



Friends of Robbins Farm Park SUNDIAL PROJECT



HUMAN SUNDIALS AROUND THE WORLD

The project at Robbins Farm was inspired by a neighbor who pointed out that there are human sundials in many public parks throughout the world.



Years ago, the Needham Science Center may have developed one of the very first schoolyard human sundial projects. Their analemmatic sundial stenciled on the playground pavement became a model that has been copied widely at schools in many countries around the world.



Needham students stenciling the "original" human sundial

HUMAN SUNDIAL AT STRATTON
In 2002, Stratton Elementary School in Arlington painted a human sundial on the blacktop of their schoolyard.



Three Stratton School parents worked with the Stratton PTO Science Enrichment to create the project. The Stratton sundial told the time accurately within 10 minutes, and accounted for daylight savings time.

SOME KEY TERMS: THE ANALEMMATIC or "HUMAN" SUNDIAL

Adapted from the EVERGREEN curriculum: <http://www.evergreen.ca/en/ig/essons/human-sundial.html>

ANALEMMA: A scale in the shape of a figure 8 representing the changes in the sun's position in relationship to the Earth.



ANALEMMATIC SUNDIAL: A horizontal sundial in which the gnomon is vertical (in contrast to traditional sundials which use a fixed triangular wedge as the gnomon) and must be moved (or moves in the case of a human) with the date. The time is read from the dial by noting where the shadow of the human falls.

DATE SCALE: the central part of the marked with the twelve months of the year, on which the gnomon positions her/him-self.



ELLIPSE: a curve or conic section, essentially, the shape of the dial of the sundial. The Earth revolves around the Sun on an elliptical path.



OUR "SUNSHADE" or HUMAN SUNDIAL uses a PERSON'S OWN SHADOW to show the correct clock time!



GNOMON: the shadow-casting object used to tell time. For the current project, the human student is the gnomon.



NUMBER MARKERS: the objects used to mark the numbers representing time of the sundial.



THE VISION

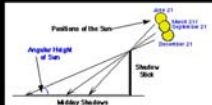
We hope to design and build a human sundial at the viewing oval, where a person, standing still, serves as the GNOMON, the vertical part of a sundial that casts a shadow.

Time Indicators, called JEWELS can be embedded in the ground or paved surface.



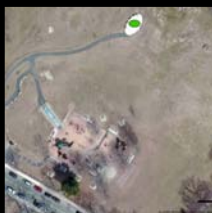
THE PROJECT

In the initial phase, the hope is to introduce students to the concept of sundial, light, and shadows, and earth rotation.



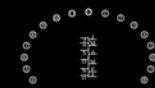
Working through the Science and Math Enrichment (SAME) Committee at the Brackett and other curriculum programs, we will encourage students to help design the oval so students at all levels and ages will appreciate the CONVERGENCE of ART, SCIENCE, and MATH in our everyday experience.

In later phases, we plan to take student designs to a more sophisticated, buildable level and initiate fundraising for a graffiti proof and enjoyable viewing oval.



MATHEMATICS OF SUNDIALS

Adapted from a University of Singapore curriculum: <http://www.math.nus.edu.sg/stalmeier/projects/sundials/>



Analemmatic dial at the University of Georgia (USA)

The analemmatic dial consists of hour points which fall along the circumference of a horizontal elliptical dial face. The major axis of the ellipse runs east-west. A date line is set along the minor (north-south) axis. A vertical gnomon, preferably a person with his hands pressed above his head, is placed on the correct date. The time is read from the point where the shadow (or its extension) of the person's finger tips intersects with the ellipse. (See Figure 51.) The size of the dial face should fit a human gnomon.



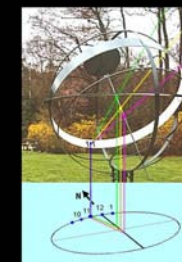
Shadows of the Human Gnomon



A vertical gnomon, preferably a person with his hands pressed above his head, is placed on the correct date. The time is read from the point where the shadow (or its extension) of the person's finger tips intersects with the ellipse. The size of the dial face should fit a human gnomon.

DERIVATION of analemmatic sundial

The principles behind the analemmatic dial can be derived from the equatorial dial. Choose a certain time, for instance 11 o'clock. At 11 o'clock on different days, the shadow of the gnomon always hits the 11 o'clock mark on the hour ring.



We can find out which point of the gnomon causes the shadow by drawing a ray of sunlight "through" the gnomon to the 11 o'clock mark. On the summer solstice (21st June) the Sun is high in the sky, and it is the green ray that causes the shadow. On the equinoxes (21st March or 22nd September), the Sun is lower and gives the yellow ray.

(The hour ring in the picture is closed, so that the front part would block the Sun. Just imagine that the front is open.) On the winter solstice (21st December), the Sun is low, and it is the purple ray that causes the shadow on the hour mark.

Equatorial Sundial with Analemmatic Projection

In this way a date scale could be constructed along the gnomon, which would run from the green dot (21st June) to the purple dot (21st December) and back again to 21st June.

Now project the hour ring vertically onto the ground. The projection is an ellipse, with the major axis running east-west and the minor axis running north-south. The projections of the hour marks are on the ellipses, some are indicated by blue dots. The point for local noon is at the north side, on the minor axis.

Also project the date scale that we constructed along the gnomon, vertically on the ground. And imagine that the vertical green, yellow and purple lines are real rods. On 21st June, the shadow of the vertical green rod will just hit the 11 o'clock mark on the ellipse. Likewise, on 21st March and 22nd September, the 11 o'clock mark will be hit by the shadow of the yellow vertical rod, and on 21st December by the shadow of the purple rod.



Analemmatic Sundial in Biarritz, France

Replace the row of vertical rods by a single, movable rod, a person for instance. When the person sets himself at 11 o'clock on the correct point of the date scale, his shadow will hit the 11 o'clock mark on the ellipse.



Leicestershire, UK

A "Human Sundial" has several advantages, when it is compared with pedestal-mounted dials - and they are often used in school grounds, private gardens, parks or any similar public areas, etc., mainly because these cannot be stolen or damaged by vandals.