Theoretical Properties of the Fourth Dimension

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Although the existence of universes with either fewer (1 or 2) or more (4+) dimensions than our own 3-d universe can't at present be proven, (and, indeed, possibly never will be) neither can their existence be disproven. Therefore, I will hypothesize that they exist, and, furthermore, assume that the latter (4+) are governed by physical laws similar to those of our own universe. If these two hypotheses are true, then the following may also be taken as true.

I will start off with three borrowed concepts. First of all, we know that the first dimension goes in one direction, say the horizontal line passing through point X in diagram A (see page 16). The second dimension would be represented by the vertical line passing through point X at right angles to the first. The third dimension, while represented by the dotted line, would actually be a line sticking straight up and down out of the paper, also passing through point X, and at right angles to both the first and second dimensions. A fourth dimension would also pass through point X and be perpendicular to all of the first three.

Secondly, there is the theory that an object transferred from its native universe into one that is one dimension higher, given a half rotation, and then returned to its original world, would be an exact reversal, a mirror image, of what it once was. In diagram B, a line segment in a 1-d world, which is dotted on top and solid on the bottom, can only move up and down. There is no way for the dots to get on the other side of the solid line. But take it into a 2-d world, give it a half turn, and stick it back into its 1-d world, and it is completely reversed, down to its basic subatomic particles.

The same with 2-d object in diagram C. Left in its planer universe (C-1) it can only rotate in a clockwise or counter-clockwise direction, (as well as being able to move forward, backward, left and right, of course). But take it out into a 3-d universe (C-2), turn it half way around and then put it back, and it too becomes its own reflection (C-3). Again the reversal would be complete, down to the smallest detail. Similarly, a 3-d object, taken into a 4-d world and given a four dimensional half twist and then returned to its original world, would be completely reversed.

Thirdly, there is the differing of distances among the worlds. For instance, the 1-d world represented by the curved line AD in diagram D is straight, from the point of view of any 1-d creatures living in it. In this 1-d world, point B is closest to A, point C is next, and point D is farthest. Furthermore, point D appears twice as far from point A as B is. But from a 2-d point of view, C is closest to A with points B and D equi-distant from A. The same type of relationship exists when a 2-d world is folded over three dimensionally (diagram E). B is closer than C to A, two dimensionally, but the reverse is true three dimensionally.

Now for my own work. The simplest 1-d structure possible is a line. The simplest 2-d structure possible is a triangle. The simplest 3-d structure possible is a pyramid with a triangular base, diagram F. The line needs two points (at least), the triangle needs three (joined by lines), and the pyramid needs four. The simplest 4-d structure possible then, must consist of 5 points joined by lines. The 2-d triangle is made up of three 1-d lines. The 3-d pyramid is made up of four 2-d triangles. The 4-d structure, therefore, should be composed of five 3-d triangular based pyramids.

A line has two sides (its no dimensional ends, diagram G), a square four sides, and a cube six. A 4-d "cube," therefore, should have eight sides.

1-d objects have length. 2-d objects have length (and width), and area. 3-d objects have length (width and height), area (surface) and volume. 4-d objects should then have length, area, volume, and something more again.

Another concept is "unlimited vision." This means that everything in a world of X-dimensions is visible to beings in a universe one or more dimension(s) greater. For instance, the middle point in diagram H is invisible to the two line beings X and Y because the two endpoints block their vision. But the mid point is perfectly visible to the two square beings A and B in their 2-d world, as are all parts of X and Y. In turn, creatures A and B can't see the dot inside circle L because from their 2-d viewpoint it is completely surrounded. But we can see it, as well as all parts of A and B. In turn, something totally enclosed by a box in the 3-d world would be perfectly visible to a 4-d world. Note that 2-d creatures can look inside only a 1-d world, while we 3-d creatures can see inside both 1- and 2-d worlds. A 4-d creature should, therefore, be able to see into 1-, 2- and our 3-d world.

Then we come to the intersection of lines and planes. In a 1-d world, the intersection of either lines or planes is impossible. In a 2-d world (diagram I), two lines extending out to infinity in both directions, can be either parallel or intersecting. Two planes cannot. In a 3-d world, two planes, extending out to infinity along two dimensions, can be either intersecting or parallel (diagram J) as can two lines; two infinite cubes (cubes extending out to infinity in all three dimensions) cannot.

In a 4-d world therefore, two infinite cubes should be able to be either parallel or intersecting. When two lines intersect, their intersection is no dimensional (a point). When two planes intersect, their intersection is 1-dimensional (a line). Therefore, when two infinite cubes intersect in a 4-d world, their intersection should be 2-dimensional, a plane.

Also, in the 3-d world 1-d lines can intersect, be parallel or skew (one goes over the other) (diagram K). Therefore, in a 4-d world, two planes should be able to "skew."

This brings us to the next concept - the intersection of an X-dimensioned object by an X-minus-one dimensioned world. For example, if a 2-d circle passes through a 1-d world, (diagram L) it would first start out as a point (line 1) appearing out of nowhere from a 1-d point of view, expand into a line (line 2) which would get longer until its length matched that of the circle's diameter (line 3). Then it would get shorter again (line 4) until it was once more a point, which would then "vanish," again from a 1-d viewpoint. A 3-d object passing through a 2-d world would follow a similar pattern. It would also apparently come out of nowhere, starting as a point (diagram M), grow into a circle as the sphere progressed and get larger and larger until the circle matched the sphere's diameter (as the line matched the circle's diameter before). The circle then would get smaller until it was back to a point, which would then "vanish."

A similar pattern should be followed if a 4-d sphere passes through a 3-d world. It would start out as a point appearing out of "nowhere," grown into a 3-d sphere which would become larger and larger until it matched the 4-d sphere in diameter. It would then shrink until it was once again a point which would go as the 4-d sphere passed out of the 3-d world.

If an X-dimensioned object were to leave its respective X-dimensioned world and move into an X-1 dimensioned world, how would it go? All at once? Or would it leave a little at a time as though going through a doorway? To answer this question two things must be taken into account. Was the X-dimensioned object moving or stationary in its respective world, and was its world straight, or bent from an X+1 dimensional point of view? As an example let's take a 1-d object in a 1-d world which is bent at one point two dimensionally (diagram N) although it appears straight from a 1-d point of view. If it is moving in the direction indicated, it would be possible for it to leave its world a little at a time, but only if it was moving and only if its world is "bent." The same is true of the circle in its 2-d world (diagram O).

On the other hand, if one or both of these conditions is not met, then the object could only go all at once; there one instant, gone the next. For example, the line in diagram P has no width whatsoever so it can't be depicted in the circle, half in and half out of its world. It's there or it isn't. The same with the circle in diagram Q. So a 3-d object leaving this world should also follow this pattern and vanish either all at once or into a crook in the universe.

However, one could say that the object would curve with its respective universe (diagram R) since it is straight from the object's point of view. However, while this is undoubtedly true for most cases (and probably true for all), there might be exceptions. For instance, if the object were travelling fast enough, it might "break out," much like a car rounding a corner too quickly. Of course, the car has mass and thus inertia, but, while it is impossible for 1- and 2-d objects to have mass, 3-d objects do. Perhaps that is why, supposedly, nothing can travel faster than light in our universe; going any faster might cause us to "run off the road."

Also an object might leave its respective universe if it were pushed from outside. For example, a 1-d object could be pushed out into the 2-d world by a 2-d object (diagram S) or the 2-d object could be pushed into the 3-d world by a 3-d object (diagram T). Thus a 3-d object might leave this universe if given a boost from the fourth dimension.

Conclusion

In conclusion, I will list the properties of the 4th dimension. It is at right angles to the first three. A 3-d object taken into a 4-d world and given a half rotation would be completely reversed. Distances in the 4-d world differ from distances in the 3-d world. The simplest 4-d structure consists of five points joined by lines and has in it five 3-d triangular pyramids. A 4-d cube should have eight sides. 4-d objects have length, area, volume, and something else. Everything in a 3-d world is visible from a 4-d point of view. Two planes may skew in a 4-d world. Two infinite cubes may intersect. If a 4-d sphere is intersected by a 3-d world, it would start as a point, grow into a 3-d sphere and back again. A 3-d object going into a 4-d world could leave either all at once or into a corner in the universe. Our universe might be curved from a 4-d point of view, and travelling faster than light might cause us to break out. A 3-d object might be pushed out of this universe from outside. There are, undoubtedly, more things that could be concluded if one took the time to think about it.

Diagram A

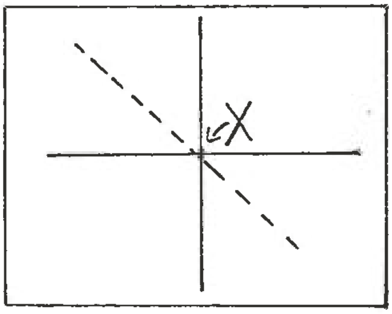

Diagram B

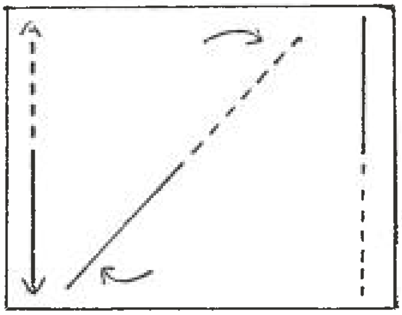

Diagram C

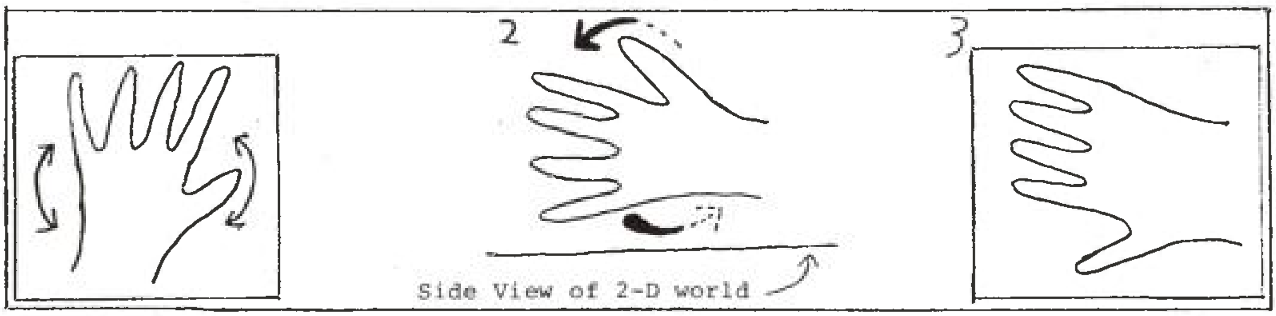

Diagram D

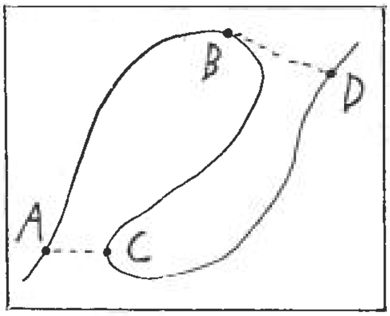

Diagram E

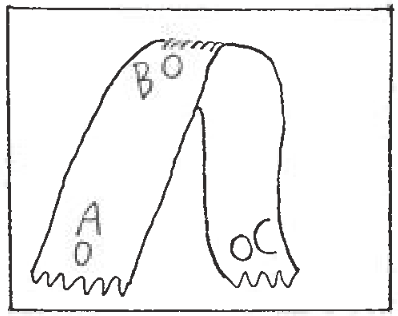

Diagram F

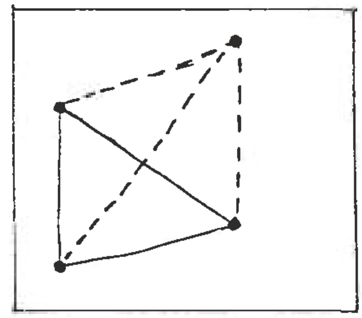

Diagram G

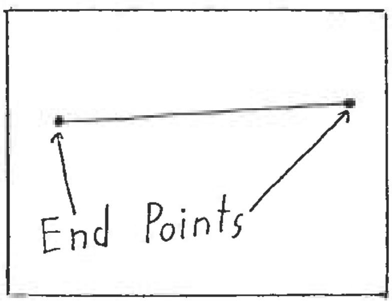

Diagram H

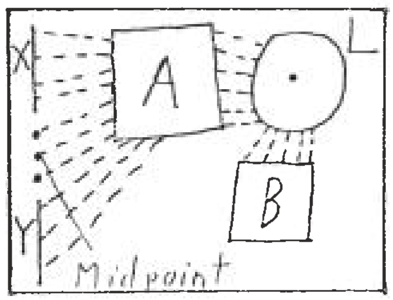

Diagram I

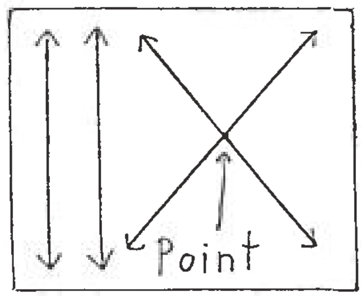

Diagram J

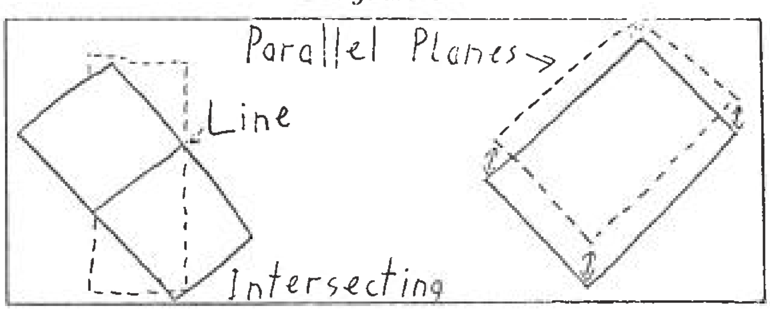

Diagram K

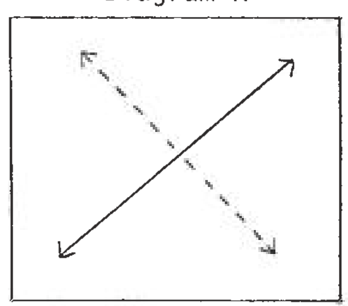

Diagram L

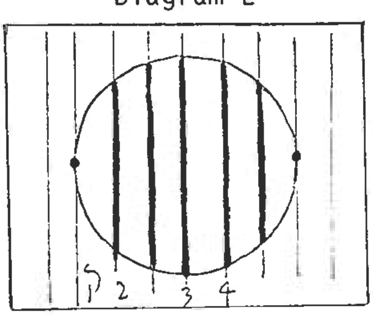

Diagram M

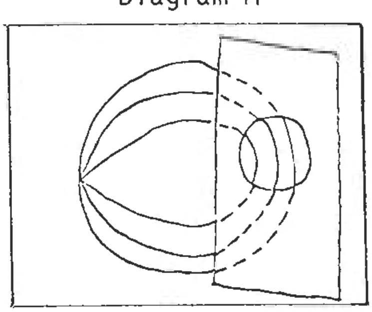

Diagram N

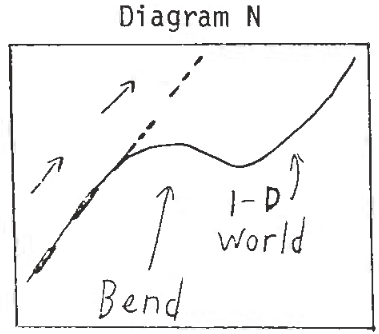

Diagram O

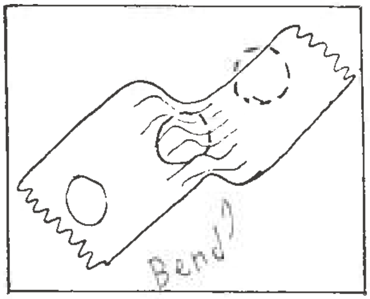

Diagram P

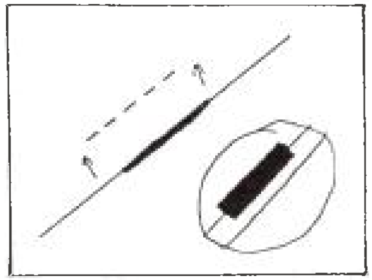

Diagram Q

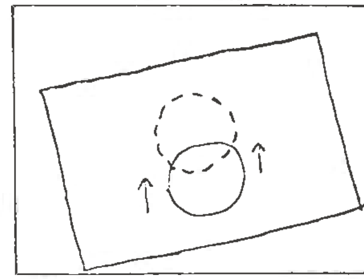

Diagram R

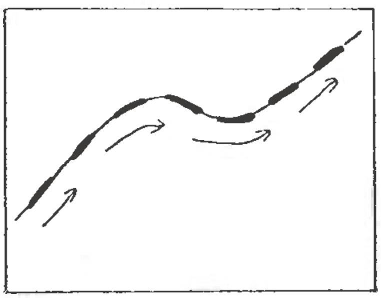

Diagram S

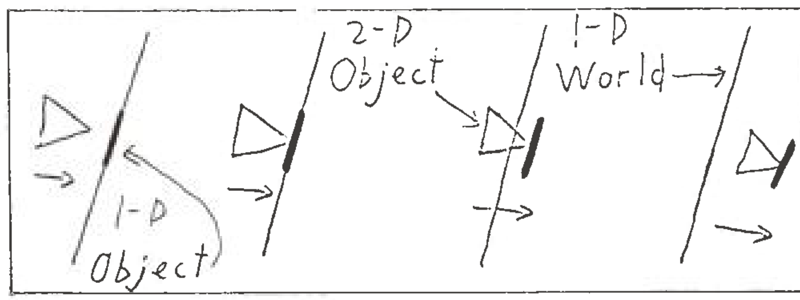

Diagram T