The Bris mini sextant is:
An educational toy for those interested in navigation.
A precision instrument for finding your position.
A back up to the GPS.

I always liked the idea of a philosopher doing a handicraft, like Spinoza grinding lenses or Thoreau making pencils. To create a similar occupation for myself I invented the Bris minisextant which is an exact, cheap, small, multiple angle measurement device it gives the suns altitude for several discrete angles.

It is intended as an educational toy for those interested in navigation. Thanks to its precise nature, it has no moving parts, it can also do duty as a backup to the GPS. Enabling you to find your position with the help of the sun.

Instead of moving parts the Brissextant produces a cascade of discrete suns. Each one having a fixed altitude. By calibrating the instrument and making an altitude table and this is the essence of the Brissextant, one gets a set of precise angles with which the navigator gets his hold on the sun much in the same way as a mechanic may use a set of box wrenches instead of an adjustable wrench to get a hold on a nut. Or to use a modern metaphore, the ordinary sextant is an analog instrument whereas the Bris sextant is a digital one.

The altitude table is an extension of the idea of the compass deviation table. But as the Brissextant has a limited number of fixed altitudes, one can go one step further and eliminate the scale on the instrument.

Which of the possible altitudes one is using is easily rememberd because they are grouped into:

morning altitudes and afternoon altitudes.
lower limbs and upper limbs altitudes.
stronger and weaker brightness of the suns.

It is a bit like finding the house of a friend who lives on this our earth. If he tells you:

which city he lives in.
which street he lives in.
which number his house has.

Then it is not difficult to find him. Of course it is far easier dealing with the limited number of suns of the Brissextant then the many houses on our earth, but the principel is the same and familar. After a while it is as easy to find the different suns as it is to find your old friends, each one having its own charecteristics.

The difference between the ordinary sextant and the Brissextant is that, in the ordinary, you see one and only one sun, but with the help of a handle attached to a mirror you bring that sun down to the horizon. Then you can reed the angle of the observed altitude by seeing where the handle is on a scale.

The Brissextant, on the other hand, has neither moving parts, nor a scale. Instead when looking through the Brissextant you see many suns. You chose the sun closest to the horizon.

Because the sun itself is moving upwards in the morning and downwards in the evning, there is no adjustments for you to do. All you have to do is to wait until one of its limbs is exactly on the horizon. Then you take the time in the usual way, swinging the little Bris mini sextant and all.

After that you simply look up that specific sun in the altitude table and there you have the angle of the observed altitude.

An interesting bonus gained is that no corrections has to be applied to the Brissextants altitudes. The altitude in the altitude table is the one to be used. The reason is, the Brissextant is a calibrated instrument.

As there is no scale on the Brissextant there can be no index error. If the person who calibrates the instrument is the same as the one who does the navigation there can be no personal error.

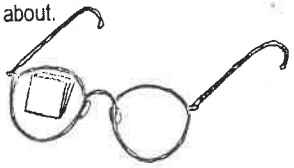
Dip is correction for height of eye above water, but if you calibrate the instrument from your own boat and navigate from your own boat, that correction cancels itself out.

Refraction will also cancel itself because unlike the ordinary sextant you are working with fixt angles.

The seasonal changement in the suns semidiameter is insignificant. However, for the knowledge of the ones so commendable striving for perfection in navigation, it is half a minute bigger in Januari than in July. But for us ordinary ones if the instrument is calibrated in the summer and navigated with in the summer corrections for semidiameter should not be made.

However the mathematics behind the calculations are the same for the Brissextant and the ordinary sextant

Because the Brissextant is so small it is very handy to atach it to your spectacles that gives it a remarcable steady reading and it leaves both of your hands free, something well needed on a rocking boat, especially if you also have paper and pencil for writing down times with to worry about.



Schlussmoral

The Brisboats and the Brissextant share the same philosophy: An instrument shall be, small, functional and cheap.

Calibrating the sextant and making the altitude table

The modern method (Sumner 1837) of finding ones position with a sextant is to compare the observed altitude with the calculated altitude.

The calculated altitude is based on the latitude and longitude of ones dead reckoning or assumed position. The difference between the calculated altitude and the observed altitude tells the navigator how far his position line is from his dead reckoning position.

Obviusly, if the place where the altitude is observed, so happens to be exactly the same place as the navigators deadreckoning position, the observed altitude and the calculated altitude must, in a logical world, be exactly the same.

It is this important and plesant fact which allows us to calibrate with ease and great precision the fixt altitudes in the Brissextant and make up an altitude table.

Chose a nice day with a clear sky and flat water where you know your position. A GPS reading may do if at sea.

When you with the help of the Brissextant see the limbs of the suns touching the horizon as in the ordinary sextant swinging it and all, note the exact time. Seconds first, as the are changing fastest, then minutes and hours.

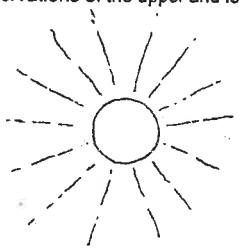
Repeat the procedure for each of the suns upper and lower limb. This will take a whole morning, but it is a morning well spent.

Then with the obtained times and the latitude and longitude of your observation place calculate the altitudes for the altitude table of your Brissextant.

That done create the altitude table as in the figure. Remember it is an important paper so make a copy or two.

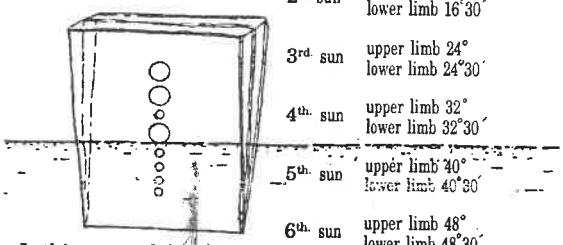
A good use of the time, when you are sitting watching the sun rise, is to make a simple drawing of how the pattern of suns look. Draw it on the left side of your correction table. This drawing will make it easier to identify the different suns later. The different suns shine with different brightness and their spacing is differently distributed. Symbolise a strong sun with a bigger circle a weaker sun with a smaller circle. You will soon be familiar with them.

Using the Brissextant for educational purposes it is sufficient to do observations of the upper and lower limb of one sun.



These values are just made up and don't agree with your sextant

1st sun	upper limb 8° lower limb 8°30´
2nd sun	upper limb 16° lower limb 16°30´
3rd. sun	upper limb 24° lower limb 24°30´
4th. sun	upper limb 32° lower limb 32°30´
5th. sun	upper limb 40° lower limb 40°30´
6th. sun	upper limb 48° lower limb 48°30´
7th. sun	upper limb 56° lower limb 56°30´
8th. sun	upper limb 64° lower limb 64°30´



In this exampel the 4th suns lower limb is on the horizon. The calibrated value is 32° 30'

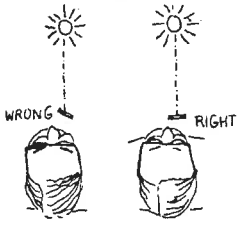
- Controlling your calibration quickly.

Another way of obtaining all the possible altitudes is to measure only one limb on each sun and then add or substract the suns diameter. In this way one only has to do half the number of observations to get a complete altitude table. In my opinion it is safer to do observations on all the upper and lower limbs and then take the difference between the altitudes. If this difference equals the suns diameter with sufficient accuracy one has a check on the calibrations in the altitude table of the Brissextant.

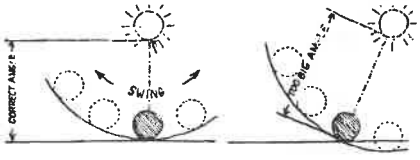
Remember the prudent navigator takes every opportunity to confirm his position!Warnings:

The sun can damage your eyes. Never look directly into the sun! If you dont find the sextant shade dark enough, use sunglasses of sufficient darkness.

Always hold the Bris mini sextant at right angle to the sun as seen from above, if not it gives a to small reading. Check for this error by turning the sextant sideways. The biggest value is correct.



The suns should be one above the other in a straight line. This should not be confused with swinging the sextant. That is done to get the angle of the sun at right angle to the horizon. If thats not done correctly one will get a too big angle. Now the smallest angle is correct



Only use the reflections in the clear glass surfaces. The glue at the upper and lower edges of the sextant bends light like a prism and will not give a true reflection.

The Brissextant cannot be used on stars as the light from them are to weak.

The Brissextant is a new product and I welcome suggestion for its improvement.

The intensity of the sun can to a certain extent be controlled by tilting the sextant up and down. The glare from too strong suns can be reduced. Suns not strong enough can be made brighter. Yes, even suns not seen before can appear, for you to use.

There are about 2 suns in a Brissextant with 2 surfaces, 8 suns in one with 3 surfaces and about 30 in one with 4 surfaces and so on.

The ordinary way to do the calculations is to use sight reduction tables the most common ones for yachtsmen is the HO 249 which are very good. However for the beginner and for calibrating the Brissextant the scientific pocket calculator is hard to beat. Especially the ones powered with solar cells. You never have to worry about replacement batteries. It is cheaper than tables, it takes less space, and you can start your calculations from your actual position or your dead reackoning position. It is very exact. Also a pocket calculator can be used for many outher pleasant calculations.

Here are formulas for the pocket calculator. If you don't understand them, ask a teacher or an engineer.

Altitude formula

$$h = \sin^{-1}(\cos L \cos d \cos t + \sin L \sin d)$$

Azimuth formula

$$Z = \cos^{-1}\left(\frac{\sin d - \sin L \sin h}{\cos L \cos h}\right)$$

Formula to precalculate the time of your sights.

$$t = \pm \cos^{-1}\left[\frac{(\sin h - \sin L \sin d)}{(\cos L \cos d)}\right]$$

t=local time hour d=declination
Z=Azimuth L=Latitude
h=height

This formula gives you the exact time to the second, when a chosen sun in the altitude table, touches the horizon at a chosen position, as seen through the Brissextant. Of course a navigator will never know beforhand exactly where he will be. Dont worry chose a point where you think you will be. If you missjudge your longitude by 15 miles the error in time will never be more than one minute. Therefore by being ready a few minutes before the precalculated time should take care of quite large errors in your navigation.

Thank you for chosing the Brissextant and contributing to my bigger yacht, the 22 feet Bris Nomad.

Good luck with your insight in celestical navigation and with your Brissextant.

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