

Episode 1

The main character of this episode is Dr Richard Archibald, who works as a videogame programmer. Many areas of Maths, among which Geometry, play an important part of his everyday job. The puzzle is an example of the kind of thinking one has to do in game programming every day.

The puzzle

Question

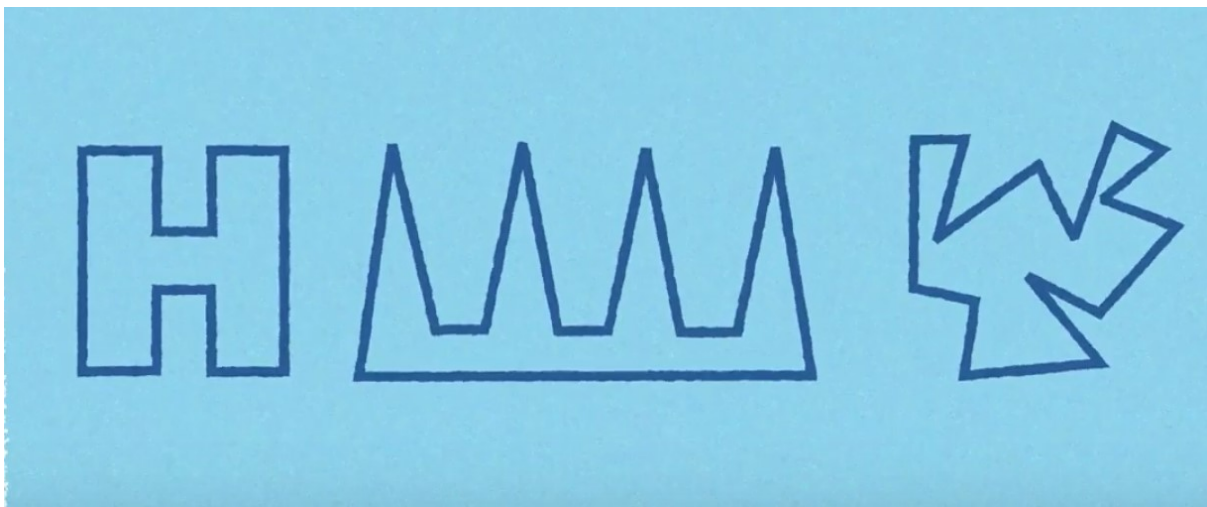
Consider the floor plan of an art gallery. Suppose that we know the room has a polygonal shape (the perimeter is only made of straight lines). We would like to place some cameras to be able to monitor the entire room.

- Cameras can only be placed in the corners
- Cameras can see all around, but obviously they cannot see through walls

What is the lowest number of cameras we need to use if we want to monitor the entire room?

Of course the answer will depend on the shape of the room. In the first video, we solve the puzzle in the case of simple shapes (a triangle and an L), just to give some examples.

Now try with the following shapes:



Aims

- Improve geometric intuition
- Showing sometimes there is more than one right answer
- Help students to better grasp the concept of convexity. In fact, if the floorplan has a convex shape, than one camera is sufficient.



How to differentiate the puzzle and target different ranges of abilities

The teacher could use different shapes, if they reckon the shapes we have chosen are too easy or too complicated to solve.

Students can be asked to draw their own shapes, as easy or complicated as they want, solve the puzzle for those shapes, and then challenge their classmates.

You could ask: "For what kind of shapes one camera is sufficient?" The answer would be "convex shapes".

The solution video: A surprising fact

The solution video is designed to be "low threshold high ceiling". It will present a slightly surprising result. Suppose that we do not know the exact shape of the room, but we only know the number of corners. Then we can always monitor the entire room, using a number of cameras which is no bigger than the number of corners divided by 3. Watch the video if you want to find out why. The arguments presented in the solution video give an example of what a mathematical argument looks like. We do not expect all the classroom will be able to follow the arguments. However, Most of the classroom would be able to grasp the following concepts:

- A question may have more than one right answer
- The job of a mathematician often consists in constructing logical arguments. A mathematical proof is one that no one can dismiss
- A difficult task can often be solved by breaking it down in simpler tasks

Material

Students will need a printout of the shapes, which is posted on the webpage.

Further details

The puzzle question is actually a simple case of a Mathematical theorem: "The Art Gallery Problem"