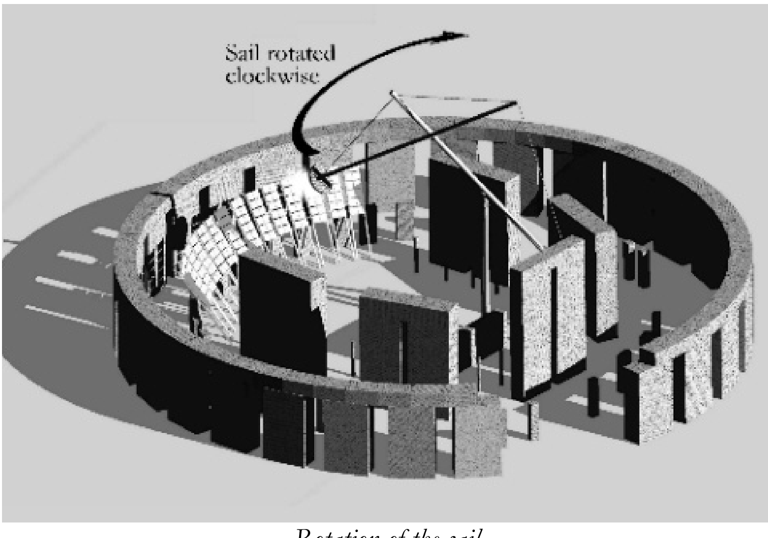
A way to get around this is to install two extra sets of platforms so that the end of the sail can be reached no matter which position the pole is placed in. Because these must be higher platforms than the two used at the north east, they need to be set at the back so that they cast the least amount of shadow:



Adding platforms for equinox and summer

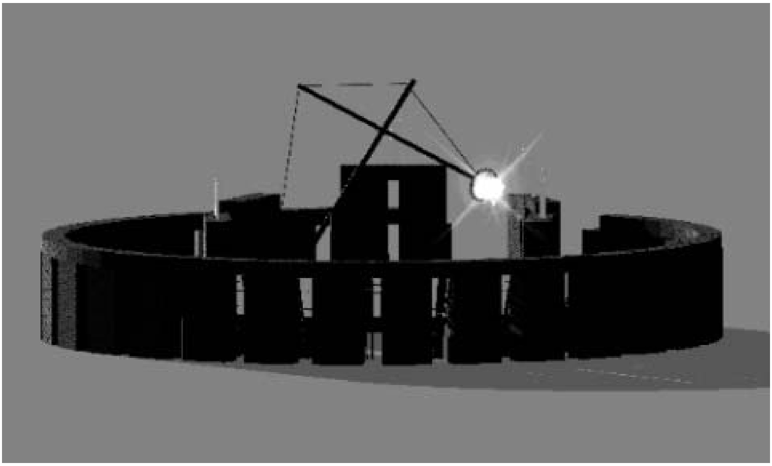
At Stonehenge, two sets of trilithons (Stones 55 & 56 and Stones 57 and 58) exist at just the right position and height to allow these operations to occur.

The 3 season device creates a ball of light. The ball appears to glide on a sunbeam because its sail always points towards the Sun. As clouds appear, the ball would turn dull and with each new ray of sunshine it would light up:



Rotation of the sail

The reflector can be a number of shapes. It can also be made to concentrate light in certain directions, but the overall effect is to create a small version of the Sun which appears to rise on the sail towards the heavens.



View from the north-east

Decay

Most modern structures are facilities which are designed to contain or carry other things. For example, a museum's purpose is related to its contents, but the contents will always be the first thing to be removed when the building becomes outdated or threatened.

A solar structure of the type described here contains two sets of temporary features: The first set of temporary features are the mirrors and the reflector, both containing precious metal. Additional temporary structure (such as the pole, ladders, ramps and so on) forms the second set.

At the time Stonehenge was constructed, the metal components would have been more valuable than a structure such as Stonehenge. Containing and using metal would have been the primary purpose of a building designed to be a solar concentrator. As with a museum, these valuable contents would be the first to be removed if the structure either fell into disuse or came under threat of pillage. In the unlikely event that any metal was left behind, tin would gradually crumble to dust over the centuries leaving no trace other than an elevated tin content within the soil.

The second set of temporary features (ladders, ropes, poles, platforms and so on) might be left in place in the event of a sudden fall into disuse. Because these items are less valuable, they could also be stored nearby. Either way, timber left above ground eventually rots and thus returns to the soil leaving no trace.

In other words, the structure described in this introduction would leave no trace other than the structure which currently exists at Stonehenge.

Summary

When the Sun leaves the far north in winter, the land becomes cold. On a world believed to be geocentric, the Sun turns with the celestial sphere but appears to have a will of its own. Knowledge of how the heavens work could therefore have been seen as fundamental to the continued existence of people living at the edges of the world.

Stonehenge's plan layout can be shown to be the same as an idealised geocentric description of the Universe. Its inner stone monument is demonstrated to be capable of producing a spectacular public display of solar movement. The arrangement of this system is shown to be based on a simple method of tracking celestial objects.

Therefore, the contention of the paper is that Stonehenge could have been both a depository of knowledge about the Universe and a place of learning designed for popular interest.

Notes

The Broken Stone and the secret of the Heavens' Henge creates a fictional world in which a geocentric demonstrator could be used to show how the Sun moves. Several more of the remaining similarities to Stonehenge are developed in this novel and its referenced non-fiction appendices.

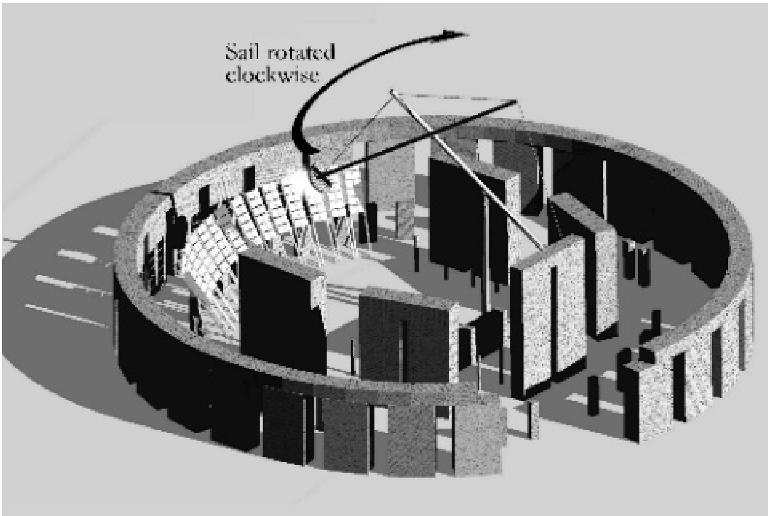
The website below was created to gauge interest in a detailed non-fiction work to describe the coincidences in detail, with accompanying archaeological and scientific references, and to expand on the other neolithic sites which have been found to contain similar coincidences.

http://www.stonehinge.co.uk

Abstract

This paper shows that Stonehenge's plan layout is the same as an idealised geocentric description of the Universe. Its inner sarsen monument is demonstrated to be capable of producing a spectacular public display of solar movement. The arrangement of this system is shown to be based on a simple method of tracking celestial objects.

The contention of the paper is that Stonehenge was both a depository of knowledge about the Universe and a place of popular learning designed for mass interest.



The inner monument