My Constellation

Understand what constellations are and create you own!

Metadata

General Info

Title: My constellation

Short description: Students investigate the definition of constellations and its historical and cultural aspects, then build a 3D model of a constellation.

Keywords
stars, space, constellations, distances

Educational Context

Context: Students understand what a constellation is, identify some constellations, understand that the stars in a constellation are not physically bound and may lie very distant from the others.

Age: 7-14

Prerequisites: know how to use a ruler or measuring tape.

Lv. Of difficulty 2

Duration :3 hrs

Educational Objective

Cognitive Objectives

- Understand that constellations are a human invention
- Understand that stars lie at different distances
- Understand the importance of models in science

Subject Domain

Big Ideas of Science

The Solar System is a very small part of one of millions of galaxies in the Universe.

Subject Domain

Physics, Arts, History

Orienting & Asking Questions

Background

Thousands of years ago, our ancestors had little leisure options during the dark hours of the night. When they stared at the starry night sky, they imagined figures and patterns connecting the stars, and associated legends and stories to these figures, thus giving birth to what we know as constellations.

It soon became clear that the rise and setting of these patterns was periodic. By registering the cycles of the Sun, the Moon, and the stars, mankind created the first calendars, allowing the prediction of the start and end of seasons.

With the calendar, human societies became able to plan the best time to sow and reap harvests. The agricultural revolution in the Neolithic roughly 7500 years ago marked the transition of nomad lifestyle based on hunting, fishing, and collecting, to the establishment of the first permanent settlements and villages, and a fast increase in population.

As an example, let's see how the representation of the constellation Canis Majoris (the Great Dog) has changed over the millennia. Canis Majoris is home of Sirius, the brightest star in the sky, and venerated in many cultures.

The oldest known representation of this constellation was proposed by the Babylonians. Sirius is the tip of the arrow aimed at the stars of Orion.

In ancient Egypt, the start of the Nile flood season was announced by the appearance of Sirius right before sunrise. The Egyptians put Sirius as part of a triangle.

Thousands of years later, the Greek replaced these representations by a great dog, or Canis Major in Latin, which is the name we still use today.

DIFFERENT REPRESENTATIONS OF A CONSTELLATION: ARROW AND BOW (BABYLON, LEFT), TRIANGLE (EGYPT), CANIS MAJOR (GREECE).

Peoples at different times have different representations for the same group of stars. As the centuries passed, more and more constellations were proposed by astronomers. Ptolemy's Almagest, written during the second century of the current era, listed 48 constellations used in the western world at that time.

The age of exploration (XV-XVII century) revealed the southern sky to European astronomers, and new constellations were proposed representing the exotic fauna of the unknown regions, and technological achievements of that time.

MODERN REPRESENTATION OF CANIS MAJOR CONSTELLATION
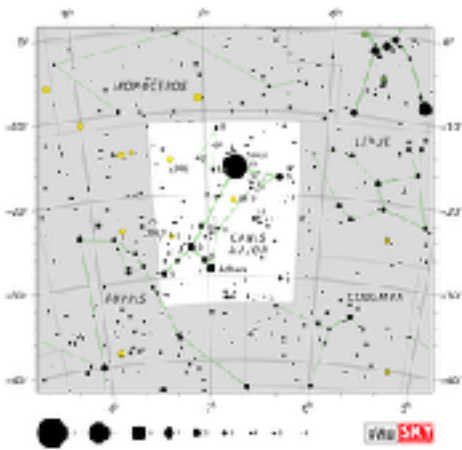
By the 1900s, some star atlases listed more than 100 constellations, and there was no consensus among the astronomers about which representation to use. In 1922, the then newborn International Astronomical Union decided to establish a working group to put an and to this confusion. A group of international astronomers, led by Eugène Delporte, published the definitive list of 88 constellations which are still in use today. Constellations are now regarded not as star patterns but as precisely defined areas of sky, rather like countries on Earth.

Teacher guidelines

To start this activity, we suggest that you have an open conversation with the students to gauge their initial knowledge on this subject. Some of the questions you can ask are:

• What are constellations?

• Do you know any constellation names?

• Do you know any legends about constellations?

• Can you identify constellations in the sky?

The next section will use Stellarium. A quickstart guide for this powerful software is provided on our toolkit. Use a projector or screen to display Stellarium to your students.

# Hypothesis Generation and Design

Generation of Hypotheses or Preliminary Explanation

After this initial conversation, continue the activity by projecting an image of the night sky with Stellarium. Do not turn on constellation lines, art, or boundaries. Ask the children if they can form any figures with the stars.

In this activity, we will use Stellarium, a planetarium simulation that can accurately reproduce the positions of stars, planets, and other celestial objects, on any location on Earth, at any moment in the past, present or future.

When you start Stellarium, it will display the appearance of the sky at your location at the current time. If you are using it during daytime, you will see a blue sky, whereas if you are using it during the night you will see stars.

We want to see the night sky. If necessary, advance the time until the sky is dark using the Date/Time tool. Look at the stars. Can you visualize any figures or patterns formed by the stars? Use your imagination!
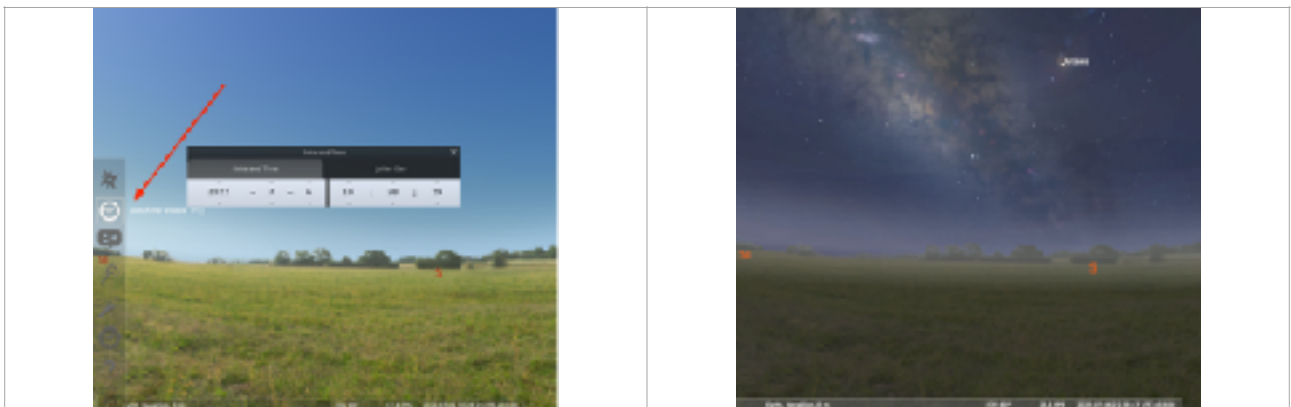
ADJUSTING THE TIME ON STELLARIUM TO DISPLAY THE NIGHT SKY

Now, let's see thee traditional representations of Western constellations. Pressing the "r" key on the keyboard will display the artwork, and the "v" key will display the constellations' names, or use the icons on the bottom menu. Do these representations resemble the ones you imagined? Did you know any of these Western constellations?
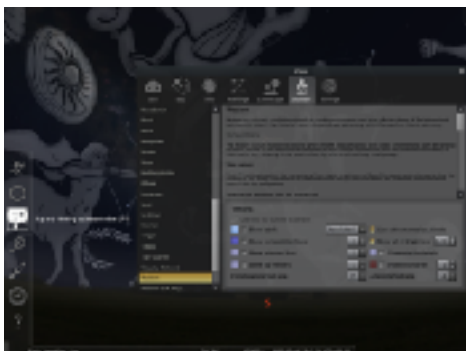
Stellarium also allow us to display the constellations of dozens of other cultures from different regions of the world. For this, you need to go to the "sky and viewing options window" on the left menu, and then select Starlore.
A list of different cultures will be available. Explore how regions in the sky are represented in different ways in different cultures. Were you aware of these non-western representations?

Design/Model

In this part of the activity, you will build a 2D model of a constellation. It can be any constellation you want - a western one, a non-western, or even a new constellation you created.

In the Resources section of our website, you will find several constellation blanks that you can use to start this activity.

Working in groups, connect the dots freely, paint and cut the figures. With your colleagues, write a short story about the constellation you are representing.

Now, let us ask you a question: are all stars in the sky at a same distance from us? Would the appearance of the star patterns change if the stars were closer or father away from us? Discuss with you colleagues.

Teacher guidelines

Ask the students to look out of the window. They will see several objects, some in the foreground, others on the background. Then, take a picture (with a smartphone or camera) out of the window and show them. Explain that, in a 2D representation, objects that appear close to each other on the picture may be in fact very distant one from another.

Now it's time to prepare the students to the next part of the activity - building a 3D model of a constellation.

Planning and Investigation

Plan Investigation

In this part of the demonstrator, you will build a three-dimensional model of a constellation. For that, you will need to investigate the distance to the brightest stars in the constellation. This can be easily done with Stellarium, just by clicking on the star. On the top left it will be displayed information about the start, including its distance in light years. You can select what kind of information will be displayed using the configuration tool menu.

CLICKING ON A STAR ON STELLARIUM WILL DISPLAY INFORMATION ABOUT IT, INCLUDING ITS DISTANCE IN LIGHT-YEARS (TOP LEFT).

Perform Investigation

For each one of the constellations, make a table of the brightest stars and their distances in light-years.

The idea is to cut strings with lengths proportional to each star's distance. Assign 30 cm to the farthest star, calculate a scale (in light years/cm) for the other stars. As an example, see the table below prepared for the constellation Crux (the Southern Cross)

The most distant star, Palida, is at 345 light years from the Earth. Thus, using a 30 cm string for this distance yields a scale of 11,5 light years per centimetre. Calculating the other string lengths we have:

Star	Distance (light-years)	String Length (cm)
Acrux (Alpha Crucis)	320	27,8
Mimosa (Beta Crucis)	278	24,2
Rubidea (Gamma Crucis)	88	7,6
Palida (Delta Crucis)	345	30
Intrometida (Epsilon Crucis)	229	19,9

DISTANCE TO THE BRIGHTEST STARS IN THE SOUTHERN CROSS AND CORRESPONDING STRING LENGTHS.
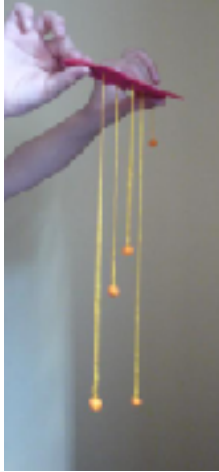
Cut the strings in the corresponding distances, and attach a putty clay ball (or any other object representing a star) in one tip of the string. Tie the other end of the string with a knot in the corresponding star in the constellation blank.

Fix the arrangement at the ceiling of the classroom and look at it from the side. Now, look at the representation from below.

Sketch watch you see from both perspectives and compare it with the original constellation blank.

Analysis & Interpretation

When you observed the representation from below, did it resemble the two-dimensional representation on paper? Do the different distances to the stars play any role on the 2D appearance? Discuss this with your colleagues.

Conclusion & Evaluation

Conclude and communicate result/explanation

Based on your observations, you should now be able to conclude whether or not star distances play a role on the constellation patterns we see from Earth. Also, you have seen that the same region in the sky can be represented differently by different cultures.

Share these findings with the remainder of the school community by organizing an exhibit of the 3D models at a common space at the school, along panels about the main points of the activity.