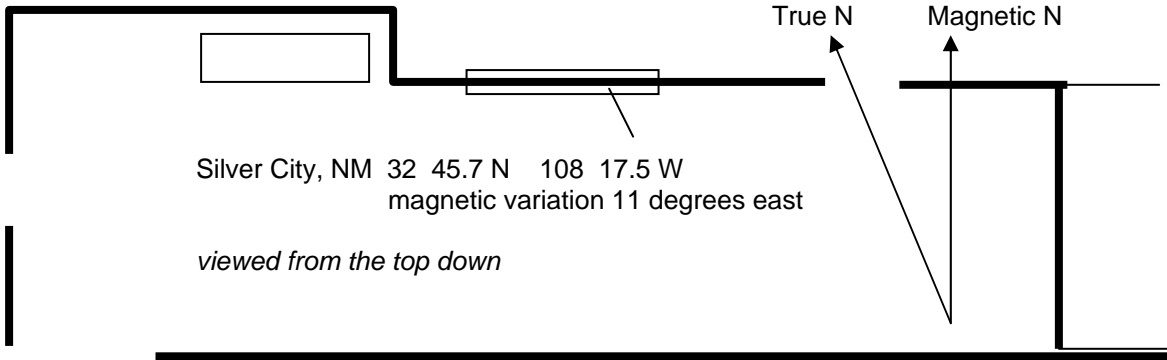
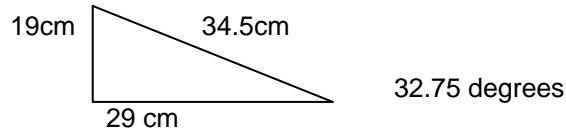


**A south facing vertical declining sundial by a barn in, Silver City, NM**  
**Using a trigon and empirical methods, and a gnomon whose sub-style was vertical**

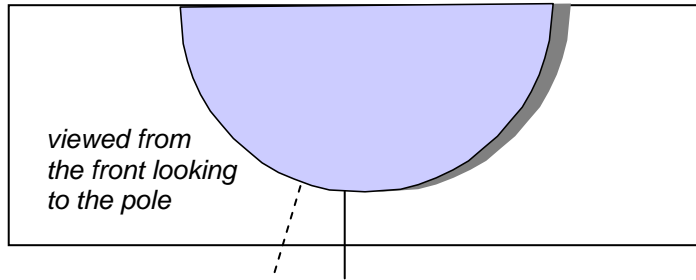


The vertical dial was built by first installing the gnomon and aligning it with true north. It was set for latitude 32.75 which is Silver City NM. The gnomon dimensions are:-



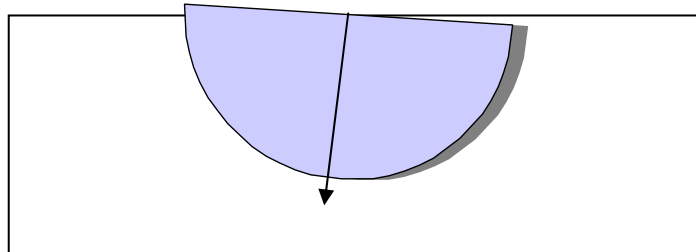
The gnomon was aligned with true north, being 349 degrees magnetic, the magnetic variation being about 11 degrees east. The wall was curved, but measured at 087 degrees magnetic or 098 degrees true, 8 degrees W declination. The gnomon had a style distance (SD) of 0, which is a different technique from many decliners.

For the hour lines, rather than calculating the hour angles, a trigon method was designed.



Since Silver City is 108 degrees longitude, the standard meridian being 105, the difference was about 3 degrees, or about 12 minutes. So the offset was to the left (as seen facing the trigon, facing north). So 12:00 o'clock at 105 degrees, is 11:48 solar in Silver City, so the 11:48 hour line shows 12:00 standard time.

In other words, when using a trigon for hour lines, the protractor scale must be rotated clockwise about 3 degrees.

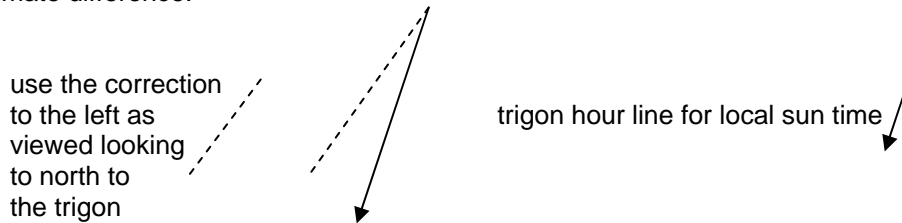


However actual hour lines were drawn with the real sun, considering the equation of time. On September 28, 2004 the EOT was -9 minutes. So at 9 minutes before the hour, the hour line was drawn. So that at 9 past the hour (indicated), the true time would be on the hour (using the EOT of -9). When the shadow is on the hour line, the observer subtracts the 9 (EOT) and gets 9 minutes to the hour.

The winter solstice and the equinox lines were drawn using a trigon with a protractor aligned with the gnomon to show the +/- 23.45 degree solar declination divergence.

Lessons learned:

1. Be clear and concise before marking the hours lines on using the longitude correction of - 3 degrees on the trigon which reflects the +3 degrees (longitude difference between Silver City at 108 and the standard meridian at 105, this results in a 12 minutes approximate difference.



2. However only use those as temporary markings, use actual sun shadows for final setup considering the EOT for the day. This will correct the trigon's errors of scale and human marking error.
3. And that requires the equation of time, which on 9/28/04 was -9 mins. So when the sun dial shows 9 minutes past the hour, it is actually on the hour. So either go outside when the clock is on the hour, and set the hour line forward 9 minutes. That way, what you see is 9 minutes fast, and the EOT corrects it.

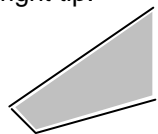
Or better still, wait until it is 9 minutes to the hour, and set the hour line where the shadow is. That way you see the hour line, and to get clock time you subtract 9 minutes.

4. It is easy to get confused.

CALIBRATION LOG:

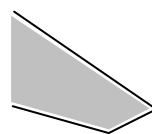
	daylight savings time	shadow on the hour line
9/29/04	0851 0951 1051 1451	VIII 9 (mst, dst) IX 10 (mst, dst) X 11 (mst, dst) but sun in and out II 3
9/30	0851, 1151, 1251, 1351, 1451, 1551, 1651	
10/1	1050, 1150, 1250, 1350	

The shadow of the gnomon/style for the first four hours is the left tip, and the last six hours the right tip.



use this for VIII to XI  
9 to 12

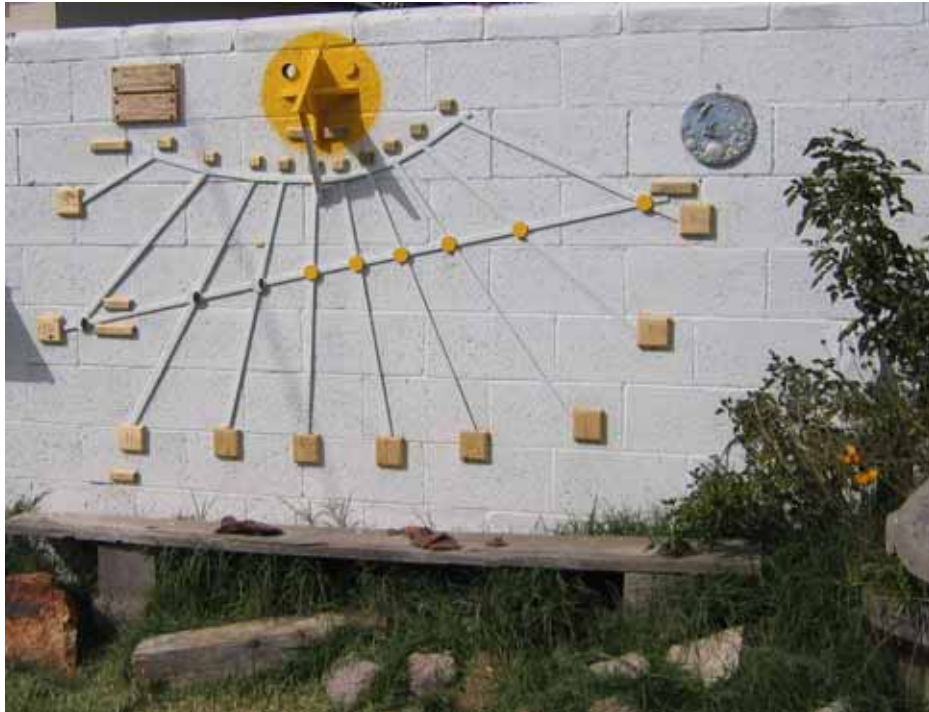
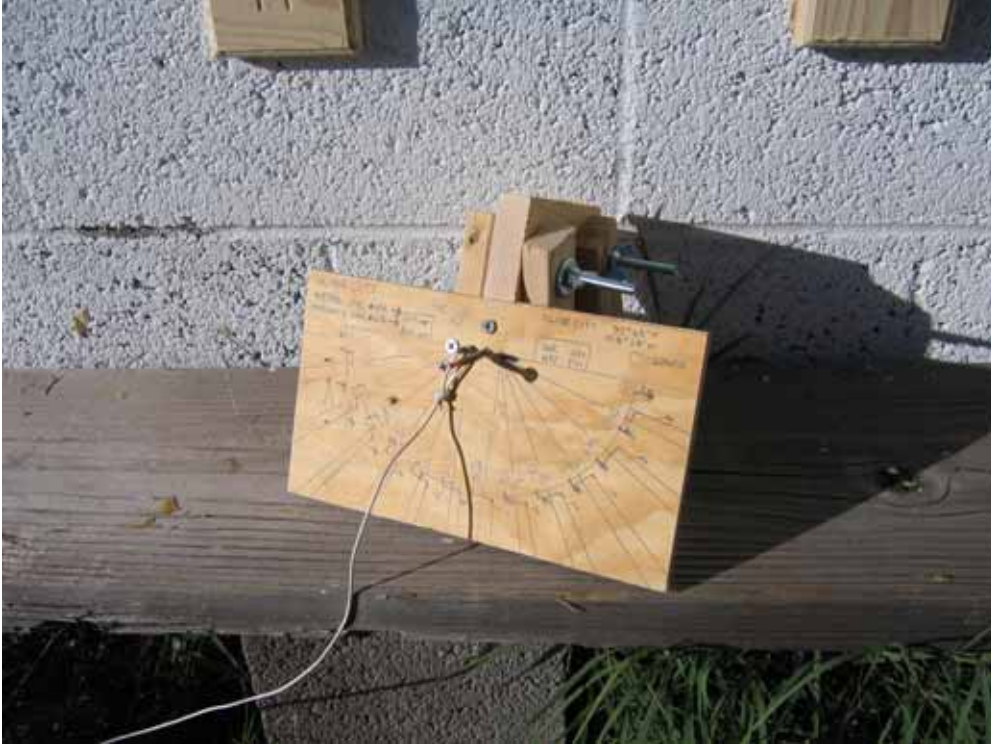
MST  
daylight savings

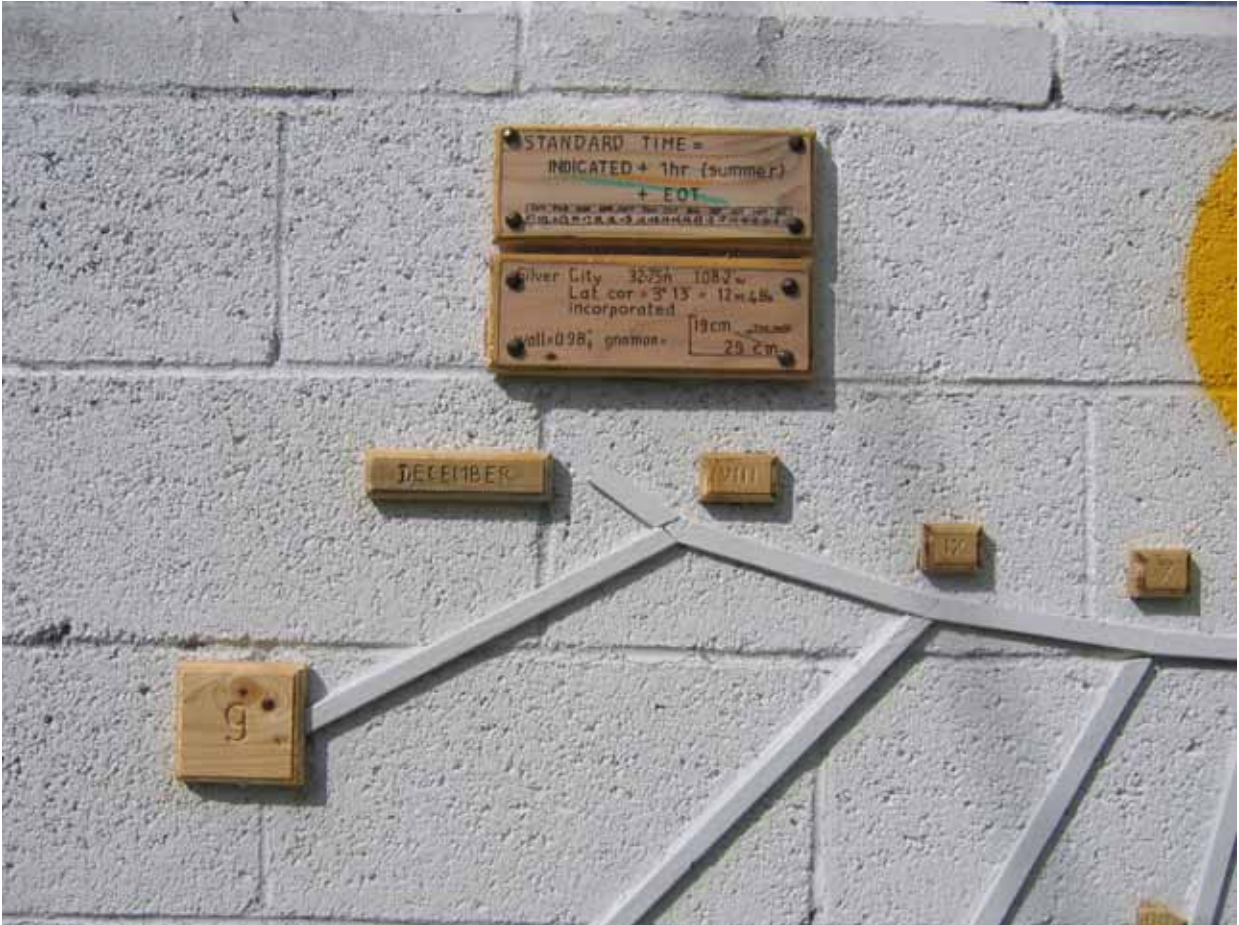


use this for XII to V  
1 to 6

MST  
daylight savings

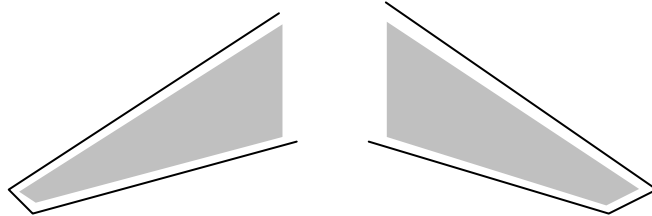
The trigon used for equinox and solstice as well as for hour line approximation





WHEN READING THIS DIAL...

The gnomon/style is about 3/4 inch thick. So the shadow displays as either of two shapes.



use this for VIII to XI  
9 to 12

MST  
daylight savings

use this for XII to V  
1 to 6

MST  
daylight savings

## ITALIAN HOURS

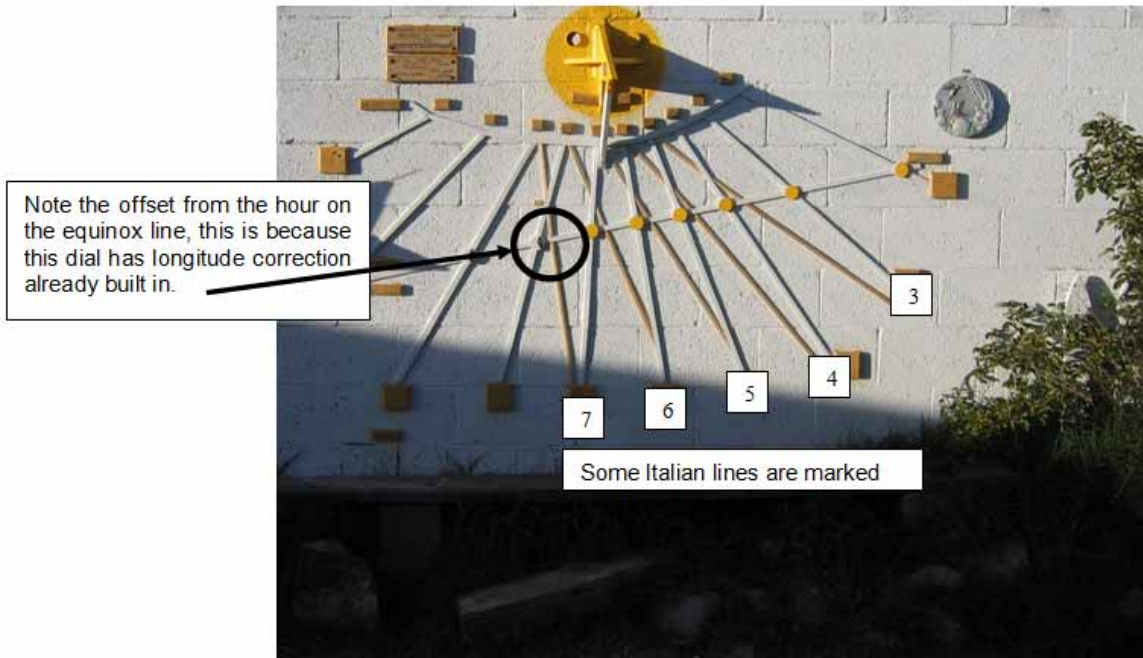
Italian hours in practical terms are hours until sunset. Refer to table A.6.4 which shows the solstice LAT times for sunrise and sunset. Italian hours are latitude dependant.

At latitude 32 degrees north,	Winter solstice sunset is:	1656	LAT
	March spring equinox	1800	LAT
	Sept fall equinox	1800	LAT
	Summer solstice	1904	LAT

In essence, there is a two hour range of sunrise and of sunset times. An Italian line is then drafted by selecting the winter solstice sunset time and 6pm LAT, and backing them off by 1, 2, 3, and so on hours. The extension of the line from the sunset at winter solstice through the equinox line and 6pm will pass on to the summer solstice line. The Italian lines are used by the nodus touching them, at which point hours until sunset are indicated. To be pedantic, Italian lines are hours from the last sunset, but convention is to use them for hours until the next sunset.

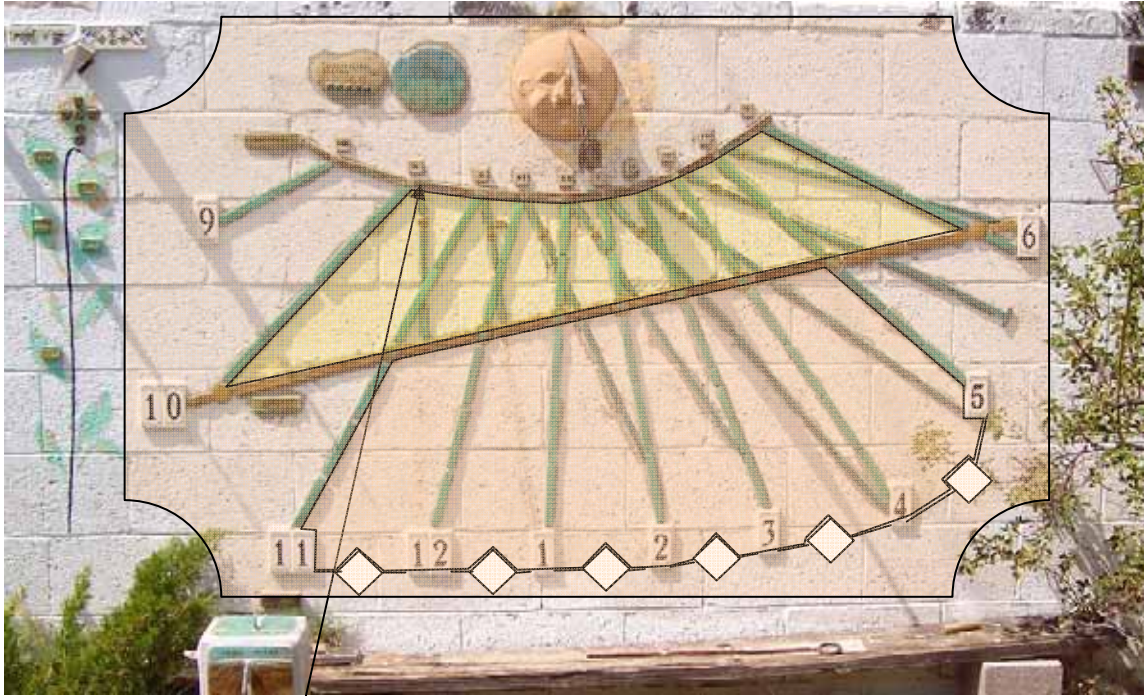
NOTE: Italian hour 6 and 5 look too high up on the bottom end, however the summer solstice curve is closer there, so the intersect at the correct hour would require them to intersect the hour lines further up than the others.

This dial is already corrected for longitude, in other words the hour lines are not LAT, they are standard time (except for the EOT). Since Italian hours are LAT, they must be on the dial at the LAT location, not the longitude corrected location. West of the meridian makes sunset a few minutes later, so, when establishing the winter solstice point for the Italian hour line and the equinox point, remember to have it be later by the time difference between the dial location and the legal meridian, this is seen in the equinox line below. Similarly for dials east of the legal meridian when they would be adjusted in the opposite direction.



July 2009

The wood and paint had faded. The hour lines and Italian hour liens and calendar data was removed and replaced with ceramics, and the gnomon replaced with a copper gnomon, additionally it was set with an SD and SH as opposed to having a vertical sub style.



The dial needed a look of completion. Several options were considered, finally the decision was made to fill the area shown, which is from the 0900 winter time point on the winter solstice curve, to where that hour line meets the equinox line, thence to where the 1800 (6pm) winter time meets the equinox, thence to 1800 on the solstice curve, back to the point of origin, namely 0900 on the solstice curve.

To the west (left) of the dial is an analemma dial, and below to the left can be seen an eight inch cube ceramic dial as well.

The final dial

