The Astronomical Gnomon

A Series of Interactive Experiments in Archaeoastronomy

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The gnomon is the part of a sundial that casts the shadow, and it is probably also the world’s oldest astronomical instrument. As basic as a pole stuck in sand, the gnomon may have been used to measure the passage of time by nomadic cultures of the Sahara for millennia. In the much later high cultures of the Nile Valley, the gnomon could have been used to determine the direction to true north for pyramids, palaces, and temples.

For those who carefully watched, the moving shadow of the gnomon revealed a profound symmetry in nature, a space-time pattern that connected heaven and earth. In the afternoon the tip of the shadow traces a pattern in the sand similar to that of the morning. The patterns are mirror images of each other, lying across an imaginary line of symmetry. That line pointed to a mysterious area to the north, around which all the stars of the sky revolve. This realm of the north, where stars never set, was viewed by the Egyptians as a timeless place of eternity.

There is more to the gnomon, for it also measures time by the tip of its moving shadow. The patterns on the sand are symmetrical about that time when the sun reaches its highest point in the sky, when the shadow is shortest.

Over the centuries the simple wooden pole in the sand was transformed into the tall stone obelisks of Egypt, a symbol of the axis mundi the line connecting heaven and earth. Obelists and gnomons may also have been perceived symbolic ladders to climb to the heavenly realms.

The earliest evidence of attention in Egypt to the norther regions of the sky comes from Nabta Playa where a ceremonial center was built by cattle herders on the edge of a seasonal lake, watered by summer solstice rains The area was occupied by nomadic pastoralists starting about 9000 B.C. and around 4500 B.C. it developed into a regional ceremonial center. In the area Nabta Playa, a gnomon (Figure 1), human and cow burials as well as a calendar circle (Figures 2 & 3) reveal the importance of north to these nomads.

Now we have Polaris, but for most of human history there has been no star at the north celestial pole. Previous cultures need a more indirect method of establishing
north than simply aligning themselves with a pole star. One way is pay attention the
rising and setting stars around the northern regions. Since the horizon is so nearly
flat in much of the Saharan desert ancient sky watchers could have observed the
rising and setting positions of the sun or bright stars in the north such as Arcturus
and then split the difference to determine north. The problem with such a method is
that is requires that the horizon be really flat. Any irregularities would have shifted
the rising positions of the sun or stars. At low latitudes, however, the shift would be
small.

The approximate direction to north could have simply been estimated by aligning
with the vacant center of the zone of the sky where stars never set. Or, they could
have used shadow casting by a gnomon, as we shall demonstrate in this experiment.

Fig. 1 Gnomon at Nabta Playa