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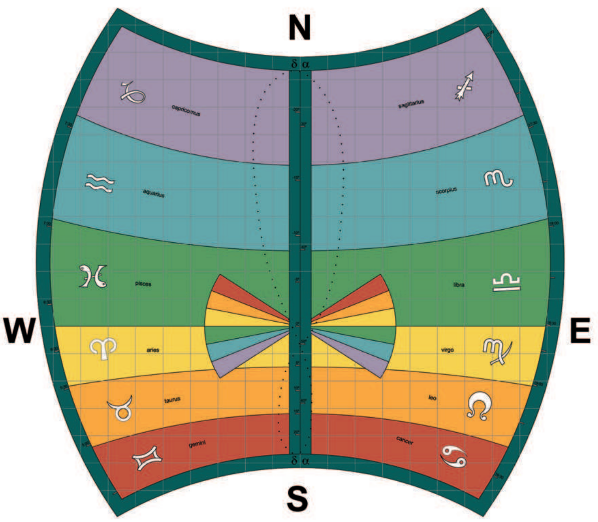
The Helioskiameter



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When the sun's rays pass through the lens of the Helioskiameter they spread out and, due to the sun's rotation, the rays' colors spin around the post and land on the ground creating what we have called "The Birth of Time". It is this poetic idea of a mixture of light, color and rotation on the pole which supports the lens of the Helioskiameter which made us decide upon this title. And, in this way, "Time"was born.

By analyzing our relationship with the sun, mankind has been able to measure time, thereby allowing us to determine noon, the length of a year, the seasons, when to harvest our crops, when to expect the rainy or dry seasons, and even the organization of social activities, etc. The lens of the Helioskiameter projects the image of the sun on to the ground. As the Helioskiameter is designed to provide us with measurements, in order to name this device we have taken from the Greek, Helios (sun), skias (image or projection) and meter (to measure). What we have done is to follow, day by day, the motion of the sun's image and made measurements.

Our aim was to represent on the pavement the measurements which we made and which show, among other things, that there are no two days in a year which are of exactly the same length, or in which the sun's altitude, the direction of sunrise or sunset is the same, and that the motion of the sun on the ground always lies between two definite lines: the line closest to the bottom of the pole, which corresponds to the summer solstice (June 21st) and the line furthest from the bottom, that of the winter solstice (December 21st). These two lines are separated by half a year and every day the sun follows a different path in between these two lines, and moves approximately 10 cms per day, except during the solstices, when the sun's path remains almost the same for about three days, as if the sun were at rest. This is the Latin meaning of solstice (sun at rest).

The curved path of the sun changes and becomes a straight line during the equinoxes (March 21st and September 21st). These are the only days when the sun rises in the east and sets in the west. On the remaining days of the year it rises (and sets) more towards the north (spring and summer) or more towards the south (autumn and winter). When examining the position of the sun when it rises (and sets), it is possible to determine which day of the year it is, and therefore, the number of hours of light the day will have.

If the sun's image were to fall outside the lines we have drawn, it would mean that the rotation axis of the earth was changing its orientation.

The average day is 24 hours long. Nevertheless not all days have the same duration. Some are 15 minutes longer and some others 15 minutes shorter, and the duration of the other days is in between these limits, each day varying by between half a minute and a little more than one minute.

All of the above-mentioned features can be measured and the Helioskiameter is a device which does this. We have used the six basic colors of the sun's spectrum to illuminate six areas on the floor, each one representing one month. Warm colors (red, orange and yellow) for spring and summer months, and the colors considered to be cold (green, blue and violet) for autumn and winter months. The sun's rays follow the line closest to the pole on June 21st and the line furthest from the pole on December 21st. The lines of separation between these two lines lines more or less correspond to July 21st, August 21st, September 21st, October 21st and November 21st, respectively. By looking at the path of the sun's rays on any particular day we can calculate the date. However, because the duration of a year is not of exactly 365 days, every four years an extra day must be added to the calendar in order to compensate for this difference.

The central line or the axis of the Helioskiameter is the local meridian line which passes through the bottom of the pole. It represents the north-south direction. To the left of this line the solar declination (delta) is represented. This is the angle the sun's rays form with the plane of the equator, which goes from +23° during the summer solstice to -23° during the winter solstice. This declination is 0° during the equinox days when the center of the sun is aligned exactly on the plane of the equator.

On the right hand side of the central line the sun's altitude (alpha), i.e. the maximum inclination of the sun's rays with respect to the ground, and this is reached when the sun passes through the meridian. In our latitude the sun's rays never go above 70°. For instance, from September 28 th until March 15th the maximum inclination of the sun's rays is always below 45°, the solar declination is below -2°, so that between those dates shadows are always longer than something's real length.

The central figure, which reminds us of a fan, represents the directions of the sunrise and sunset on the different days. If we know the sun's trajectory on a particular day, for instance a trajectory in the middle of the green region, and project that line to the horizon, we will see in the distance the points where sunrise and sunset take place on that day. In our latitude there is a variation of around 66° between these directions throughout the year.

The local times of sunrise and sunset are shown on the side strips of the device and when the sun passes through the meridian it is 12:00 local time. If, according to the official time, the sun reaches the meridian at 14:15, we have to add 2 hours and 15 minutes to the above times. During the summer solstice the sun rises at 4:30 and sets at 19:30, so that we have approximately 15 hours of true daylight that day, while on the day of the winter solstice there are only 9 hours of daylight. Every time the sun's rays enter a new band of color, there is one hour's difference in the amount of daylight. Nevertheless, the number of hours of daylight is actually greater because both before sunrise and after sunset, the atmosphere diffracts the sun's rays, even though the sun itself is not visible.

The length of the day can be measured with a clock by taking the time the sun crosses the meridian on two consecutive days. A day is rarely 24 hours long. Some days are longer and some days are shorter. The red line in the shape of an eight, known as the Analemma, represents the 24 hour curve. It can be drawn by choosing any particular day, marking on the floor the position of the center of the sun's image, and repeating this operation every day after exactly 24 hours. We have chosen April 13th as the starting date in order to maintain harmony in the figure depicted.

The Zodiac symbols correspond to the old denomination of the constellations along the path followed by the sun with respect to the background of fixed stars, when Assyrians created the Zodiac three thousand years ago. We have maintained these symbols for historical reasons, although today we know that the position of more than one constellation is different from what was then believed, and moreover, a new one, Ophiucus, has now been discovered. For instance, in ancient times, it was considered that the constellation behind the sun between April 21st and May 21st was Taurus. Today, however, the sun aligns with Taurus between May 14th and June 20th.

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