Comp220 Proposal

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1 Outline of intended artifact

1.1 Area for improvement

Too many games these days are focused around the boring 3d Euclidean space, simply because it's the one we happen to live in. What I propose is a puzzle game, similar to Portal, where the player will navigate a 4 dimensional space, aiming to reach the end of each level, then proceed on to the next one. This world would have an extra spatial dimension that the world we currently exist in. Doing so allows the puzzles to involve hiding things in different 4D spaces, which are impossible to see from the player's normal perspective.

1.2 Approaches to the problem

There are two main schools of thought for showing 4d hypershapes in 3d space: Projection and Slicing.

Projection In the projection method, the entire shape is crushed down into 3d space, allowing all parts of it to be seen at once. This gives rise to the classic tesseract shape of a hypercube, which apears to be a small cube inside a larger cube.

In Figure 2, both the inner and outer cubes are the same size, one is just farther away along the 4th axis. It is analogous to how in Figure 1, one square is smaller than the other, even though they would be the same size in

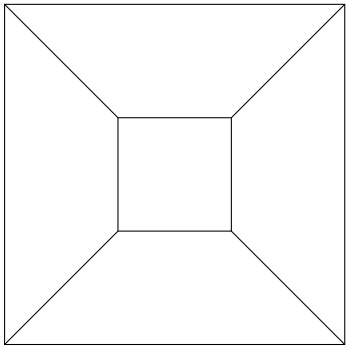

Figure 1: Shadow of a wireframe cube

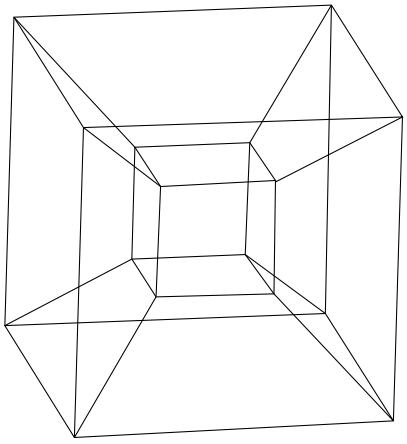

Figure 2: Shadow of a wireframe tesseract

the real cube.
In addition to this, all the pyramid-shaped areas in Figure 2 are cubes, like how the trapezoids in Figure 1 are actually squares.

Slicing The other method is simply taking a 3d cross-section of the hypershape. This is like cutting a 3d shape with a knife, and looking at the shape of the cut. If a cube is cut in line with one of the sides, the cross section will be a square. Similarly, if a tesseract is cut in line with one of it's faces, the cross-section will be a cube. This would show a hypercube just as a normal cube, and would not allow the viewing of all parts of the hypershape at the same time, which is a lot easier for a person to see and understand, but an additional control is needed to move through the 4th dimension.

1.3 Benefits of suggested approach

When I do this, I would prefer the slicing method over projection. This view is more intuitive from a 3d perspective, as looking at it would be akin to looking at a 3d scene. However, moving along the 4th dimension would make the shapes appear to morph and shift, when in reality they are simply being moved.

1.4 Potential challenges

4D maths is very hard, and I have been working on and off on it for over a year now, without significant headway being made. However, since this is actually being done for the uni now, I should be able to get more support from uni staff with this matter, which shopuld help me along massively.
The player might also have trouble understanding what is going on when they move through the 4th dimension. I could try to mitigate this through storytelling or tutorials, and through the visuals. I could try fading the geometry along the 4th dimension, so that the player could see it fading in and out, however that may make it hard to discern what is passable and not.