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# Higher Dimensions in the Writings of C.S. Lewis

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"There arose gigantic before her the edge of a world of such incredible dimensions that she was breathless at the faint hint."[1]

Charles Williams

There are many relationships or connections between mathematics and literature, or more generally, between science and the arts. For example, as early as 1931 Charles Williams was discussing alternate universes in his book Many Dimensions[2] in a remarkably similar way to the descriptions by the physicist Paul Davies in his 1980 book, Other Worlds: Space, Superspace and the Quantum Universe. As another example, the mathematical concept of infinity inspired a series of prints by M.C. Escher attempting to capture the idea of infinity on a finite two-dimensional sheet. This kind of fertilization is not one way. Directly or indirectly each form of culture influences every other form of culture.

Mathematicians throughout history have recognized the role of imagination in mathematics. One of the great British mathematicians of the last century, Augustus DeMorgan (teacher and friend of Lord Byron's mathematically talented daughter) said that the moving power of mathematical invention is not reasoning but imagination. The twentieth-century mathematician, Herman Weyl, said, "Science would perish without a supporting transcendental faith in truth and reality, and without the continuous interplay between its facts and constructions on the one hand and the imagery of idea on the other."[3] The philosopher of science, Karl Popper, has said that the reason we can achieve knowledge is, "Because we can invent myths, stories, theories; because we have a thirst for explanations, an insatiable curiosity, a wish to know. Because we not only invent stories and theories, but try them out and see whether they work and how they work... [for example] by making up a myth about 'invisibles' such as atoms or gravitational forces which explain the visible."[4] Voltaire went so far as to say, "There is an astonishing imagination, even in the science of mathematics... there was far more imagination in the head of Archimedes than in that of Homer."[5]

There are times when our imaginations need to be stretched so that we can have even the possibility of comprehending reality; times when the imaginative constructs of the past are inadequate for the present and our minds are not yet capable of creating the necessary new constructs. Before geometry could begin, someone had to imagine a straight line. Geometrical lines do not exist in the real world. Our closest approximations are not perfectly straight and must have three dimensions even if two of its dimensions are very small. A geometrical line, having only one dimension, could not be seen. Thus, the concept had to come from someone's imagination. Then it could be used to help us understand the real world. Euclidean geometry has certainly helped us to do that.

In the mid-nineteenth century several mathematicians, Gauss, Bolya, and Lobachevsky, had

imaginations powerful enough to conceive of the possibility that, in a given plane, there might be no parallels to a given line through a given point. Some other mathematicians, Saccheri, for example, had studied the problem just as much or possibly more than Gauss, Bolya, and Lobachevsky, but his mind did not make the necessary imaginative construct and so he was unable to develop non-Euclidean geometries. Other imaginative minds constructed various kinds of models to help us understand non-Euclidean geometries and others developed them. These geometries helped to stretch men's minds and within a half century Einstein used one of them as a basis for a new model of reality, his theory of relativity.

Imagination is important in that it allows us to have knowledge of truth which exceeds propositional truth. Human language is finite; we are limited in what we can express. God is infinite and so finite human language cannot describe God completely in propositional form. And, of course, we are finite and there is no way we can completely comprehend God. But through imaginative constructions we may be able to apprehend some reality about God which we are unable to put into propositions. Writers like Tolkien, Lewis, and Williams expand our minds, making us aware of new possibilities, and helping us to make sense out of difficult parts of reality.

C.S. Lewis has said, a story may do "what no theorem can quite do. It may not be (like real life) in the superficial sense: but it sets before us an image of what reality may well be like at some more central region."[6] For example, God's sovereignty and man's freedom have successfully defied man's attempt to describe them in words. I believe that Lewis' imagination can take us a little further toward understanding those concepts through his description of the struggle between good and evil in the unfallen planet, Perelandra, and through the experiences of some of the bus travelers from the grey city in The Great Divorce.

There was one mathematical concept that Lewis must have pondered often. He used it creatively in over a dozen of his books, both fiction and non-fiction. He used it to enrich his stories and to help us understand the nature of God. This is the concept of four or more space dimensions. Einstein has used time as a fourth dimension, but here we are considering the possibility of more than three spatial dimensions. I am not aware of mathematicians doing this before the nineteenth century so this may be an example of mathematics borrowing an imaginative concept from philosophy or literature. However, since the mid-nineteenth century it has been extensively developed by mathematicians and then used by Lewis and many others.

Even though our intuition seems to be limited to a space of three dimensions, this did not keep mathematicians from using their imagination to create a four-dimensional geometry. By analogy from two and three dimensions, they could make some assumptions about four and use reason to develop it. Mathematical reasoning is not restricted to three dimensions or for that matter, to four. So mathematicians have had great fun building five, six, and even infinite- dimensional geometries.

It might seem that these creations are purely imaginary with no relation at all to reality. First of all, though, they were valuable to mathematics. By using reason in these different situations, they contributed to our insight into the reasoning process and even though the geometry was strange it did contribute to the corresponding algebra. So higher-dimensional geometries became an important part

of mathematics.[7]

The really surprising thing about these new geometries is that physicists found applications for them. Einstein found that a four-dimensional geometry developed by the German mathematician, Bernhard Riemann, had precisely the right characteristics to be used in his theory of relativity to explain gravity. As physicist William G. Pollard, Executive Director of the Oak Ridge Institute of Nuclear Studies and an Episcopal priest, relates it, "how planets move or how gravity behaves had not the slightest influence on Riemann in the development of his geometry. Only the human mind and imagination were involved in that development"[8] Perhaps even more surprising is the application of an infinite-dimensional geometry developed by David Hilbert with no idea of any connection with the real world. Physicists have used Hilbert's geometry to describe "accurately all the properties of atomic nuclei, atoms, molecules, and crystalline solids."[9]

One other contribution of higher-dimensional geometries is the way it stretches our imaginations, expands our horizons (I wonder what horizons are like in a space of five dimensions?), makes us aware of new possibilities, as Lewis' space trilogy does, and thus aids us in a new and deeper understanding and appreciation of reality. A device employed by Edwin A. Abbott in his classic book Flatland will help to illustrate this. Approximately a century ago, Abbott, a schoolmaster with primary interests in literature and theology, wrote a captivating story of spaces of various dimensions.

By way of summary, imagine a completely flat universe, something like the top of a table or a perfectly level floor. In this universe, called Flatland, there are creatures of various, more or less regular, shapes; triangles, squares, other polygons, and even circles. They are capable of movement, rational thought, emotions and other human-like characteristics. They live in houses which appear like floor plans to us looking down on them. Many questions could be raised (some of which could be answered) concerning these creatures. The main thing we must keep in mind is that they are completely restricted to two dimensions. They have no experience and no conception of a third dimension.

One of the creatures, a square, is alone in his study with the door closed. Incidentally, he is a mathematician. He feels secure within his four walls and has no idea that we can look down on him in his room. We can, in fact, see inside of him as well as the inside of his room. (See Figure 1.)

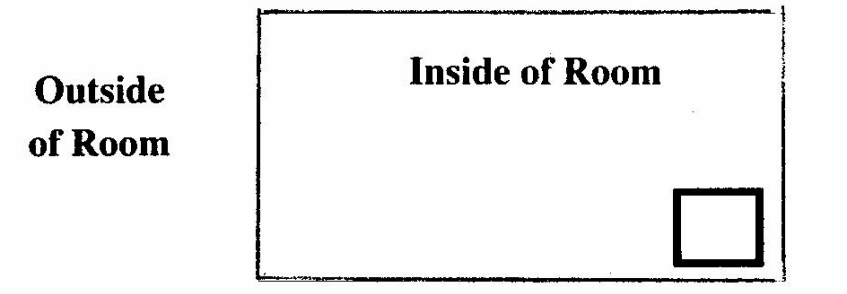



Figure 1.

Suddenly, in the closed room, the square is shocked to see a small circle appear and grow larger. From our vantage point we can see that a sphere has dropped into his room from the third dimension. The sphere tries to make the square understand that he is a sphere and not just a circle with a variable radius. The square, having no concept of a third dimension, cannot understand the sphere at all. Finally, in desperation, the sphere snatches the square and drags him out of his plane into the third dimension.

Then the square can look back on Flatland and, through a long conversation with the sphere, can understand the nature of three-dimensional space. Recently, it seems providentially, the square had had a dream about Lineland. So the square can use the process of going from one dimension to two as an analogy to help him in going from two to three. For example, in his dream he dropped into the line from his two-dimensional world, but to the Linelanders he appeared to be a line segment, just as the sphere had appeared to him to be only a circle.

Finally, in their conversation, the square announces that he has mastered this step and is ready to move on to a higher dimension. Now it is the sphere's turn to be confused, he knows nothing of a fourth dimension and insists that there is none. The square having made the difficult transition from his native two dimensions into three can readily imagine a fourth and even higher order dimension, but the sphere cannot. The sphere can make nothing of the square's argument for a fourth and eventually deposits the square back in Flatland. Now the square has the unenviable, and in fact, impossible task of convincing his fellow Flatlanders of the existence of a third dimension. He seems compelled to try. He ends up in solitary confinement. If you are interested in learning more about Flatland and the square's adventure, I heartily recommend that you read the book.[10]

Perhaps I should tell you about one of the square's devices for moving into higher dimensions. I do this for two reasons, one to give an idea of how these analogies might work and because we will use this particular one later. Figure 2 should be helpful in following this discussion.

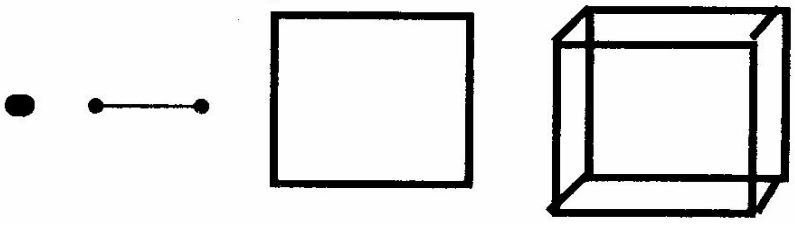


Figure 2.

First of all, there is only one zero-dimensional object, a point. In a line, if you take two of these points or zero-dimensional objects and join them, you get a one-dimensional object, a line segment. In a plane if you take two of these line segments or one-dimensional objects and join their endpoints, you get a two-dimensional object, a square. In space, if you take two of these squares or two-dimensional

objects and join their vertices, you get a three-dimensional object, a cube. Now, said the square, if you take two cubes in the space of four dimensions and join their vertices, you get a four-dimensional object. Although the square did not know its name, mathematicians call this hypothetical fourth dimensional analogue of a cube a tesseract. Figure 2 does not contain a drawing of a tesseract because a two-dimensional (which is what a sheet of paper is) model of the fourth dimension is quite complicated. I do have a three dimensional model of a tesseract hanging in my office. It was easy to make out of sticks. It just takes two cubes with their vertices connected. We will return to a discussion of these figures later. At this point you may feel like Dorothy L. Sayers who commented that "trying to visualize the fourth dimension (is an) admirable exercise for the imagination, but arduous and inconclusive."[11]

For anyone interested in learning more about this subject, I would recommend the books, The Fourth Dimension Simply Explained[12], edited by Henry P. Manning and The Fourth Dimension by Rudy Rucker.[13] The Manning book is a collection of essays in response to a request from the journal Scientific American. Regardless of how much mathematics of the fourth dimension is developed or even applied, the status of its existence is described by Manning in this way. "Even a workable hypothesis based on the existence of four-dimensional space, though it might serve temporarily better than any other hypothesis, would hardly justify a belief in this existence. But we do say that the existence of space of four dimensions can never be disproved by showing that it is absurd or inconsistent; for such is not the case. Nor, on the other hand, will the most elaborate development of the analogies of different kinds ever prove that it does exist."[14] In other words, no matter how interesting and useful it is we will never know if it is true and, on the other hand, no matter how strange and opposed to our intuition it is, we will never know that it is false.

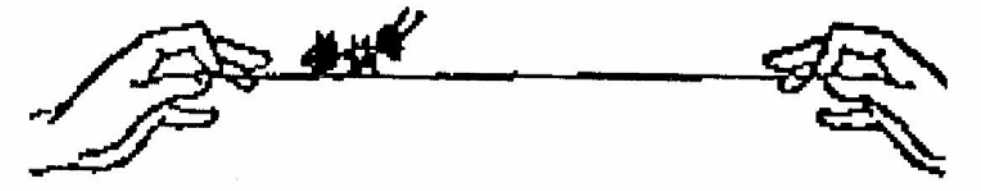
In The Dialogues (Book VII) Plato has Socrates tell of a group of people who are chained in a cave. They are facing a wall and cannot look behind them. There is a fire behind them, so that all they can see are shadows on the wall of the cave. As a student in The Dialogues says, the truth for these people would be literally nothing but the shadows. Now, shadows, of course, are only two-dimensional. Therefore, reality for these three-dimensional beings has been restricted to two dimensions. Perhaps we are four, or higher-dimensional beings restricted to three-dimensional experience. As Lewis has said, "it is possible that our material world... is the copy of an invisible world."[15]

We have already seen that higher-dimensional geometry is profitable in understanding nuclear physics. Pollard describes how, shortly after World War II, it was thought that matter could be adequately described in terms of protons, neutrons, and electrons. Then it was discovered that they are in turn made up of a throng (or rabble) of other particles which in turn may be made up of very elusive particles called quarks. It begins to appear as though when, if ever, we get to the very heart of matter we will find, not matter, but simply mathematical properties. As Pollard says, "Like Plato's famous cave, the whole material universe in three-dimensional space and time with all its seeming substantiality may be at heart made up of mere shadows of realities which transcend space and time and so are inaccessible to our direct observation."[16] If this is right, then truth is, for us in this life, nothing but the three dimensional shadow of reality.

Before looking at Lewis' use of the fourth dimension, we might consider a few other Christian writers. In the short story "The Image in the Mirror,"[17] Dorothy L. Sayers has a character who believes he has been flipped through the fourth dimension. He comes to this (erroneous) conclusion after reading "The Plattner Story" by H.G. Wells in which someone actually experiences this extra dimensional trip.

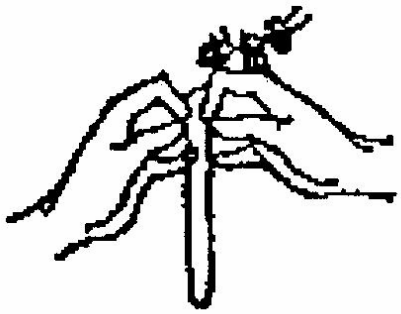
A fourth space dimension is used extensively by Madeleine L'Engle in A Wrinkle in Time. The main use is to travel quickly through astronomical distances by using the extra dimension. L'Engle describes it as follows: "Mrs. Who took a portion of her white robe in her hands and held it tight.

`You see,' Mrs. Whatsit said, `if a very small insect were to move from the section of skirt in Mrs. Who's right hand to that in her left, it would be quite a long walk for him if he had to walk straight across.'"



"Swiftly Mrs. Who brought her hands, still holding the skirt, together.

`Now, you see,' Mrs. Whatsit said, `he would be there, without that long trip. That is how we travel.'"[18]



Since time is one-dimensional and a line can be wrinkled as in the above diagram, time travel is possible also. As Mrs. Which says, "We tesser (from tesseract). Or you might say we wrinkle."[19]

In Many Dimensions, Charles Williams also makes extensive use of extra space dimensions and even considers the possibility that time is two dimensional. "The past might, even materially, exist; only man was not aware of it, time being, whatever else it was, a necessity of his sensuousness. `But because I can only be sequentially conscious,' he argued, `must I hold that what is not communicated to consciousness does not exist? I think in a line -but there is the potentiality of the plane.' This perhaps was what great art was - a momentary apprehension of the plane at a point in the line."[20] Lewis also based his unfinished story "The Dark Tower" on the idea that time is two-dimensional.

We know from Lewis' diary[21] that by the age of 24 he was considering implications of a fourth

dimension. I don't know when Lewis read Flatland, but from his biographers[22] and his own writings we know that he did read and enjoy it. This concept of higher dimensions certainly influenced his development of Perelandra. In it, he even has a footnote, probably fictitious, crediting Natvilcius, 1627, with the idea that angels or eldila are higher-dimensional beings.[23] Actually, Natvilvius probably comes from the Anglo Saxon, Nat Whilk, which means "I know not whom". Lewis had used Nat Whilk as a pen name. He could have referred to the real seventeenth century scholar, Henry More, instead of the ficitious Natvilcius. More, who influenced Isaac Newton's ideas about space, did suggest that spirits may be four-dimensional. Lewis had studied More as a possible thesis topic.

Lewis' beautiful descriptions of the eldila in the latter part of Perelandra owe much to his contemplation of higher dimensions. In describing the Great Dance of God's creation he writes "the whole solid figure of these enamored and inter-inanimated circlings was suddenly revealed as the mere superficies of a far vaster pattern in four dimensions and that figure is the boundary of yet others in other worlds: till suddenly as the movement grew yet swifter, the interweaving yet more ecstatic, the relevance of all to all yet more intense, as dimension was added to dimension and that part of him which could reason and remember was dropped farther and farther behind that part of him which saw, even then, at the very zenith of complexity, complexity was eaten up and faded, as a thin white cloud fades into the hard blue burning of the sky, and a simplicity beyond all comprehension, ancient and young as spring, illimitable, pellucid, drew him with cords of infinite desire into its own stillness."[24] If one imagines a Flatlander observing the cross sections of a stellated dodecahedron (or any interesting solid) as it drops through a plane and then gradually acquires three-dimensional sensibilities so that he or she can comprehend the solid in all its three-dimensional beauty, then Lewis' description takes on new meaning.

He also uses the idea of dimensions in comparing Malacandra, Earth, and Venus. "He had seen already how the pattern grows and how from each world it sprouts into the next through some other dimension. The small external evil which Satan had done in Malacandra was only a line: the deeper evil he had done in Earth was as a square: if Venus fell, her evil would be a cube - her redemption beyond conceiving. Yet redeemed she would be."[25]

The children in The Magician's Nephew drop into and out of rooms (the doors being shut) as they travel from London to the Wood between the Worlds much as three-dimensional beings could do in two dimensions or four-dimensional beings could in three. Lewis' descriptions of these travels were enhanced by his reading and contemplation of the fourth dimension.

I believe that Lewis' most extensive and most profound use of higher dimensions occurs in the sermon "Transposition." In it he points out that whenever something in a richer medium is described in a lower medium there cannot be a one to one correspondence. For example, as in Figure 2 a cube represented in a plane must use parallelograms to represent squares while in the same drawing another parallelogram may represent a parallelogram. In a similar way, if we try to explain a spiritual experience we must use terms which a good psychologist would recognize as psychological experiences with meanings in other settings. In fact, after trying to explain a cube to a Flatlander, the Flatlander would probably respond, "You keep on telling me of this other world and its unimaginable shapes which you call solid. But isn't it very suspicious that all the shapes you offer me as images or reflections

of the solid ones turn out on inspection to be simply the old two-dimensional shapes of my own world as I have always known it? Is it not obvious that your vaunted other world, so far from being the archetype, is a dream which borrows all its elements from this one"?[26] Although we can understand the difficulty the Flatlander has, how else could one try to explain a three-dimensional object to a Flatlander except by using concepts from his world? And, as three-dimensional beings we know that his argument does not destroy the reality of three dimensions. In the same way, the psychologist's argument does not destroy the possibility of a spiritual reality.

A similar thing occurs in The Silver Chair when the children try to explain the overworld to the wicked witch of the underworld. For example, when they tell her about the sun they must use something from the underworld, lamps, to describe it, or in describing Aslan they use cats. The witch replies, "And look how you can put nothing into your make-believe without copying it from the real world, this world of mine, which is the only world."[27]

In Mere Christianity, Lewis uses two and three dimensions to aid in our understanding of the Trinity. "On the human level one person is one being, and any two persons are two separate beings - just as, in two dimensions (say on a flat sheet of paper) one square is one figure, and any two squares are two separate figures. On the Divine level you still find personalities; but up there you find them combined in new ways which we who do not live on that level, cannot imagine. In God's dimension, so to speak, you find a being who is three Persons while remaining one being, just as a cube is six squares while remaining one cube. Of course, we can not fully conceive a Being like that: just as, if we were so made that we perceived only two dimensions in space we could never properly imagine a cube. But we can get a sort of faint notion of it. And when we do, we are then, for the first time in our lives, getting some positive idea, however faint, of something super-personal - something more than a person."[28]

Elsewhere, Lewis writes, "At this point we must remind ourselves that Christian theology does not believe God to be a person. It believes Him to be such that in Him a trinity of persons is consistent with a unity of Deity. In that sense it believes Him to be something very different from a person, just as a cube, in which six squares are consistent with unity of the body, is different from a square. (Flatlanders, attempting to imagine a cube, would either imagine the six squares coinciding, and thus destroy their distinctness, or else imagine them set out side by side and thus destroy the unity. Our difficulties about the Trinity are much of the same kind.)"[29]

In Miracles, Lewis elaborates on what is meant by believing that God is super-personal. "The Christian means by this that God has a positive structure which we could never have guessed in advance, any more than a knowledge of squares would have enabled us to guess at a cube. He contains `persons' (three of them) while remaining one God, as a cube combines six squares while remaining one solid body. We cannot comprehend such a structure any more than a Flatlander could comprehend a cube. But we can at least comprehend our incomprehension, and see that if there is something beyond personality it ought to be incomprehensible in that sort of way. The Pantheist on the other hand, though he may say `super-personal' really conceives of God in terms of what is sub-personal - as though the Flatlanders thought a cube existed in fewer dimensions than a square."[30]

In another essay he writes, "To explain even an atom Schrodinger wants seven dimensions: and give us new senses and we should find a new Nature. There may be Natures piled upon Natures, each supernatural to the one beneath it, before we come to the abyss of pure spirit; and to be in that abyss, at the right hand of the Father, may not mean being absent from any of these Natures - may mean a yet more dynamic presence on all levels."[31] In reply to Dr. Pittenger who criticized him for this use of geometry in theology, Lewis wrote, "I do not understand what is vulgar or offensive, in speaking of the Holy Trinity, to illustrate from plane and solid geometry the conception that what is self-contradictory on one level may be consistent on another. I could have understood the Doctor's being shocked if I had compared God to an unjust judge or Christ to a thief in the night; but mathematical objects seem to me as free from sordid associations as any the mind can entertain."[32]

At a meeting of the Socratic Club in Oxford in 1945, while discussing Jesus after the resurrection, Lewis says, "He apparently passed into some spatial relationship with a new universe. The senses of His new body were responsive to multidimensional space and to a time that was not unilinear...From the local appearances, from the accounts of Christ's eating, it would seem that the new nature was at some points interlocked with the old. That to our view it was supernatural and yet it was natural. This to the modern mind, conceiving of nothing real between the unconditional and the world of our senses, was shocking, but reality...was like a skyscraper with several floors. God could create more systems than one, and there might be natures piled upon natures."[33]

In a 1942 sermon delivered in St. Jude on the Hill Church, London, Lewis comments on the Ascension, "a being still in some mode, though not our mode, corporeal, withdrew at His own will from the Nature presented by our three dimensions and five senses, not necessarily into the non-sensuous and undimensional, but into, or through, a world or worlds of super-sense and super space. And He might choose to do it gradually. Who on earth knows what the spectators might see? If they say they saw a momentary movement along the vertical plane - then an indistinct mass - then nothing - who is to pronounce this improbable?"[34]

To help us understand some comments Lewis makes in "The Problem of Pain" let us consider Flatland one more time. If I were to stick my five fingers on one hand into the plane of Flatland, the inhabitants of that plane would see five distinct objects, the planar cross-sections of my fingers. They would not suspect, in fact, could not be made to believe, that they were all parts of the same object. If we are three-dimensional cross-sections of four-dimensional reality, perhaps we are parts of the same body. In fact, we know we are parts of the same body in some way, this four-dimensional idea just may help us to see it more clearly. Remember the preceding comments are mine, not Lewis'. He puts it this way, "That we can die `in' Adam and live `in' Christ seems to me to imply that man as he really is differs a good deal from man as our categories of thought and our three-dimensional imaginations represent him; that the separateness... which we discern between individuals, is balanced, in absolute reality, by some kind of inter-inanimation of which we have no conception at all. It may be that the acts and sufferings of great archetypal individuals such as Adam and Christ are ours, not by legal fiction, metaphor, or causality, but in some much deeper fashion. There is no question, of course, of individuals melting down into a kind of spiritual continuum such as Pantheistic systems believe in; that is excluded by the whole tenor of our faith. But there may be a tension between individuality and some other principle... Legal fiction, adoption, and transference or imputation of merit and guilt,

could never have played the part they did play in theology if they had always been felt to be so artificial as we now feel them to be."[35]

In conclusion, the imaginative construct of higher dimensions may have originated in philosophy or poetry but it was developed and used extensively in mathematics. Lewis was aware of at least some of this mathematical development through Abbott's book and probably through other sources as well. He used the ideas from mathematics to help us understand the transcendence of spiritual reality over the reality of our five senses. After reading Perelandra we have a better understanding of heavenly beings. In The Silver Chair ordinary objects such as cats and a lion, lamps and a sun, are used to show the limitations of our experiences. Then in his sermon "Transposition", two, three, and four dimensions are used to illustrate how spiritual experiences transcend physical experiences and at the same time show the necessity of using one to describe the other. In several places he uses dimensions to help us understand the trinity and the nature of Jesus after the resurrection. Even the unity of humankind is seen in a new light by means of higher dimensions. Although other Christian and non-Christian writers have used the concept of higher dimensions, perhaps none have used it as extensively and creatively as Lewis has to illuminate the spiritual world in both his fiction and nonfiction.

## ENDNOTES

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4. Karl R. Popper. Conjectures and refutations: the Growth of Scientific Knowledge. (New York: Harper & Row, Publishers, 1965), p. 95.

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7. For anyone interested in learning a little bit more about this, there is a good pamphlet (only 28 pages) written by Adrien L. Hess and published by the National Council of Teachers of Mathematics, entitled Four-Dimensional Geometry, An

Introduction.

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33. James T. Como, Ed. C.S. Lewis at the Breakfast Table. (New York: MacMillan, 1979), p. 151.

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