

Suitable for
3-7 years

- Solo
- ✓ Pairs
- ✓ Groups

Jinglang's activity

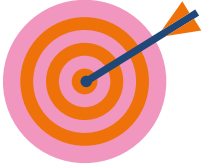
Space junk tidy up

Balance game



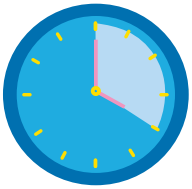
Jinglang's activity guide

Space junk tidy up



Aim

Your job is to clean up space – see if you can take the space junk off the balancing board without disturbing the satellites that are still useful!



Time required

Prep to build framework 5-10 mins; build of game with children ~10-15 mins; playing time a couple of mins per round.



Story to guide activity

Space Junk Tidy up by Jinglang



Materials

- **Print out of our space map** (or draw your own)
- **Cardboard to create an approx. 23cm diameter circle** (garlic bread or pizza cardboard bases work really well for this. Otherwise you can cut up a cardboard box or perhaps even some old cereal packets)
- **Cork (from wine bottle)**
- **String**
- **Hook**
- **Screw**
- **Washer**

- **Framework** (build out of some scraps of wood and dowel – you could get the children to help assemble this part as well but it is probably best to have pre-cut the pieces – see photos below. This can also be provided: request via e-mail h.l.bridle@hw.ac.uk)
- **Items to balance**, e.g. we used a mixture of wooden peg people, wooden half circles and wooden spools from Buddy Crafts (different weights and sizes are good – our items weighed between 2 to 6 grams each).



Safety

Depending on how much of the build you undertake with the children watch out for sharp implements like the hooks and the screws.



Instructions

1. Read the comic Space Junk Tidy Up
2. Discuss what satellites do and why some of them need to be removed from space
3. Build your own Space Junk Tidy Up game board (see the photos below)

Building the game board

4. If your cardboard is not already the correct size and shape cut a circle 23cm in diameter. A pizza base can be used directly. For cut out cardboard sellotape/glue two layers together – if it is from cereal packets four layers is likely to be best.
5. Identify the centre of the circle and mark it on the cardboard
6. On the other side of the cardboard stick on the space map with Earth at the centre of the circle

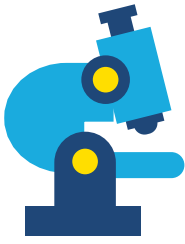
7. Cut the cork so that it is approx. 2cm high (depending on your children you might want to pre-cut corks – you could provide different sizes for them to select and test)
8. Insert/screw the hook centrally into one end
9. Screw the screw into the centre of the other end of the cork
10. Remove the screw to complete the full assembly of the board: place the washer on the back of the cardboard circle with the cork above the Earth on the other side of the cardboard; screw through the washer, cardboard and into the cork; tighten the screw so that the cardboard is held firmly against the cork
11. Tie a loop in the end of the piece of string
12. Hook the hook through the loop and hang the board from the framework

Building the framework and space junk

13. Our suggested framework dimensions are length of the bottom pieces of wood ~25cm, height ~16-20cm, top arm of wood L 25cm, W 2cm and thickness 7mm. However this is just the spare wood we had available and other dimensions will also work.
14. Build your own Space Junk Tidy Up game pieces. Decorate the items which will be balanced on the board – designate the majority as space junk with some pieces as useful satellites (make sure it is easy to tell the difference)

Playing the game

15. To play the game balance the board with all of the game pieces (it might be easiest to do this by placing two pieces of the same weight opposite one another and continuing like this until all pieces are added).
Take it turns to remove items of space junk but without knocking everything else out of orbit and off of the board. Each round of the game takes a couple of minutes.



Background information

Satellites: a satellite is something that orbits a planet or a star so the Moon is a natural satellite orbiting the Earth. There are thousands of other man-made satellites orbiting the Earth doing jobs like: sending TV or phone signals, helping with navigation through systems like GPS, monitoring the weather etc. Satellites are launched into orbit using rockets and the orbit is achieved when the speed of the satellite balances the pull of gravity. When a new satellite is launched an orbit is selected (or designed) for the satellite to avoid it crashing into other satellites. Some satellites go the same speed as the Earth rotates so it seems like they are 'parked' above one place on Earth – these geostationary satellites are useful in sending communication signals or observing the weather in the specific location below them. Other satellites travel at different speeds and at different distances from the Earth depending on what job they need to do, e.g. being closer allows for higher resolution pictures to be taken.

Space junk: space junk is made up of old satellites that no longer work, any other machinery left behind by humans in space or even bits that have fallen off of rockets. There are more dead satellites than active ones orbiting the Earth. The dead ones can get in the way of the active ones and cause a crash. Satellites should be removed once they stop working but people don't always tidy up! Some suggestions for removing space debris include using a harpoon or magnet or robotic arms to grab a satellite, catching satellites in a net or even firing lasers at a satellite to make it so hot that it slows down and falls out of orbit back to the Earth or using a puff of air to push the satellite out of orbit. Engineers are still working on the best idea. <https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html> and <https://www.space.com/24895-space-junk-wild-clean-up-concepts.html> or see this video on the use of the net: <https://www.theverge.com/2018/9/19/17878218/space-junk-remove-debris-net-harpoon-collisions>

The balancing game: the force exerted by different objects on the board depends upon their mass and the distance from the centre point. The trick to making the game construction

work is the rigid connection between the circular board and the cork – without the cork the board will be too wobbly to balance anything on, and the taller the cork gets, i.e. the longer the rigid component perpendicular to the board that it is hanging from, the more stable it will be.



Prompt questions

- What happens if we remove one on the edge or one close in?
- Is it easier to remove a bigger one or a smaller one?
- What happens if we redesign the game board?



Extension ideas

- Link this activity with our circus skills orbiting activity and learn to hula hoop
- Try balancing different items on the board to see how different shapes, sizes and weights work (and other balancing games)
- Think up ideas about how we could remove space junk – if you have magnetic items maybe you could balance these on your board and try the magnetic removal idea. Or maybe you could make a small net and see if you can use that to take items off the board. Or you could try these capture ideas with a rolling ball, e.g. try to capture it in a net or grab it with a robotic arm while it is slowly rolling or even blow a puff of air at it with straw to see if that changes its direction, e.g. knocks it off orbit
- Older children could experiment with different designs of the balance board: what happens if you make a larger board, a non circular shape or a taller cork?
- Find out more about other flight related engineering by meeting Adah (rockets), Sarah (aeroplanes) and Antonio (drones)

Photos to help construction



