Cubetto in Space - Unit 1

Year 1, Ages 5 to 6, UK National Curriculum

Subjects covered:

Science

PE

Art / DT

Humanities

Music

Materials required:

6x Cubettos

6x Boards

6x Sets of Blocks

6x Standard Maps

Resources provided:

Diagram of Cubetto

Solar system guide

Primo map key

Space mission guide

Glasses template

Investigation table

Primo Board template

Introduction

The Cubetto Playset is a Montessori inspired coding toy that allows children ages 3 to 6 to program a friendly wooden robot without screens and is powered by a programming language you can touch.

New technology can sometimes be overwhelming to understand and adopt. The activities contained in this guide were created by educators for educators.

We want to make it simple for you to integrate the Cubetto Playset and its tangible programming language into your teaching.

Development and learning in other key areas

Beyond coding

The collaborative nature of Cubetto makes it an extremely versatile tool for the classroom. Cubetto fosters learning in key development areas that go beyond programming.

Communication

Children practice listening through a range of stories and narratives in relation to Cubetto, accurately anticipating key events and responding with comments, questions or actions. They also develop their own narratives and explanations.

Dexterity

Children develop coordination in large and small movements around the playset. They negotiate the placement of obstacles around the world map and place blocks on our tangible interface.

Social-Emotional

Children become confident by trying new, open-ended activities that remove “wrong” outcomes, and easily encourage group work. The open nature of the maps allows them to choose the resources they need for their play session.

Mathematics

Children add and subtract blocks to a sequence. They solve problems, including doubling and halving to get Cubetto from A to B. They discuss size, shapes and patterns, distance, position, and time to solve problems.

Logical reasoning

The blocks allow children to create and debug simple programs with their hands. They use technology purposefully to create, organise, store, manipulate and retrieve meaningful sequences.

Introducing the Playset

Introducing Cubetto

Introduce Cubetto as a friendly robot that children can program. Children should be told that Cubetto cannot think for himself, and can only move as programmed by the child, just like any other machine. If in a group setting, sit children in a circle, and allow them to pass Cubetto around to one another, saying hello or acknowledging the presence of the object.

Doing so forms a bond with Cubetto, in the same way they would with a stuffed animal, or a toy, and solving problems through narratives later on is more engaging.

Introducing the Board

Introduce the Board as a remote control that children can use to send instructions to Cubetto.

Without the Board, there is no way of sending Cubetto his instructions.

It is important for children to understand Cubetto is only able to move with a human's command. This is not only empowering, but also key to understanding computing.

Encourage children to also explain what other objects in their homes and lives function within a similar paradigm. A television needs a human to change its channels for example, or a washing machine needs a human to select its settings.

These examples, like Cubetto, are machines that need human programming to do their job.

Introducing the Blocks

Introduce the Instruction Blocks as the directions Cubetto follows when inserted in the Board and sent by pressing the action button.

Different Blocks represent different instructions, and an unambiguous, distinct command. These Blocks are what make up Cubetto's hands on coding language, and are key in the learning of computational thinking.

When each block is inserted in the Board, a child should be encouraged to predict what Cubetto will execute before pressing the "Go" button.

This is key in understanding concepts like program design, and it helps develop abstraction.

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Unit 1 Overview

Year 1

By the end of the unit pupils will be able to:

- Understand what an algorithm is, how it is implemented on devices, and that programs execute by precise instructions.

- Pupils will also be able to create and debug a simple algorithm and use logical reasoning to predict the behaviour of simple programs.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
NC Computing Objectives	To explore a digital device	To understand what algorithms are	To understand that programs execute by precise instructions	To create a simple program
Outcomes	• I can talk about Cubetto's parts • I can predict what will happen to falling objects	• I can say what an algorithm is • I can balance while making different movements	• I can break down an algorithm into smaller parts • I know where Earth is in solar system	• I can write a simple algorithm • I can put pictures of a space mission in order
Cross-curricular Subject	Science	PE	Art/DT	Humanities
Computational Thinking	Logic,Tinkering	Algorithms, Collaborating	Decomposition, Tinkering	Algorithms, Creating
Main Activities	Cubetto's Gravity 1. Introduce Cubetto and space as a theme. Predict and test how gravity affects different objects. 2. Discuss Cubetto: what he does, how he works and what he is made of. Open Cubetto up, identify parts and materials, then label a simple diagram.	Cubetto's Spacesuit 1. Write a simple algorithm using the blocks and move your blindfolded partner around a life-size Primo map, remembering to instruct clearly. 2. Move around like an astronaut in a spacesuit. Focus on balance.	Cubetto's Solar System 1. Identify parts of our solar system on the Primo map, including Earth and the sun. Predict and break down a longer algorithm into smaller parts 2. to get Cubetto to the sun. 3. Make a model of our solar system using fruit.	Cubetto's Launch 1. Using real examples of astronauts' space missions, order images of their journey to make an algorithm. 2. Move Cubetto around the Space Map, visiting different planets but being careful to avoid asteroids and volcanoes!
Challenge	Can you talk about what we could and couldn't do if we didn't have gravity?	Can you use the function (blue) block and say why it's useful?	Can you find each of the planets, and the whole solar system, on the map?	Can you travel from the moon to the sun without hitting the asteroids?
Creative Play	Make Cubetto a jet pack to get into space.	Design a badge for Cubetto's spacesuit.	Make constellation art using black card, stars & white pencil.	Role play being inside Mission Control at take off.
Resources	Diagram of Cubetto, Space images, Selection of objects suitable for dropping, Play screwdrivers/coins	Image of spacesuit, Masking tape/ cones, Optional: blindfolds	Guide of solar system, Primo map key, Signs/labels for the different planets, Different-sized fruit	Space mission guide (images and words), Images of astronauts (incl. an animal mission), Paper, Glue
Assessment	Prediction, Labelled diagram, Photos, Observation	Algorithms, Observation of movement, Photos, Verbal statements	Solar system models, Verbal statements about block functions, Photos, Observation	Ordered images, Algorithms, Photos, Verbal statements, Observation

	Lesson 5	Lesson 6	Lesson 7	Lesson 8
NC Computing Objectives	To debug a simple program	To use logical reasoning to predict the behaviour of simple programs	To create a simple program	To create a simple program
Outcomes	• I can debug a program • I can predict what an algorithm will do	• I can spot patterns • I can spot things that are the same and different	• I can create an algorithm • I can choose an instrument to make a certain sound	• I can evaluate an algorithm • I can identify translucent and opaque materials
Cross-curricular Subject	Humanities	Science	Music	Science
Computational Thinking	Logic, Debugging	Patterns, Perseverance	Logic, Collaborating	Evaluation, Creating
Main Activities	Cubetto's Moon Landing 1. Discuss reality of problematic space missions. Introduce debugging through example of Grace Hopper, then predict, test and fix algorithms. 2. Work out which block is missing from a series of algorithms. Write out the correct algorithm.	Cubetto's Planets 1. Compare different algorithms and spot the similarities and differences, then predict what will happen. 2. Compare different planets and decide a common pattern. Relate to programming and why it's useful to spot patterns.	Cubetto's Space Orchestra 1. Explore what sound a volcano, star and rocket would make, then choose an instrument to recreate the sounds. 2. Comparing the job of a composer and a Computer Programmer, re-order mixed up algorithms to move Cubetto.	Cubetto's Return 1. On Cubetto's return the sun is so bright! Investigate different translucent & opaque materials to make blackout glasses. 2. Write an algorithm that makes sure Cubetto only touches the black squares with stars in them. Evaluate a partner's algorithm.
Challenge	Can you write an algorithm for a friend to predict, test and debug?	How can you use the function block to get Cubetto from the rocket to the solar system (B6)?	Work in a group to program Cubetto & make a matching soundtrack.	Cubetto is stuck in a black hole! Can you get Cubetto from the bottom right corner (F6) back to Earth?
Creative Play	Write a postcard to send home from the moon.	Design a new, peaceful planet.	Draw or paint what you feel as you listen to different music.	Role play the first thing you would do after returning from a year in space.
Resources	Coloured whiteboard pens, Grace Hopper and Apollo 13 images and key facts, Example algorithms to debug (for both activities)	Example pair of algorithms, Images of the eight planets, Glue, Coloured whiteboard pens	Images of Programmers, Variety of percussion instruments	Solar system, Glasses template, Investigation table, Evaluation questions, Variety of paper, fabric & plastic, Scissors and glue
Assessment	Debugged algorithms, Photos, Verbal statements, Observation	Pattern-spotting, Photos, Verbal statements, Observation	Re-ordered algorithm, Observation of instrument choice, Photos	Investigation table, Algorithms, Verbal evaluation, Observation, Photos

Lesson 1: Cubetto's Gravity (1 of 2)

Cross-curricular area: Science

NC Objectives
To control a digital device

Outcomes
- I can talk about Cubetto's parts
- I can predict what will happen to falling objects

Resources Needed
- Space images
- Selection of objects suitable for dropping
- Play screwdrivers/ coins

Prep Needed
- Check batteries.
- Check sound and video.
- Draw a simple prediction table on paper or mini whiteboard for the objects that will be dropped.

Resources Provided
- Diagram of Cubetto

Key Vocabulary
- Space
- Gravity
- Force
- Predict
- Materials

Computational thinking concept

Logic

Computational thinking approach

Tinkering

Teacher-led Introduction

1. Introduce Cubetto to the class (try not to give anything away other than his name). Ask: What would you like to find out about Cubetto? Collect the pupils' questions on the board to refer back to at the end of the lesson.
2. Explain that Cubetto is a robot that they control and that, over the term, they will be helping Cubetto explore an exciting place.
3. Show an image of space and ask pupils if they know what this is. Ask: What do you know about space?
4. Ask: What would you like to find out about space? Collect pupils' questions about space and keep these on the wall for the entire unit.
5. Explain that today they will be finding out more about Cubetto and about gravity.
6. Ask: What is gravity? Have you seen pictures or videos of people in space? Can you describe how they move and what their movements look like?
7. Show video of Chris Hadfield clipping his nails in space: https://goo.gl/KajBlP and ask: Why is Chris floating?
8. Explain that gravity is a force, and that forces make things stop, start, move and change shape. In space, there is no gravity, so everything floats!

Lesson 1: Cubetto's Gravity (2 of 2)

Creative Play

Make Cubetto a jet pack to get into space using small drinks bottles, tissue paper and masking tape.

Guided Activity

1. Ask: What does it mean when we predict something? Clarify that 'predicting' means using what has happened before to tell what will happen in the future (e.g. If I go outside when it's raining, I will get wet and, if I wear a raincoat, I won't get wet).
2. Show the objects that the group will be testing today and describe what material they are made from.
3. Then, for each one, ask: What do you predict will happen if I drop this object? Why?
4. Record their predictions in a simple table on paper/mini whiteboard (e.g. this object will fall straight, slowly, bounce etc.).
5. Reinforce fair testing by demonstrating that all the objects must be dropped from the same height each time.
6. Allow pupils time to test dropping each object. After each one, discuss how it fell and compare the outcome against their predictions.
7. Ask: Why do you think each object falls down towards the floor? Clarify that gravity is the reason it falls.

Independent Activity

1. Describe what Cubetto is made from. What materials can you see? Can you see any wood? Plastic? Metal?
2. Why do you think Cubetto is made from these materials? What if Cubetto was made from glass? Or brick?
3. Remember that Cubetto is very special and we have to take very good care of him.
4. Open up Cubetto using the play screwdrivers or coins. What can you see? Can you see any other materials inside?
5. On the diagram of Cubetto, label his different parts and what they are made of (e.g. Cubetto's wheel is made of plastic).

Challenge

Can you talk about what we could and couldn't do if we didn't have gravity?

Plenary and Assessment

1. Ask: What materials did we look at today? What does 'material' mean? What is Cubetto made from, inside and out?
2. Ask: What is special about how things move in space? What is it called when things don't fall to the ground?
3. Ask volunteers to share what they predicted would happen to different objects on earth, where we have gravity.
4. Discuss what surprised them about different objects and what material each one is made from.
5. Ask: Why is it important to predict before we try something? Reinforce that prediction helps us to learn and prepare by thinking about what we already know.

Lesson 2: Cubetto's Spacesuit (1 of 2)

Cross-curricula Area: PSHE

NC Objectives

To understand what algorithms are

Outcomes

- I can say what an algorithm is
- I can balance while making different movements

Resources Needed

- Image of spacesuit
- Masking tape/ cones
- Optional: blindfolds

Prep Needed

- Check batteries.
- Check sound and video.
- Book hall for session.
- Prepare four large Primo blocks on IWB to move around.
- Create a large grid in hall using tape or cones to mark.

Resources Provided

- N/A

Key Vocabulary

- Spacesuit
- Visor
- Protect
- Algorithm
- Programmer
- Balance

Computational thinking concept

Algorithms

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Show the video of an astronaut putting on a spacesuit https://goo.gl/WmSfzL and ask: What different parts can you see?
2. Show a picture of a spacesuit and ask pupils to identify the helmet, visor, suit, gloves, moonboots and jet pack.
3. For each of the parts, ask: Why would an astronaut need this in space? (Recap Lesson 1's session on gravity if completed.)
4. Label the picture with a helmet = to protect the head and give the astronaut air to breathe; visor = to protect the astronaut's eyes from the bright sun; suit = filled full of air to protect the astronaut's body from cold; gloves = thick rubber protects the astronaut's hands; moonboots = to protect the astronaut's feet; jet pack = gives the astronaut power to fly around.
5. Ask: What order do you think the astronaut needs to put these things on in? Collect the pupils' ideas and create a list.
6. Explain that just like when putting on a spacesuit, computers only work if they are told what to do in the right order.
7. Introduce the word 'algorithm' to describe a set of instructions in the right order and show the different blocks. Ask the children to work out what each one might do.
8. Show the three key blocks on IWB: red (right turn); yellow (left turn); green (forward) and explain that the pupils will use these to move a partner (the astronaut) around a map. Clarify 'right' and 'left turn' with the help of volunteers if needed.
9. Explain that the astronauts will only be able to move when their partner (the programmer) tells them what to do - just like how Cubetto and most other computers can't move without a human telling them to.

Lesson 2: Cubetto's Spacesuit (2 of 2)

Creative Play

Design a badge for Cubetto's spacesuit.

Guided Activity (in hall/playground)

1. Put the children in pairs and ask them to choose who will be the astronaut and who will be the programmer (they will both have a turn).
2. Model (with the help of an 'astronaut' volunteer) the decision-making process of pupils choosing where to start and finish, then programming an algorithm with clear instructions (forward, left, right) to map the astronaut's journey.
3. State the rules: one instruction at a time; there is no backwards block so if it goes wrong, you must start again; be patient with each other (just like with a computer!).
4. Allow time for the pairs to build an algorithm to move each other around the map.
5. For more able pupils, programmers can keep their destination secret and astronauts can wear blindfolds.

Independent Activity (in hall/playground)

1. Ask: Why do you think astronauts train in swimming pools? It's similar to what it's like with no gravity – we float around slowly.
2. Ask for a volunteer to walk around like an astronaut in a spacesuit. Ask: How are they moving? What shows you that?
3. Ask: What does 'balance' mean? What does balance help us do? Explain that balance is important for astronauts. Why do you think?
4. Explain that some methods to help with balance involve moving slowly and focusing on something that is still and not moving.
5. Tell pupils to move around the space slowly in different ways by balancing. Begin by asking them to pretend to swim or carry a heavy load, then move on to walking down a straight line carefully and balancing on the spot on one leg.

Challenge

Can you use the function (blue) block and say why it's useful?

Plenary and Assessment

1. Ask: What is an algorithm? What algorithms did we write today? Ask: What was easy and what was more difficult about programming?
2. Show a simple algorithm of four or five blocks on the IWB and ask: Who can show me how this would make Cubetto move?
3. Ask a volunteer to program Cubetto with the algorithm on the IWB using the Primo blocks and Board.
4. Ask: What does balance mean and what does it help us do? Why do astronauts need good balance?

Lesson 3: Cubetto's Solar System (1 of 2)

Cross-curricula Area: English

NC Objectives

To understand that programs execute by precise instructions

Outcomes

- I can break down an algorithm into smaller parts
- I know where Earth is in the solar system

Resources Needed

- Signs/labels for the different planets
- Different-sized fruit (for modelling)

Prep Needed

- Check batteries.
- Prepare nine signs for the children to hold.
- Write up names of planets on IWB.
- Make cardboard ring for Jupiter.
- Prepare a few longer algorithms.

Resources Provided

- Solar system guide
- Primo map key

Key Vocabulary

- Solar system
- Planet
- Algorithm
- Break down

Computational thinking concept

Decomposition

Computational thinking approach

Tinkering

Teacher-led Introduction

1. Show an image of the solar system and ask: Does anyone know what this picture shows? Can anyone name anything in the picture?
2. Explain that this is a picture of the solar system, but that it's much, much bigger in real life. The solar system contains the sun and various planets.
3. Point out the sun and ask: Where do you think we are? Explain that we live on Earth, which is a planet. Point Earth out on the picture (3rd in).
4. Ask nine children to stand up and hand out the signs to each other in any order.
5. Explain that all the planets move around the sun but some are near the sun and others are much further away. Point this out on the picture.
6. Using the picture for reference, ask: Can you tell the 'planets' where to stand so that they are in the right order?
7. Explain that all the planets are different. Ask: Can you tell me which planets are similar in the picture? And which are different?
8. Show the words (see guide) and ask for volunteers to match one word to each planet (e.g. Which one looks icy cold?).
9. Explain that today the pupils will be exploring Cubetto and making models of the solar system using different fruits!

Lesson 3: Cubetto's Solar System (2 of 2)

Creative Play

Make constellation art using black card, stars & white pencil.

Guided Activity

1. Ask: Can you find any of the planets on the map? Where is the sun? Can you find Earth?
2. Use the Primo map key to point out the planets on the map.
3. Show one of the prepared algorithms containing at least two turns (e.g. start at the compass; end at the sun).
4. Ask: Where do you predict this will take Cubetto? Collect the pupils' answers and their reasons, pointing out that longer algorithms can sometimes get confusing.
5. Ask: What can we do to make this easier to understand? Explain that Computer Programmers often break down their algorithms.
6. Ask for suggestions for how we could break the algorithm down into smaller parts (e.g. before each turn).
7. Allow time for pupils to decide which part they want to test out first, then ask them to predict what this part will do.
8. Give them the blocks to program Cubetto and compare the outcome against their predictions.
9. Repeat this until the group has broken the algorithm into several parts and tested each.

Independent Activity

1. Look at the fruit (e.g. melon (Sun), small currants (Mercury, Venus, Earth, Mars), grapefruit (Jupiter), apple with a cardboard ring (Saturn), plums (Uranus & Neptune)).
2. We're going to work as a group to make a model of the solar system!
3. Which fruit do you think could be the sun? Why? The sun is an enormous star (not a planet!) at the centre of our solar system.
4. Which is the next biggest fruit? Which is the biggest planet? So which planet could the grapefruit be?
5. Using the picture of the solar system, take it in turns to match each fruit to a planet until you have used up all the fruit.
6. Tell everyone in your group to close their eyes (except you). Take one fruit away and the group has to guess which planet is missing!

Challenge

Can you find each of the planets, and the whole solar system, on the Primo map?

Plenary and Assessment

1. Ask for three volunteers to stand at the front.
2. Show each coloured block and ask one of the volunteers to move as if they were Cubetto (e.g. red block = right turn).
3. Show the solar system map and ask: What is this a picture of? Who can point out where Earth is?
4. Ask: Why do computer programmers sometimes break down long algorithms? How did this help us today?

Lesson 4: Cubetto's Launch (1 of 2)

Cross-curricular area: Humanities

NC Objectives

To create a simple program

Outcomes

- I can write a simple algorithm
- I can put pictures of a space mission in order

Resources Needed

- Images of astronauts (e.g. Helen Sharman - include an animal mission)
- Paper
- Glue

Prep Needed

- Check batteries.
- Mix up the images in the mission guide on the IWB so that they can be moved around.
- Print images and words from the space mission guide for the pupils to match and order.

Resources Provided

- Space mission guide

Key Vocabulary

- Astronaut
- Space mission
- Algorithm
- Mission Control
- Asteroids
- Volcanoes

Computational thinking concept

Algorithms

Computational thinking approach

Creating

Teacher-led Introduction

1. Show a range of videos of astronauts and ask: What do you think an astronaut needs to do before they go into space?
2. Introduce some of the astronauts from famous missions and explain that they have to train for many years before they can fly.
3. Ask: Why do we go into space? What are the reasons? Often to discover new things. Do all missions have humans on board?
4. Show the images from the space mission guide and clarify what each image shows.
5. Ask: What do you think is the first thing an astronaut needs to do to prepare for space? Collect ideas.
6. Explain that today the pupils will write an algorithm for what needs to happen before a space mission.
7. Recap: What is an algorithm?
8. Model starting to write the algorithm by moving the first image chosen earlier by the pupils to the left-hand side of the board.
9. Ask pupils to come to the front to choose the next four steps in a space mission:
10. Training
11. Packing
12. Mission Control checks
13. Rocket launch
14. Outer space
15. Ask: What dangers do you think there might be in space? Show the map and point out the volcanoes and flying asteroids.

Lesson 4: Cubetto's Dance (2 of 2)

Creative Play

Role play being inside Mission Control at take off.

Guided Activity

1. Ask pupils to look at the images of the space mission and support them in reading the words.
2. Ask: Can you help each other match the words to the pictures?
3. Allow time for pupils to stick the words to the corresponding pictures.
4. Ask: Can you remember what we decided was the first thing an astronaut needs to do before going into space?
5. Allow time for pupils to continue to put the photos and words in the right order, then stick the sequence down on paper.

Independent Activity

1. Find Jupiter on the map (hint: it's purple).
2. Now find the rocket.
3. Work in pairs to write an algorithm: start at the rocket, end at Jupiter.
4. BUT you have an extra challenge: there are dangerous flying asteroids and a volcano that you cannot go over or land on!
5. Move Cubetto to Jupiter without touching the asteroids or volcano.

Challenge

Can you travel from the moon to the sun without getting hit by

Plenary and Assessment

1. Ask pupils to share their space mission algorithm in pictures. Point to Mission Control and ask: Can you tell me what this picture shows?
2. Ask children working with Cubetto to share their algorithm which avoids volcanoes and asteroids. Ask: How did you make sure you didn't go near the asteroids?
3. Ask: What is important to remember when we write an algorithm? Clear steps, in order.

Lesson 5: Cubetto's Moon Landing (1 of 2)

Cross-curricular area: Humanities

NC Objectives

To debug a simple program

Outcomes

- I can debug a program
- I can predict what an algorithm will do

Resources Needed

- Coloured whiteboard pens
- Grace Hopper and Apollo 13 images and key facts
- Example algorithms to debug (for both activities)

Prep Needed

- Check batteries.
- Prepare algorithms for the children to debug.
- Prepare numbered cards for the five steps to debugging.

Resources Provided

- N/A

Key Vocabulary

- Computer Programmer
- Debug

Computational thinking concept

Logic

Computational thinking approach

Debugging

Teacher-led Introduction

1. Ask: What problems do you think can happen on space missions? Running out of fuel, crashing, problems at lift-off.
2. Explain that space travel is very hard to do and often doesn't work, but people keep trying over and over again to make it better.
3. Share example of the Apollo 13 mission that failed because an oxygen tank exploded. Tell the children that hundreds of people working with computers tried to fix it and get the astronauts safely back to Earth (which they did!).
4. Show image of Grace Hopper (an image that doesn't hint to her job) and ask: What do you think her job was? Collect ideas.
5. Explain that Grace was a Computer Programmer who made the word debug popular when talking about computers.
6. Ask: What do you think 'debug' means? To work out what's wrong and fix it (Grace's team is said to have found a real bug – a moth – that caused a computer she was working on to break).
7. Explain that today pupils will be debugging different algorithms to make them work. Debugging computers can be annoying – you have to try over and over to test out different ways of fixing it, but also really exciting – when you finally work it out.

Lesson 5: Cubetto's Moon Landing (2 of 2)

Creative Play

Write a postcard to send home from the moon.

Guided Activity (algorithms with wrong turns)

1. Introduce the debugging process on numbered cards and clarify each step:
2. Predict what the algorithm will do
3. Test it out
4. Work out what's wrong
5. Fix it
6. Test it again
7. Mix up the cards, give one to each pupil and ask the group to put themselves in the right order.
8. Show one of the prepared algorithms that includes a wrong turn and ask: What do you predict this will do?
9. Repeat for the next steps in the process until pupils have debugged the algorithms.

Independent Activity (algorithms with blocks missing or no function lines)

1. Look at one of the algorithms with your partner: something is missing!
2. Can you work out which block (or blocks) is (or are) missing?
3. Why do you think that?
4. Write the correct algorithm using the Primo Board template and the coloured pens.

Challenge

Can you write an algorithm for a friend to predict, test and debug?

Plenary and Assessment

1. Ask five pupils to come up to the front and hand out the mixed up steps to debugging.
2. Ask: What order should the steps be in? Why do you think that?
3. Ask: What does debugging mean? What was the name of a famous Computer Programmer who debugged computers?
4. Ask pupils to share an algorithm that they debugged and explain how they worked it out.

Lesson 6: Cubetto's Planets (1 of 2)

Cross-curricular area: Science

NC Objectives

To use logical reasoning to predict the behaviour of simple programs

Outcomes

- I can spot patterns
- I can spot things that are the same and different

Resources Needed

- Images of the eight planets
- Glue
- Coloured whiteboard pens
- Example pair of algorithms

Prep Needed

- Check batteries, video and sound.
- Print planet images.
- Prepare an algorithm for drawing two planets.
- Prepare algorithm pairs on Primo Board templates.

Resources Provided

- N/A

Key Vocabulary

- Planet
- Solar system
- Pattern

Computational thinking concept

Logic

Computational thinking approach

Perseverance

Teacher-led Introduction

1. Show video of Earth taken from space (from 40 seconds in): https://goo.gl/ZLLwfX.
2. Ask: What planet can you see? Ask pupils to tell you when they spot the moon, lightning and London!
3. Explain that there are things that are the same and different about the planets in our solar system. Ask: How many planets are there?
4. Show pictures of all eight planets and ask: What can you spot is the same about these planets? Round, large, marks on them.
5. Ask: What can you see is different between them? Collect ideas.
6. Ask: What could you say about these planets that is always true? Decide on one sentence (e.g. all planets are round).
7. Explain that what they have found is called a pattern.
8. Explain that Computer Programmers use patterns to make their work easier because they can re-use the pattern each time.
9. Ask: If I wanted to program a computer to draw Mars and Earth, what would be the same?
10. Share algorithm (e.g. pen down, draw big circle (both the same), then Mars would be different (fill in red) and Earth (fill in green & blue).

Lesson 6: Cubetto's Quest (2 of 2)

Creative Play

Design a new, peaceful planet.

Guided Activity

1. Show example pair of algorithms and ask: What pattern can you spot between these two?
2. Model circling the blocks that are the same.
3. Ask: What is different about them?
4. Ask: What do you predict the first one will make Cubetto do? Repeat for second algorithm.
5. Optional challenge for more able pupils: How could we use the function block (blue) to program Cubetto to do both algorithms?
6. Repeat steps for other algorithm pairs, identifying the patterns.

Independent Activity

1. Look at the pictures of the planets.
2. Choose two and write or draw what is the same about them.
3. Now write or draw what is different about them.
4. Choose two more planets and repeat.
5. Look at the things that are the same. What patterns do you notice?

Challenge

Can you say the coordinates of where the treasure is hidden?

Plenary and Assessment

1. Ask: What patterns did we spot between the planets today?
2. Ask pupils to share their comparisons of the planets. Ask: What is the same and what is different?
3. Ask pupils to share their algorithm patterns.
4. Ask: Why is it helpful to spot patterns in algorithms? How do patterns help Computer Programmers?

Lesson 7: Cubetto's Space Orchestra (1 of 2)

Cross-curricula Area: Music

NC Objectives

To create a simple program

Outcomes

- I can create an algorithm
- I can choose an instrument to make a certain sound

Resources Needed

- Images of Programmers
- Variety of percussion instruments

Prep Needed

- Check batteries.
- Check sound on IWB.
- Prepare mixed up algorithms for pupils to re-order.

Resources Provided

- N/A

Key Vocabulary

- Composer
- Computer Programmer
- Algorithm

Computational thinking concept

Logic

Computational thinking approach

Collaborating

Teacher-led Introduction

1. As pupils enter, play Chris Hadfield's cover of 'Space Oddity' filmed in the space station: https://goo.gl/IJL5ET and discuss.
2. Play Gustav Holst's 'The Planets': https://goo.gl/qE9Xuu and show the music for 'Jupiter'.
3. Ask: Does anyone know what any of the symbols mean? Explain that they are notes placed in an order carefully chosen by the composer.
4. Explain that writing music is similar to making Cubetto move: the composer decides which notes should go where and in the right order.
5. Ask: What would it sound like if all the notes were in the wrong order?
6. Show images of Computer Programmers and explain their job as the 'composer' of computers: just like music, a computer's instructions (algorithm) have to be in the right order.
7. Reinforce that computers can't do anything without humans telling them what to do.
8. Explain that they will be composers and computer programmers today BUT some of the algorithms are mixed up!
9. Model looking at a mixed-up algorithm on the IWB (e.g. start at rocket, end at space station (facing up the map): left turn, green, blue [function line: green, green, green]).
10. Ask: Do you think the algorithm is mixed up or correct? Why? Ask volunteers to program Cubetto to work out how to re-order it.

Lesson 7: Cubetto's Space Orchestra (2 of 2)

Creative Play

Draw or paint what you feel as you listen to different music.

Guided Activity

1. Ask: What sound does a rocket make? Which of these instruments could you make that sound with?
2. Decide on a signal for pupils to put their hands in the air and stop playing.
3. Allow time for pupils to explore the sounds, then show the signal to stop.
4. Agree as a group which instrument can make a good rocket noise.
5. Repeat for the stars and a volcano.
6. Looking at the Primo map, ask: What other sounds could you hear in space? Allow time for pupils to think and explore instruments.

Independent Activity

1. Working in pairs, use the algorithms to program Cubetto to move around the map.
2. BUT there's a problem: the algorithms are mixed up!
3. Look at a mixed up algorithm and talk about what you think it will make Cubetto do.
4. Test out the algorithm on Cubetto. Does it take you to the place you wanted?
5. Talk about what you could do to make it work.
6. Change the order of the blocks and test it again. Did it work this time? Why/why not?

Challenge

Can you use someone else's ideas to make your algorithm better? How could you use the blue block to improve it?

Plenary and Assessment

1. Ask: What is an algorithm? Why is it important to put things in order? Why do we use algorithms when telling computers what to do?
2. Ask for volunteers to share how they put an algorithm in the right order. Ask: What did Cubetto do when it was in the wrong order? How did you know when the algorithm was in the right order?
3. Ask for volunteers to share which instrument they chose for the rocket and to demonstrate playing it for the class. Ask: Why did you choose that instrument? What other instrument could you choose to make this sound?

Lesson 8: Cubetto's Return (1 of 2)

Cross-curricula Area: Science

NC Objectives

To create a simple program

Outcomes

- I can evaluate an algorithm
- I can identify translucent and opaque materials

Resources Needed

- Card
- Variety of transparent and opaque paper, fabric & plastic
- Scissors and glue

Prep Needed

- Check batteries.
- Print the glasses templates onto card, preparing one example and at least two printouts per child.
- Print investigation table.
- Write evaluation questions on cards.

Resources Provided

- Solar system guide
- Glasses template
- Investigation table
- Evaluation questions (below)

Key Vocabulary

- Light source
- Materials
- Opaque
- Translucent

Computational thinking concept

Evaluation

Decomposition

Computational thinking approach

Creating

Teacher-led Introduction

1. Ask: How long do you think astronauts can spend in space? Tim Peake was in space for over 6 months (186 days) in 2016.
2. Explain that Cubetto has been in space for a long time now and is ready to come home to see his family and eat real food!
3. Show the image (or video) of the solar system and ask children to point out Earth and the sun.
4. Explain that the sun is a light source and the reason why we can see.
5. Tell pupils that the sun is so bright when Cubetto passes it on the way home, Cubetto has to cover his eyes or he will be hurt.
6. Explain that today's session will involve investigating different materials to work out which material would be the best for covering Cubetto's eyes.
7. Model cutting out the template and gluing on the arms to make the glasses.
8. Ask: What do we call materials that block out light completely? Opaque. What do we call materials that let some light through (but not all)? Translucent.
9. Model cutting out two pieces of a chosen material and sticking these to the glasses. Ask a child to wear the glasses to test out whether this material blocks out light.
10. Using the investigation table, model sticking a piece of that material in the relevant column (alternatively, you can write in the material's name down).

Lesson 8: Cubetto's Return (2 of 2)

Creative Play

Role play or draw the first thing you would do after returning from a year in space.

Guided Activity

1. Allow time for the pupils to look at, touch and discuss the different materials on the table.
2. Ask: Which materials do you predict will block out all the light? Why? Collect ideas.
3. Allow time for the pupils to cut out and stick their glasses together (they will need support cutting out the holes).
4. Tell children to secretly choose one of the materials that they think will block out the light and keep it to themselves. Tell them to describe the material to a partner for them to guess.
5. Allow time for pupils to cut out two pieces of their chosen material, stick onto the back of the glasses and put them on.
6. Ask: Can you see through the material at all? Is it opaque or translucent? Where would you stick this material in the investigation table?
7. Repeat for other materials.

Independent Activity

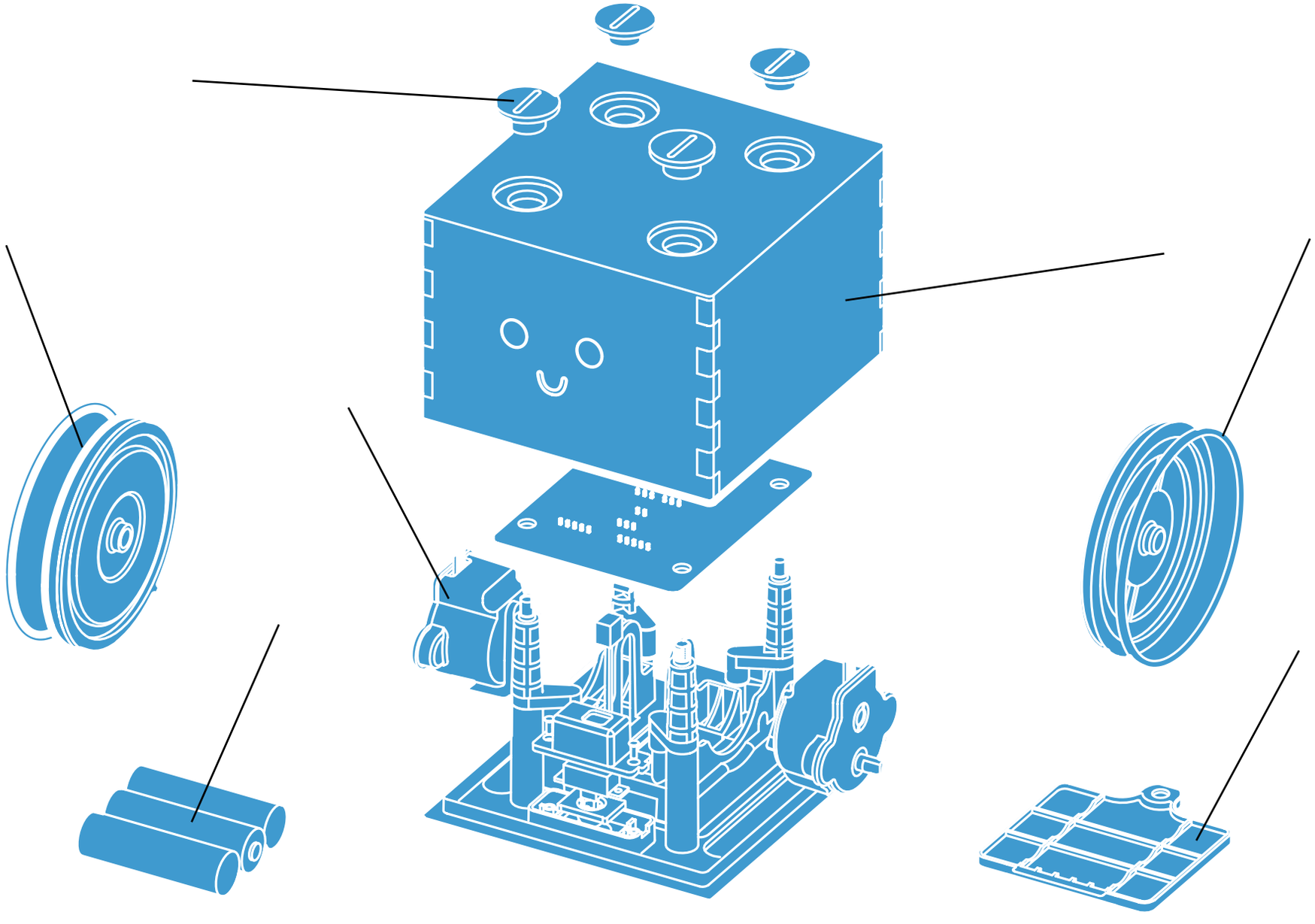
1. Choose a start and an end point on the Primo map.
2. Program Cubetto to move from your start to end point, ONLY touching the black squares with stars in them!
3. If it is too difficult, you may need to change your end point.
4. When you have finished, swap algorithms with another pupil and ask them where their start and end point is. Test out their algorithm.
5. Answer the three evaluation questions: Does it work? Why/why not? Can you find a shorter route to the same place?

Challenge

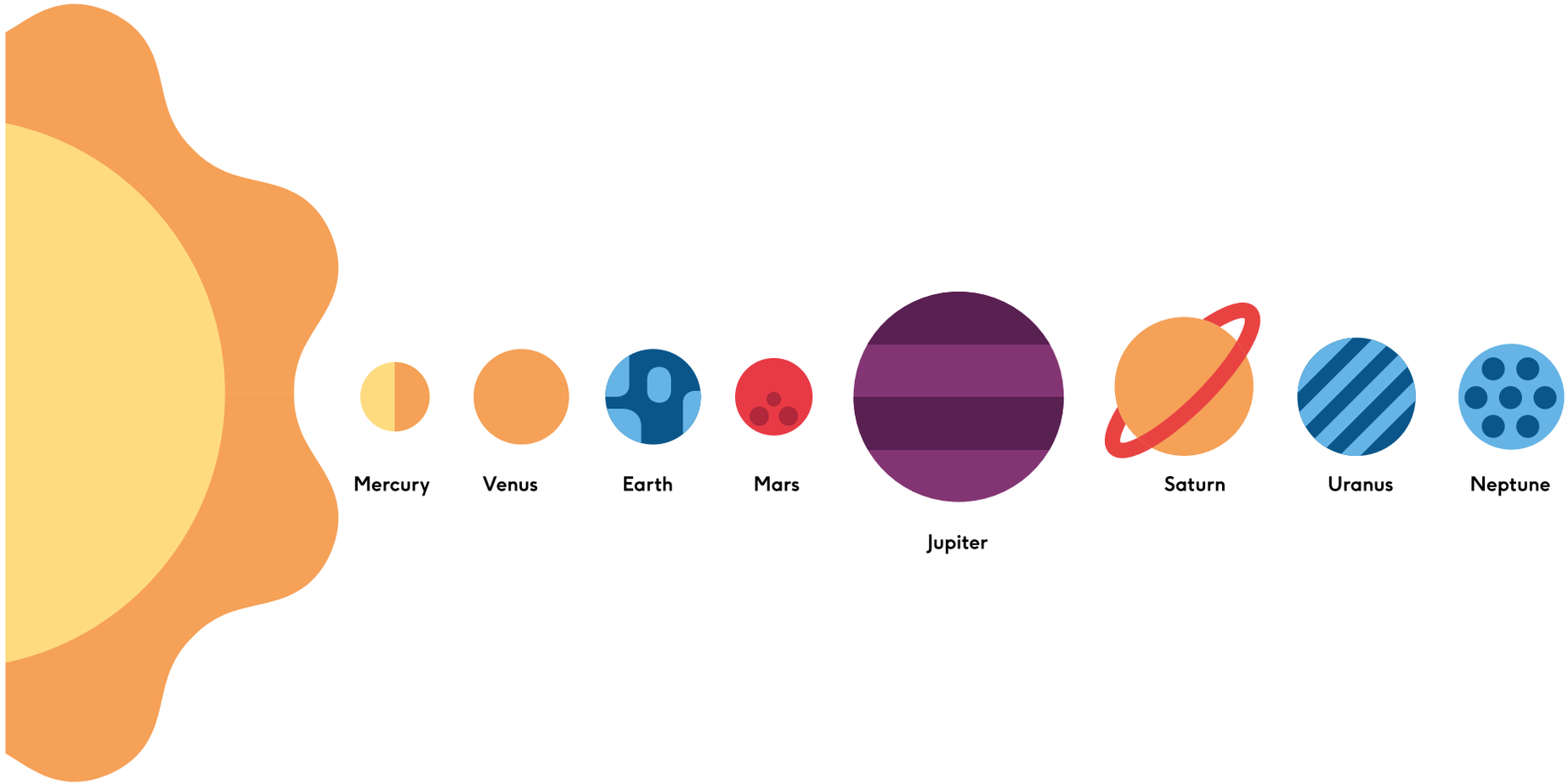
Cubetto is stuck in a black hole! Can you get Cubetto from the bottom right corner (F6) back to Earth?

Plenary and Assessment

1. Volunteers who used an opaque material bring their glasses to the front. Ask them to wear their glasses and describe the material.
2. Ask: Which other materials were opaque? Which materials were translucent?
3. Ask: What is the light source that Cubetto goes past on his way home?
4. Ask for a volunteer who evaluated a partner's algorithm to share what they found out. Ask: Did you find a shorter route?
5. Refer back to list of questions created in Lesson 1 and discuss what pupils have learnt about space and programming.

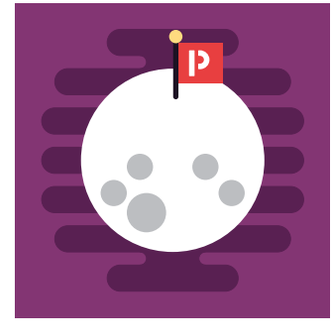


Our solar system

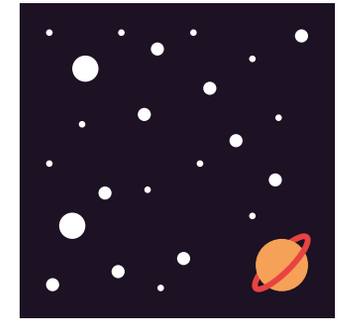


Earth

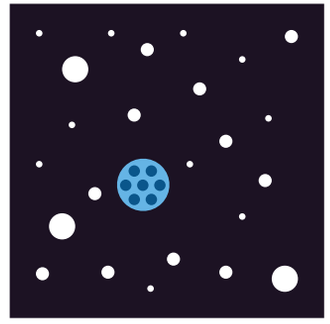
Uranus



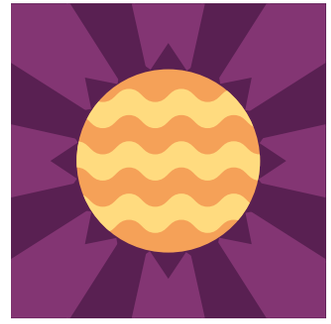
Moon



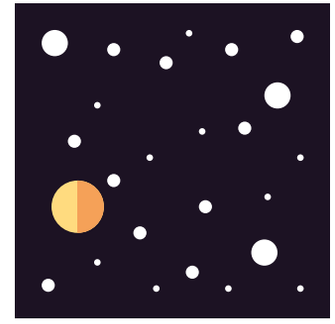
Saturn



Neptune



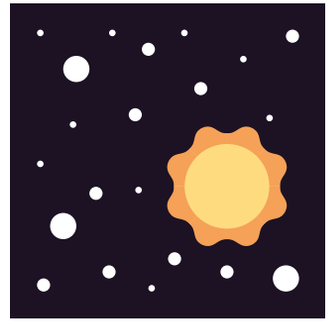
Mars



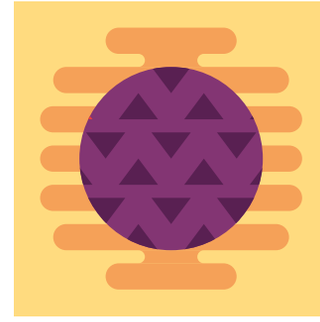
Mercury

Neptune

Jupiter



Sun



Venus

Stages of space flight:

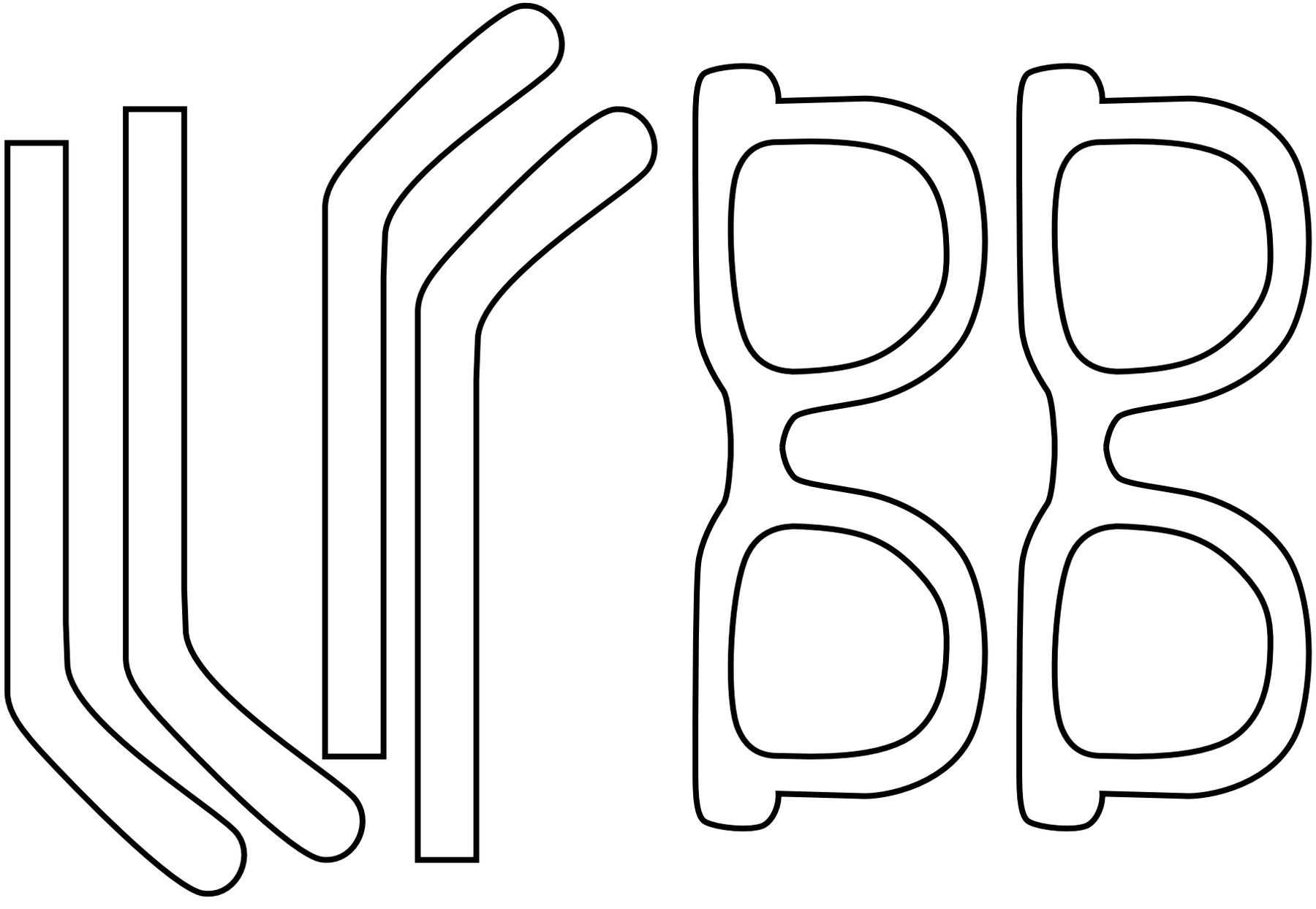
Training

Packing

Mission control checks

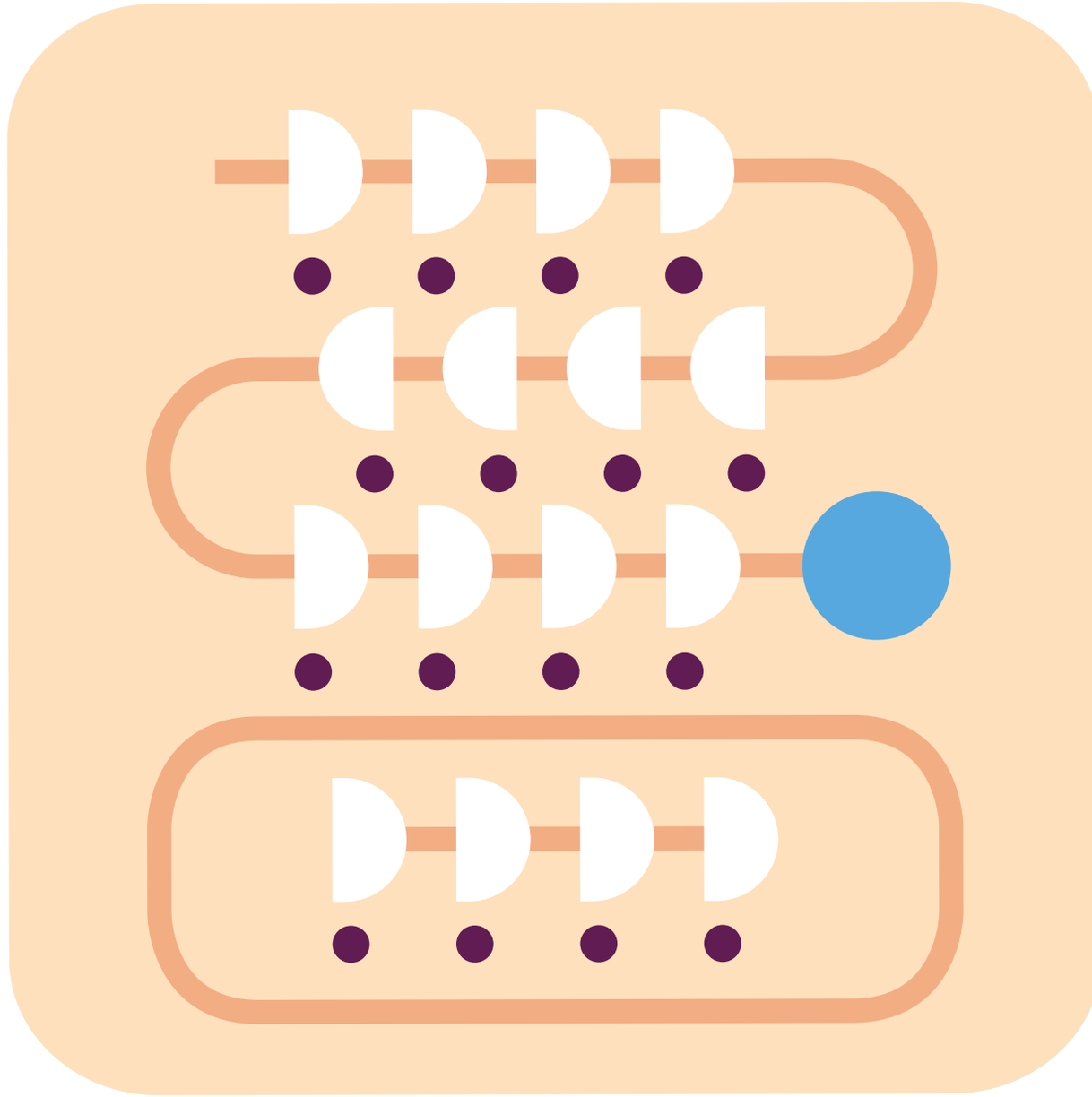
Rocket launch

Outer space



Which material will block out the sun from Cubetto's eyes?

Lets some light through (translucent)	Blocks out the light (opaque)



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