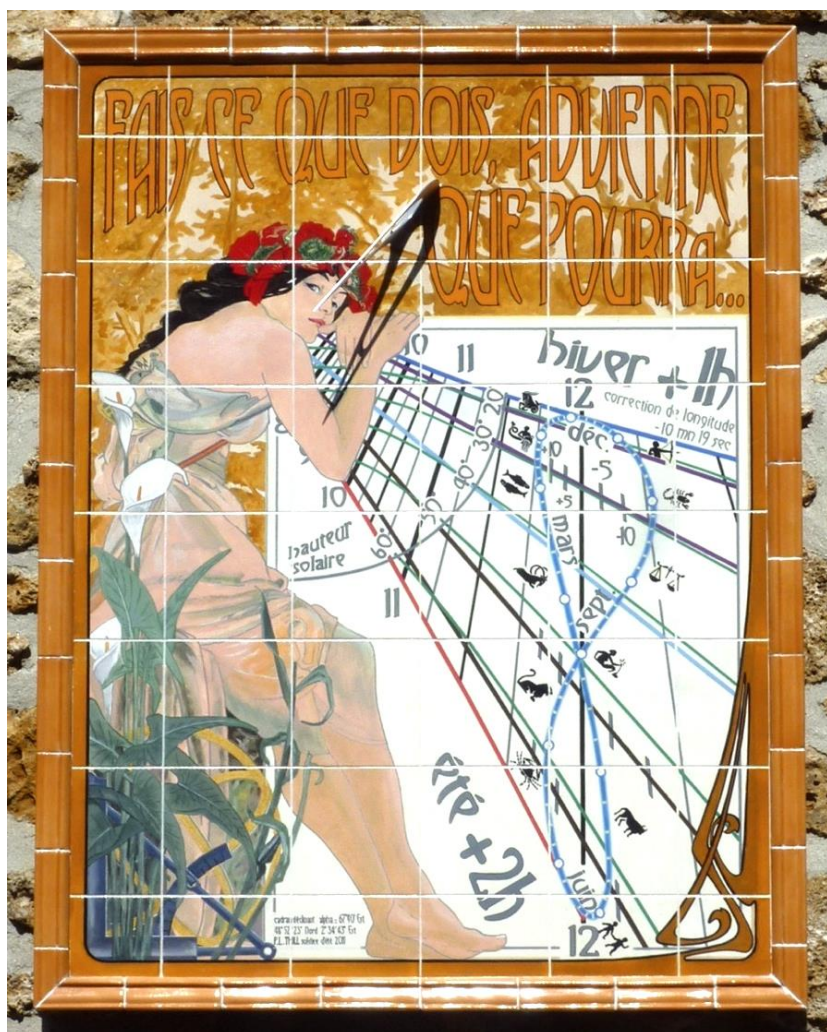




CREATION OF A VERTICAL DECLINING SUNDIAL WITH THE SHADOWS SOFTWARE

This document explains the creation of a sundial using data calculated by the Shadows software, and shows the practical steps until the sundial is finished and installed. The design and realization of this sundial were made by **Pierre-Louis Thill**. Thanks a lot to him for sharing his experience with the community of Shadows users.

The Shadows software can be downloaded on www.shadowspro.com. Its user manual can be found on-line on www.shadowspro.com/manual.



The sundial is installed at Chelles near Paris, France.

Latitude 48° 52' 23" North,

Longitude 2° 34' 43" East.

The position was found on **Google Earth**, after a first approximation on a regional map at scale 1:25000.

The longitude correction with Greenwich (UTC) is -10 min 19 s.

The sundial is installed on the front wall of a pavilion made of river stones, and the wall is declining by 67° 40' towards East.

That angle was measured initially on a local map (the wall is perpendicular to the street). The angle was refined later by measuring the time when the shadow is just tangent to the wall, and by looking at the hour angle for that time, in the ephemeris.

The size of the sundial frame is 752 mm x 504 mm, with a style height of 112 mm.

The complete panel size, including decoration and frame border is 1 035 mm x 795 mm.

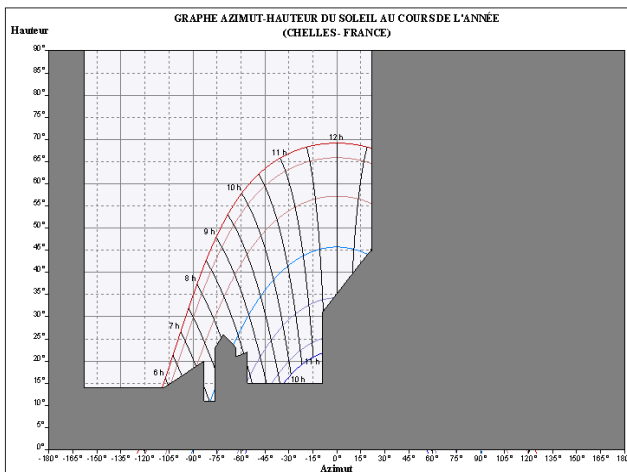
USING THE SHADOWS SOFTWARE

The freeware version of Shadows was used during the first phases of the project, especially for defining the sundial size and the size and position of the style. Several simulations of decoration were made during these phases.

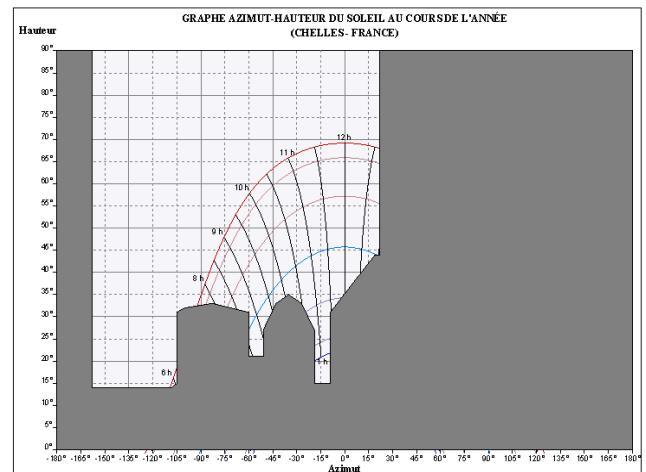
Later, **Shadows Pro** was used to refine the results and simulate the illumination with respect to the day of the year. The illumination is somewhat reduced on this sundial, due to:

- its declination (East),
- the wall of the 2-story house of the neighbors at only 5 m from the sundial (near the South direction),
- two 4-story buildings nearby, at approx. 50 m in the East direction,
- three 10 m high trees in the garden, near the East direction,
- the overhang roof of the pavilion.

The tool **Define the horizon mask** in Shadows was used to simulate the obstacles, during winter when light can cross naked branches and during summer when vegetation is larger. The position on the horizon of these obstacles was measured using a compass and a quadrant quickly assembled. The simulation allowed the definition of the best position of the character on the sundial, so that his arms would hide parts of the sundial that is not illuminated anyway.



Horizon mask during Winter



Horizon mask during Summer (with tree leaves)

The solar graph can be displayed in **Shadows Pro** from the **Display** menu > **Solar graph** and by defining the mask in **Configuration** > **Define a horizon mask**.

The tool **View the shadow cast by the roof** made it possible to simulate the optimal position of the sundial in height on the wall, so it is illuminated during summer when the Sun is high.

CREATION OF THE SUNDIAL DECORATION



The illustration used to decorate the sundial is taken from the allegory of summer, from **Alfons Mucha** (lithography from 1896, variant used in a poster from 1902).

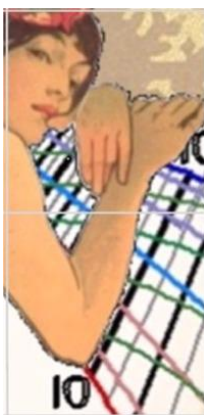
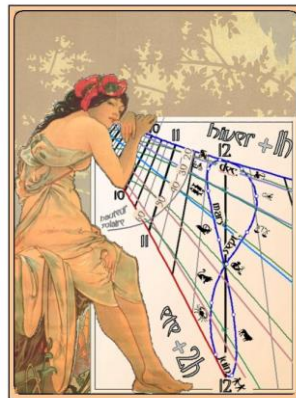
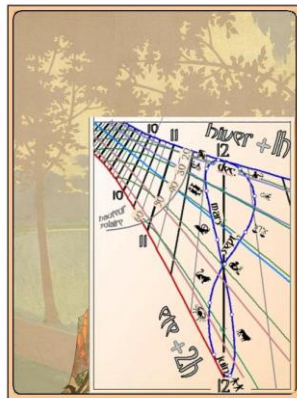
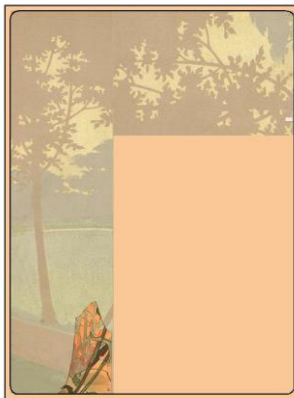
The woman rests on the sundial edge.

Arums flowers on the front scene and trees in the background recall the vegetation of the pavilion's garden.

Text use the **Gismonda** font.

PowerPoint was preferred instead of CAD software packages. It allowed an easy positioning of images scanned from books and their resizing and superposition.

Below are shown four stages of the project made using PowerPoint.



Once the draft was finalized, it was printed to scale and a grid was superimposed to mark the size of tiles. (In Shadows, a grid can be displayed in the **Preferences > General > Display a centimetric grid**), and the layout was transferred on the final support using carbon paper.

On the left, a A4-size paper covers two tiles.

REALIZATION OF THE SUNDIAL TABLE

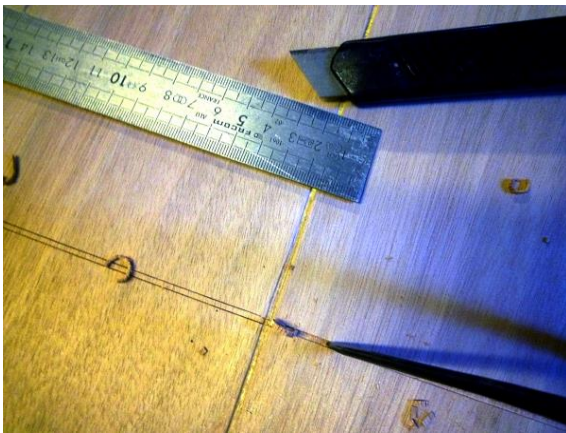


The aspect of the material recalls varnished tiles that were used during the beginning of the 20th century, especially in Spain.

The « Art Nouveau » inspiration corresponds to the epoch of construction of the pavilion (1912), and colors were chosen to match those of the stones and cement.

For practical reasons, (weight, realization, ease of adjustment on site), the decoration is not made of real tiles but painted on a wood panel, by simulating the tile separation. Water resistant paint and three layers of varnish ensure the durability and brightness of the sundial.

Only the outer frame is made of real ceramics.



Creation of the (fake) tiles

Grooves are engraved using a cutter, on a 12 mm thick wood panel. The 1.5 mm depth and 2 mm wide grooves are obtained by removing the upper layer of wood. Edges are then smoothed by grit paper and corners are eroded.

Then 2 or 3 layers of white paint are applied to prepare the support for the decoration and provide a first protection against humidity.

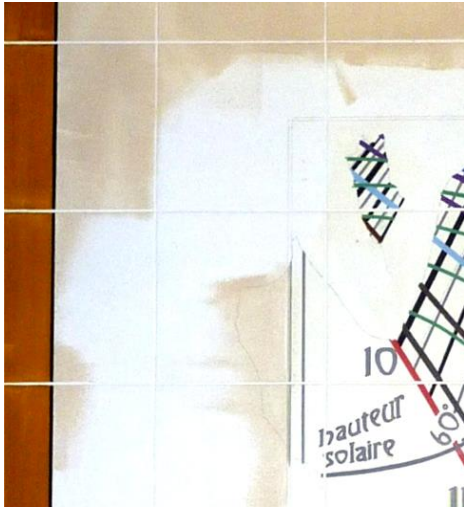


Tranferring the layout

A beige color is then applied to the background where vegetation will be later drawn.

The layout is transferred page by page using carbon paper. An A4 page covers approximatively 2 tiles.

The photo on the left shows the previous tiles already reported and the corner that was used as a reference for the layout. A special water resistant marker was used to redraw above the initial lines.



Painting the sundial

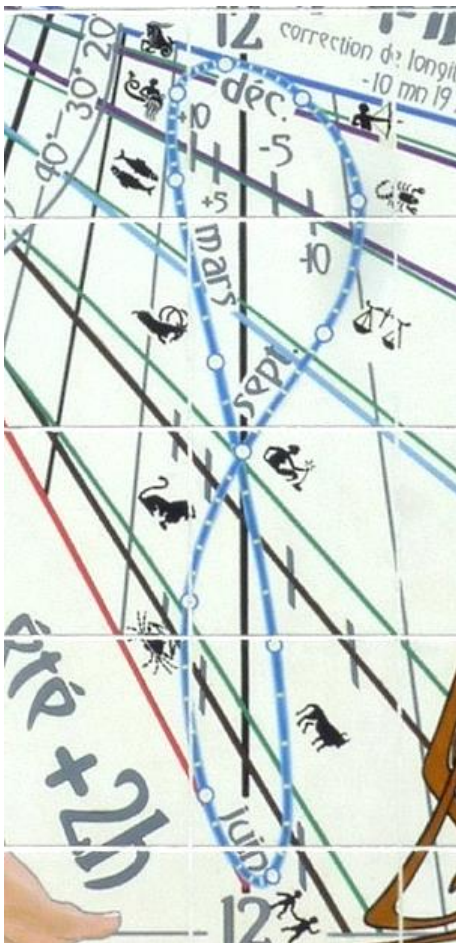
The thickness of lines is chosen to ensure a proper visibility from the garden (usually from a distance of 8 to 10 m). Several tests were made to fine the correct thickness and color using **Shadows Pro** in the **Drawing menu > Style of lines**.

To test the thickness of lines, a printout of a portion of the sundial was made at scale $\frac{1}{4}$ and tested at a distance of 2 to 2.5 m.

Text letters are made using **WordArt**, a module in Microsoft Word that provides curved text (used for the motto, the longitude correction and DST).

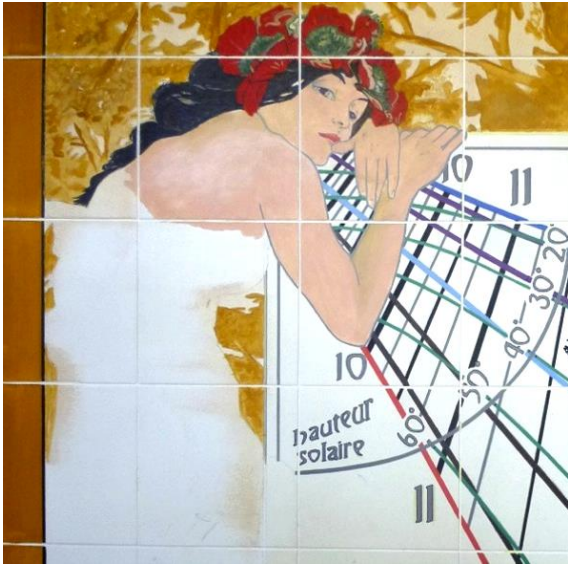
The final layout is then redrawn using **Marabu** markers, with a ruler for straight lines, and a French ruler for curves (a thick electrical cable can also be used as a flexible ruler, for declination arcs).

Letters are painted using an outdoor paint, and outlined with a black marker.



Drawing the analemma

The analemma is drawn as a thick blue line with a point every 5 days to provide a date scale. Larger points of 8 mm diameter are drawn at each month beginning.



Painting the decoration

After the background made of trees and leaves is done, the most difficult part can start with the woman, and especially her face.

Colors are obtained from a mix of several paints and applied with a brush and several pencils, in several passes after complete drying.

The female character is outlined with a dark marker, as in the Art Nouveau style.



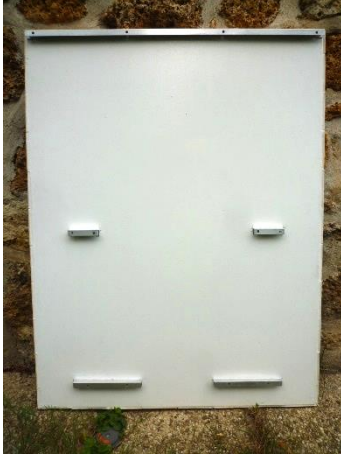
The picture on the left shows an intermediate state where Arum leaves are not all drawn.

The style is cut in a 1.5 mm thick aluminum sheet. Its height was increased by 5 mm to allow its fixture in the panel.

The fixture is made with a metal L-shape screwed at 5 mm of the base of the style on one part and on the sundial plate on the other part. Once the position verified with the Sun, it is glued to avoid any movement.

The ceramic frame elements are glued on the wood plate.

Montage du cadran



Segments of aluminum U-shape rods (15,5 x 15,5 x 1,5 mm) are screwed on the back of the plate after it was protected by a special outdoor paint. These rods allow their insertion into the negative space of the panel fixed on the wall. That panel is also protected against humidity. Four bolts on the sides allow a precise adjustment on the wall, and finally are glued once everything is checked and verified. The screws are inserted in holes made in between stones to avoid their degradation.



The quality of the fixture, and the accuracy of the drawing provided by **Shadows** allow a very good accuracy below one minute; It was verified at local noon, on August 5, when the shadow is long, by checking time with a radio controlled clock.

The sundial is installed at 4 m on the wall, so a scaffold was necessary to install the sundial and make all the position adjustments.

The materials, products and paint were bought in retail stores specialized in DIY and decoration.

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www.shadowspro.com