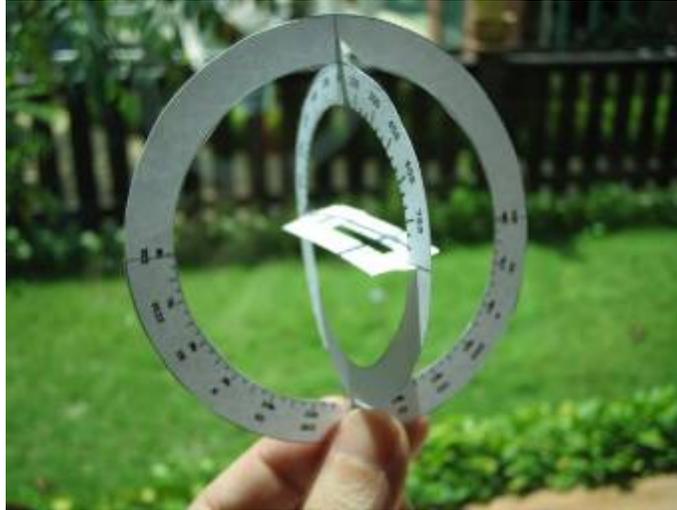


# Universal Ring Sundial

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June 2005



I was intrigued by the simplicity of the universal ring sundials made of brass on the Internet. I was curious to see if it would work in Singapore and whether one could create it out of card.

My initial prototype was a paper ring where I held a slotted card in the centre. Next a disc was tried to see if the ray of sunlight can be seen on it.

Once successful, many weeks were then spent trying to figure out how to create the hinged double ring structure. Initial thoughts were to use paper tubes and tooth picks for the hinge but being influenced by Origami Architecture, a simpler method using a folding triangle was discovered.

The next challenge was the “gnomon”; how to make it at right angles to the hour ring. All the universal dials I saw had the hour ring on the inner dial rather than the outer dial. Using the folding triangle technique, the only way I could get the “gnomon” at right angles to the hour ring was to put the hour ring on the outer circle and the latitude ring in the inner circle. A check was again done to see if the Sun ray can light up the outer hour ring.

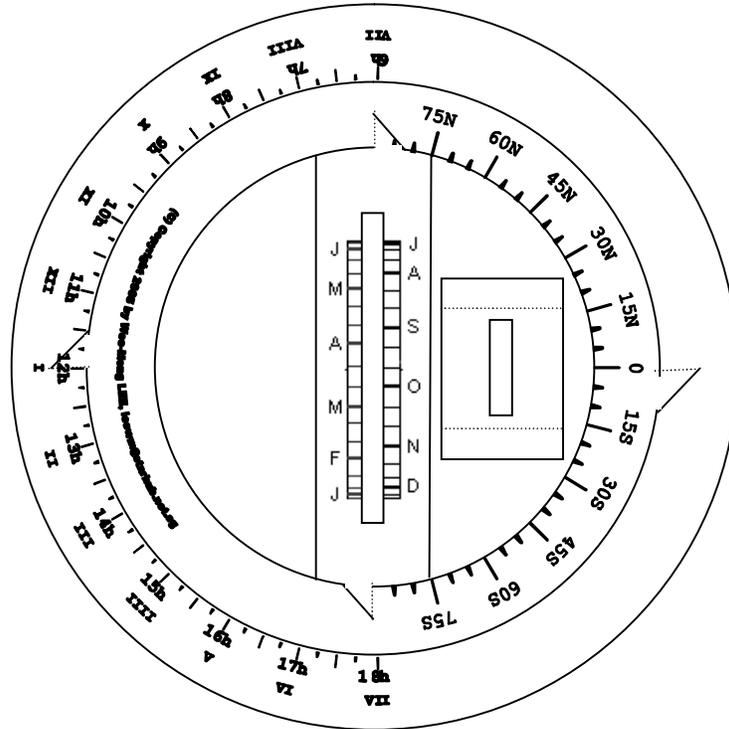
Now came the difficult part being new to sundials; how to mark the hours and position the dates on the gnomon scale so that the mask can be positioned correctly. The former was quickly found in how equatorial sundials were constructed. The Sun moves 15 degrees per hour, so the hour marks are 15 degrees apart. For the latter, I tried as hard as I could but I couldn't find the answer; I only knew there had to be a tangent(theta) in it. So I asked for help on the sundial mailing list. Fer J. de Vries and Chris Lusby Taylor came to my rescue (thanks guys!) with the “secret” formula:

$$\text{Distance from centre of scale} = \text{Radius of hour ring} * \tan(\text{declination of the Sun relative to date})$$

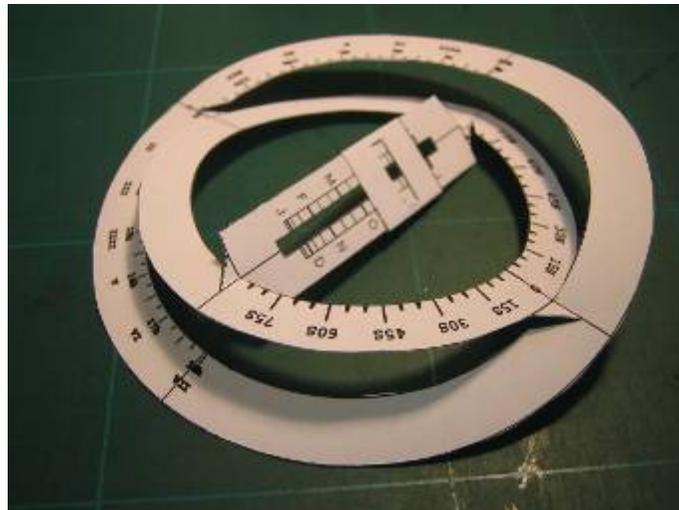
I hope you will enjoy making the sundial as much as I did designing it and learning more about sundials along the way.

## CONSTRUCTION

Cut along the dark continuous line and take special care at the triangular sections as these are the pivot points.



Fold along the dotted lines like so:



## HOW TO USE

Fold the rings apart until they are at right angles to each other.

Fold the gnomon until it faces the sun squarely.

Slide the movable mask along the gnomon slot until it shows the date. In the example on the right it was set to June.



Locate your latitude in the inner ring and balance it on your finger. You can also use a piece of thread.

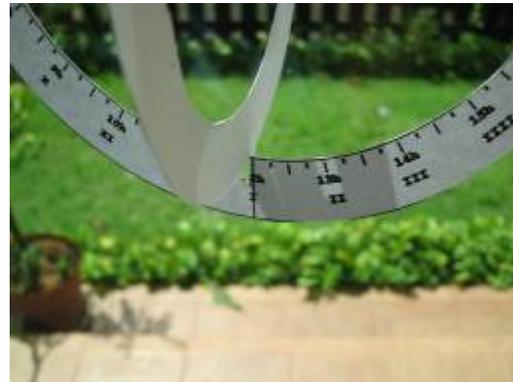
Latitude is 1.37N in Singapore.



While balancing on your finger/thread, rotate the ring until sunlight from the square hole, made by the mask, shines on the outer hour ring.

There's the time!

In the picture on the right, it was taken at about 2pm Singapore time. The local time here is 1 hour ahead of solar time. The Roman numerals show the corrected time in Singapore (thanks for the idea Tony Moss). I am not sure if it can be used when daylight savings are in effect for countries that practice it.



Because the contraption was so light, it kept flying off my finger when I was trying to take a photo of it; so I closed the glass door to take a picture of it.

Perhaps making it out of heavier card (brass sheet?) or weighing it down with a paper clip directly on the opposite side of the latitude dial would help.

Enjoy!