SPACE awareness

BUILD YOUR OWN ASTROLABE

Discover how people from ancient and medieval times measured angles

Grom D.Matthies, Nuclio

Matière au programme
Constellations, stars

Une grande idée de la science

Mots clés
Islamic Heritage

Tranche d'âge
12 - 16

Niveau d'études
Primary School, Middle School, Secondary School

Durée
1h30

Taille du groupe
None

Supervisé par rapport à la sécurité
None

Dépense
None

Lieu
None

Compétences de base
Developing and using models

Type d'activité d'apprentissage
Full enquiry

DESCRIPTION SUCCINCTE

This activity shows how to assemble a customised astrolabe and how to use it. The astrolabe used here is an adaptation of parts commonly provided on the rear of complex astrolabes.

OBJECTIFS

Children learn how to build a simple astrolabe and how it can be used for several measurements.

OBJECTIFS PÉDAGOGIQUES

After this activity, the children will be able to:

- describe the main features of the rear of a traditional astrolabe.
- explain how to use it to measure angles.

ÉVALUATION

After constructing the astrolabe according to the instructions provided in this activity, the children should be allowed to play around with it and discover its applications. If needed, the exploration can be supported by showing a protractor.

- Let them discuss the possible use of the different scales on the astrolabe.
- After taking a few angular measurements, let the children describe in their own words how to use the astrolabe.

MATÉRIEL

- Astrolabe and alidade template

- Scissors, paper glue (preference: glue stick)
- 2 pieces of cardboard (A4 size) for the astrolabes base
- 1 or 2 pieces of stiff cardboard for the alidade and the sights for aiming
- Small piece of string (~15 cm)
- 1 bendable iron wire of ~5 cm length (alternative: paper clip)

INFORMATIONS COMPLÉMENTAIRES

Astrolabes have dozens of possible uses. One can measure stellar positions, predict the time of rising and setting of selected stars, determine the current location (latitude and longitude) on Earth and much more. While astrolabes were invented in ancient Greece, they were perfected in the medieval Orient.

DESCRIPTION COMPLÈTE DE L'ACTIVITÉ

Assembly of the astrolabe Carefully cut out the astrolabe, the alidade and the two small sights for aiming. Glue the astrolabe onto a piece of carton and cut excess material.

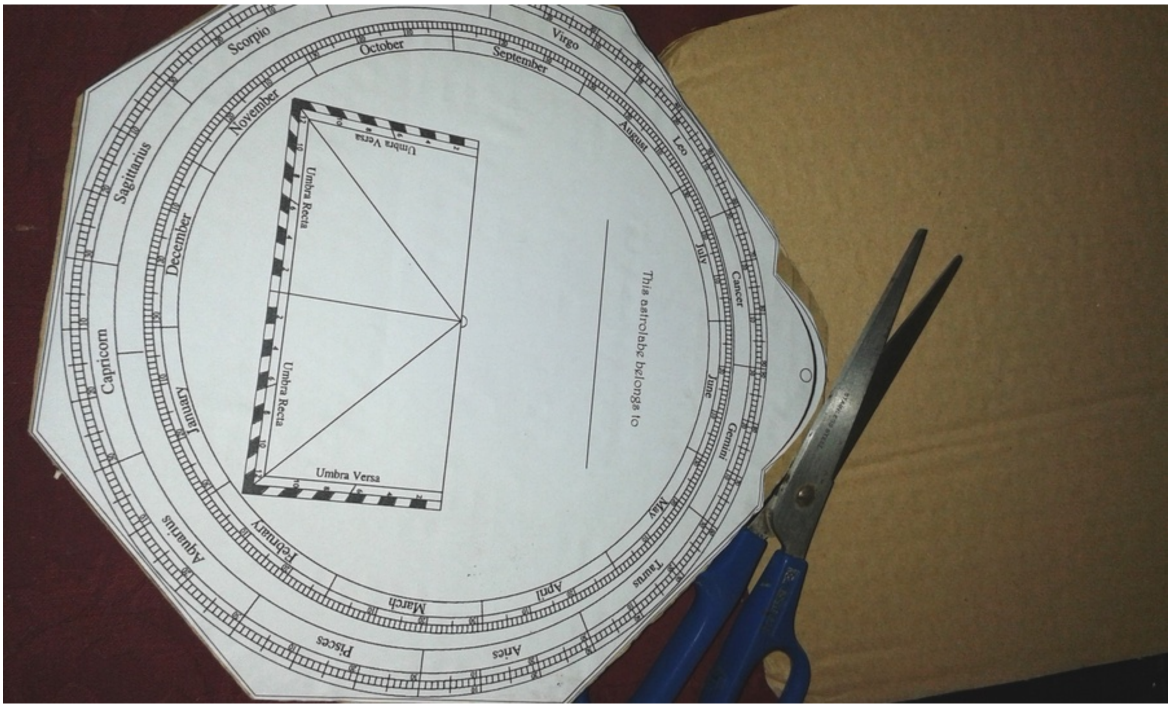


Fig. 20 Cutting out the astrolabe form (Credits: Grom Matthies)

To add rigidity, glue a second piece of carton and cut away any excess material.

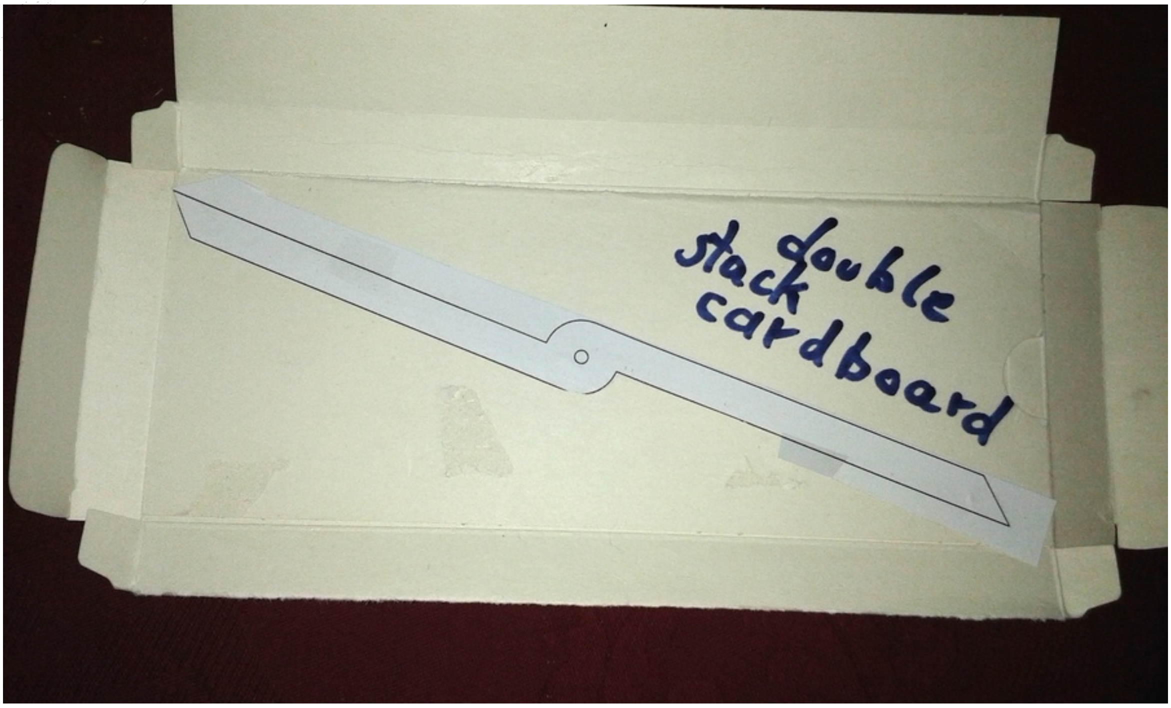


Fig. 21 Reinforcing the alidades (Credits: Grom Matthies)

Stack and glue 2 pieces of cardboard together, then glue the alidade on top. Cut out the alidade carefully along its shape.

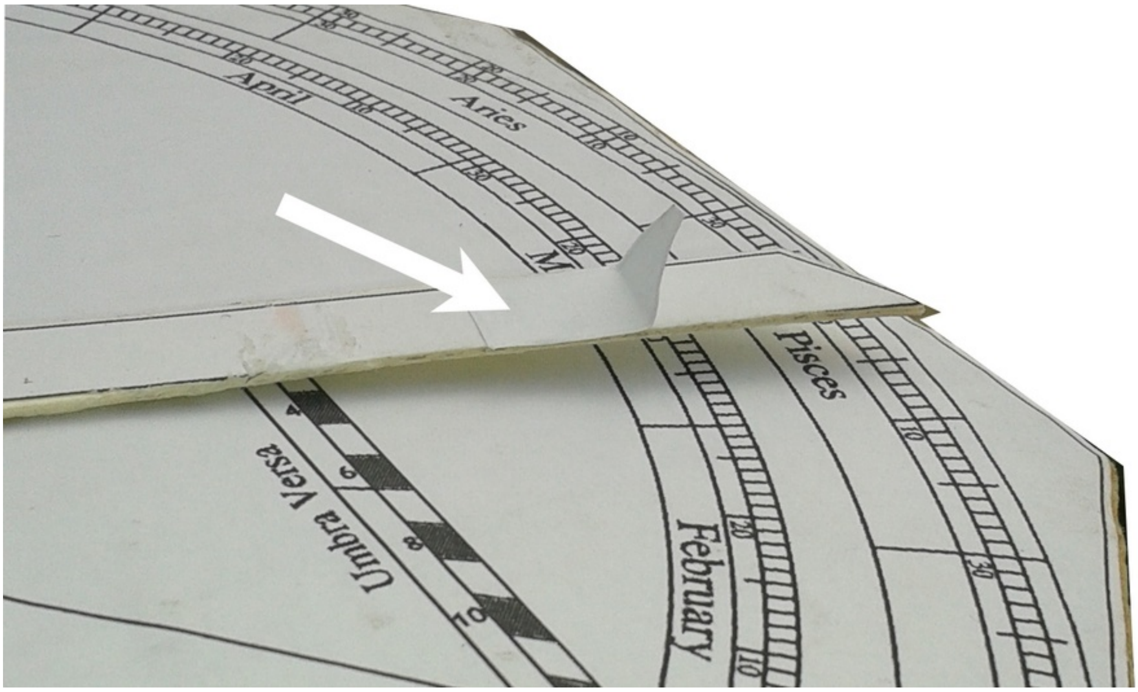


Fig. 22 Positioning the aiming aids (Credits: Grom Matthies)

Carefully cut out the two small aiming aids (sights). Fold each sight along the dashed line. Each aiming aid has its destination position marked on the alidade. Glue each sight onto the proper marking on the alidade. Note that the sights easily get damaged. If this happens, you can always replace it with a new one cut from plain paper.

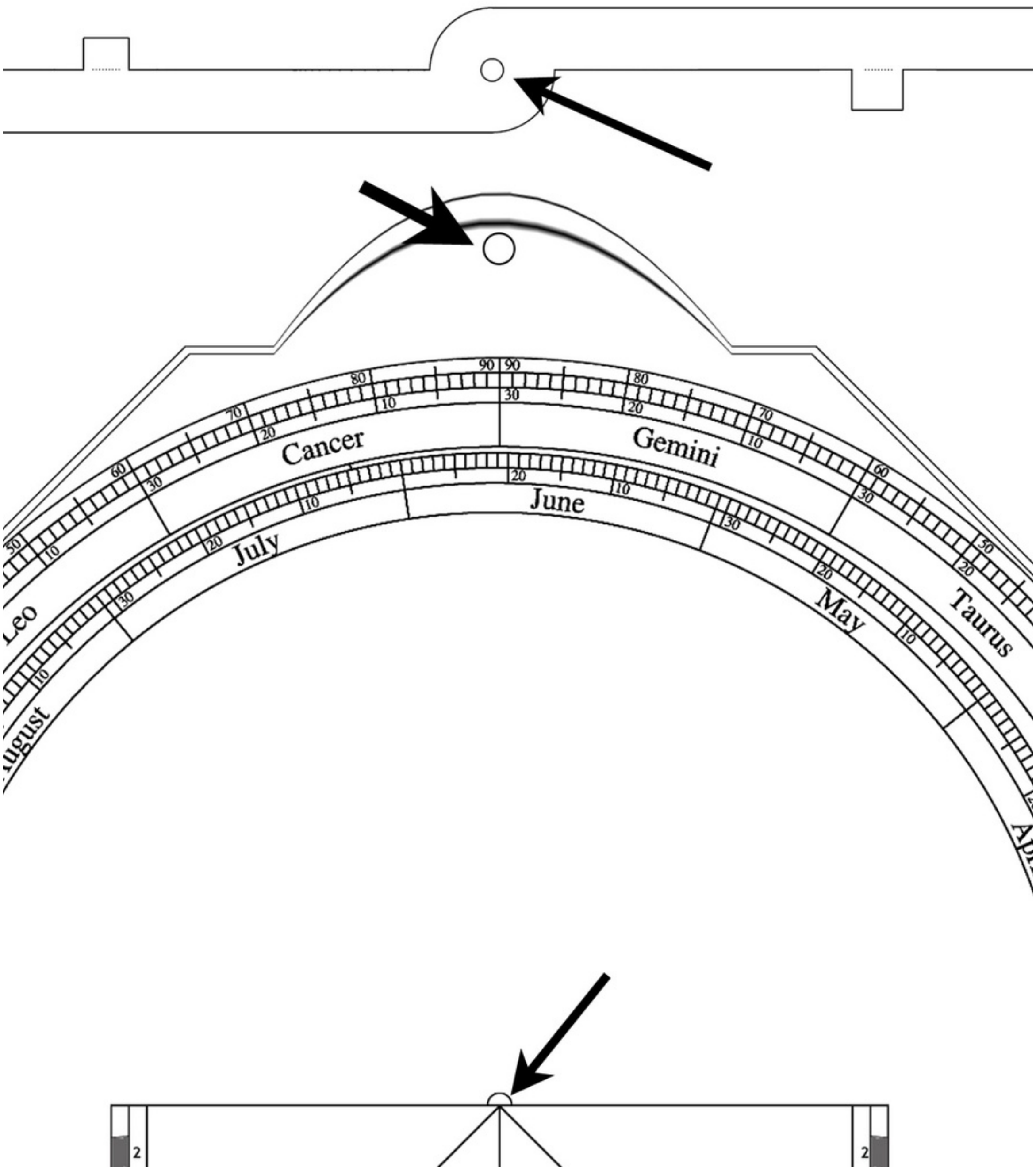


Fig. 23a Last instructions to build the astrolabe (Credits: Grom Matthies)

Punch a hole through the marking at the arched top of the astrolabe. Prick a small hole into the centre of the astrolabe and into the centre of the alidade (Figure 23a). Pass the iron wire through the holes in the alidade and the astrolabe; bend the wire on both sides as near to the surface as possible and test if the alidade rotates properly (Figure 23b).

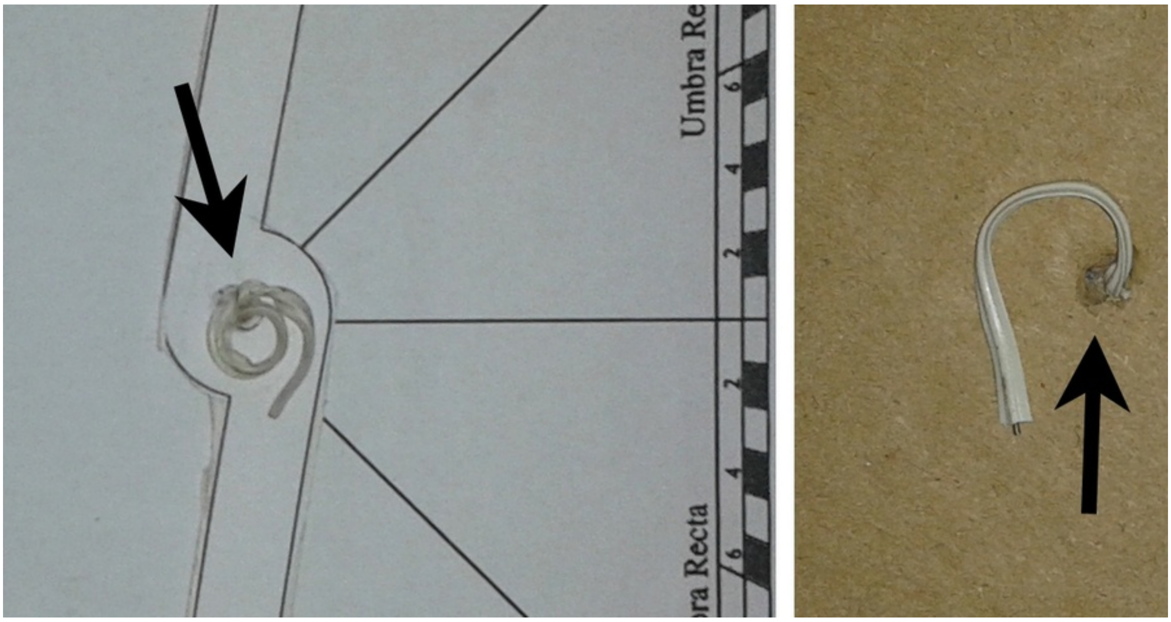
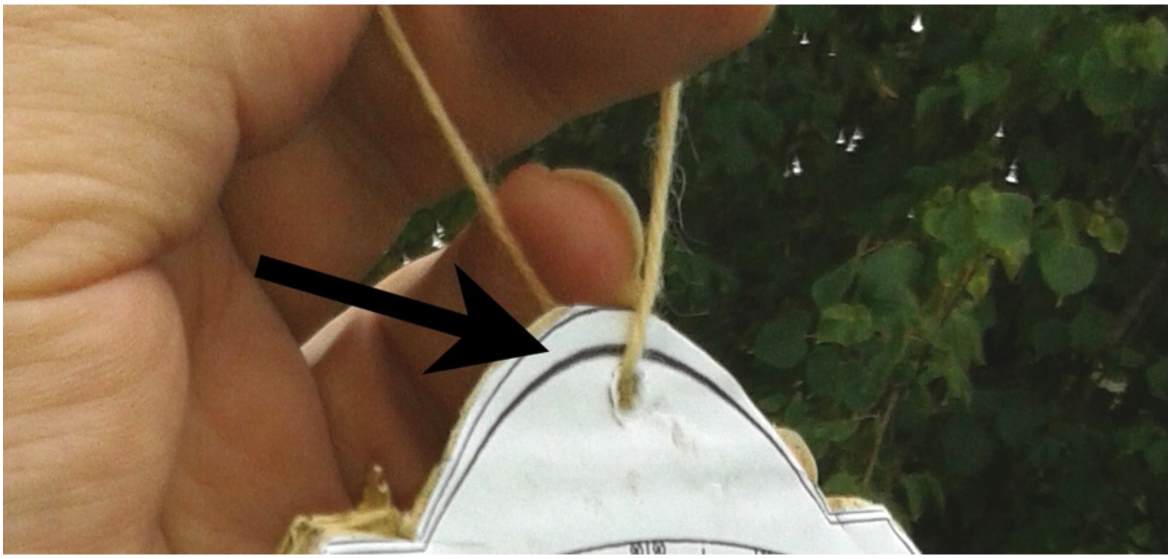


Fig. 23b Last instructions to build the astrolabe (Credits: Grom Matthies)

Pass a string through the hole on top and tie a knot with both ends. When you pick up the string, the astrolabe should hang freely.

You are ready to go!



How to use the astrolabe

Hold the astrolabe by its string, so it hangs freely like a plumb line weight.

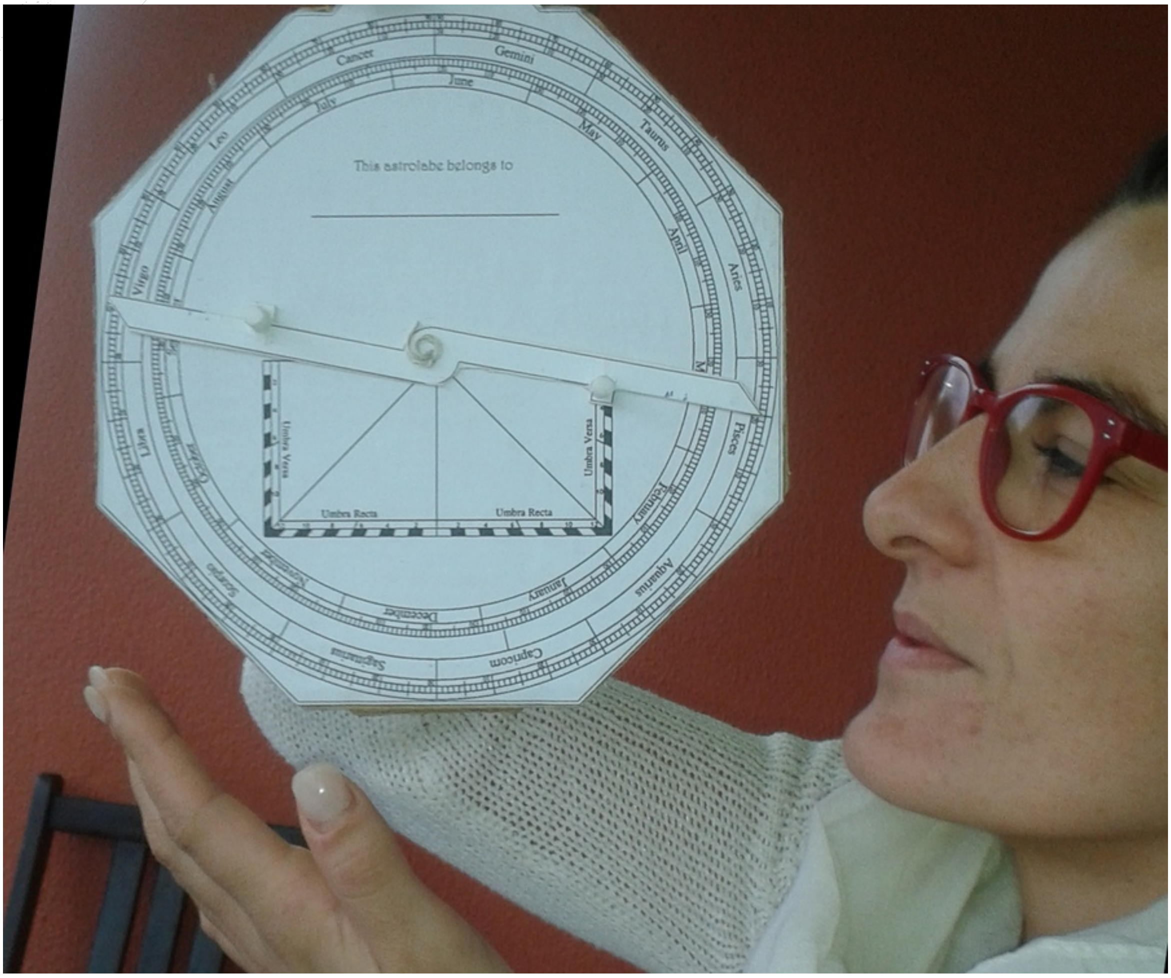


Fig. 24 The correct way to hold the astrolabe (Credits: Grom Matthies)

The astrolabe has a rotatable arm, the alidade, with two small aiming aids. To aim, hold the astrolabe at eye level, look at the desired target and turn the alidade until the target is perfectly aligned with both sights.

In figure 25, the door’s upper rim is aligned with the target. Once you find the alidade aligned with your target, use the circular scales or the shadow squares for your readouts.

It is likely, that handling may seem strange and aiming will seem tricky. Like learning to tie shoelaces, you should train the aiming process for a while.

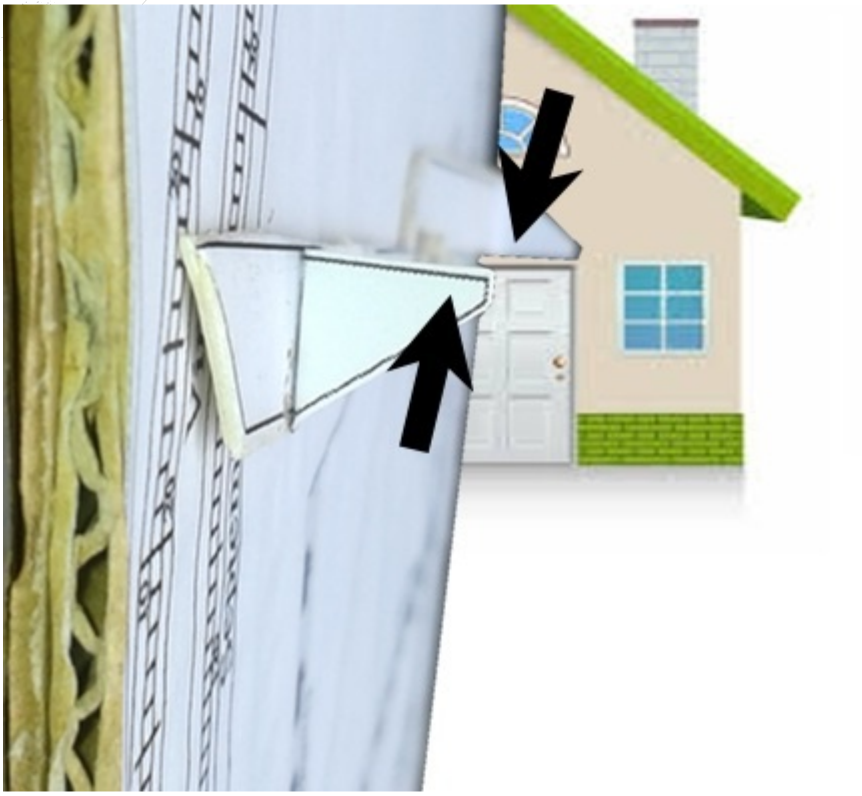


Fig. 25 Positioning the two aiming aids (Credits: Grom Matthies)

WARNING: NEVER LOOK INTO THE SUN.

In one of the exercises the Sun will be measured. To point to the Sun you use the shadow of the leading sight until its shadow falls onto the second sight.

Take a few minutes to read and familiarize with the different scales and try to guess what they mean.

Components for readouts

Shadow squares

Shadow squares on the astrolabe are used to determine heights, depths or distances. You can use either the left or the right shadow square.

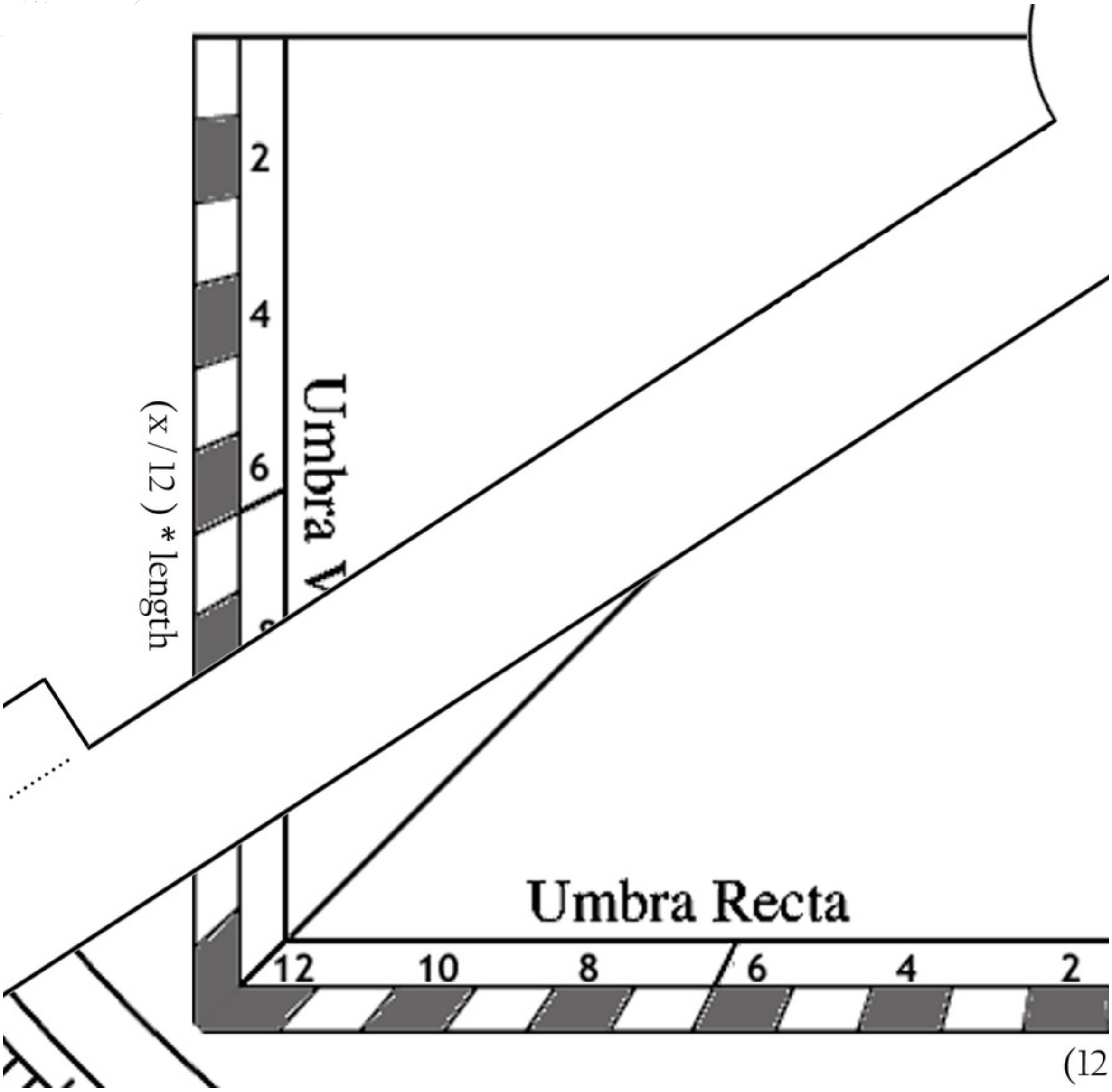


Fig. 26 Meaning and use of the shadow squares (Credits: Grom Matthies)

The value to read out is where the alidade crosses the shadow squares scale. In the example this is the number 8 in the umbra versa scale. Umbra means shadow. You will need to remember which scale you read, as the calculation for your measures changes. To help, each scale has the method of calculation printed along its side.

Date and constellation scales

The inner circle marks months and days (see figure 27a). The outer circle represents constellations in the sky.

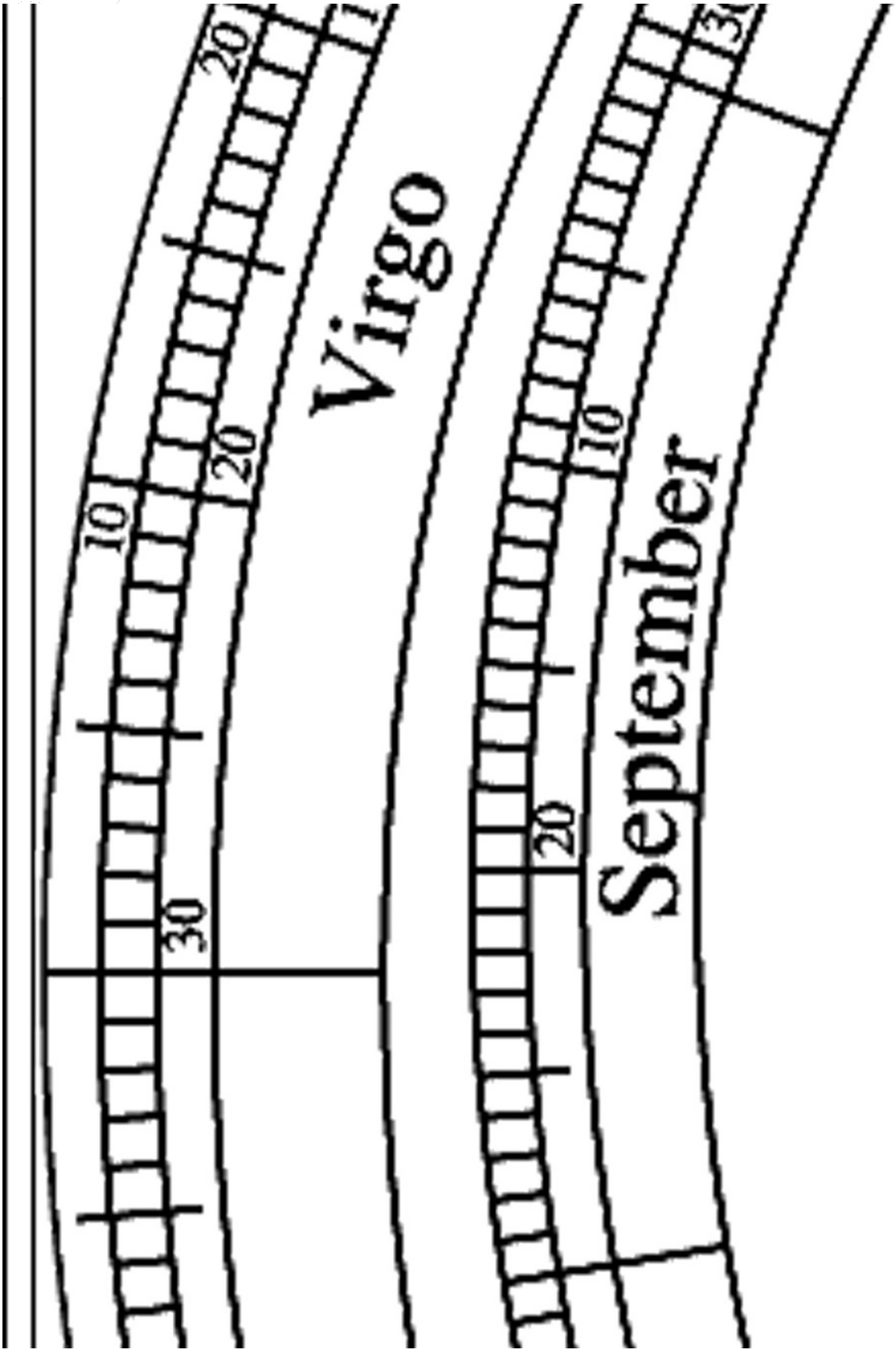


Fig. 27a Fixing the dates and showing the visible constellations (Credits: Grom Matthies)

The alidade marks September 21st and points to constellation Virgo (see figure 27b).

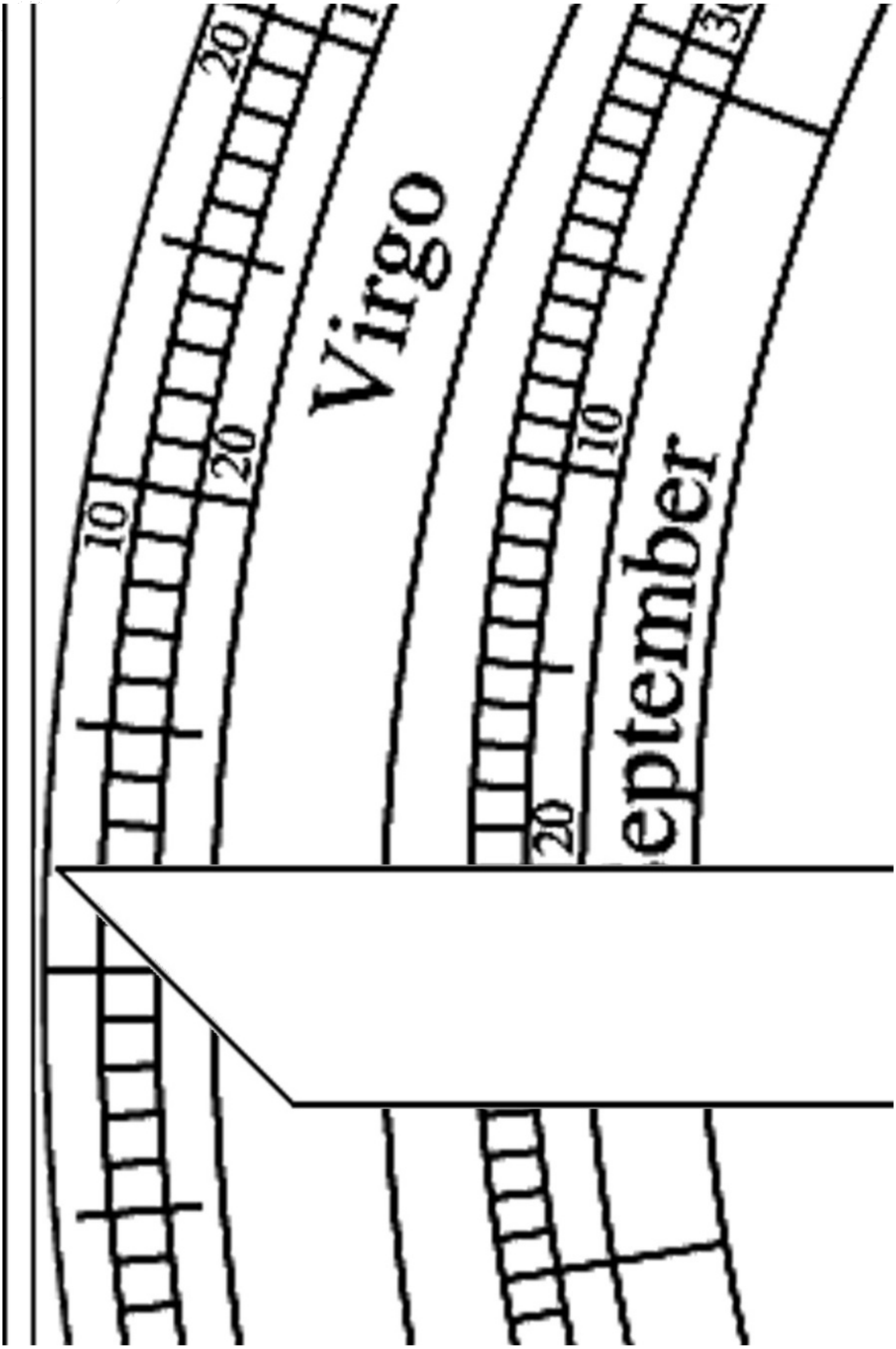


Fig. 27 Fixing the dates and showing the visible constellations (Credits: Grom Matthies)

Angle scale

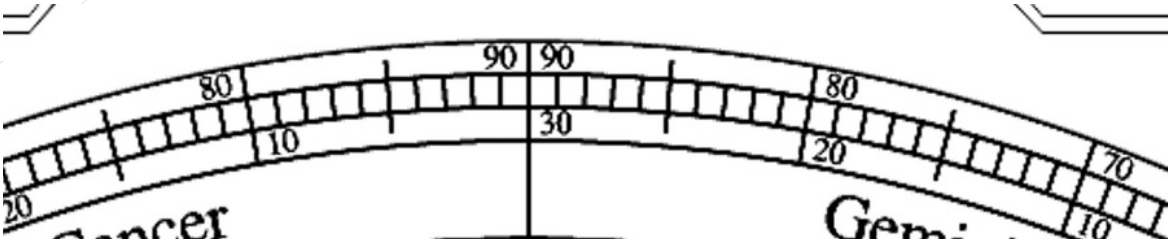


Fig. 28 Description of the angles scales (Credits: Grom Matthies)

The outermost scale on the rim of the astrolabe is used to measure the altitude angle of objects in the surrounding or in the sky. It counts from 90 degrees down to 0 degrees, from the top of the astrolabe to either side, left and right.

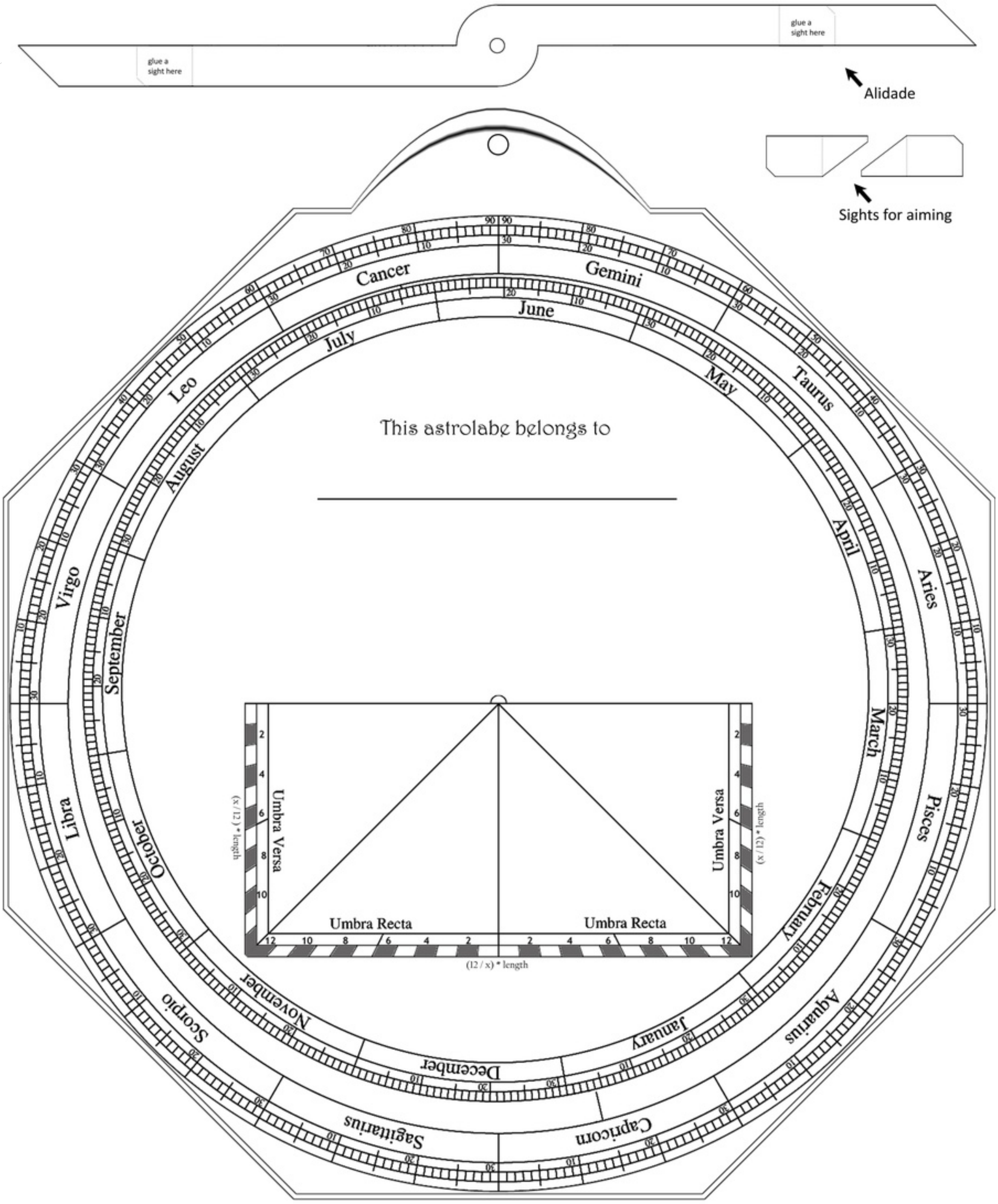


Fig. 29 The form to build an astrolabe (Credits: Grom Matthies)

PROGRAMME SCOLAIRE

Space Awareness curricula topics (EU and South Africa)

The journey of ideas, Constellations, stars

CONCLUSION

This activity is the precursor to the following ones. The children build and apply their own tool to measure angles - part of an astrolabe. Taking their first test measurements, the children may develop a sense of its complexity and possibilities.

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