PART I: Literature & Mathematics

AGE RANGE: 13-15

TOOL 52: TOPOLOGY IN THE HITCHHIKER'S GUIDE

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Educator's Guide

Title: Topology in The Hitchiker's guide to the galaxy

Age Range: 13-15 years old

Duration: 1,5 hours

Mathematical Concepts: Topology

Artistic Concepts: Sci-fi literature, sculpturing

General Objectives: This tool will make your students get a chance to see mathematics in a new perspective and think outside the box.

Instructions and Methodologies: First you read the excerpts from The Hitchiker's guide to the galaxy and then you read about topology. The tasks in the end will be in the same line of reasoning (as the literature), namely to think outside the box and find out that things are not always what they seem to be.

Resources: This tool provides pictures and videos for you. You will also need a piece of string, clay and a stick with the size of a broom handle.

Tips for the educator: Try to encourage the students to solve the tasks without looking at the videos. If they get stuck, however, the videos will help.

Desirable Outcomes and Competences: At the end of this tool, the student will be able to:

- Understand logic in an improved way and especially topology.
- Explore their handicraft skills.

Debriefing and Evaluation:

Write 3 aspects you liked about this activity:	1. 2. 3.
Write 2 aspects that you have learned	1. 2.
Write 1 aspect for improvement	1.

Introduction

It has been argued that topology can be traced in science fiction literature, where things are not what they seem to be and are related in strange ways. One example can be seen in Douglas Adams' book "The Hitchhiker's guide to the galaxy". The book is about a man from Guildford, UK called Arthur Dent. Dent wakes up one day to find that his house faces the risk of being torn down. It is situated at a place where a new bypass is going to be built. A few minutes later he realizes that his house is not the only thing that is on its way of being torn down. The entire Earth is actually in the way of a new intergalactic motorway.

Excerpts

""First I've heard of it", said Arthur, why it's got to be built?"

   Mr Prosser shook his finger at him for a bit, then stopped and put it away again.

   "What do you mean, why it's got to be built?" he said. "It's a bypass. You've got to build bypasses."

   Bypasses are devices which allow some people to dash from point A to point B very fast whilst other people dash from point B to point A very fast. People living at point C, being a point directly between are often given to wonder what's so great about point A that so many people from point B are so keen to get there, They often wish that people would just for once and for all work out where the hell they wanted to be.

   Mr Prosser wanted to be at point D. Point D wasn't anywhere in particular. It was just any convenient point a very long way from points A, B and C. He would have a nice little cottage at point D, with axes over the door and spend a pleasant amount of time at point E, which would be the nearest pub to point D. His wife of course wanted climbing roses, but he wanted axes. He didn't know why – he just liked axes. He flushed hotly under the derisive grins of the bulldozer drivers." (Adams, D. (1979). "The Hitchhiker's Guide to the Galaxy". London: Orion Publishing Group. p.5f).

"A sudden silence hit the Earth. If anything it was worse than the noise. For a while nothing happened.

The great ships hung motionless in the sky, over every nation on Earth. Motionless they hung, huge, heavy, steady in the sky, a blasphemy against nature. Many people went straight into shock as their minds tried to encompass what they were looking at. The ships hung in the sky much the same way that bricks don't.

And still nothing happened.

Then there was a slight whisper, a sudden spacious whisper of open ambient sound. Every hi fi set in the world, every radio, every cassette recorder, every woofer, every tweeter, every mid-range driver in the world quietly turned itself on.

Every tin can, every dustbin, every window, every car, every wine glass, every sheet of rusty metal became activated as an acoustically perfect sounding board.

Before the Earth passed away it was going to be treated to the very ultimate in sound reproduction, the greatest public address system ever built. But there was no concert, no music, no fanfare, just a simple message.

"People of Earth, your attention please", a voice said and it was wonderful. Wonderful perfect quadrophonic sound with distortion levels so low as to make a brave man weep.

"This is Prostetnic Vogon Jeltz of the Galactic Hyperspace Planning Council," the voice continued. "As you will no doubt be aware, the plans for development of the outlying regions of the Galaxy require the building of a hyperspatial express route through your star system, and regrettably your planet is one of those scheduled for demolition. The process will take slightly less than two of your Earth minutes. Thank you." (Adams, D. (1979). "The Hitchhiker's Guide to the Galaxy". London: Orion Publishing Group. p.5f).

The Math behind The Hitchhiker's guide to the galaxy

Topology

Topology can be described as a description of a series of geometrical shapes that share one dimension and can be transformed into each other by stretching, bending and shaping. Tearing or gluing is not allowed though.
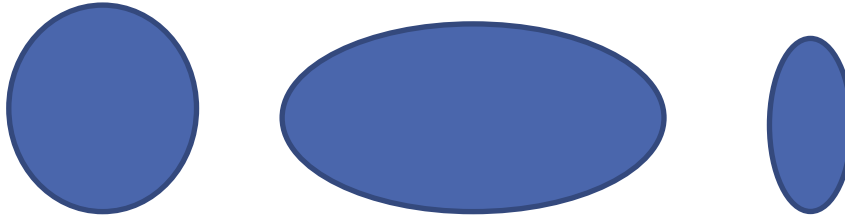
**Picture 1**: Rounded objects

All the rounded objects above belong to the same topological family.

Picture 2: 4-sided objects

The three objects in picture 2 above are also in the same family (but not the same as the rounded objects) since their common characteristic is that each object has 4 sides.

What you do when you decide that a series of shapes share features, is that you try to look for similarities that may not be obvious to start with. For example all times given by an analogic watch belong to the same topologic family, since the hands of a watch are one dimensional lines.
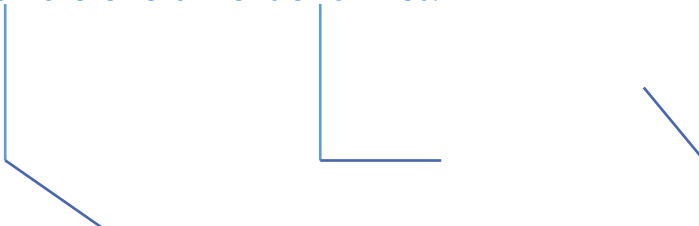
Picture 3: One dimensional lines

Another practical example is a map of public transport, where all stations often seem to be equally big and the distance in between them is not always true to real scaling.
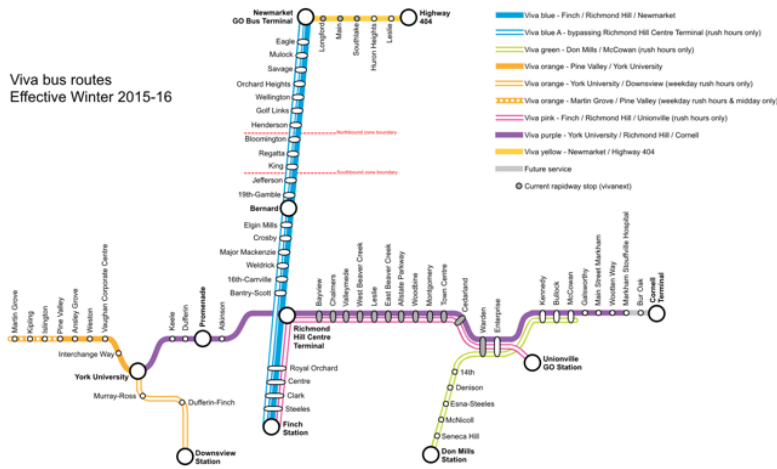
Picture 4 Public transport

https://upload.wikimedia.org/wikipedia/en/9/9d/VIVA_Bus_Rapid_Transit_Map_-_effective_feb_2016.png

As you can see this is one of the ideas from topology that can be seen in the first excerpt from The Hitchhiker's guide to the galaxy. It is not really interesting for Mr Posser exactly how far away points A, B, C and D are. The important thing is that they are connected and separated.

TASKS

1. As you could see in the excerpts from The Hitchiker's guide to the galaxy, some items are related in ways that you could not think about in advance. Use this reasoning and try to find out the solution to this riddle. What should be the answer to the last question (2581=?) if you follow the same pattern as in the first 20 examples?

    8809 = 6
    7111 = 0
    2172 = 0
    6666 = 4
    1111 = 0
    3213 = 0
    7662 = 2
    9312 = 1
    0000 = 4
    2222 = 0
    3333 = 0
    5555 = 0
    8193 = 3
    8096 = 5
    7777 = 0
    9999 = 4
    7756 = 1
    6855 = 3
    9881 = 5
    5531 = 0
    2581 = ?

2. Take a piece of clay and a stick. Form the clay to an eight (like in picture 1 below) and put it on the stick.

Try to get the other loop on the stick without breaking the eight.

Have a look at the videos below if it becomes too hard!

3. Take a piece of string and form numbers from 1-9. Decide which numbers that are topolically in the same family.

LEARN MORE...

In this article you will find more information about topology

http://mathworld.wolfram.com/Topology.html

Here is a film that shows how a cup and a doughnut are topologically similar.

https://www.youtube.com/watch?v=dwrhCSORERA

In this film you will see what can be done to a certain figure without tearing it apart.

https://www.youtube.com/watch?time_continue=45&v=S5fPwE7GQOA