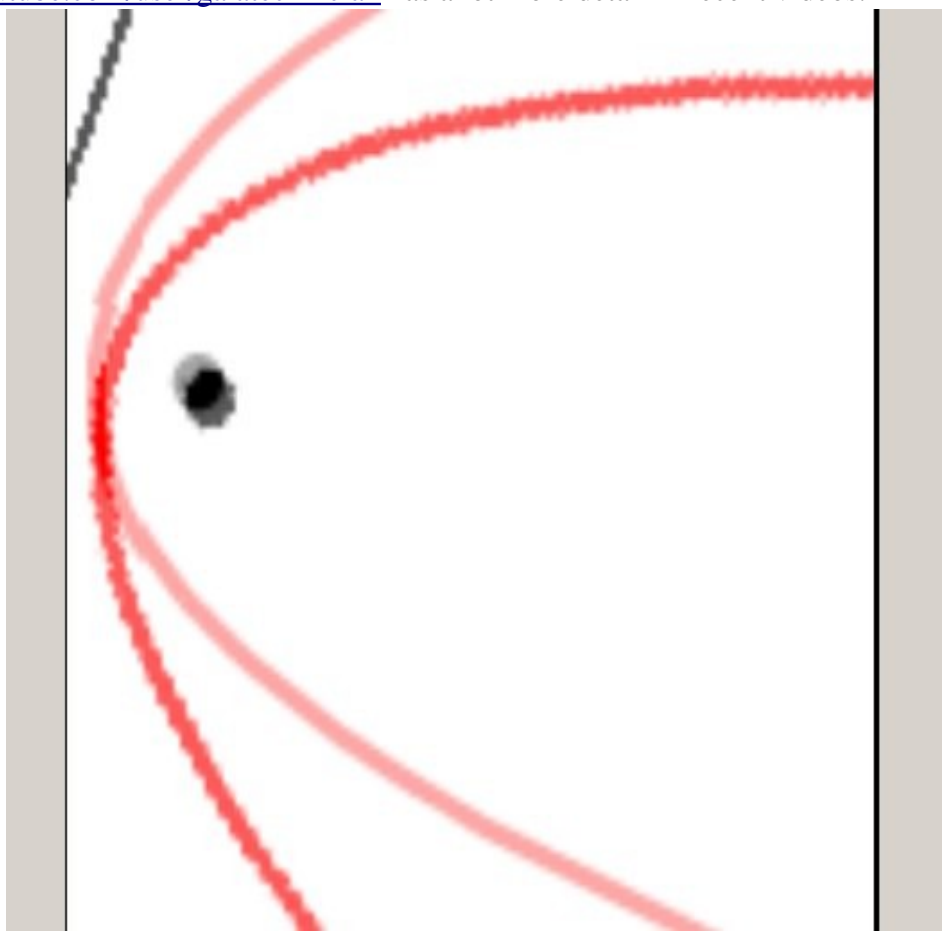
This is the story of my first compound parabolic solar cooker.
Designing the cooker involved reading “understanding solar concentrators” on appropedia.com and then downloading parabola pictures of different sizes off the internet.
I wanted to understand what happened to the light striking a parabolic reflector when it was not directly aimed at the sun. It then involved using tracing paper to copy the parabola and rotate the new one round various points.
I modeled the light using a protractor to approximate the light bouncing from various points on the curve. This was SO slow.
So I inquired about software to do this on the internet. I did not find anything suitable.
It is important to help others understand the concepts too so I came up with a physical model that I could easily put on a desk.
Basically when you twist a parabola on its focal point and use the 2 inside curves as your new shape, the energy no longer all strikes the focal point, instead, it ends up in an area extending from the focal point to the back of the parabola.
http://www.youtube.com/user/gaiatechnician has a lot more detail in recent videos.



The model uses a laser level, reflective plastic and photocopys of the curves.
It is a great learning tool!
I encourage people to use it when designing their own reflectors.
I think a lot of people will redirect their efforts when they understand the difference between an ordinary parabolic dish and a compound parabolic dish.
I decided on a size close to 1m2 for my reflector because it makes the math easier.
I chose a 3 hour acceptance angle because this allows me to cook unattended for quite a long time.

It also fitted in nicely with the pot size that I intended to use.

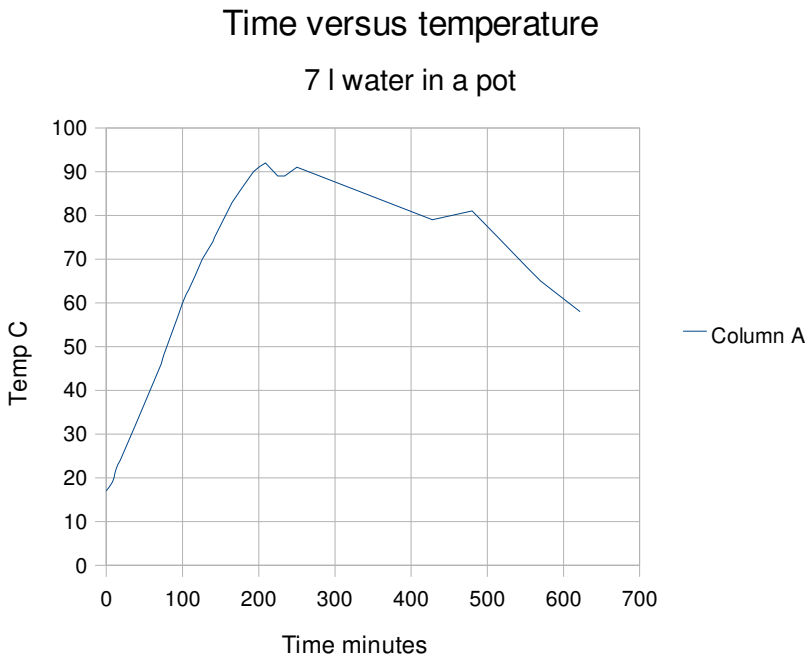
I intend my methods to be easily replicated by people with no training and also tried to use materials that would be commonly available even to very poor people. Thats why I chose to use cob to make the mold and why I used a tsquare and string to draw the parabolic curve. I also deliberately chose an awkward sheet material (sign corrugated plastic) for the sheet material to cover the mold!
You would find it very difficult to cut and then bend this material if you used a template. (Because it has much greater strength in one direction than in the other).

Cutting at on the dome, folding it down, then cutting away the “undercuts” works even if you are unskilled like me! Then all you got to do is tape it and stick on the mylar. Alu foil should work too.
I stuck on the mylar with flower paste.

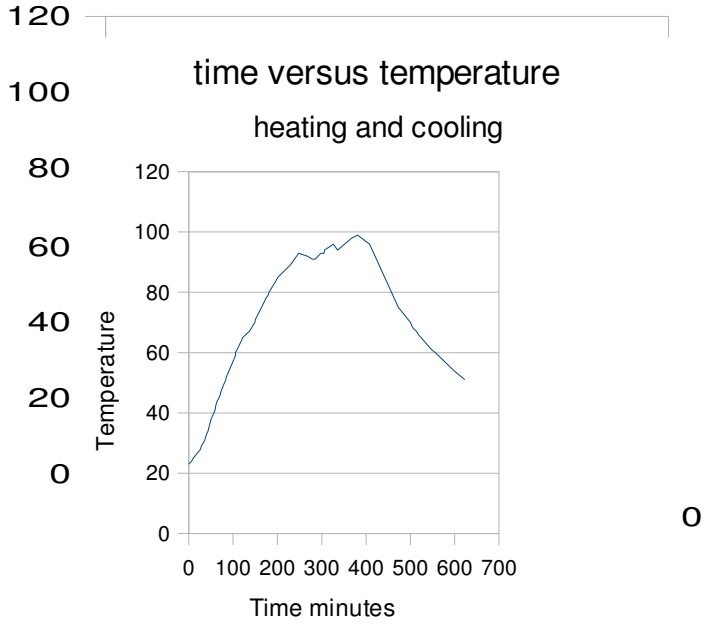
Here is the finished first reflector.

As you can see, I didnt do a neat and tidy job. As with the sheet marerial, I cut the mylar whatever way it suited to make it fit. Thin strips, fat strips, whatever.
For once I got nice weather in a time when I was not working much so I got some worthwhile results! My results are all from early september 2008. I let the dish flop around until recently. I tied a piece of twine across the middle to keep it more or less circular and this has helped its performance. 63C is ribs cooking temperature 98C is the temperature of the water or soil that was within the 7 liter pot!

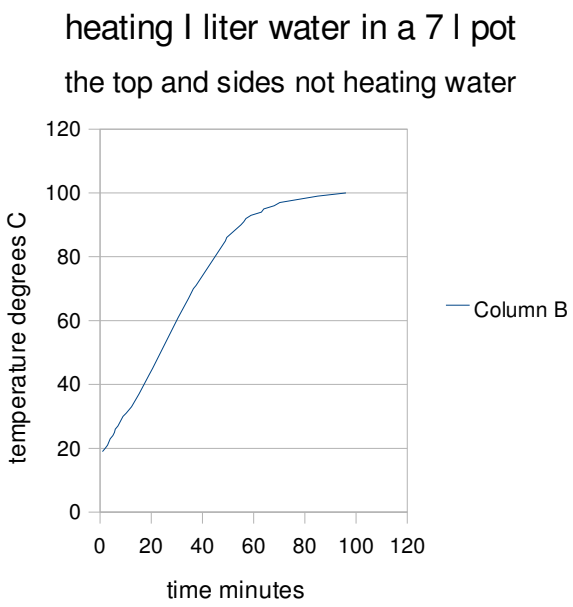
Here is my first test heating 7 liters of water in a 1.25 kg aluminium pot. It was hung at and behind the focal point to try to catch all the sunlight



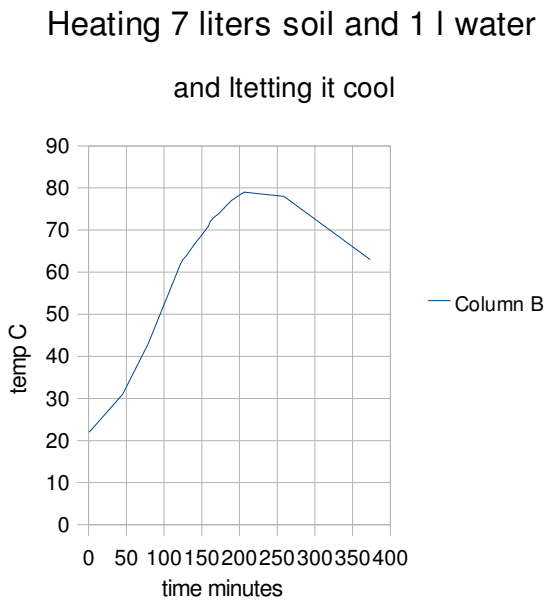
And here is a test I ran on 13th september with the same parameters.
I let it cool down in the evening after the sun no longer shone on it just to see the cooling curve.
This allows an estimate of heat losses through the turkey bag if you wish.



I also did a test with 1 liter of water in the 7 liter pot



And I also heated soil to steralize it. You should be aware that heat moves through soil slowly so I put the thermometer in the middle at the top. Heat approaches the thermometer slowly! So the curve is not the same as when you heat water!
On a good day the soil can go to 100C.



I have been very pleased with this solar cooker,
after the design process, it proved easy to make, it has known parameters of operation
and I shall use it and test it out until the cloudy winter comes in here.