Introduction to Philosophy of Physics   Homework 2

Space, dimensions   Due: 26 March 2018

1. Give examples of the following kinds of spaces. I recommend that you use figures of low-dimensional spaces to illustrate your responses. Briefly explain these spaces.

   (a) A finite space with edge.
   (b) A finite space without edge.
   (c) A space open in one dimension and closed along another.
   (d) A two-dimensional space closed in all dimensions.

2. Consider the following beings in their worlds and help them solve their problems.

   (a) Ms Unidime is a one-dimensional being living in a one-dimensional world. Unfortunately, she doesn't like her neighbour. How could she get rid of him, if at all? Do her prospects change if she develops the magical ability to move through the second dimension? If so, how?

   (b) Mr Flat is a two-dimensional being living in a two dimensional world. One morning, he discovers that the Hilbert Train Company has built an infinitely long train track across his entire world, separating it into a Western and an Eastern half. Living in the Western half, he would like to visit his friends in the Eastern half. Can he do that without disrupting the train line if he has no magical power to move through the third dimension? Explain your answer.

3. In the final step of his argument, Whitrow argues that we can reasonably explain the dimensionality of space on the basis that intelligent life requires space to have precisely three dimensions. Analyse this step by parsing out what can and what cannot be reasonably explained on that basis.

4. A direct flight from Los Angeles International Airport (LAX) to London Heathrow Airport (LHR) typically covers a distance of 8780km, initially heads 34° northeast after takeoff at LAX, and flies over the southern tip of Greenland. Given the latitude of LAX at $33°56'33''$N, of LHR at $51°28'39''$N, and of the southern tip of Greenland at around 60°N, this seems like a big detour. Explain.

5. How can a two-dimensional being living in a two-dimensional world find out whether it lives in a flat or curved space? Propose an experiment which would allow the being to find out the answer.