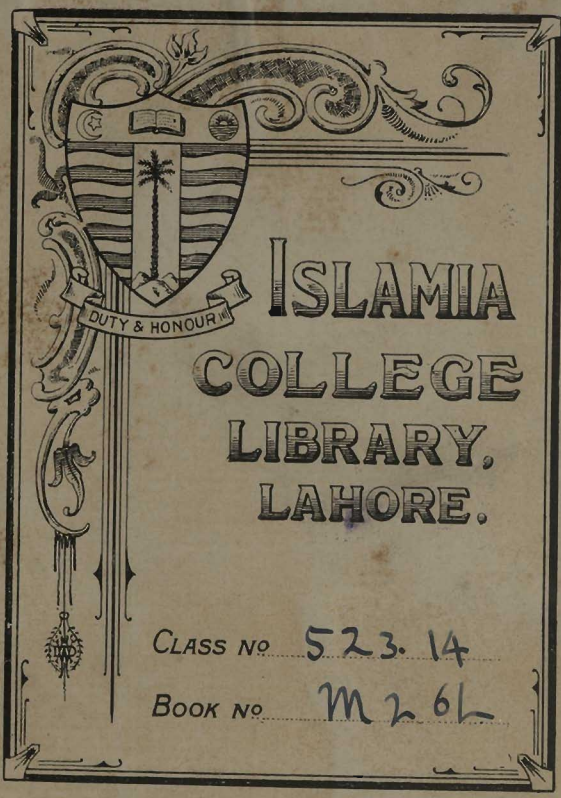


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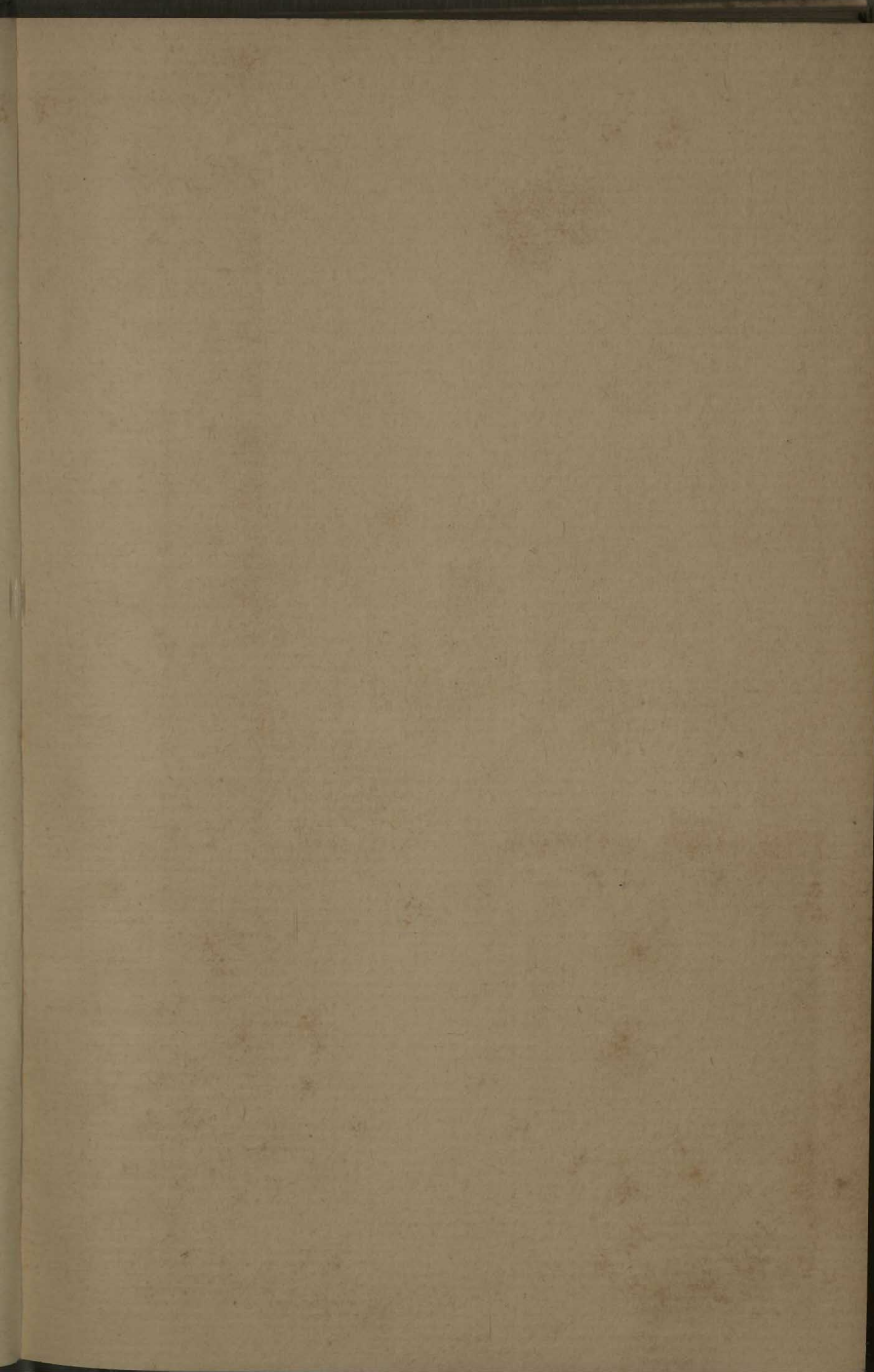
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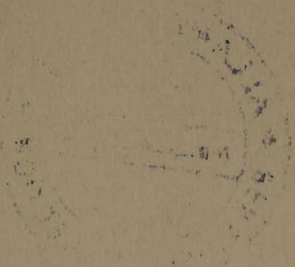
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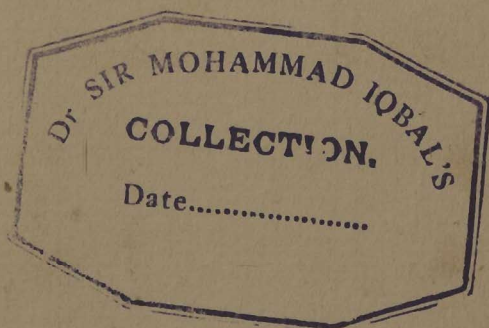
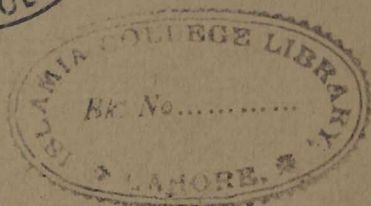
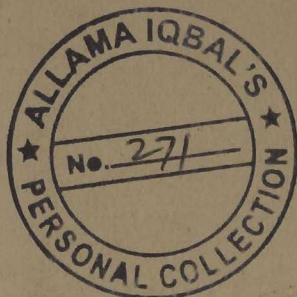
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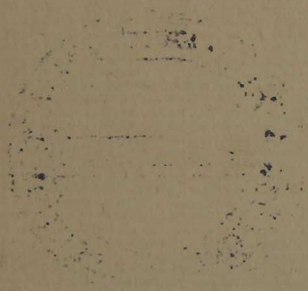
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THE LIFE OF SPACE





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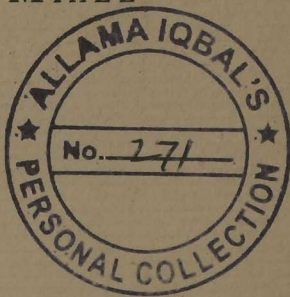
THE LIFE OF SPACE

By

Maurice Maeterlinck

TRANSLATED BY

BERNARD MIALL

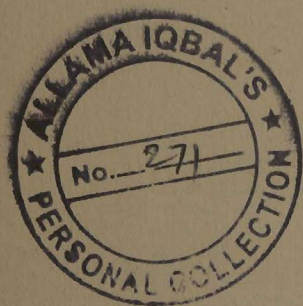


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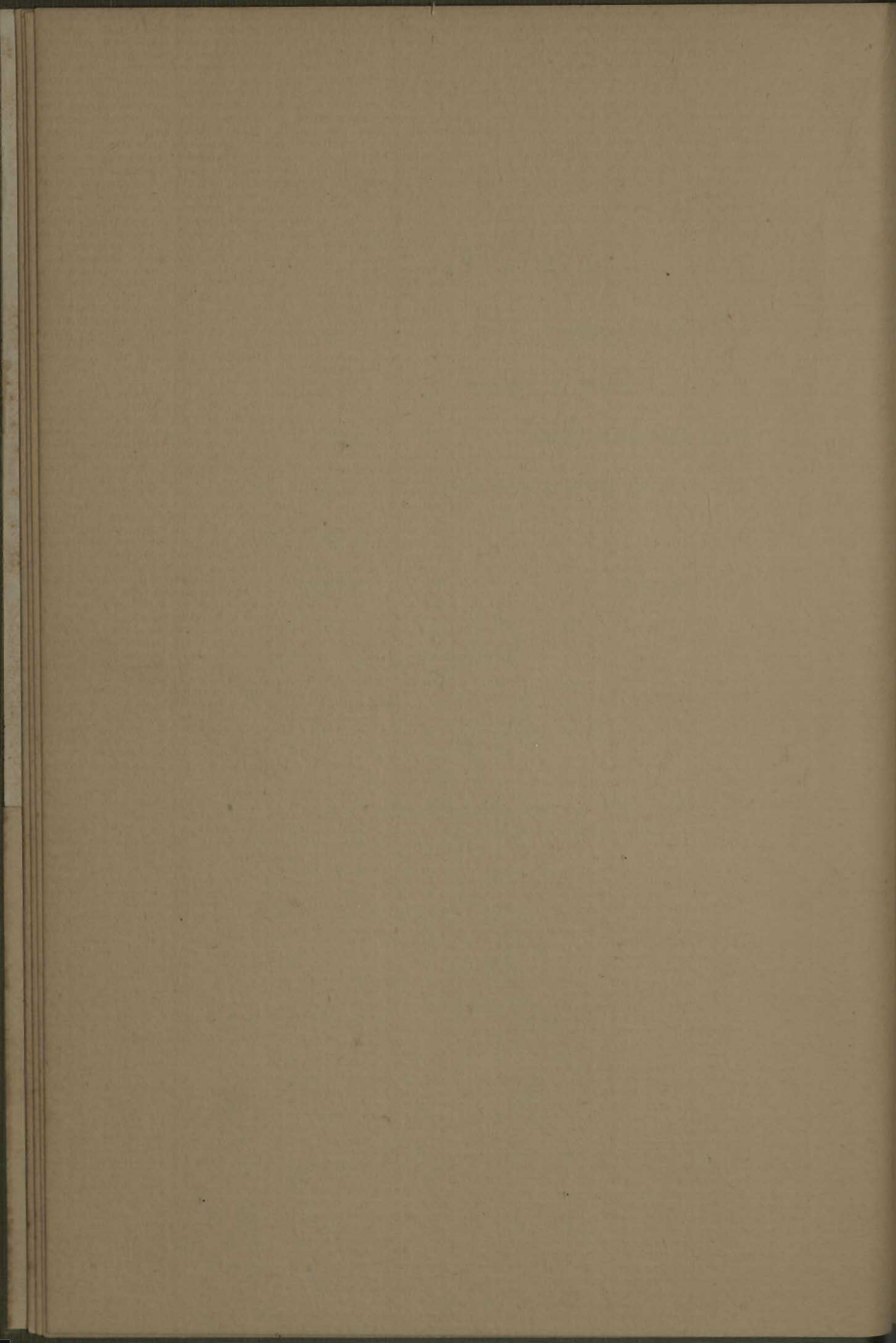


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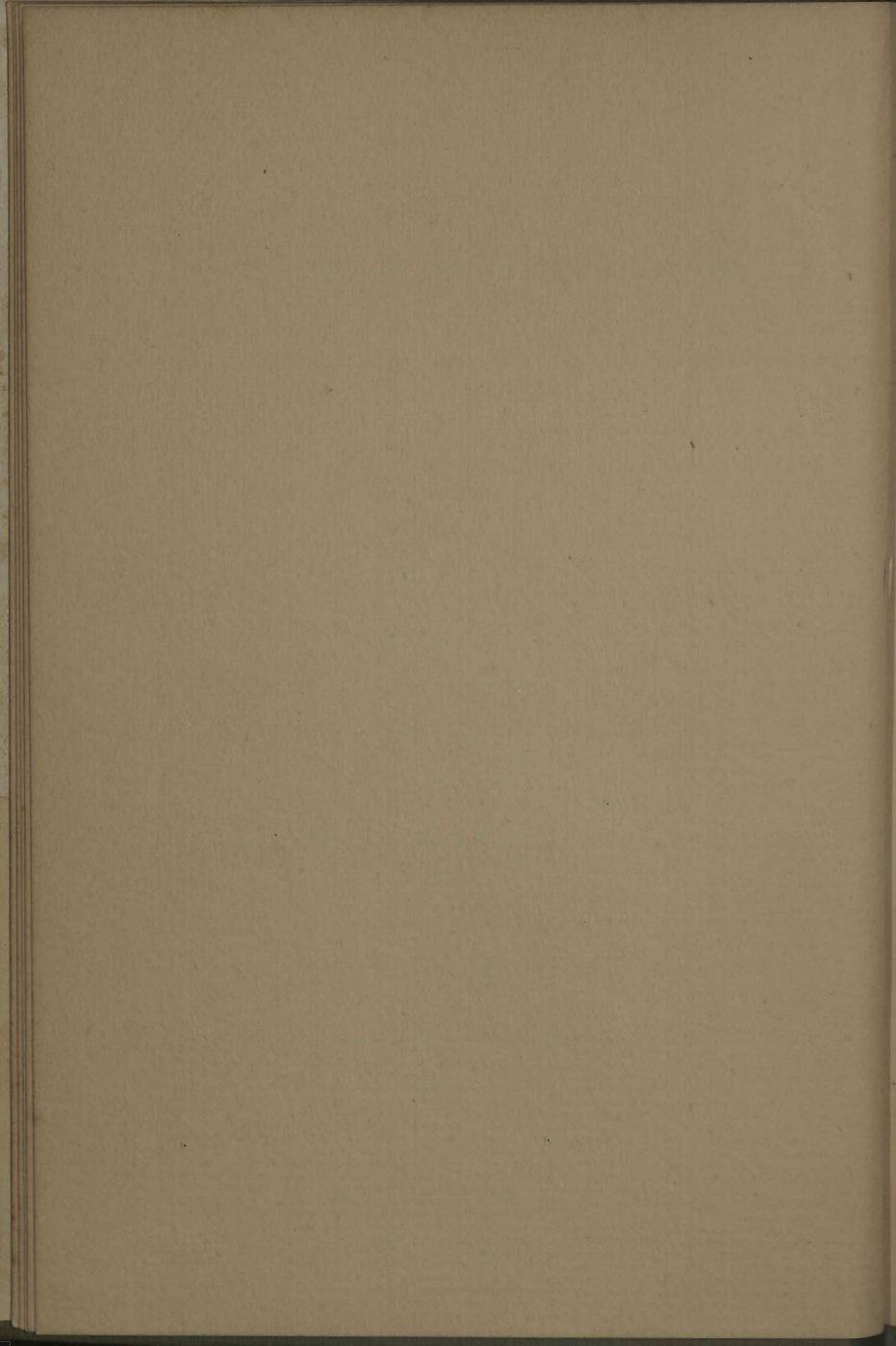
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THE FOURTH DIMENSION



THE FOURTH DIMENSION

I

SPACE was for long a mystery, and especially after the days of Kant, who seemed to have given it its final place in our minds—a great mystery, perhaps the greatest of all, and one that was wrapped in slumber. Men believed that all that could be said had been said, and this all was almost nothing. But now, a physicist of genius having touched it with his wand, it wakes; it comes to life again; it multiplies itself and peoples itself with unexpected data and unforeseen events; it expands beyond the powers of sight, imagination and reason; it acquires a fourth dimension; and under new aspects Space, and Time, its unknowable brother, are celebrating a miraculous espousal to which men of good will are bidden.

It is not my intention to venture here on a technical study of the fourth dimension. Such a study is reserved for the higher mathematics, which constitutes a region full

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of peril. I have frequented only its frontiers, like a curious inquirer observing a sequence of operations whose mechanism is of less importance than their results.

The problem of the fourth dimension is not merely a mathematical problem; it is a problem that affects our actual life, or at least the higher regions of our everyday life, and as in many problems of this nature—for example, the problems of theology, metaphysics and strategy—under the illusive scientific apparatus which at first sight renders it unapproachable, there is concealed a mere question of common sense—that common sense which is able to derive sustenance from facts and observations which are often almost unknown, but which the first-comer, once they are placed before him, may study and comprehend with advantage.

It is, I suppose, unnecessary to add that this essay is elementary. In writing it I have had no other aim than to interest the reader for a moment in certain unusual aspects which inanimate objects and living beings assume in space, and perhaps to inspire in some inquiring mind the idea of proceeding further in the study of these aspects.

The Fourth Dimension

Do not imagine that when you have read this essay you will know what the fourth dimension is. At most you will have learned to distinguish what it is not. "Anyone who devoted his life to it might perhaps in the end form some idea of the fourth dimension," said Henri Poincaré. This is not, as some have supposed, a merely whimsical observation. No one hitherto—with the exception, it appears, of an English mathematician, Howard Hinton—has succeeded in representing to himself a hypervolume, a polyhedroid. The imagination is unequal to the task. But to say that we cannot form any idea of the fourth dimension does not mean that it must be chimerical. Apart from a very few lovers of paradox, all the masters of the higher mathematics, and Henri Poincaré at their head, are agreed, as we shall presently see, that it exists, and even that its existence is incontestable.

II

The problem of this dimension, which is not imaginary but abstruse, is at the present

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time occupying the attention of a certain number of scientists and philosophers. It is fairly recent, and has replaced the problem of squaring the circle, which has to some extent been solved, and that of perpetual motion, which seems to have been almost abandoned. During the last few years it has made great advances, but it is still far from the goal. Clearly to conceive a fourth dimension we should need other senses, a different brain, and a different body; in a word, we should need the power to emerge completely from our terrestrial envelope; and that means that we should no longer be human. But it is quite possible that man will not remain indefinitely what he is to-day.

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We know that Euclidean geometry admits of only three dimensions—length, height or thickness, and breadth. But so long ago as the year 1621, thanks to the labours of Sir Henry Saville, there was born, of the insufficiencies of geometry properly so called—and notably of its insufficiency in respect

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of parallels—a non-Euclidean geometry. In this new science shine the names of Saccheri, Lambert, Gauss, Lobachevsky (whose works made a tremendous sensation in the world of science), Bolyai, Riemann, Helmholtz, Beltrami, and others. This new geometry declares that our space is not strictly Euclidean, and that we are capable of conceiving various kinds of space, in which parallel lines may meet, in which the curve is not longer than the straight line, in which the angles of a triangle are greater than two right angles, and in which, when the sides of a triangle are produced, its angles are diminished without limit; and there are other inexplicable anomalies. This non-Euclidean geometry becomes hypergeometry or meta-geometry, which is the method of investigating hyperspace or four-dimensional space—fictitious in the opinion of some; entirely real in that of all the rest. And this is the space in which Einstein develops his tremendous problems. This geometry—to mention but one of its theories—regards the three-dimensional sphere as a section of hyperspace, and studies the possible properties of lines which lie outside our Euclidean space,

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together with the relations of these lines and their angles to the lines, angles, surfaces and solids of our geometry.

III

But what precisely is this hyperspace? Here our difficulties begin. Is it a human space—in other words, is it a space such as a human imagination may attempt to conceive, with the help of data that may lead it very far afield? In order to suggest an idea of this space, Professor Oumoff has estimated that in our universe as we know it the volume occupied by matter, compared with the void that surrounds it, is comparable to a second in a million years; in other words, if all the matter contained by all the stars that are visible through our most powerful telescopes were rolled into a single sphere, on which was inscribed all that we know about matter—for all that we know relates only to matter—this single sphere would float amidst as many milliards of other spheres, which would contain (if we may speak thus) only the vacuum of the inter-

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sidereal gulfs, as there are seconds in ten thousand centuries.

But what of the space which would contain these milliards of spheres—a space in which we should still find ourselves beneath a dome whose limits are those of our senses and our imagination? Is it hyperspace? Or is this hyperspace rather the space of the Einstein theory, a theory based on the density of matter and the curvature of the universe? This of necessity entails a finite universe, for every curve, if we produce it, returns upon itself and forms a circle or a sphere. We know that this curvature of the universe at a given point is related to the density of matter in the neighbourhood of this point, and from this we conclude, says Emile Borel, one of the most penetrating interpreters of Einstein's ideas, "that if this average density is greater than a given value, small though this value may be, the universe is necessarily finite, and, in consequence, the total quantity of matter is itself finite."

Further, it may be remarked that in an infinite universe the number of stars would likewise be infinite; and that consequently the heavenly bodies scattered in innumerable

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galaxies and indefinitely superimposed would fill the heavens, so that they would form an immense vault of light without a single chink through which we could perceive the black gulfs of the void or ether-filled space. But do we perceive the stars whose remoteness exceeds a certain number of light-years? There is nothing to prove it. Is it not probable that there is a limit to the range of the eye and of our telescopes, or that the light is finally absorbed by interstellar space?

However this may be, if the universe is a finite sphere, in what does this sphere float, and what is there beyond its limits? Emile Borel replies to this objection that the sphere is a finite surface, but without edges. For, he says, men living on the earth and having no geometrical or astronomical knowledge would arrive at the discovery, by continuous and patient exploration of the globe, that it is finite but has no edges. But is not this a mere play upon the word? What is an edge? According to the definition of Littré, and according to usage and common sense, it is the extremity of a surface. If we say that the finite universe has no edges—that is, no

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boundary—is not this equivalent to saying that it is infinite?

In any case, if the hypothesis of a finite universe is more *convenient* for mathematicians, just as Henri Poincaré states that it is *convenient* to assume that the sun revolves round the earth, it is very much more incomprehensible than the hypothesis of an infinite universe.

IV

But the infinity of the mathematicians must not be confounded with our profane infinity. Louis Couturat, a luminary of the science of numbers whose light was too soon extinguished, wrote a most remarkable book—a great volume of nearly 700 pages—on *L'Infini Mathématique*. This will tell you that the question is abnormally complex. The dialogues between the “Finitist” and the “Infinitist,” in particular, recall the most abstruse debates of scholasticism. We will not seek to penetrate this jungle of numerical, geometrical, analytical, potential, actual, abstract and concrete infinities. It will suffice to remember the very just distinction between

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the indefinite and the infinite. The infinite which our imagination seeks to embrace is nothing more than the indefinite. It is merely a variable infinity, which surpasses all the limits we may impose upon it. Our imagination can never perceive more than a finite expanse, to which it adds another finite expanse, and so on, until it can continue no longer. It can arrive at the infinitely great and the infinitely small only so long as they remain finite; but it cannot compass infinity, the limit of the infinitely great, nor "zero," the limit of the infinitely small. These two extremes of magnitude are pure ideas, accessible to the reason only. The infinity of the reason, made up of shreds and tatters, is, as Couturat says, no more than "the shifting and fugitive phantom, the parody of the infinite."

The mathematical infinite passes the imagination by and makes its first appeal to the reason. To conceive and compass the infinite the reason has no need to traverse the domain of the finite and exhaust the series of indefinite magnitudes. It is enough, for example, for the reason to state that a finite straight line may be produced in both

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directions, or that any given number may be increased by a unit, and it perceives that this is always possible, however great the number and whatever the straight line.

Couturat, who is a dogmatist, affirms that this infinity is quite another thing than the infinity of the imagination, and that here the reason alone intervenes. It is obviously more simple; it is, in a manner of speaking, canalized; but for the rest I do not see that it is very different. It is still the finite, added indefinitely to the finite.

I am rather inclined to believe that the mathematical infinite is a sort of spontaneous infinity, an infinity which takes shape outside the imagination and the reason, and which is born of the nature of things, or, rather, of the infinite numbers and the ultra-logical projections of the higher geometry. Thus, as Jouffret has observed, it creates itself: "a geometrical entity which has its own individuality, which is above the finite and the illimitable, existing apart from us, by the same right as the finite, while the illimitable is merely allied to our thought, and would be nothing without the existence of a thinking being." In other words, it is no longer the

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subjective space of Kant that surrounds us, but its equivalent in the illimitable of the objective finite.

It would appear, then, to constitute a fantastic entity which would very soon return to its parent and lead the latter farther than it ever thought to go; an impersonal space which would extend outside our imagination, whether in the infinitely large or the infinitely little, and would no longer have anything in common with this imagination.

There can be no question even of a space such as might be conceived by a being a hundred thousand times more intelligent than ourselves, because this space, although conceived by an intelligence so prodigiously enlarged, would still fall short of space itself. We want a space which we should have to try to conceive outside our thoughts; and this would naturally be impossible, were it not that the mysterious power of the new mathematics seems to come to our assistance, imposing on us the idea of a space which is extra-human, and at first sight more unreal than our hereditary space. Nevertheless, things happen in this space

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which are as majestic, as astonishing and as incontestable as those which take place in our accustomed, everyday space, which we believe to be the only real and possible space.

V

It is not surprising that we do not find it easy to conceive or define the nature of hyperspace. It is difficult enough already, not to say impossible, to define three-dimensional space. After groping in all directions we are still unable to discard the Kantian formula, that space is a subjective intuition, a pre-supposition necessary to all experience; despite the objections of a less transcendental and more psychological philosophy, which very justly calls upon us to note that this spatial conception depends on the perceptions of our senses, and that the senses of a man blind from birth, for example, have little in common with those of a normal human being.

Balanced between the "a priorists," who hold that the idea of space is innate in us,

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and the empiricists, who believe that this idea is acquired only by experience, we do not learn very much from those who tell us, as Leibnitz does, that space is an order of co-existence in time, and that time is an order of succession; or assure us that it is by means of space that we are able to form a conception of time, or that space is the necessary medium of all representation. One thing is certain, as I stated in *The Unknown Guest*, namely: that all the efforts of the Kantian and neo-Kantian "a priorists," the pure empiricists and the idealistic empiricists end in the same obscurity; that all the philosophers who have concerned themselves with space and time—and among their names are the greatest names of recent and contemporary thought: Spencer, Helmholtz, Renouvier, James Sully, Stumpf, William James, Ward, Stuart Mill, Ribot, Fouillé, Guyau, Bain, Lechalas, Balmès, Dunan, Bergson and many another—have been unable to domesticate the twofold and formidable enigma; and that their most contradictory theories are equally defensible, and struggle vainly in the darkness against shadows which are not of our world.

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VI

When we consider hyperspace there can be no question of our sensual perceptions. Is it yet another subjective intuition, vaster or more illusory? Are there stages, are there relays in the infinite, in illusion? It is very doubtful; for we cannot well conceive of a subjective intuition as superimposing itself on a first subjective intuition which already occupies the whole of infinity.

But can we say that it is only an illusion, since the higher mathematics and the higher geometry, as though drawing upon an extra-human source of information, have caused it to dawn on the horizon of our mind, and imposed it on us as a necessity?

On the other hand, can mathematics and metageometry discover anything that is not within us? That is the great enigma. "In the problems of dimensions," a mathematician tells us, "it seems that mathematics can see farther than we can, beyond certain limits that hold us up, yet by no means check them; it is as though they gave us to

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understand that our conceptions of dimensions do not correspond with any reality."

G. de Pavlovsky, a *littérateur* and a scientist, who has written a most curious essay on the fourth dimension, to which we shall refer again, is not of this opinion. "In the secular labour of ideas," he says, "mathematics plays the part that is played by capital in the history of societies; it is the crystallization of intellectual labour; it represents acquisitions of which we are proud, a security well earned; it may even serve as a basis and a point of departure for new enterprises, but it never takes part in these enterprises themselves."

Is this really true?

"Calculation," he adds, "is a key which enables us to open the door itself, but the key does not tell us what is behind the door. Mathematics is too often merely the scaffolding necessary for the construction of the monument."

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But does not the scaffolding always precede the monument? However this may be, all that Pavlovsky says is perfectly correct so

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long as there is a question of numbers which, however vast we may suppose them, are in reality finite. But the moment there is a question of infinite or trans-finite numbers the aspect of the problem is completely changed; and this aspect interests us as greatly as the first, for though we may believe and say the contrary, we are essentially infinite beings, and on all sides we touch, both with our body and with our soul, that which had never a beginning and that which will never have an end.

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"Mathematics," yet another great mathematician has declared, "creates nothing, and is content with transforming elements which have their provenance outside it."

But what elements, and what is their outside source? It may be that this little phrase conceals the most important point of the mystery; for we must first of all emerge, if only for a moment, from the prison without doors or windows in which the brain of man has confined him ever since his birth. We must at all costs find a helper, even a mere glimmer of light, coming no

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matter whence and bringing us no matter what, provided it is not, as always, exclusively human. This little phrase points the way to another path, which we shall now try to follow, while waiting for others which it is not yet possible to foresee.

VII

It has been observed by P. D. Ouspensky, a writer to whom we shall refer again, and who might be called a kind of Slav Pascal—a Pascal, of course, on a smaller scale—that we have in reality two mathematics: the mathematics of finite and constant numbers, which takes account only of the phenomena of a restricted and artificial universe—that is to say, of a universe which represents only our limited and incorrect conception of the actual world; and the mathematics of the infinite and variable magnitudes which introduce us to a world which is no longer the world of our own creation, a world which is no longer dependent on us, where it does not follow that a value is equal to itself, where of two equal magnitudes the first may be

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infinitely greater than the second, and where we encounter yet other curiosities, which, from the standpoint of the first mathematics, appear to be absolutely absurd. But this first mathematics, which calculates the relations of artificial and conditional magnitudes, which do not exist in Nature, is no less absurd than the other, "because," adds Ouspensky, "in Nature there are no finite and constant dimensions, just as there are no concepts. Constant values and constant concepts are conditional abstractions; they are not realities, but sections of reality, if one may say so."

"Science cannot deny," he says further, "that mathematics escapes from the limits of the visible and measurable world. Whole provinces of mathematics deal with quantitative relations which do not exist in the actual world of positivism—that is, relations which do not correspond with any reality in the visible world—the world of three dimensions.

"But it is impossible that there should be mathematical relations with which no relation to reality corresponds. This is why mathematics exceeds the limits of our world and makes its way into an unknown universe.

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It is the telescope by means of which we are beginning to explore multi-dimensional space and its universes. Mathematics is outstripping our thought, our powers of imagination and perception. At this very moment it is calculating relations which we can neither imagine nor comprehend."

* * * *

If it is true that mathematics outstrips the understanding, can it be that it is a force which exists outside us, a kind of diffused genius, emanating from a being no longer human? This is hardly probable, for it seems to be very specifically our own, and in its lower and its middle regions, which are the only parts of it that we can judge from a sufficient height, it remains the prisoner of all the prejudices of our logic. It escapes them only when, to our eyes, they become absurd, perhaps because they are pressing more closely upon a reality of which we have as yet but a vague presentiment.

At the close of a magnificent essay on the Relativity which is, at bottom, only one of the aspects of the Fourth Dimension, the English astronomer Eddington, speaking of

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those mysterious calculations which draw us away from ourselves, makes this admission: "We have found a strange footprint on the shores of the unknown. We have devised profound theories, one after another, to account for its origin. At last we have succeeded in reconstructing the creature that made the footprint. And lo! it is our own! "

VIII

Can it be, then, that mathematics is no more than a kind of tool forged by the brain, which, urged onwards by an intelligence that was not wholly within it, had no very precise idea of what it was proposing to do? A magic tool, which, as in a fairy-tale, moves the hand that thinks to guide it and makes it work miracles? It often happens, even in our world, where we believe that all the fairies are dead, that certain mechanisms appear to be much more perfect and more intelligent than the engineer who imagined them, and perform labours of which he himself would be utterly incapable. Or, if

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you prefer it, is mathematics perhaps the telescope of which Ouspensky speaks—the telescope which reveals to us worlds of whose very existence we had no suspicion, but which sees nothing by itself, and would be no more than a simple tube of copper, steel or aluminium were it not animated by the human eye, directed by the human brain? When it discovers a new star, no one dreams of attributing to it the honour of the discovery; no one maintains that it is more intelligent than the astronomer who sweeps the heavens with it. Similarly, all that mathematics enables us to perceive plainly has its existence in ourselves. Mathematics merely translates what we cannot as yet say, what as yet we are unable even to think. When we believe that it is leading us out of ourselves it is only testifying to the fact that we often unwittingly surpass ourselves; and when it introduces us to a superior space, a space of more than three dimensions, it has only told us that this space really exists within us and for us, and that it has awaited us since the beginning of the world.

It should be, therefore, one of the most

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interesting instruments of research, an unexpected interpreter of the latent or subconscious man. This, perhaps, is why an eminent mathematician, Bertrand Russell, stated, in a famous epigram, that mathematics is a science in which one never knows what one is talking about, and does not know if what one says is true.

There is, then, a geometry of the fourth dimension whose theorems are as logical, as rigorously deduced and as well knit as those of Euclidean geometry, *but cannot be imagined*, "because," as M. E. Jouffret observes in his *Traité élémentaire de Géométrie à Quatre Dimensions*, "it is utterly impossible to revert from the projection of a four-dimensional body to that body itself, or in any way to conceive of its shape. Our minds are not capable of seeing these entities as having definite shapes and in definite positions. None of the material images which surround us afford us a basis or elements of comparison."

This geometry unfolds itself in spaces which are still unknown to us, in spaces outside our own, and probably, as we shall see later, *in a portion of time which has not*

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as yet a countenance. It is a sort of inverted geometry, inverted in an internal mirror of incalculable depths, a region almost inaccessible, which has been called *the fairyland of mathematics* and which might equally well be called the geometry of mysticism, or the mysticism of geometry.

IX

I will not dwell on the technique of hypergeometry, which is, of course, dry and abstruse, for like every science it has a special vocabulary, each of whose terms would have to be explained, one by one, to those who are not conversant with it. It is none the less necessary to say a few words on the subject, since it is the scientific and relatively solid basis of all the theories which we are about to examine. It is enough, for our purpose, to know that the introduction of a supplementary dimension, or, rather, of a new direction in space, or in a space external to our own, involves the conception of an infinite number of different spaces, contained in a space of four dimensions, and it

The Fourth Dimension

involves also the impossibility of any exact, actual and palpable representation. We have already alluded to these spaces and their mysteries, which are, for the time being, impenetrable.

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But it must not be supposed that there can be no question of any but imaginary problems. The higher mathematics and hypergeometry have already yielded, notably in astronomy, tangible and irrefutable results. It is true that we cannot by the mere powers of our understanding escape from the world of three dimensions; but the rudiments of evidence have been adduced, in the region of physics, and above all in electro-magnetic phenomena, in favour of the reality of the fourth dimension, and it may be affirmed that from the mathematical and geometrical point of view all the conceptions of its extension, even to any number of dimensions whatsoever, may be deduced and justified in an absolutely logical manner; and these conceptions assure us that certain problems, above all in the domain of the infinitely little, which offered no acceptable solution in the

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third dimension, may and should be pursued outside the region habitable by our minds. For the world is not confined to that which we see, nor to that which we comprehend with our intelligence when the latter is not assisted by mathematics and geometry, whether the latter make their appeal to a spiritual and extra-human power, or whether, as is far more probable, they are only an anticipatory manifestation of the human intellect, which is not as yet completely acquainted with itself.

This is a point which some still regard as debatable. Let us in conclusion hear what Henri Poincaré has to say. He is not a man to pursue chimeras. "The geometry of n dimensions," he states explicitly in his *Analysis Situs*, "has an actual object. To-day no one doubts this. The entities of hyper-space are susceptible of definition as precise as the entities of ordinary space, and if we cannot represent them to ourselves we can at least conceive and study them. Thus, though the mechanics of more than three dimensions, for example, might be condemned as possessing no object, the same objection cannot be made to hypergeometry."

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X

The mathematicians of the fourth dimension, then, make their calculations as though this space, which is external to our own, and in which they imagine their fourth perpendicular, which cannot be drawn in our three-dimensional space, had an actual existence; and sometimes (but such a conjunction is of necessity rare), as in the celebrated instance of Einstein and the secular variation of the perihelion of the planet Mercury, these calculations are confirmed by verifiable facts.

It must be admitted that there are a few mathematicians who vigorously oppose this geometry and declare it to be totally fictitious. One of the most ardent defenders of the Euclidean geometry, Captain Stefan Christesco, an engineer of the College of Naval Engineers in Paris, takes especial exception to the theories of Lorentz, Einstein and Minkovski, and declares roundly "that the essential characteristic of the conception of the fourth dimension is, firstly, that it

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renders 'adiagonal,' and therefore fictitious, the Euclidean geometry which serves as its basis, and, secondly, that it erects, for its assistance, a scaffolding of mathematical theories which belong to the domain of the imaginary and the absurd."

He supports his contention by demonstrations which, however peevish in tone, are by no means negligible. He asserts, in particular, in respect of the celebrated displacement of the perihelion of Mercury, which is the triumph of the Einstein theory, that the formula relating to the deviation of light is absolutely identical with that discovered, without resorting to a fourth dimension (of which there was as yet no question in the year 1801), by an obscure German astronomer, Von Soldner, as we may read in the *Bulletin de la Société astronomique de France* for October 1920.

This is perfectly true; but is it not remarkable that Einstein should have arrived at the same result by the aid of a geometry which is declared to be fictitious, imaginary and absurd? Does not the argument turn against its user?

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XI

Being neither a mathematician nor a metageometrician, I shall not venture to take sides in these scientific disputes. I will refer those who are disposed to study these questions to the treatises, already mentioned, of Boucher and Jouffret. In Jouffret's work in particular they will find bibliographical notes which will enable them to take cognizance of all that has been written on this subject in France, Switzerland, Belgium, Italy, Spain, Germany, Norway, Austria, Holland and England. It is already a copious bibliography, and even as early as 1900 *L'Europe mathématique* gave a list of 439 articles which had appeared in a great variety of scientific publications. During the last twenty-five years this list has been considerably enlarged.¹

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¹ Prominent among the scientists who have explored and fertilized the geometry of multiple dimensions, the following may be named (I am quoting from Jouffret's bibliography):

In France, Switzerland and Belgium : Camille Jordan

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Passing on from hypergeometry properly so called, I will not linger amidst "these beings of hyperspace," as Poincaré calls them; amidst these inconceivable figures whose parent is hypervolume and which bear fabulous names: hyperspheres, hyperquadrics, hyperquartics, hypercones, hyperpolyhedra or hyperpolyhedroids, octahedroids, pentahedroids, hexacosihedroids, icosatetrahedroids, and hecatoncosahedroids, which seem to be the offspring of a polytechnical nightmare, or of Father Ubu himself, and which conjure up a whole fauna of unimaginable

(one of the earliest and most important writers on the subject), Halphen, Poincaré, Goursat, René de Saussure, Mansion.

In Italy, where this branch of geometry is in high repute, there is in our days a brilliant constellation of mathematicians: Aschieri, Bertini, Cassini, Castelnuovo, Cesaro, Fano, Loria, d'Ovidio, del Pezzo, Pieri, Segre, Veronese.

In Spain: Galdeane.

In Germany, Norway, Austria and Holland: Biermann, G. Cantor, Kelling, Hoppe, Klein, Sophus Lie, Lipschitz, Puchta, Rudel, Schlegel, Schoute, Schubert, Simony, Van Oss.

In England and the United States: Ball, Cayley, Cole, Hall, Heyl, Hinton, Lasker, Sylvester, Stringham, Spottiswoode, Mrs. Boole Stott.

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monsters, linear, multitriangular and polycubical; insects, dragons, polypi, larvae and lemures; spectres which the unhappy geometers endeavour in vain to imagine as they pursue them through a space of whose very existence they had, until lately, not the faintest suspicion, into the geometrical infinity in which they pullulate, as ultra-spiritual entities which surround us on every side, and which must influence us in a way that will one day be defined, for it is probable that they participate in the fundamental laws of our being.

XII

Having thus briefly glanced at this more or less technical aspect of the problem, I shall content myself with modestly accompanying those thinkers who have made the most strenuous efforts to elucidate the mystery. Although they too, for the most part, are mathematicians and hypergeometricians, no less than the professional mathematicians of whom I have just been speaking, their demonstrations no longer bristle with

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interminable and cabalistic equations or bewildering figures and diagrams. Like the women of Eastern lands, these all too esoteric formulae have been relegated to a sort of gynaeceum. We feel that they are there, behind the curtains, that they have made ready the chambers in which the guests are seated, and that they hear and approve of what is said; but we no longer behold them, and we may use, freely and simply, an idiom which all can understand.

First among those writers to whom I am referring I will mention Howard Hinton, author of *The Fourth Dimension, A New Era of Thought, An Episode of Flatland*, and *Scientific Romances*, to which I shall frequently refer. All those who have written of the fourth dimension owe something to him—even the professional hypergeometricians. I may mention also J. W. Dunnes and his *An Experiment with Time*; G. de Pavlovsky and his extraordinary *Voyage au Pays de la Quatrième Dimension*, a remarkable though slightly evasive book, which in any case is not as well known as it deserves to be; Alfred Taylor Schofield and his *Another World, or the Fourth Dimension*; and lastly,

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the most recent and one of the most interesting of these explorers of hyperspace, who has not failed to profit by the labours of his predecessors, P. D. Ouspensky, with his *Tertium organum*, translated from the Russian into English by Nicholas Bessaroff and Claude Bragdon.

Ouspensky's aim is to complete the *Organon* of Aristotle and the *Novum organum* of Bacon; this is why he entitles his book *Tertium organum*. The *Organon* of Aristotle, the translators tell us, formulated the laws under which the subject thinks; the *Novum organum* the laws under which the object may be known; but the third canon of thought existed before the other two, and our ignorance of its laws does not justify their violation. The *Tertium organum* will henceforth guide and govern human thought.

This assertion is more than a little temerarious, and, above all, it is more than a little vague. Let it be said at once that this too-ambitious programme is not realized. The laws that govern thought cannot thus be changed from one day to another. The author, indeed, does not change them at all, but he shows that their government is

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relative, unstable and extremely restricted, and that it is very necessary that some change should be made in them. He instils into them an element which is more or less novel, a sort of scientific mysticism, which, by devious and difficult paths, often joins hands with religious mysticism, and, above all, with the mysticism of the East. Its conclusions are equally deceptive and contingent and are incapable of verification.

XIII

One curious characteristic of all these authors who attack the arduous problem of the fourth dimension is that they rarely linger over it. They escape from it in the course of a few pages, and then proceed to speak of quite other things. Dunnes, for example, expatiates on dreams and their premonitions, while Pavlovsky constructs learned and fantastic Utopias. He seems to put into practice the theories of Hinton, or certain remarks of the geometrician Boucher, who tells us that a man who was able to make use of the fourth dimension

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would see the whole of the interior of material bodies without being arrested by their surfaces, and even without noticing them, and that the smallest particles of all objects, whether inside them or on the surface, would all appear to him to be at the same level, and as though juxtaposed, not superimposed throughout their extent. He would be able to emerge from a space closed in all directions without passing through its boundaries, for bodies in space are in a certain sense superficial in their extension, relatively to the fourth dimension.

Hence Pavlovsky's extraordinary little flat house—a house so flat that one cannot see it in profile; a house with two exits, one giving on to the Place de la Concorde and the other on to the terrace of Saint-Germain-en-Laye; and the ribbon, which, being knotted, always comes untied, since in the fourth dimension matter is permeable, reversible, and subject to the mind; the horizontal staircase, which, after an undeniable succession of stairs, returns to the landing from which one started; the innumerable coach or ubiquitous motor-bus, which is found at all points along the route

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at all times of the day; with other delicious phantasies, which at first sight seem to be absolutely crazy; but in a world in which we had acquired the sense and the habit of the fourth dimension they would have become quite natural, and it may be that in the more or less remote future they will no longer astonish our descendants.

We might easily continue and complete these "anticipations"; we might suppose, for example, that if the fourth-dimensional being feels the need of a dwelling-house—which is, for that matter, hardly probable—his house would have nothing in common with those that suffice for us; we could not possibly be content with the house of the flat being, a house which would have neither height, nor roof, nor enclosing walls, but merely a surface which its occupant would not even perceive. Similarly, the citizen of hyperspace would not be able to accommodate himself to one of the cubes in which we consider ourselves to be at home, but which all beings of his order would enter as water enters a sponge. He would need at the very least what Hinton calls a "tesseract"—that is, a hypervolume of a

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form which we cannot even represent to ourselves, born of the movement of a cube in a direction which does not exist in the cube, and which is outside all those directions which are possible in a three-dimensional body; that is to say, in a direction which provisionally, as we shall presently see, appears to be time. Who can tell us what the architecture would be like in cities whose buildings were constructed on these principles? Who can say how the inhabitants of these cities would pass through one another, and how they would conceal from view those matters which should be hidden? Who can tell us of the laws of their molecular or atomic existence, which our higher mathematics has dimly glimpsed, and which bear no relation to the laws of our world? And lastly, who can tell us of what they speak among themselves, these beings of hyperspace, who, for all we know, pass through us as light passes through a crystal, bringing us happiness or misery, health or death, without knowing what they do or without attaching the least importance to it? To these might be added many other fancies which the reader will draw from the depths

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of his meditations and elaborate far better than I could.

XIV

Alfred Taylor Schofield, who is more or less a disciple of Hinton's, gives us an ingenious reconstruction of the life of three dimensions, which, being amplified a little, may be summed up as follows: He starts from the "point" being, without dimensions, and all the more pretentious in that he can see nothing, not even himself. Around him all is void, and he is convinced that his void is the whole universe. Then comes the linear being, who lives with his congeners, all head to tail in the same line. He can never see anything more than the extremity of the line ahead of him—that is, a point. Then we have the plane being, or the being of two dimensions, who can see nothing but lines; and then the three-dimensional or voluminal being like ourselves, who sees only surfaces; to culminate in the hyper-voluminal or four-dimensional being, who would perceive volumes not as concepts, but as wholes and completely, with all that

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they contain. But after a while, at the very moment when we are beginning to feel interested in the lot of these fantastic individuals, who are so like ourselves, Schofield abandons them in order to launch into a Biblical sermon, in which he vehemently affirms that all the revelations and apparitions of the Old and New Testaments come from four-dimensional beings; which is, for that matter, admissible, and tallies with the hypothesis of Hinton, according to which the birth, growth, life and death of animate beings are merely the phases presented by the passage of a four-dimensional being through our space; a hypothesis which appears, moreover, to be corroborated by the theories and calculations of Professor Karl Pearson, as expounded in his *Ether Squirts*.

XV

Ouspensky himself does not long concern himself with the heart of the problem, and after a hundred pages, in which he presses it hard, he digresses into vast speculations, which are often remarkable enough, but

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whose relations to his main subject become increasingly remote.

Howard Hinton alone applies himself stubbornly and almost exclusively to the solution of the problem. Hinton, who is an expert mathematician, may be regarded as the high-priest—some, perhaps, will say the monomaniac—of space. For him, space is everything. He regards it as the sole serious instrument of human thought, and declares that we have no hold on things except in so far as we consider them in space. He is an incomplete but incontestable genius, and no one has applied himself with greater ardour and knowledge to demonstrating, if not the proof, at least the probability of the fourth dimension.

Nevertheless, despite his persistence, the subject of which he is treating is so evanescent that he does not always succeed in keeping it in sight until the end of his investigation. For example, in a sort of geometrical romance, entitled *An Episode of Flatland*, in which there are frequently strange and profound glimpses of light, but which achieved no success, and remains almost unknown, he relates the story of a people of

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two dimensions, a people of very flat triangles, who inhabit a planet that is no more than a disc wandering through infinity. The psychology of these beings of two dimensions, as intelligent and civilized as is possible to those who are unaware of the third direction in space, is extremely interesting and instructive, so scientifically and scrupulously has the author imagined them. But little by little he forgets that his heroes are only triangles who have no more thickness than the line that bounds them, and that *Astria*, their planet, is only a huge circular plate. For the plate becomes covered with forests and lakes and blistered with mountains; the flat triangles grow more and more like men; and like men they launch into adventures and speculations, allegorical, political, religious and cosmical, always original and often very fascinating, but which, like those of Ouspensky, lose all touch with the subject which the author had in view.

XVI

It is the same with his *Scientific Romances*. In this connection, the reader will forgive me

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if I speak at greater length than may seem strictly necessary of Hinton and his works, even when they touch only indirectly on the subject which concerns us here. Hinton is indeed the great zealot of the fourth dimension; it is therefore only fitting that we should realize that we are not dealing with a mediocrity, with a mere mathematician of a whimsical turn of mind, who indulges in the fascinating pastime of evolving temerarious hypotheses. On the contrary, it would be impossible to find a more perfectly balanced mind or one more ruthlessly geometrical. He is, moreover, endowed with a powerful imagination of a very singular quality, which enables him to give most of his abstractions a visible form and life; so that, besides his technical works, he has written books which may be classed with the work of Poe, Villiers de l'Isle, Adam and Wells, but which are quite different in manner, and often go very much farther; for the author, sure of his foothold, makes his way into regions which these forerunners of the future have not dreamed of visiting. Unhappily he has not their gift of telling a well-constructed and well-balanced story. He

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is not exclusively an artist, and in him the literary beauties of his work—which are often very striking—seem accidental and involuntary, as though they sprang from a soil or a subsoil which has not yet been tilled. He never ends as well as he begins, and some of his books, like the mermaid, end in a fish's tail. This is to be regretted, for certain of his stories, more or less symbolical, and always with a scientific basis, for want of some quite trivial quality, are not the masterpieces which they might have been.

Let us take, for example, *Stella*, one of the best of his inventions. Stella is an adorable young girl whom her adoptive father, an aged, visionary scientist, has rendered completely transparent, and consequently invisible, proceeding from the incontestable principle that light, when it passes from one medium to another, is refracted at different angles. Since our bodies are composed of a multitude of parts and substances, none of the angles of refraction in them is the same, which is why they are opaque. If we could reduce their index of refraction to unity they would be transparent as air. The old scientist succeeds in obtaining this index

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of refraction, and Stella's body becomes more transparent than a statue of crystal. In other respects all is unchanged; neither her life nor her mind nor her character is altered; she remains what she was before the miracle, but she can no longer be seen unless she is clothed. In order that she may not appear headless she ought to paint her face, but she refuses to do so, because it is unseemly, and contents herself with wearing a thick veil; and when she marries she has to plunge her hand into a floury paste before the clergyman can see the finger on which he is to place the nuptial ring.

It is obvious that a very interesting fairy-tale might have been based on this conceit. Hinton, however, was concerned with other things, cared little for his invention, and abandoned it after a few hastily written scenes, which, none the less, are often charming in their laconism. I will mention only those which are played in an old-English garden, surrounded by high, well-trimmed hedges and intersected by symmetrical paths bordered with lavender and other sweet-smelling herbs, where flowers, carried by unseen hands, float before the invisible girl,

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who is welcomed by the dogs that guard the ancient manor, and obey only the presence which they follow with their eyes, but which they alone can perceive. The story ends in a summary fashion, as though the author was in a hurry to get it off his hands, with a rather commonplace marriage and a mutiny of Chinese pirates, who seize a passenger steamer and put the crew and the husband in chains, but are routed by the supernatural intervention of the invisible woman.

XVII

But while Hinton, in some of his books, loiters a little by the way, like other authors who speak of the fourth dimension, he does not do so in *A New Era of Thought* and *The Fourth Dimension*. In the very first pages he plunges us into the obscurities of the great enigma, and there he keeps us until our attention and our intelligence are exhausted.

With the assistance of an excessively complicated game with 81 cubes, 27 slabs, 12 other cubes, variously coloured, 100 names for surfaces, 216 for cubes, and 256 for

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four-dimensional bodies, he professes to realize certain four-dimensional solids which he calls "tessaracts"—that is, octahedroids—which, according to him, give us a tangible and irrecusable idea of the fourth dimension. Hundreds of pages are devoted to these operations. Although, in these pages, there are no calculations, but only combinations of triangles and cubes, it is almost impossible to follow the author in his argument, which requires a special education of the memory and imagination, demanding months of labour and an intensity of application which often leads to hallucination and even to a sort of delirium.

To grasp the fabulous entity known as a "tessaract" obviously calls for special faculties, analogous to those of certain chess-players who are able to play several games simultaneously without seeing the chess-boards and with their backs turned on their adversaries. An American, by name Pillsbury, is deserving of special mention; under these conditions he played 22 games, winning 17 and losing 1, while 4 were drawn; and in this way he played 675 moves in ten hours without ever seeing the boards.

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Hinton, by these exercises, is aiming, above all, at developing our spatial sense, for this alone elucidates realities, and, according to Kant, is the fundamental faculty of the intellect, the true thinker being he whose spatial sense is well developed and cultivated.

The consciousness, therefore, must be trained to regard things from another than the personal point of view. "When," says Hinton, "in any mode of our thought we encounter the infinite, this is a sign that this mode of thought enters into relations with a reality superior to the reality to which it has adapted itself."

"Our space," he adds, "as we usually conceive it, is limited, not in extent, but in a certain fashion which can only be 'realized' when we think of our way of measuring the objects which exist therein." But why should space be limited to these independent directions? The geometers have found that there is no reason why it should be, and only practical experience can answer the question. Hinton claims that he has answered it, and that he has made us familiar with the fourth dimension. At all events, after years of negative experiments, he feels justified in

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affirming as a verifiable fact that if we go about it in the right way it is possible for us to experience life in four dimensions, and that the human being is, in one way or another, something more than a three-dimensional being; in what he differs, and how, is for science to discover. "All that I shall do here," he adds, "will be to advance certain suppositions which, in a forced and arbitrary fashion, will give a sketch of the relations of our bodies to a four-dimensional existence, and will show how in our minds we have faculties by which we recognize this relation. The mind can acquire a conception of the higher space—that is, of four-dimensional space—adequate to that of our space of three dimensions, and can make use of it in the same manner." I must confess that so far it does not seem to me that he has succeeded in proving this or in convincing us.

XVIII

The subject undoubtedly is ungrateful and elusive, and wrapped in chimerical vapours

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which must first of all be dispelled. When we have said that we do not know precisely what the fourth dimension is we have said almost all that we can really know of it. The rest is hypotheses, speculations, presentiments and more or less reckless approximations. But these are useful as soundings which explore the incontestable unknown, which one day we shall perhaps know. All our science is based on analogous soundings. Moreover, the most interesting things, as is often the case in writings of this kind, that dare to aim at objectives which man is as yet very far from attaining, are those which we encounter as we proceed: the incidents of the journey, the digressions, the observations, the unexpected and perfectly justifiable hypotheses which frequently support a thesis which is itself less justifiable—the *Parerga* and *Paralipomena*, as Schopenhauer used to call them. The road we travel is often more beautiful than the goal. It is of more importance to welcome or discover a few ideas as we proceed than to reach conclusions which as yet are highly debatable.

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XIX

The point is, then, to establish, or at least to perceive, that whatever our obviously imperfect senses may tell us, a fourth dimension, and doubtless a fifth, a sixth, and we know not how many others, must necessarily exist in the universe. For the moment let us content ourselves with the fourth dimension; it is in itself a sufficiently thorny subject.

Let us say, at the outset, in order to settle our ideas, that the three dimensions are not measures of space, which, being infinite, is not mensurable. In order to measure anything we must have a point of departure from which to measure; but where shall we find this in space, which has neither beginning nor end? The three dimensions are thus the measures of the matter in space—that is, in something which we believe that we can more or less conceive, but which escapes us the moment we try to get to the bottom of our thought or imagination. These measures take account of only a single attribute or quality of matter: its

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extension in space; and from this point of view it is impossible to find anything other than length, height and breadth. But it is almost certain that other senses, or merely a slightly more perfect ocular mechanism—eyes, for example, endowed with independent movements of different velocities—would reveal other attributes and unforeseen coordinations of space and time, and in particular a fourth extension in an expanse which is not similar to that which we believe that we comprehend. This is the knot of the problem, which will perhaps be untied in the more or less distant future.

XX

Ouspensky, in the wake of Hinton, groping in space to discover something definite, begins by telling us that, just as the line is limited by points, and the surface by lines, and the solid by surfaces, it is possible that the four-dimensional body is limited by the body of three dimensions. Or, again, we may say that the line separates two or more points one from another; that the

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surface separates two or more lines, and that the solid separates several surfaces; and at the same time we may say that the line links up a number of separated points into a certain whole (a straight line, a curved line, a broken line); that the surface links up several lines into a certain whole (a quadrilateral, a triangle); and that the solid combines several surfaces into a certain whole (a cube, a pyramid). Hence it seems possible that four-dimensional space is the distance between a group of solids, separating them and nevertheless at the same time connecting them, combining them in some inconceivable whole, although they seem to be separated one from another.

While the premisses are scarcely contestable, the conclusion is disappointing enough; for all this, like that which preceded it and that which is to follow, does not afford us any definite proofs, though it makes us feel that we are perhaps on the brink of some discovery, for it is always thus that the most dazzling tableaux of our human fairyland begin.

The conclusion becomes much more intelligible when we transfer the whole problem

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into another world—namely, into that of time; and hither tend, as we shall presently see, all the demonstrations and hypotheses relating to the fourth dimension. At first sight the relations of this other world, or rather of this other plane, with the material world or plane seem to be wholly fictitious; but if we regard it more closely we shall find that it is as intimately involved in the material plane, and is as indissolubly a part of it, as is space itself.

Let us not speak, then, of solids, but of movements or events which play in time the same part that solids play in space. "By time," says Ouspensky, "we understand the distance which separates events in the order of succession while connecting them in different wholes. This distance is *in a direction which is not contained in space of three dimensions*; this is why it must be *the new dimension of space*—that is to say, the fourth dimension. It cannot be compared with the dimensions of three-dimensional space any more than a year can be compared with St. Petersburg. It is perpendicular to all the directions of three-dimensional space and is parallel to none of them. By the

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term 'time' we are in reality expressing a certain space and a movement in this space; and consequently extension in time is extension in unknown space; and this is why time is the fourth dimension of space."

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Is this merely a device that enables us to evade the difficulty? Is it as though we were doing a sum in addition by mixing horses and potatoes in order to arrive at any cost at a certain total of anonymous unities? Less so than might be supposed, for we shall presently see that solids, for beings that live in a two-dimensional world, behave, with reference to time, precisely as events behave with reference to beings who live, like ourselves, in a three-dimensional world.

For that matter, even for us, in our three dimensions, the most apparently immovable solids have, like our events, an extension in time, for we know that all that exists, even if it does not move in space (supposing this immobility to be possible, for the earth bears it onwards in its headlong course) moves eternally in time.

Time and space, then, are at certain points

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interchangeable. Those mathematicians confirm this who, in some of their calculations, employ *four co-ordinates, three of space and one of time*; in other words, *they treat time as though it were a dimension of space*.

XXI

I am anxious not to misrepresent Ouspensky's ideas; to grasp them, to clarify them and to bring order into them; for Ouspensky is a Slav, and his ideas have the qualities and defects of Slav thought—that is, they are original, unexpected, daring, unstable, subtle and often contradictory.

Ouspensky, then, divides the creatures that people this earth into three classes: those that know only one dimension—the slug or snail, for example; those that know two—the horse, cat, monkey, dog; and those that know three—men.

The slug or snail moves always along a line, and beyond this line it is probably conscious of nothing and feels nothing. This line is its whole world. All the sensations that come from without are experienced

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on this line, *and they enter upon it by emerging from time*. From being potential they become present. For the snail, our world exists in the future and in the past—that is, in time. In space there exists only a single line, and all the rest is time.

It is evident that the snail is not conscious of its movements. "In its efforts it moves towards the green edge of the leaf, but it seems to the snail that the leaf comes towards it, emerging from time, as the dawn comes to us."

All this is more or less disputable, and would be exact only were the snail unable to move excepting on a single line—that is, if it were able only to advance or retire, straight forwards or backwards. But it traverses the breadth as well as the length of the leaf. That it is not conscious of the length and breadth is almost certain; but at this rate all animals, and even primitive man, live in a world of one dimension.

XXII

The example proposed by Hinton in his *Episode of Flatland* is more arbitrary but

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more demonstrative. He imagines a being imprisoned in a line. For my own part, I should prefer, for the sake of probability and lucidity of demonstration, to see it imprisoned in a groove from which it could not emerge. This being has no idea of anything, excepting what is in front of it, in this line or groove. This linear individual has two extremities, which we may call the head and the tail. The head points in one direction, the tail in another. It is impossible for it to reverse these directions. If two monsters of this kind meet, head to head, it will seem to them impracticable that they should be placed in such a manner that their heads would point in the same direction.

We know that it will be easy for us to work this miracle by turning one of them about. We are able to do this because we have at our disposal a second and even a third dimension. Since he is unable to move in two dimensions, the being imprisoned in the groove imagines that this impossibility is imposed by the nature of space. We do the same when we believe that the very nature of space restricts us to three dimensions.

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XXIII

The example of the creatures that Ouspensky calls the two-dimensional animals is likewise open to certain objections. The cat, the dog and the horse, he tells us, are conscious only of the length and width of things, of their surface. They are not conscious of their height. Is this really correct? When the horse has to pass under an arch that is too low for him he is perfectly well able to reckon by how many inches he must drop his head, just as he judges at a glance that a fence is too high, or a ditch too wide, and refuses to jump it. Similarly, the dog knows perfectly well how far he must crouch in order to enter his kennel. But it is true that they do not realize the ratio of the length and width of an object to its height or thickness. This is a concept, a creation of the mind, of which they have no notion. I am even inclined to ask, although Ouspensky does not do so, whether they distinguish length from width or height. On a surface they resemble the snail in that they are scarcely conscious

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of anything but the straight line which runs from the point which they wish to leave to the point at which they wish to arrive. Length and width, as concepts, are for them as inaccessible as the concept of the sphere or the cube. It is therefore very possible that they are animals of one dimension, and not, as Ouspensky affirms, of two. Even the swallow, continually afloat in the three dimensions, in all probability is conscious only of one.

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However this may be, if we place a cat or a dog in front of a large disc, and place beside the disc a sphere of the same diameter, the disc, seen from the front, and the sphere will look, to the animal, exactly alike. If the animal approaches the disc and wishes to see what is behind it, the disc will presently be only a narrow stripe; and from this stripe, if he continues his exploration, another disc will gradually develop. On the other hand, if he approaches the sphere and moves round it, the sphere will always present the same appearance of a disc, and

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this disc will seem to follow him and to rotate upon itself. What the animal does not understand in this third dimension, which for us is incontestable, although it is only a creation of our thought, will be translated into movement—that is to say, this third dimension, for the animal, is necessarily transposed in time. The example is still more striking if instead of a disc or a sphere we place a square and a cube side by side. When the animal begins to make the circuit of the cube, he will see, as soon as he has passed the first corner, a new square, which will develop as he advances, while the first square will disappear and enter into the past; and thus, at each of the four successive corners, the surfaces are successively transposed into three times: future, present and past. The animal, then, perceives the object of three dimensions only while he is passing it. The sphere and the cube exist for him only as a function of time; they are merely time made visible.

It goes without saying that the dog or the horse is not capable of these complex arguments, but he behaves as though he were. As Ouspensky observes, if he were

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capable of reflecting on these phenomena, which have not yet entered into his life—that is, on angles and convex surfaces—he would imagine them only in time. He would not be able to imagine that they have an actual existence until they have made their appearance; and if he were able to express an opinion on the subject, he would say that the corners have a potential existence: that they will be, but that for the moment they do not exist. The third dimension, for the animal, is a temporal phenomenon, not a spatial phenomenon, as it is for us.

Experiments made upon a person who was born blind, but who acquired the sense of sight, after an operation, at the age of seventeen, confirmed this animal psychology. The cube, sphere and pyramid appeared to him as flat as the square, the disc and the triangle. He could see no difference between the disc and the sphere. It was only by touching them that he could realize that they were not identical. He lacked the sense of space, of perspective. To him all objects appeared flat, even the human face, despite the prominence of the nose and the concavity of the orbits; and for several days

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he lived in a world which had only two dimensions.

XXIV

To give us an idea of what the life of a two-dimensional being may be, Hinton proposes yet other examples. Here is one of the simplest: Imagine one of the inhabitants of "Flatland"—that is to say, a being incredibly thin and flat as a sheet of paper, living on a marble table, from which he cannot possibly escape, just as one cannot escape from the earth. All his movements are restricted to gliding over the marble as our shadow glides over the ground. On this marble table exist only objects as flat as himself. For this being the surface of the table is all space, and he knows only two dimensions, length and breadth. His eyes and limbs are not made to see or to sound the space that exists above him. He is absolutely unaware of the fact that this space exists, so that he has no idea of the thickness or height of objects. He has never seen objects which have height or thickness; as far as that goes, he cannot see them, and if by chance he encountered one

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on his table he would not realize what it was, and would regard it as an insurmountable obstacle which he would have to go round, without asking useless questions about it. We suppose him to be as intelligent and curious and inquiring as ourselves, and equally civilized; but, restricted by his organs, he must of necessity be entirely ignorant of the third dimension in which we live.

Let us cut out of paper two identical

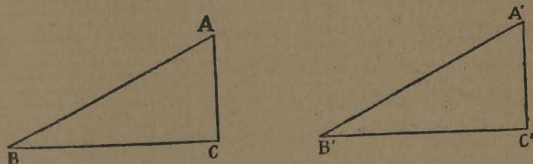


FIG. I

triangles, preferably scalene, in order to avoid any confusion of the angles, and let us place one beside the other on the marble which is the world of our flat being. Having studied the lines which enclose them, and which are all that he can see and touch, he will conclude that the two triangles are equal and similar; and he will be able to conceive that the one occupies precisely the same space as the other. Moreover, by

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sliding the right-hand triangle under the left-hand triangle he can superimpose them, and ascertain that all their lines coincide.

But instead of placing these triangles on the table as in Fig. 1, let us make the right-hand triangle revolve towards the right on the line $A'C'$, which gives us Fig. 2.

The flat being will once more look at his triangles, and after examining them he will discover that the lengths of the sides

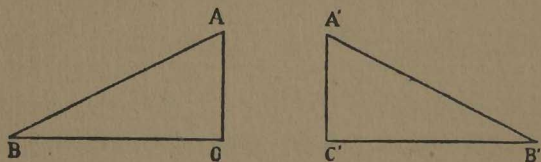


FIG. 2

and the angles of the triangle $A'B'C'$ of Fig. 2 are still absolutely equal to those of the triangle ABC of Fig. 1; that there is no difference between the two triangles as regards the space which they occupy—in a word, that they are precisely similar; but to his inexpressible amazement, after exhausting all possible combinations, after sliding one triangle on to the other in all possible positions (he cannot, we must remember,

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conceive the idea of lifting them up), he will discover that although he can still superimpose them he cannot make them coincide, even though he were to devote the rest of his days to the task.¹

¹ Here is another diagram which presents the same problem under a slightly different aspect:—

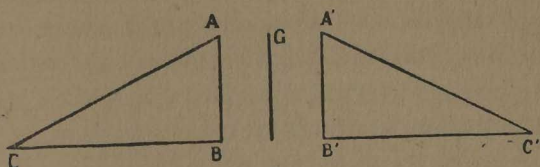


FIG. 3

The flat being, by sliding the triangle ABC across the line G, can place it in the position occupied by the triangle A'B'C' in Fig. 3, but whether it passes the line G above or

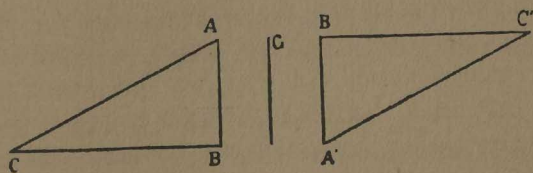


FIG. 4

below the latter, no amount of perseverance will ever enable him to place the triangle ABC in the position occupied by the triangle A'B'C' in Fig. 4. Before this can be done the triangle must be rotated on the line AB; and this

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Something, indeed, has happened which is, to the flat being, unimaginable; something has occurred in another world which seems for ever to have changed the nature and the properties of the triangles—an event as inexplicable as would be, for us, the possibility of placing the palm of the right hand on the back of the left and making them coincide, or of passing behind a mirror which reflects us and making our actual body coincide with the reflection which we had by some means fixed upon the glass.

Thanks to the intervention of a being having knowledge of a world possessing three dimensions—a world which in consequence is immeasurably superior to that in which the flat being is confined—the second triangle has rotated on one of its sides, in a direction of which he has no knowledge, in a space which for him has no existence, and of which he can form no conception. For him there is a certain frontier of possibilities which he cannot cross. But this frontier does not correspond requires the intervention of a being having at its disposal a third direction in space—or in other words a third dimension.

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with what is really possible or impossible. It corresponds with a certain condition which is proper to the flat being but not to the triangle. If the flat being says that it is impossible to make the two triangles coincide, this is an assertion which does not refer to the triangle, but to himself.

It is the same with us. We make many assertions about the outer world which concern only ourselves, and which, from the standpoint of the still unknown reality, are of no more value than that of the flat being; but instead of saying, with the latter, that there are only two independent directions, we rashly assert that there cannot be more than three.

It is useful to insist on these points, because they are, on a lower plane, the precise counterpart of our position in the universe.

The unfortunate flat being might thus wear out his life over this problem, which to us seems childish, just as we might waste all the hours of our earthly journey without succeeding in making our right hand coincide with our left in the position which I have described, or our reflection with our real

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image, whereas we can readily make our left-hand glove coincide with its right-hand fellow by turning the latter inside out, as one might turn an eel-skin or an umbrella-cover inside out—that is to say, by resorting to a subterfuge which approximates to, or parodies, our vague notion of a fourth dimension which we cannot as yet utilize for our body, in order to superimpose it on its reflection. But apparitions and ectoplasms, in metapsychical experiments—which, for that matter, are still disputed—are already producing analogous results, which presuppose the existence of a fourth dimension, to which that sixth sense is said to respond whose vestiges the modern occultist believes he has discovered or revived.

XXV

Hinton, whose imagination is inexhaustible, has provided yet another example of the tricks which we might play upon the plane being in order completely to confuse the knowledge which he believes himself

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to possess of the laws and the phenomena of his universe. Let us suppose him to be on a square surface enclosed by a line one millimetre in thickness. He is a prisoner in his plane, and does not even think of the possibility of passing its boundaries, just as a man might be imprisoned in a cube or a room which had no opening. But we can lift the plane being and place him on the other side of his plane. He will then suddenly find himself removed from the surface that held him captive without having crossed the insurmountable lines which bounded that surface. His astonishment will then be precisely similar to the astonishment of a man who should suddenly find himself outside his closed chamber without having passed through the windows, the door, the chimney, or any other opening in the walls, floor or ceiling—a man, in a word, whom one had liberated by resorting to the unknown direction which the fourth dimension gives us.

This, we are told, can already be done by the entities of metapsychical phenomena; and we can at all events realize it in our thought, which has at its call a dimension

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which our body is perhaps on the verge of knowing.

But the simplest example is still the famous cavern of Plato, although the great philosopher of Aegina was not thinking of the fourth dimension. It will be remembered that Plato imagines human beings who have been chained, hand and foot, since their infancy, in an underground cavern, so that they can neither turn their heads nor move their hands to touch anything. Behind them burns a great fire, and between this fire and the entrance to their prison, to which their backs are turned, is a path on which men and women pass to and fro. The prisoners, with their faces turned always to the wall which forms the end of the cavern, have never seen anything but their own shadows and the shadows of those who pass along the path. They have no knowledge of anything but shadows and flat surfaces; for them the image of all existing things is without thickness, and they live in a world of two dimensions.

If they were set free, and were to perceive the truth of things, and above all the truth of solids, they would be as surprised to

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enter a world of three dimensions, whose existence they might perhaps have suspected, but whose possibility they would doubtless have denied, as we ourselves should be did we enter a world of four dimensions, whose existence we too suspect, but whose reality we are in the meantime too prone to deny.

In order to suggest yet another resemblance to the foregoing, let us suppose that we take the plane being up a height—that is, into a third dimension which overlooks his plane world. Having accustomed his eye (for he would probably have only one) to this prodigious spectacle, this being, who had hitherto seen only the lines that limit the surfaces of his universe, and not these surfaces themselves, which were for him an impenetrable and unimaginable mystery, would suddenly see what these lines enclosed; in other words, he would see the inside of everything in his world; the inside, for example, of the houses, which could not have any roofs, and the inside of the plane beings' bodies, whose organs, hidden until this moment from his eye, would of necessity lie on the surface. Similarly, if

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someone were to lead us up the heights of the fourth dimension, we should see the whole interior of the world of three dimensions—that is, of all the solids, cubes, spheres, pyramids, houses and living creatures, of which, from the depths of our third dimension, we see only the surfaces, just as the plane being, from the deeper depths of his second dimension, perceives only lines.

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It may be added, in other words, in order to summarize the problem in a formula, that just as the lines of the disc, triangle or square which the plane being perceives are only the exterior of surfaces which he cannot see, and which themselves are only sections of the sphere, pyramid or cube, so the sphere, pyramid or cube of which we see merely the surfaces are only sections of unimaginable solids, whose existence it is just as impossible for us to conceive or represent to ourselves as it is for the plane being to conceive and represent to himself the existence and the forms of the sphere, pyramid or cube.

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XXVI

Let us return to Ouspensky, and endeavour to condense his arguments, which are sometimes rather elusive. Just as the second dimension is for the snail the movement of the first, or the movement of a line *in a direction which it does not contain*—for if this line were to move in a direction which it does contain it would continue to be a line and would not become a surface; just as for the dog or the horse the third dimension is the movement of the second, *which likewise moves in a direction which it does not contain*, for otherwise it would remain a surface; just as this movement outside itself, so to speak, becomes for us a solid, which the dog can conceive only in the form of time, is it not probable that the fourth dimension is the movement of the third, or of a solid, in a direction which is not contained in it, and which lies outside all the directions which are possible in a three-dimensional figure? And just as time, for the animal, replaces the concept of the

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solid of which it can have no notion, does the explanation by time, which all the investigators end by offering us, replace something which it is as impossible for us to conceive as it is for the animal to conceive the sphere or cube? With this brain of which we are so proud, and which for us represents the spiritual summit of all the worlds, shall we not find some other explanation than that of the dog or the snail?

XXVII

It must be admitted that none of those who have made a profound and special study of the subject have succeeded in finding any other interpretation. They themselves confess as much. To quote the same sagacious of these inquirers, Ouspensky: "Just as in the point it is impossible to imagine the line and the laws of a line, just as in the line it is impossible to imagine the surface and the laws of the surface, just as in the surface it is impossible to imagine the solid and the laws of the solid, so in our space

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it is impossible to imagine a body having more than three dimensions and impossible to imagine the laws of the existence of such a body."

They are thus, of necessity, led to draw the same conclusions as the horse, the dog, or the snail, and to transpose into time what they cannot conceive or understand. But to transpose something into time in order to explain it by this transition is to transpose it into that which does not exist, or which exists only relatively to ourselves, and to explain it by what we understand least of all. *Obscurum per obscurius*. When we say, with Ouspensky and Einstein, that time is the fourth dimension of space, we might just as legitimately assert that space is the fourth dimension of time, which for us has only three: the future, the present, and the past. It would perhaps be simpler to declare at once what is probably the ultimate truth: that eternity, perpetual and universal simultaneity, or the eternal present, is the fourth dimension of space and time—that is, the greater unknown of two terms which comprise only the unknown.

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XXVIII

In the meantime, we say that it is time in order that we may not be dumb before the infinite; but we might as well maintain that it is any other thing unknown: the ether, for example, that mysterious plane of electromagnetic phenomena, more solid than a block of adamant, since it bears the worlds, and yet more invisible than a vacuum. It is the substance of space, and is consequently another aspect of time; and its waves, which form and animate all things, are space in movement, just as space is the ether at rest. It is insensible to the supreme unknown, the greatest of all, whose brother it may be: I mean gravitation. To this also we might have recourse in order to explain the inexplicable; to gravitation, which is a mixture of mass and space and time, and an utterly inconceivable mystery. It is perhaps the last word of the enigma, and in any case it is the only universal law, independent of all external action, and unaffected by any alien circumstance. We see, indeed, that light

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is arrested by opaque bodies and deviated by prisms or lenses, and that electric or magnetic actions are modified by the neighbourhood of certain bodies, while no means will enable us to increase or diminish gravitation, which remains indifferent to all physical circumstances and to the chemical nature of the bodies which are subject to it.¹ Why should it not replace time when space will no longer answer our questions? It is better qualified to answer them, since it is gravity that produces the movements of the stars, and gravity alone that regulates the stupendous clock which we see in the heavens. Fundamentally it is only a pseudonym of time; it is time's moving countenance, and, when all is said, can hardly be distinguished from time.

Let us add that during the two centuries that have passed since its laws were formulated with adequate precision, no one has

¹ We note, however, that recently an Italian scientist, Signor Majorana, has obtained results in respect of the absorption of gravitation by interposed bodies which, if they are confirmed, will perhaps transform our whole existence. I do not know whether these experiments have fulfilled their initial promise.

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succeeded in explaining the nature of its mechanism and its influence. Nearly two hundred theories have been hazarded; but even the most plausible of these lead us nowhere, and they do not support an experimental test. We do not as yet know the velocity of gravity; we do not know whether it is equal to or greater than that of light.

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"Einstein's theory," says Emil Borel, "may be summarized by saying that the complete and total knowledge of the relations of space and time would suffice for the description of the world; and that the localization of matter and electricity in particular may be deduced by simple formulae from these relations of space and time."

But what can we hope to gain from these relations between two illusions born of the infirmity of our understanding? This is equivalent to saying that no explanation is possible, as the plane being would have to say when he discovered that his triangle

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had rotated in a direction of whose existence he had not even a suspicion.¹

XXIX

To attempt to explain space by time and time by space is to seek to explain the night by darkness and darkness by the night; it is to revolve hopelessly in the circle of the unknowable. Time and space are two masks of the same enigma, which as soon as we look at them fixedly assume the same

¹ We know that the theory of relativity is founded on the limited and constant speed of light. Now, recent experiments by Miller, a pupil of Morley, show that at the altitude of Mount Wilson—5,250 feet above sea-level—the velocity of light is no longer a universal constant, for the ether, which at a height of 600 feet from the ground appears to be carried along completely by the earth, seems, at this altitude of 5,250 feet, to partake of only two-thirds of the velocity of the globe. It is probable that at a height of 15,000 feet—for example, on Mont Blanc—there would be what is called an “ether drift” of at least 12 miles per second, which, apart from the fact that it would establish the existence, which has often been disputed, of the universal fluid, would denote a “lag” of 12 miles. The necessary experiments, however, have not as yet been carried out at such an altitude.

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expression. "The sense of time is an imperfect sense of space," says Ouspensky, "the fringe and limit of our spatial sense." Each lives and prospers at the other's expense. When the first increases the second is diminished, and vice versa. Every existing body is prolonged in time as well as in space; its head is bathed by duration, its feet are rooted in extension. Space is the present made visible. Time is space that is on the move and becoming the future or the past. Space is time extended; it is horizontal time; time is space perpendicular, vertical space. Space is time that endures; time is space that flies. We cannot measure our limited space save by the time we take to traverse it, and we can only measure the space which is beyond our frontiers by the number of seconds or of centuries which the light takes to traverse it; and so soon as we endeavour to give time a sort of countenance, we can only imagine it as an immaterial space. It presents to us only an expanse which is empty of objects but peopled by events; and for that matter it exists only by virtue of the events which take place in it. One might say that space is the time of the body and time the space of the spirit.

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Time begins for us when we cease to understand space; and when we are no longer able to follow time the image of space encompasses us. As Silberstein has very truly said: "There is no difference between time and space except that our consciousness moves along time."

Wherever we look, we perceive that they have common (or, so to speak, conjugal) properties; for example, in centrifugal force (that mysterious energy which at first appears to be the immortal enemy of gravitation), for the rotation of the earth is mathematically expressed by formulae in which both space and time play their part.

They are both alike infinite in the metaphysical sense of the word: *Quod nihil ultra se habet praeter se ipsum* ("which has nothing beyond itself but itself"). In virtue of this principle time should be limited only by time and space only by space. Now, space is almost always limited by time, and time is surrounded by space. Their frontiers are confounded, and vanish into the same unknown.

Space necessarily exists in time; on the other hand, where would time be if it had

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not space? To quote Minkovski, the eminent mathematician: "Never has a point of space been seen other than at a certain moment; never has time been perceived other than at a given place"; and elsewhere he adds: "Space in itself and time in itself dissolve into a shadow, and only a kind of union of the two can maintain an independent existence."

The astronomer Eddington, on the other hand, asserts that "the fundamental measure is not the interval between two points of space associated with instants of time. Space without time is as incomplete as a surface without thickness."

The best we can do is to consider time as the movement of space and space as the repose of time. In reality, time is as motionless as its brother. We represent it as a river for ever flowing, coming we know not whence, going we know not whither. The truth is that it has never stirred; it is not time that flows, it is we that pass away.

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Caught between space and time, we fall into a sort of cosmic impasse. When the

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mathematicians take us out of space, when they come to the critical point where space no longer responds to their investigations, they call in a fourth variable, t ; it is time that restores equilibrium in their calculations and enables them to carry them farther, after which they are compelled to recognize that time is nothing more than space which has changed its name. It is enough, therefore, that space should assume a different form or a different name, and operations become possible which, though they seem to be based on a twofold illusion, are none the less capable of attaining truths which experiment will confirm.

XXX

The most discouraging fact is that time has no fixed and actual point on which we can fasten. We do not know where its centre is to be found. For some, the only solid portion of time is the future, to which it may be objected that this is the most illusory portion, for how can that of which no one knows anything provide our intellect with

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a point of reference, a basis? For others it is the past. It is true that the past has a countenance, which the present and the future have not as yet; but it no longer exists; it is only the image of a reality which is no more and can never return. Lastly, for others it is the present, and only the present. What we call the present is the transition from the future to the past. But this transition has neither extent nor duration. It escapes us completely. Before we think of it the present is still the future; as soon as we give it our attention it is already the past. It flies us even more promptly than that which precedes and follows it, and we no longer know of what we can take hold, for our hands grasp only the void. "What we call the present," says Whitehead very truly, "is the living fringe of memory tinged by anticipation."

If we cannot seize and hold the smallest vestige of the present on this earth, how can we hope to comprehend the eternal present, for ever immobile, which is the sole verity, the fundamental enigma of the universal stability, total and endless, to which is opposed that other no less fundamental

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enigma of perpetual movement and eternal becoming?

What is to be our position between these two poles of eternity, if indeed eternity, which is infinite, can possess poles?

XXXI

Into these mysteries does the fourth dimension plunge us. It is only a name, a more accessible, more human, more tractable, and, above all, a more recent name for the inexpressible unknown. How far does it really exist? How far is it tenable?

Hinton offers us this alternative: If there are four dimensions, we have only a three-dimensional existence, or, rather, we do actually possess four dimensions, but we are not conscious of them. If we find that we exist in three dimensions when in reality there are four, we must be, in respect of those who exist in four dimensions, what lines and planes are with regard to us—that is to say, pure abstractions. In this case we exist only in the mind of the entity which

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conceives us, and our experiences are none other than his thoughts—a conclusion at which the majority of idealistic philosophies have arrived, by different paths, and which, in our condition of absolute ignorance, is just as defensible as any other.

Lastly, in a chapter entitled “The Evidences for a Fourth Dimension,” he asserts, in contradiction to what we have been told by others, that no phenomenon explained by mathematics proves for us the existence of the fourth dimension. On the other hand, the “evidences” which he adduces are not irresistible. The first of these evidences, derived from “folding,” which gives rise to the symmetry of right and left, is finally discarded by Hinton as insufficient and valid only in the regions of the infinitely little. Other proofs, which he derives from spheres of elastic material rotating on different axes or from electric currents, remain extremely obscure, even if we have the assistance of diagrams which cannot be reproduced here, and which, for that matter, culminate in brain-racking puzzles like the “tesseract,” which Ouspensky himself, despite the importance which he attaches to

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the work of the English mathematician, is obliged to discard as too "personal."

For the rest, Hinton admits that we can never see a four-dimensional shape with our bodily eyes, but only with the mind's eye, and then only when we have acquired the faculty of carrying a great number of details in our mind. This—and we shall meet with the same peculiarity in more than one hypergeometer—is almost the language of the great mystics, from Plotinus, Ruysbroeck the Admirable and Jacob Boehme down to St. Theresa, John of the Cross and others. And in truth they are seeking the same unknown, the same God, under other forms and by other methods.

XXXII

"We must, of course," says Hinton, "be creatures of four dimensions, for otherwise we should not have the notion of these dimensions." But have we, as a matter of course, the notion of the fourth dimension? Mathematics and hypergeometry have given rise to this idea, and have gradually insisted

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on its necessity. It is true, as I have already remarked, that mathematics and geometry are still ourselves, and that if they impose upon us the idea of the fourth dimension it is hardly probable that this idea can come from without. We have as yet no scientific knowledge of any being superior to ourselves. Nevertheless, the higher mathematics seems to afford us the beginnings of the proof of its existence; but I repeat that they are able to do so only because this existence is already and uniquely in ourselves. We cannot, up to the present, affirm that any sort of assistance has ever reached us from another sphere, or that any helpful indications come down to us across the gulfs of the beyond. In this connection the reader will find, farther on, in an essay entitled *The Isolation of Man*, a few considerations which I have no space to develop here.

XXXIII

Lastly, summing up the doubts which may persist as to the existence of a fourth dimension, the astronomer, A. S. Eddington, in

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his remarkable work on *Space Time and Gravitation*, one of the best essays on these problems that has hitherto been published, very justly calls our attention to the fact that however great the value and the success of the theory of a four-dimensional world, we often hear "a voice inside us which whispers: 'At the back of your mind you know that a fourth dimension is all nonsense.' I fancy that that voice must often have had a busy time in the past history of physics. What nonsense to say that this solid table on which I am writing is a collection of electrons moving with prodigious speeds in empty spaces, which relatively to the electronic dimensions are as wide as the spaces between the planets in the solar system! What nonsense to say that the thin air is trying to crush my body with a load of 14 lb. to the square inch! What nonsense that the star-cluster which I see through the telescope, obviously there *now*, is a glimpse into a past age 50,000 years ago! Let us not be beguiled by this voice. It is discredited."

"When, therefore, we are asked," he says farther on, "whether the four-dimensional world may not be regarded merely as an

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illustration of mathematical processes, we must bear in mind that our questioner probably has an ulterior motive. He has already a belief in a real world of three Euclidean dimensions, and he hopes to be allowed to continue in this belief undisturbed. In that case our answer must be definite; the real three-dimensional world is obsolete, and must be replaced by the four-dimensional space-time with non-Euclidean properties. . . . The four-dimensional world is no mere illustration; it is the real world of physics, arrived at in the recognized way by which physics has always (rightly or wrongly) sought for reality."

XXXIV

The position of metageometry is comparable to that of metapsychics. Metapsychics seeks beyond the ego, and above all beyond death—for we do not yet know whether the dead live in us or outside of us—in manifestations of which some (as telepathy, for example) are to-day admitted and classified by science, and of which others, such as

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communication with discarnate spirits, are still debatable. In respect of the essential points it has as yet no more than the beginnings of proofs, and it will probably be a long time before it has anything more, for if it were to attain to certainty the whole face of the universe would be changed and we should cease to be what we are.

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Metageometry, on the other hand, searches outside our space into the nature of the space or spaces, no longer subjective and conventional, which envelop us, and which are only vaguely related to the space which we have had to create, or which has been created in us, in order to help us to understand, or to have the appearance of understanding, something of the phenomena of the universe. Its calculations have led it in another direction, towards the expanses which it believes to be independent of man, and which are at least derived from another convention or another illusion. Metageometry also has no more than the beginnings of proofs in respect of the essential points. But it does really

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seem that its demonstrations—so positive, so logical, so peremptory are they—must respond to something which exists, but which it cannot represent to itself, and which, perhaps, is not necessarily to be found in the space in which metageometry places it, but possibly in man himself, who, thanks to this something, believes that he can escape from himself and at last evade the limits of his imaginary ego.

It will perhaps lead to the physical manifestation of the fourth dimension, just as metapsychics may lead us to the proof of immortality or of the life beyond the grave.

XXXV

Whatever we may think about it, all that moves on the confines of our being is more profoundly interesting and more fruitful than that which exists in its lower regions or its centre; and we are not wasting our time when we interest ourselves in it and investigate its eddies, which are to-day more lively than ever. In any case, as far as hyper-

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geometry is concerned, we may say that there is assuredly no other science which enables us to sound and to feel so definitely, so almost sensibly, certain important points of the great mystery of this world.

But when all is said, and in spite of all the incontestable phenomena which unfold themselves in the invisible, it may be asked how far the fourth dimension is of importance to our practical life. As yet there is no very definite answer to this question; and it is probable that there will not be any answer for some time to come, for if there were one an extremely interesting part of the riddle of the universe would be solved, and we should begin to breathe under other heavens.

XXXVI

Hitherto, then, we have had no need of the fourth dimension, except in the infinitely small, in the hyper-invisible, where almost everything requires it; and sometimes in the infinitely great, where many things remain inexplicable without its aid—and here, pro-

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visionally, it takes the shape of time—and in the majority of electro-magnetic phenomena and in almost everything that refers to the theory of Relativity. As Bergson tells us—who, in his *Duration and Simultaneity*, has given us valuable if complicated hints on these problems—"the notion of a fourth dimension introduces itself, so to speak, automatically into the theory of Relativity, and the physics of Relativity is compelled to include it in its calculations. . . . A fourth dimension," he adds, "is suggested by all spatialization of Time." Now, the time of the mathematicians is of necessity a time that is measured, and is consequently a spatialized time.

Professor Whitehead, in his *Concept of Nature*, sums up the situation from the astronomical point of view: "It is incontestable that certain difficulties in connection with the agreement of delicate observations—such as the movement of the earth through the ether, the perihelion of Mercury, and the position of stars in the neighbourhood of the sun—have been solved only by means of this new conception of 'Space-Time'"—that is, by means of the fourth dimension.

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It is, moreover, quite possible (for such a thing often happens in the forward march of humanity) that, gaining on us little by little, the necessity of a fourth dimension will make itself felt in our daily life, in which it already exists and operates in a latent state. It is as well, therefore, to prepare ourselves to know it, so that it shall not enter our life suddenly, like an intruder of whom we had never heard.

XXXVII

When at last we have come to comprehend the fourth dimension, or are able to make use of it, we shall be almost super-human. In order to obtain some approximate idea of our transfiguration, let us try to put ourselves in the place of an animal—a horse or a dog, for example—accustomed to his two dimensions, who, making his way little by little into the world of three dimensions, gradually became human. Hitherto he would have seen only surfaces, for we too see only surfaces, but we know that behind them there is another dimension.

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From the moment when a glimmer of a concept of solids enters the animal's brain, when it makes the circuit of a house or a haystack, or approaches a lamp-post in a slanting direction, these objects, to his great astonishment, will no longer move, will no longer seem to rotate upon themselves. The whole world of solids—that is, almost everything that exists, and which he used to see constantly in movement, since he attributed to it all the movements which he made himself—will become suddenly and tragically immobile. His universe will be changed from summit to foundation—unrecognizable, menacing, and for a time uninhabitable—and the poor little hereditary and experimental logic by which he had lived so peacefully will suddenly find itself standing on its head with its feet in the air.

Note that this illusion of the animal's, for whom each step is translated into movements which he attributes to his surroundings, is one that we too experience (or, rather, used to experience), but only above a certain speed. When we are in an express train, for example, the landscape distinctly passes before our eyes; it revolves at different speeds in different

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planes, and makes its way forcibly into the railway-carriage. A village takes to flight behind hedges that unroll like ribbons at a dizzy speed, and its church tower, a little farther away, follows it at a limping pace; a cow lying in the grass is making a speed of sixty miles per hour; and so on. Long habit has taught us instinctively to rectify these errors of our eyes; we no longer take any notice of them; and in La Fontaine's words, they "deceive us never while lying ever."

Nevertheless, under exceptional circumstances the atavic illusion may sometimes be rekindled. Thus, I remember that in the first days of the motor-car, thirty years ago, those who experienced the first intoxication of long excursions saw the hills, woods and fields come to life in the same way. I find the ingenuous evidence of this in a page of *The Double Garden*, published in 1904 but written in 1901, in which I spoke in lyrical phrases of the road "which advanced to meet me with a rhythmical movement, which was presently leaping and furiously hurling itself to meet me in a dizzy flight, while the trees which bordered it hastened

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forward, putting their green heads together, closing their ranks and conspiring to bar my way."

These were innocent and primitive emotions which the present generations, born in a motor-car, will no longer experience. I myself procured them modestly enough by favour of a little De Dion of three and a half horse-power, with four seats, always occupied, which could make over eighteen miles an hour when a benevolent descent came to its assistance.

XXXVIII

It is probable enough that there will be an upheaval of our habits analogous to that which would so disconcert the animal, when, in imitation of the problematical quadruped which we supposed to have mastered the concept of solids, we have acquired the concept of hypervolumes, of which we have as yet but a very vague idea, and have progressed finally from the mathematics of finite and constant numbers, from the Euclidean geometry and the Aristotelean logic, to the mathematics of numbers beyond infinity, to

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hypergeometry and the logic of the universe, of which we have as yet merely the presentiment.

Will the animal one day acquire the concept of the third dimension, and shall we at last comprehend the reality of the fourth? On a planet which has still thousands and even millions of years before it, the one thing is no more impossible than the other.

XXXIX

In the meantime, all this shows us how difficult it is to escape for a moment from ourselves, to imagine a superior being who shall be less limited than ourselves. But faint as the glimmer of light may be that we have glimpsed, or merely hoped or dreamed, to set our minds towards it is the greatest and noblest effort that man is capable of making before death overtakes him.

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After all, the most probable hypothesis, and the most defensible, is that which tells us that if the creatures inferior to man

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know only one or two dimensions, whereas we know three, it may be presumed that for a being superior to ourselves—and such a being is only too easily conceivable—or for ourselves when we have sufficiently progressed beyond our present stage of development, there will necessarily be more than three.

Moreover, just as the point is comprised in the line, and the line in the surface, and just as two-dimensional beings, without suspecting it, are already immersed in the third dimension, so, in our present stage of development, under the pressure of the infinite, the fourth dimension is creeping into our lives from every side. The axiom of the three dimensions no longer suffices to account for molecular or atomic phenomena, whereas the calculations into which the fourth component enters confirm these phenomena or even foretell them. It may be noted in passing that we are too much inclined to neglect these infiltrations of the infinitely little, although in themselves they are just as important as those of the infinitely large. But our thought does not range nearly so far afield, and is incomparably more

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restricted in the infinitely little, which is like the concave side of the illimitable, of which the convex face is the infinitely great. Our imagination is immediately paralysed by the invisible, which even the microscope is far from revealing, and which, for us, dissolves into nothingness. But it is here precisely that mathematics comes to our assistance, far more frequently and in a much more authentic fashion than in the infinitely great.

What is true of atomic or molecular and electro-magnetic phenomena is equally true of the phenomena of life, which are movements in a space of a higher quality, and of certain chemical phenomena which are akin to them. And the same thing is true of some of the phenomena of the infinitely large in hyperspace. It is true also of many of the states of matter which are revealed to us by metapsychics. Lastly, it is true even of a whole region of our spiritual, sentimental and artistic life, which is continually passing from the third to the fourth dimension. Already to-day our shadow, which goes before our actual presence, is haunting this dimension, even though we hardly realize its existence,

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and have no idea to what extent it intervenes, under other names, and notably under the name of the ideal, in our thoughts, our passions, our aesthetics and our subconsciousness, in which so many things are still unexplained. When our body is able to follow the shadow that precedes it we shall begin truly to live upon this earth; and it is very possible that this moment is less remote than we suppose.

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MORE than a third of our lives is passed already in a region where the rigid laws which are imposed upon us by our space of three dimensions no longer weigh upon us. It is true that we are not conscious that a fresh direction in the infinite has opened for us the gates of a world in which we do not dwell by day; but we act as though we had never been the slaves of extension and duration. We find ourselves simultaneously, without feeling any surprise, in places remote from one another; matter becomes reversible, permeable, ductile as air; weight no longer exists; the past and the future are confounded in the same present; our habitual logic is completely overturned: to say nothing of a host of other abnormal manifestations, which it would take too long to enumerate.

It would seem that the study of oneirical phenomena has not yet emerged from the period of tentative hypotheses. Dr. Vaschide, in his remarkable book, *Le Sommeil et les*

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Rêves, gives a very precise account of the present state of the problem. He sums up and analyses the works of the great oneirologists, and notably those of Alfred Maury, Mourly Vold, Max Simon, P. Tissié, Goblots and Freud, for whom, as we know, every dream is merely the disguised realization of a repressed desire; and lastly, those of the Marquis d'Hervé de Saint-Denis, which are more valuable than all the rest.

The investigations of the Marquis d'Hervé have attracted less attention than those of the fathers of psycho-analysis, but they are more strictly controlled, and, above all, their conclusions are infinitely less venturesome. He first of all applied himself to cultivating the oneirical memory, and after six months of a special training he was able regularly to remember his dreams of the night at the moment of waking. Then, proceeding from the principle that neither the attention nor the will is abolished during sleep, he applied himself to controlling his dreams. He succeeded in doing so to a certain extent, being endowed with special aptitudes, but at the cost of efforts and a discipline which are not calculated to en-

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courage those who would follow in his footsteps.

Having examined these learned and ingenious studies of the subject, we are forced to admit that the mysterious kingdom of dreams, which fills almost half our lives, has not hitherto surrendered to us any of its essential secrets.

My intention here is merely to consider for a moment the relations of dreams to the future, a point which these scientists have not even touched upon, and which is perhaps more interesting, and at all events more defensible, than most of those which they have examined.

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Some time ago this problem was treated in a little book by an English writer, Mr. J. W. Dunnes, *An Experiment with Time*. The principal object of this book is to elucidate the notion of time considered as the fourth dimension, for every body is extended in time as well as in space. This attempt at interpretation is hardly likely to interest any but specialists; it is too technical, too abstruse, and doubtless contestable. Unless one is at

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home in the subject it is difficult to follow the writer, and when all is said, what we obtain from a perusal of the book seems to be more verbal than actual.

Mr. Dunnes, in support of his thesis, relies almost exclusively on oneirical premonitions. Anyone who has dabbled in metapsychics knows what is meant by premonitory dreams. I have spoken of them at some length in *The Unknown Guest*, in which they form the subject of an essay entitled "The Knowledge of the Future." Such dreams, more or less prophetic, have been recorded since the beginnings of history, and are no longer seriously disputed. M. Ernest Bozzano, in a volume devoted to premonitory phenomena, profiting by the labours of the Society for Psychical Research, and completing their data by the results of his own investigations, has collected a thousand instances of premonition, of which he has retained one hundred and sixty—not so much because he regards the majority of the remainder as of no particular value as in order to avoid exceeding the normal limits of a monograph.

The hundred and sixty cases which have

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been retained are controlled as vigorously as possible. By the very nature of the phenomena recorded, they depend almost entirely on the relations of those who were the actors or the figurants—that is to say, on human evidence, which is always suspect. But in such a case we must renounce all certitudes and all knowledge excepting that which is acquired in the laboratories or by mathematical operations; in other words, three-fourths of what we know. However, a few cases are corroborated by written evidence, and notably the case recorded by M. Th. Flournoy, professor in the faculty of science in the University of Geneva, in his remarkable book, *Esprits et Médiums*. The postmarks give positive evidence of the date of a letter sent from Geneva to Kazan, in which a friend of Professor Flournoy's, Mme. Buscarel, relates, with details which exclude any idea of a fortuitous coincidence, a dream announcing a tragic event which did not take place until a week later.

Unless we are guilty of systematic and childish incredulity, we are therefore compelled to admit that prophetic dreams exist and have always existed, and that they must

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be definitely classed among the most defensible acquisitions of metapsychics.

Before we go farther, let us recall two principles on which the majority of oneirologists are agreed, the first of which is that there is no sleep without dreams. It is, as a matter of fact, highly improbable, if not impossible, that the brain should entirely cease to function during sleep, however profound that sleep may be. It continues to perform its vital mission, just as the heart continues to beat, the lungs to aerate the blood, the stomach to digest, the liver and the kidneys to eliminate waste products and toxins, etc. In order to assure himself of the fact, M. d'Hervey had himself awakened a hundred and sixty times during his first sleep, on various occasions and at different periods of his life, and notably on thirty-five consecutive nights, and discovered that his thoughts were always fixed on some sort of oneirical image.

If we believe that we have slept a dreamless sleep, this is not because our sleep was wholly free from dreams, but because on awakening our memory of those dreams was instantaneously and completely dissipated.

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The memory of what happens during sleep, as we have all had many opportunities of observing, is of a very special nature. It is superficial, as though it did not take hold upon the sources of life; it is fugitive and inconstant, and the first ray of dawn sweeps away its vapours in a moment. I am even of opinion that we never have any knowledge of the dreams of our profounder slumber. We capture only the remnants of those that lurk on the frontiers of the waking state.

Moreover, we must be on our guard against the complaisances of the oneiric memory. If we feel the slightest preference, if even unknown to ourselves we solicit that memory, it will instantly respond, and will be lavish of what we obscurely desire.

However this may be, it is very rarely that the memory of our dreams, even of the most distinct and most impressive of them, survives until the middle of the day, and by evening not a trace of them is left. These circumstances are so well known that it is unnecessary to insist on them.

The second principle admitted by the specialists is this: that as it is possible to cultivate and develop the ordinary waking

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memory, so it is possible to cultivate and develop the oneiric memory. We shall perhaps succeed in discovering some other method, but in the meantime the simplest method consists simply in making written notes, whenever we wake in the night, of the dream which has just deserted us. After a while the memory begins to lend itself to this unaccustomed demand, and we can successfully reconstruct and re-animate the most complicated of dreams; and it is a curious fact that, as though flattered by the honour we are paying them, they become more regular and less incoherent, and, in a word, are on their best behaviour, like children who know that they are being watched. Above all, we find that they grow unexpectedly more numerous, apparently because we lose far fewer of them.

It may be noted in parenthesis that statistics furnished by Mrs. Sarah Weed and Mrs. Florence Hallam show that of 100 dreams 58 are painful and 26 actually agreeable, the rest being neither one nor the other; which amounts to saying that, as in our daily life, unhappiness is in excess of happiness.

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What interest can there be, you will ask, in retaining our dreams, or inviting them, seeing that to-day we no longer believe in presages, and that oneiromancy, which included oneirascopy, oneirocriticism and teratoscopy, is relegated to the graveyard of sciences that are definitely dead and forgotten, just as are ornithomancy, or the study of the flight of birds, and astrology, and with equally good reason?

It is true that we should be wasting our time, although everything is not equally worthy of condemnation in oneirocriticism and teratoscopy, which are the arts of unravelling and interpreting the symbols and prodigies of our dreams. But there is another aspect of the matter to be considered. Dreams are the product of an organ or a complex of organs which, in the waking state, are almost completely under the control of our conscience and our reason—that is to say, of that portion of ourselves which is jealously separated and differentiated from the rest of the universe, with which it no longer has any but scanty and precarious communications, over which a strict watch is kept.

In sleep this organ, of which the reason,

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properly so called, is perhaps no more than a parasitic and tyrannical excrescence, recovers its independence to some extent, escapes from the principal restraints of the personality, and wanders, at its will, or as chance directs it, into the illimitable, and enters into relations with all the things that it is forbidden to approach lest it should lose its way among them; and it loses, in particular, the notion of those two illusions which are most essential to the maintenance of our little individual life—illusions which mask for us the reality of the eternal everywhere and the eternal present, and to which we have given the names of space and time.

Now, experiments which have not as yet been carried very far have already enabled us to establish the fact that the brain, set free by sleep, and wandering through the eternal present which is real time, encounters, in the course of its wanderings, as much of the future as of the past. It confounds the two. It no longer perceives the imaginary but rigid line that separates them in the name of reason. It no longer distinguishes between what we have done and what we shall do, between that which has not yet

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happened and that which has already befallen us, and it returns to us—though of this it knows nothing—laden with prophecies as much as with memories. It is for us to sort and to select what it has gathered, as the bee gathers pollen from the flowers, and to learn how we may profit by the warnings which it casts before us, indiscriminately mingled with regrets and remorse.

For this reason the ancients, who, under the forms which it assumed of old, and which, for that matter, it still assumes to-day, had succeeded in detecting and honouring that sort of instinctive, obscure, incoherent, but almost unlimited wisdom which we to-day call the subconscious, attached as much importance to oneirical manifestations as to sidereal observations. As always, having more imagination than scientific method, they exaggerated, systematizing blindly and falling into somewhat childish errors; but, as always, there was probably a truth concealed beneath their error. This truth is one which it should be interesting to investigate. Before it can be adopted it must be subjected to numerous and detailed experimental tests.

The subjects of these experiments should

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be our humble and everyday dreams. It is true that a great premonitory dream, like that of the Chevalier Giovanni de Figueroa, recorded by Signor Bozzano, which marks a period in the archives of the metapsychical societies, produces a greater impression; but dreams of this quality are somewhat rare, and their authenticity is always open to suspicion. On the other hand, on provoking, so to speak, and noting and attentively analysing the trifling prophetic incidents of the lesser dreams which we dream each night, we shall before long be convinced, by our own personal experience, that the future already exists in the present; that what we have not yet done is already to some extent accomplished; for example, as we shall presently see, a bottle that is accidentally overturned was already falling, in that very place, we know not since when; and this, after all, is the most salutary and perhaps the only manner of acquiring a conviction and preparing to profit thereby.

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For example, here is one of the experiments noted by Mr. J. W. Dunnes. One

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day he was shooting over ground which was not familiar to him, and, not being precisely aware of the boundaries of the estate, he ventured into some fields which did not form part of it. He was angrily hailed by two men who began to run after him, loosing a dog upon him, which barked furiously. He promptly beat a retreat, found a door in a wall, and succeeded in escaping before his pursuers could reach him.

That evening he was turning over the leaves of the book in which he noted his dreams, and found, at the foot of the page, the following note:

Pursued by two men and a dog.

He had dreamed this dream two days before the actual scene, had completely forgotten it, and was able to reconstitute it only after finding the line which summed it up.

At his instance a cousin of his, Miss B——, who professed that she never dreamed, endeavoured at least to recall the thought that was in her mind at the moment of waking and to inquire into its origin. This method was wonderfully successful, and on each of the six following days Miss B——

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was able to remember a dream. I will cite only one of these; it is rather striking.

On arriving at a country hotel someone told her of a woman who was suspected of being a German spy (this was at the end of the war). A little later she met this woman in the garden of the hotel, which was so large that it might easily be taken for a public park. The woman was wearing a black skirt and a black and white striped blouse; her hair was combed back and fastened in a "bun" on the top of her head.

Two days earlier Miss B—— had sent her cousin a note describing a dream, in which she had met, in a public garden, a German woman wearing a black skirt and a black and white striped blouse; her hair was combed back and fastened in a "bun" on the top of her head.

It should be added that Mr. Dunnes and Miss B—— had decreed—in my opinion in a very arbitrary fashion—that the event announced must occur within two days, otherwise it would not be taken into account, but would be considered as not having happened.

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Let me now cite three ends of dreams, which, among others of even less value, have visited me during the short time which I have devoted to the question. I must warn the reader that they are of no interest, do not prove very much, and are even slightly ridiculous. As soon as you give the matter your attention, you yourself will assuredly have dreams which will be far more picturesque and more conclusive. If I have been able to obtain any results whatsoever in this order of phenomena, anybody may legitimately hope for anything, since nobody could be more devoid than I of any metapsychical gifts or paranormal or supranormal faculties. Their poverty should in itself be a guarantee of their authenticity, for no one would take the trouble to fabricate such sorry dreams, and the smallest schoolboy could invent much better.

I was dreaming that a bottle filled with hydrogen peroxide stood on a small three-legged table in a corner of my dressing-room. One of its legs rested on a biscuit-coloured carpet and the other two on the bare Provençal tiles. On passing the little table, I accidentally struck it with my knee;

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the bottle was overturned, rolled off the table, and fell on the tiles, where it broke. The peroxide flowed over the carpet, which began to smoke as though it had caught fire. Motionless and bewildered, I watched the destruction of my carpet without making any attempt to save it.

On waking, I made a very brief note of the dream, without attaching the least importance to it, but stating that there was no bottle on the little table, and that one of the legs of the table was resting not on a biscuit-coloured carpet, but on a bright red rug.

Three days later, having totally forgotten my dream, I bought a half-litre of sulphuric acid, which I required for my accumulators, and placed it on the little table, and a few hours later I shook the table in passing. The bottle rolled off the table, fell, and was broken. The rug, being slightly damp, began to smoke freely, and it was only at this moment that I suddenly remembered the dream which I had had three days before it was realized.

Two errors of detail will be noted: the biscuit-coloured carpet, which was that of the adjacent bedroom, and which, by trans-

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position, replaced the red rug, and the half-litre of sulphuric acid, which took the place of the peroxide. This latter error is rather curious, for the peroxide, on flowing over the carpet, would not have given rise to smoke or vapour. Here the chemical reality prevailed over the illusion of the dream, even in the dream itself.

Such errors or inexactitudes are frequent in dreams which involve the future; for that matter, they are just as frequent in those that refer to the past, which is often unrecognizable, as a result of fantastic alterations. We all of us know that nothing is more illogical, more distorting and more disconcerting than dreams, or rather than the subconscious, or the Unknown Guest who engenders them and leads them by ways which the reason rarely frequents.

Another night I dreamed that part of the wall of my garden at Nice was falling down and that the debris was obstructing the bowling-green which lay beneath it. Five days later a local whirlwind, such as often occurs in this region, overturned another part of the wall, running at right angles to that which had fallen in my dream, and the

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debris blocked the path leading to the gate. I admit that this was probably a mere coincidence, and that the fact does not prove very much, so that I have noted it here only to satisfy my conscience.

Lastly, one night I dreamed that I was in Belgium, and thinking to reach Ghent by a short cut, I came to a house which I did not recognize. A young man standing by the door of a church obligingly told me that I was in Bruges. I wanted to go into the church, but he (I do not know why) severely forbade me to enter. We had some conversation, and he told me that he was the son of a friend of my childhood. For twenty years I had rarely met this friend, and during that period I had not seen his son. Then a sort of motor-bus rushed out of the church, and this the young man entered. The bus set off like a kangaroo, made a frantic turn of ninety degrees, and fell over. Most of the travellers were hurt, and among these I saw my friend's son. Then everything faded away in an incoherent and fantastic confusion of events.

About a month later I met the friend in question. After touching on various topics,

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he informed me that his son, whom I had known as a little child, had three weeks earlier been the victim of a motor accident; his car, which he was driving himself, had capsized while turning a corner. In addition to a head wound and severe bruises he sustained a clean fracture of both bones of the right forearm. He had not yet completely recovered, but would escape without permanent injury. At the moment I saw no connection between the accident and the dream, which I had quite forgotten. It was only on returning home that I seemed to have a faint memory of something. I opened my notebook, and after writing to my friend I learned that the accident had taken place two days after my dream.

Let us confess that the behaviour of the dream or the subconscious is unexpected and incomprehensible.

It informs me twenty-four hours in advance of an accident which, at the corner of a road, awaited a young man who for me no longer existed; and it gave me a vision of this accident, while transforming nearly all the circumstances. I do not attempt to explain the enigma.

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For the rest, I cannot too often repeat that these little anecdotes do not profess to persuade anyone of anything. It is quite possible that they refer to mere coincidences, and the reader may even doubt their existence. You will believe in them only when analogous dreams, which you will perhaps be able to call forth, and remember, as I remembered mine, have proved to you that they are credible, and less rare than is supposed.

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The important thing is to come to the assistance of the oneiric memory. You will find, I think, that it is fairly easy to develop. But you must not look for marvels or for one of those extraordinary premonitions which are so frequently recorded in the metapsychical reviews. For that matter, I hope you will experience nothing of the kind, for premonitions, like the great prophecies, never announce a fortunate event. One must remember that in a normal life sensational or even notable events are not of everyday occurrence, and the best of prophets will have nothing to announce when nothing is going to happen. In order to

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exercise his gifts he must find himself at the centre of a life full of stirring incident, for otherwise he will have to confine himself to discovering, amid the mysteries of the future, a barking dog, or a broken bottle, or a collapsing wall. This is all the more probable, inasmuch as our subconsciousness, to which, until we have some better explanation, we attribute these excursions into the unknown, seems to interest itself only in petty facts which concern its ephemeral host, and pays no heed to general ideas or predictions of a certain amplitude. Do not let us despise these precognitions because they refer only to little things. One might even maintain that they are the more remarkable precisely in proportion to their insignificance. If once we admit the existence of the faculty, it is not surprising that it should perceive and be able to predict a catastrophe which occupies a sensible portion of the future. But to see in the future a falling bottle calls for a much keener vision, and supposes a much more extraordinary pre-existence of the present.

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Do not suppose, either, that the principal mission of your dreams is to warn you some days beforehand of the good or ill fortune that awaits you. We do not know yet what purpose they serve, but they do not seem to be at all eager to enable us to profit by what they tell us. They give us their warnings only by chance and without paying attention to what they do. And the advantage you will derive from them will be practically negligible, inasmuch as it is extremely difficult, if not impossible, to determine, at the time, whether that which seems to belong to the future is not congealed in the past. We do not discover that a warning is serious until it has been realized, and if we gave ear to all those that are never fulfilled we should end by being afraid to move so much as the little finger of the left hand.

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Nevertheless, the experiment is an interesting one. If it is practised for some time we shall discover in ourselves a region entirely unknown, and such a discovery is always profitable. It teaches us also that if we really

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choose to take the trouble to cultivate certain latent faculties we are all prophets more or less, and may become our own vaticinators. And we do not as yet know how far the experiment will take us in this direction. Above all, it teaches us to investigate the most stupendous of all the problems which the unknown of the universe offers us: the pre-existence of the future, to say nothing of all that attaches thereto, and particularly the insoluble riddle of free will. It matters little how insignificant or trivial the fact which reveals this pre-existence; the enigma is no less tremendous and insoluble, for it requires, somewhere, in eternity, the perfect, entire and unalterable presence of that which for us is not as yet. A bottle which I see falling in my dream to-day, whereas it will not actually fall until three days later, reveals a mystery just as extraordinary and inexplicable and of precisely the same nature, the same origin and the same dimension as the mystery comprised in the prediction of the fall of a great empire which will not collapse until three centuries have passed away.

But I have already discussed these ques-

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tions in *The Unknown Guest*, and if it is useless to attempt to find satisfactory answers for them, it is even more useless to repeat myself.

THE ISOLATION OF MAN

THE ISOLATION OF MAN

SUPPLEMENTING what has already been said in one of the later chapters of *The Fourth Dimension*, and at the same time returning to a hypothesis which was barely touched upon in *The Life of the White Ant*, let us suppose that some thousands of years hence we have managed to hypertrophy our brains, just as the white ants have managed to hypertrophy the mandibles of their soldiers and the abdomens and ovaries of their queens. We have thereby created a man a thousand times more intelligent than the most intelligent of this generation. Thanks to the counsels of this hypertrophic brain, we have been able to modify to our advantage the structure of our bodies, in order the better to adapt them to the practical demands of life, just as the termites have armoured the fore-parts of their warriors with a cuirass of chitin, a hundred times lighter than steel, and almost as tough. This *Homo novus* has completely tamed all those forces of Nature of which we are still the pitiable playthings.

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He has discovered and has learned how to utilize other forces of which we have no knowledge.

But lest we lose ourselves in the infinite of imaginary inventions, let us simply assume that he is able to do readily what even now seems to some of us almost feasible: he can at will disengage his spirit from its carnal envelope, without danger or injury to the latter, which he can re-enter when he thinks it opportune to do so. Nothing is more probable. Some of the saints, and certain mediums, appear to have done so already. He need only have developed a faculty already latent in the majority of human beings, and to render the operation completely certain, prompt and harmless. His disembodied spirit has naturally learned how to move and guide itself in space, and perhaps in time, to pass in a moment the limits of all the planetary systems known to us, to wander at will in the Infinite as we ourselves take a walk in our garden. Let us note that the Egyptians of the time of the Pharaohs were convinced that their *Ka*, or their immortal breath, possessed this faculty in the life beyond the tomb—a life

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which resembled our life on earth—as well as the power to assume any shape at will, even that of the gods.

It is to be presumed that this faculty of escape will be one of the first conquests of the intelligence thus raised to the thousandth power, or the mind which has acquired the sense of the fourth dimension, since it will be comparatively the easiest, the most seductive and the most fruitful. Our man, thus liberated, will visit first the nearer planets: Mercury, Venus, Mars and Jupiter. If there are living beings there, whether bodies or spirits, it is highly improbable that he will fail to perceive them, for, unless they are entities of some absolutely unforeseen kind, it is natural that a spirit should perceive other spirits, and there is no reason why it should not detect material beings, however gross or however subtle. It is, then, almost certain that the inhabitants of the neighbouring planets will no more be able to escape his investigations than human beings would escape those of a being from Mars or Jupiter who should descend upon earth. Do not let us forget that he is a thousand times more intelligent than our-

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selves, and that his senses have been strangely spiritualized.

Whether these beings of other planets are material or spiritual, he will endeavour to get into communication with them; and it is hardly credible that he will fail to do so, for if he is dealing only with spirits he will communicate with them by means of psychic vibrations, without the aid of sounds or signs, just as a few specially gifted mediums, enveloped though they are in a dense layer of matter, sometimes grasp the thoughts of our subconsciousness without the aid of the senses. On the other hand, if he is dealing with material beings, he will be able to call upon his body, which is still on the earth, to lend him the substance, or the appearance of substance, necessary to manifest himself, to render himself perceptible, as our mediums do with ectoplasm.

There on the planets or here on earth he will encounter spirits or bodies more or less highly evolved than our own. If they are less developed he will become their master. If they are superior to him he will listen to their teaching, learn what they know, and enlarge his intelligence to the

The Isolation of Man

full extent of theirs; and being already a thousand times more intelligent than ourselves he will have the opportunity of becoming yet a thousand times more so, and of developing his mind indefinitely, passing from world to world; for each of these worlds will serve as a luminous stepping-stone by means of which he can ascend still higher, until he has captured the last word of the great secret, if such a word and such a secret really exist in the universe and are not eternally incommunicable.

Let us suppose that in the meantime the civilization of one of these planets is very much less advanced than our own. Religious laws and customs obtain there which are more barbarous, absurd and cruel than those of our most primitive or degenerate savages. Maladies and epidemics which we have long ago learned to prevent, or extirpate, or cure, are decimating the inhabitants. Will not the first care of our discarnate brother be to reveal all that he knows to his unhappy stellar neighbours, and straightway to remedy their most violent and unendurable misfortunes?

But it is equally permissible to suppose

The Life of Space

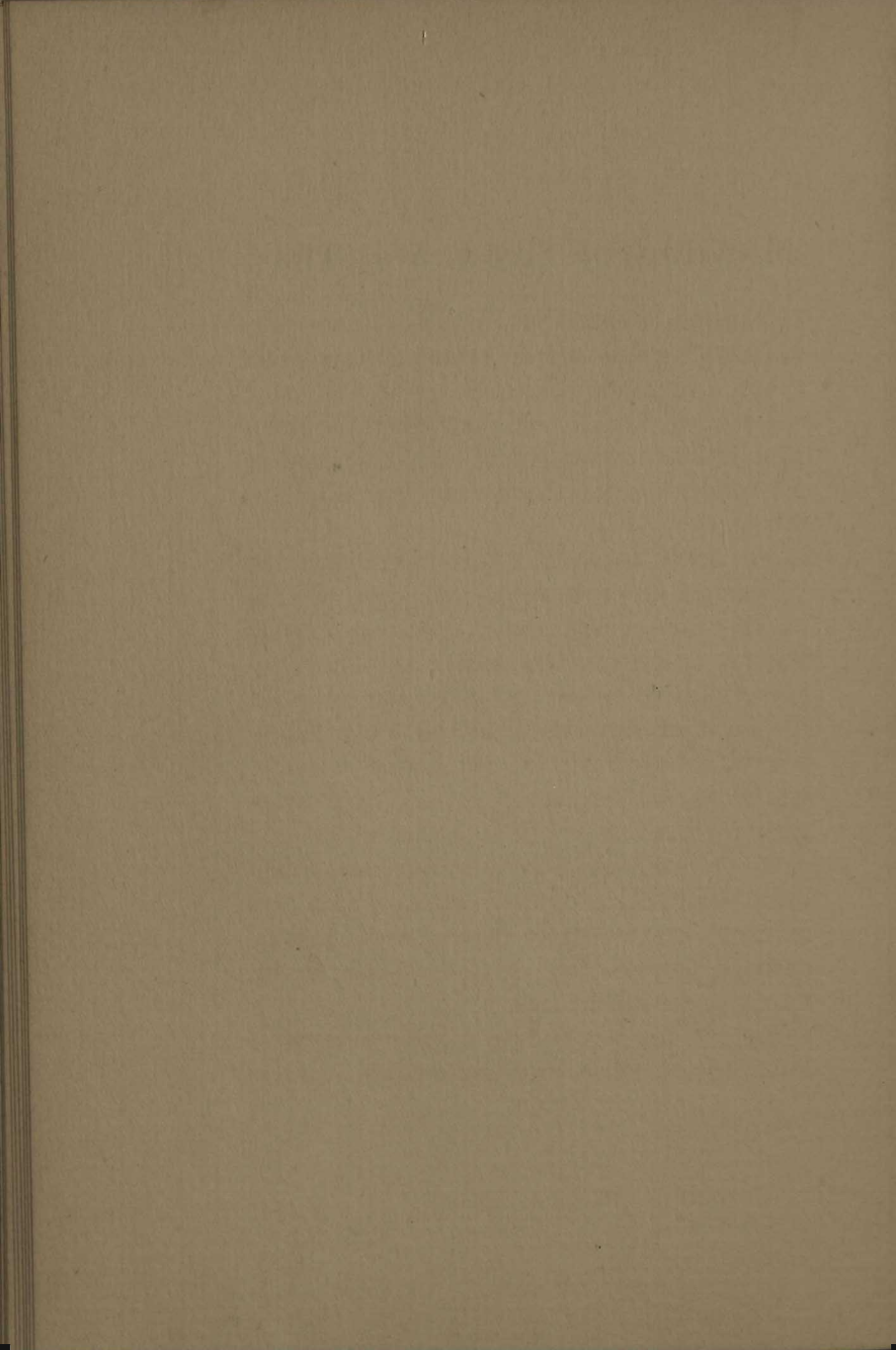
that the civilization on other planets is infinitely more perfect than that on this earth. Admitting that a spirit from one of these genial planets, having descended upon our earth, would not be very greatly interested in our scientific gropings, our verbose and childish philosophy, our puerile literature and art, our political foolery, and the imbecility of our laws and customs, there is nevertheless one spectacle which will inevitably attract his attention, however careless or disdainful his inquiry, namely, the spectacle of the natural injustices which we are still powerless to repair, and which are far more numerous and far more flagrant than our own. He will see everywhere children the prey of abominable and inexcusable sufferings, women and old men burdened, without reason or purpose or hope, until the end of their days, with frightful and unmerited afflictions. Having for centuries surpassed what our medical science has not as yet even begun to discover, he knows the sovereign remedies, and he has only to say a word in order to abolish all these torments, and restore to the cradle and the sick-bed health and the joy of life.

The Isolation of Man

If we were in his place, should we hesitate a moment?

Let us question ourselves seriously; let us ask ourselves whether a messenger from another world, in the eternity before the moment in which we are living, has ever come to our assistance. Has humanity, as far back as it can remember, ever experienced an influence, an intervention from beyond—not manifest, indisputable and decisive; we will not ask so much as that—but merely suspected and capable of detection? Has not the little that we have learned been drawn exclusively from our own resources, our own wretchedness? And if this is so, what does it mean? Is there not reason to fear that we are for ever alone in the universe, and that no other world has ever been more intelligent or better than our own? And if this is so, if we are truly its crown and summit, if there is nothing better to hope for, since there has never been anything better, what *is* this universe, and what is the God, the idea, the fatality, or the chance that created it?

MARVELS OF SPACE AND TIME



MARVELS OF SPACE AND TIME

IN the last chapters of *The Fourth Dimension* we have spoken of the strange relations of space and time. Here is an example of these relations and the unexpected problems which their entanglement or amalgamation or fusion evokes from the depths of the infinite.

We know to-day that light travels 300,000 kilometres in a second, and that this is, up to the present, the greatest velocity known to exist in the universe. The light of certain stars—let us take, for example, the light of the star *S* in the Swordfish, a constellation visible in the austral heavens, whose actual brilliance is 500,000 times greater than that of our sun—takes 100,000 years to reach us. There are thousands and even millions of other stars which are infinitely more remote, whose rays, emitted perhaps before the origin of our earth, have not yet reached us.

But do not let us lose ourselves in these immensities, where the imagination is para-

The Life of Space

lysed and bewildered. Let us choose another star—Mira, for example—which is not a mere modest luminary, since it is the largest that has hitherto been discovered, but is nearer to our little globe. Mira of Balaena, the Whale, is known as “the Marvellous” because it undergoes a prodigious variation, whose period is 333 days, which diminishes its brilliance from the second to the ninth magnitude.

The Mount Wilson Observatory has established that its diameter is about 120 million miles, whereas that of our sun is only 864,000 miles, although its volume is almost 1,310,000 times that of the earth.

A ray of light emanating from Mira does not reach us until seventy-two years have elapsed.

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Suppose that on this gigantic star, where civilization is perhaps far more advanced than with us, an astronomer possessed a telescope, or some more perfect apparatus, powerful enough to distinguish clearly what is happening on our planet, and, in order to give him an opportunity of encountering

The Marvels of Space and Time

in space a majestic and memorable spectacle, suppose he had turned the objective of his enormous telescope on Paris three years ago. He would have seen the events which occurred in that city in the year 1853—that is, he would have seen, in all their brilliant details, the magnificent fêtes which celebrated the marriage of Napoleon III with Eugénie de Montijo de Guzman.

* * * *

This spectacle, which he observes as though he were still in the year 1853, leaning out of a window in the Place de la Concorde, has travelled on the rays of light, across the boundless ocean of the ether, for seventy-two years before reaching his eye. It is more than fourteen lustres since those processions passed through the streets of Paris, and all those who took part in them lie sleeping in the cemeteries that surround the city. Nevertheless, in the eyes of the astronomer who is watching them, this immobile and subterranean life, buried in the past, is indisputably present, since the present, for the astronomers, is necessarily that which he sees.

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years; for there is no reason why the image of life (or, perhaps, life itself) should ever fade away in space and time; only our means of recovering them, of overtaking and capturing them, are insufficient. We asked ourselves a moment ago where real time is to be found. Might we not equally well ask ourselves where real life exists?

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It is certain that this interstellar life exists; whether it has or has not witnesses matters little. But what, then, becomes of our ideas of the present, the past and the future? In this plurality of times which are merely pure conventions, are not the events of the future already present somewhere, just as the events of the past are still present? They cannot be stinted for room, since the present is eternal, which means that it is infinite in space as in time.

In any case, we cannot imagine time save with reference to ourselves; and this is indeed the proof that it does not exist in itself; that it is always relative to the person who has the notion of time; that there is no absolute past or future, but everywhere and

The Marvels of Space and Time

always an eternal present. In reality it is not the events that approach or recede; it is we who pass them by. An incident does not approach us; it does not move; it has never moved; it lies hidden in the to-day which has neither beginning nor end; it is we who go towards it.

It is thus that we cast a furtive glance into a world of four dimensions, in which before, after and now are superimposed, piled upon one another like photographic films and co-existing from all eternity.

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The crowds which pass before his eyes, dancing in the streets of Paris, have not risen from their tombs, for they have not yet entered them. These men and women, who to us on earth seem dead, have continued to live in space or spatialized time, and their existence—that is, their present—is thus prolonged indefinitely in an expanse whose confines they will never reach; and thus that which no longer exists in respect of time still exists in respect of space, which is, as we have seen, merely another aspect of time.

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If we assume, what is probable enough, that the astronomer of Mira is acquainted with the speed of light, which, up to the present, appears to be the same in all parts of the Universe, he will tell himself that what he sees is only the illusory present, the present retarded. Does this imply that the present of the earth is the only real and cosmic present? "Real time," says Bergson, "is time that has been lived or might have been lived." Yes, but lived by whom? Have not all the worlds equal rights?

The Marvels of Space and Time

Is it not rather the fact that there is in this case a relative and local present, which assumes significance and takes precedence over other presents only because we are considering events which are occurring or have occurred on our globe? But where, then, is real time, absolute time? Or is there no real time, no absolute time, because there is no time at all? Since all here is convention, another and contrary convention may abolish it.

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Let us now suppose that there are telescopes in echelon from star to star, so that they constitute relays of vision of seventy-two years, until the total amounts to centuries. If there are means of communication more rapid than light, the astronomer on Mira will be able to foretell, to the astronomer of the star one hundred and forty-four light-years distant from us, what the latter will see on the earth in seventy-two years' time, although for him the future which he announces has been the past for nearly fourteen lustres; and so on from star to star, for thousands of millions of endless

GOD

GOD

APPROPOS of the life of Space, in the depths of which looms the stupendous shadow of the enigma of the Universe, which is at the same time the shadow of the Master of the worlds, I was recently asked: What is the God of your fourth dimension? What does He become in this hyperspace, and what do you know of Him?

Who can answer these questions? Whether there are four dimensions or a thousand, they will always be full of God. As for saying what I know of Him, I return to the great religions, the great philosophies, which know absolutely nothing. Having said that He is the Spirit of the Universe, the non-being which is Being *par excellence*, the Absolute of the Absolute, who occupies all time and all space—or rather that He is infinite space and infinite time, the only forms of the illimitable which are accessible to our eyes and our imagination; having asserted that He is the primordial and universal energy of which ether is the substance; having

The Life of Space

declared that He is the causeless cause of all causes, the triple darkness in the contemplation of which all knowledge dissolves in ignorance—after all these sonorous and futile attempts and a thousand like them, and no more fruitful, they all finally confess that He is the unknown principle of all things. Now, all things are unknown to us, and first and foremost that which we think we know. And this, in the lack of something better, is the only proof of the existence of God, for the unknown is the only thing which indubitably exists, since we cannot say that we know anything whatsoever.

The Catholic religion itself—the most affirmative of all—is, when we sound its thought, as agnostic as the rest. St. Denys the Areopagite, who is at the source of all Christian mysticism, speaks of God only in negative terms: "The cause of all things is neither soul nor intellect; it has no imagination, opinion, reason or understanding; it is not reason or understanding, and it is neither spoken nor thought. Neither is it number, order, magnitude, smallness, equality, inequality, similarity or dissimilarity. It neither moves nor is at rest. . . .

God

It is neither essence, nor eternity, nor time. Even intellectual contact does not appertain to it. It is neither knowledge nor truth. Nor is it royalty, nor wisdom, nor one, nor unity, nor divinity, nor goodness, nor even spirit as we know it."

According to Scotus Erigenus, the great theologian of the ninth century, who reproduces the doctrine of the Areopagite, God is Being without predicates, above all the categories—that is to say, Nothingness; that is to say, the incomprehensible essence of the Universe. This negative theology has never been condemned by the Church, and is found even in Bossuet, the most affirmative, rigid and orthodox theologian the world has seen. "The whole vision of faith," he tells us, "seems to be reduced to seeing plainly that we see nothing. And when we say that the soul sees God by faith, this is merely saying that it does not see Him"—words which take hands across fifty centuries with those of the great doctrines of India, and notably with the phrases of the *Sama-Veda* which I quote on a later page.

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The Life of Space

He is, then, the immense, irreducible, eternal unknown, the unknown of the unknown, the En-Sof or nothingness of nothingness, the "Who?" or the note of interrogation in the darkness and the infinite of the Zohar, the "That" of the Vedas, "the Mysterious amidst the Mysterious." In order not to entomb Him in the silence which is the only temple that one could consecrate to Him, it may be said that He is the Spirit, the Mind of the Universe. The mind of the universe, being necessarily infinite, is inaccessible to us. We do no more than catch a glimpse of an infinitesimal part of it in that which we call Nature, which is the pageant of life on our tiny earth. But even in this insignificant theatre this mind, which seems at times alien to our own, is constantly disconcerting us. On this stage it accumulates wonders that exceed all that our genius could invent or imagine; but, on the other hand, we see there instances of error and improvidence and awkwardness which we cannot explain. Nor can we explain why this mind, which must have an aim, has not yet attained it in the eternity which preceded the moment

God

in which we exist; for this seems to say that it will never attain it, since the two eternities—that which precedes and that which follows us—are identical, or rather are but one.

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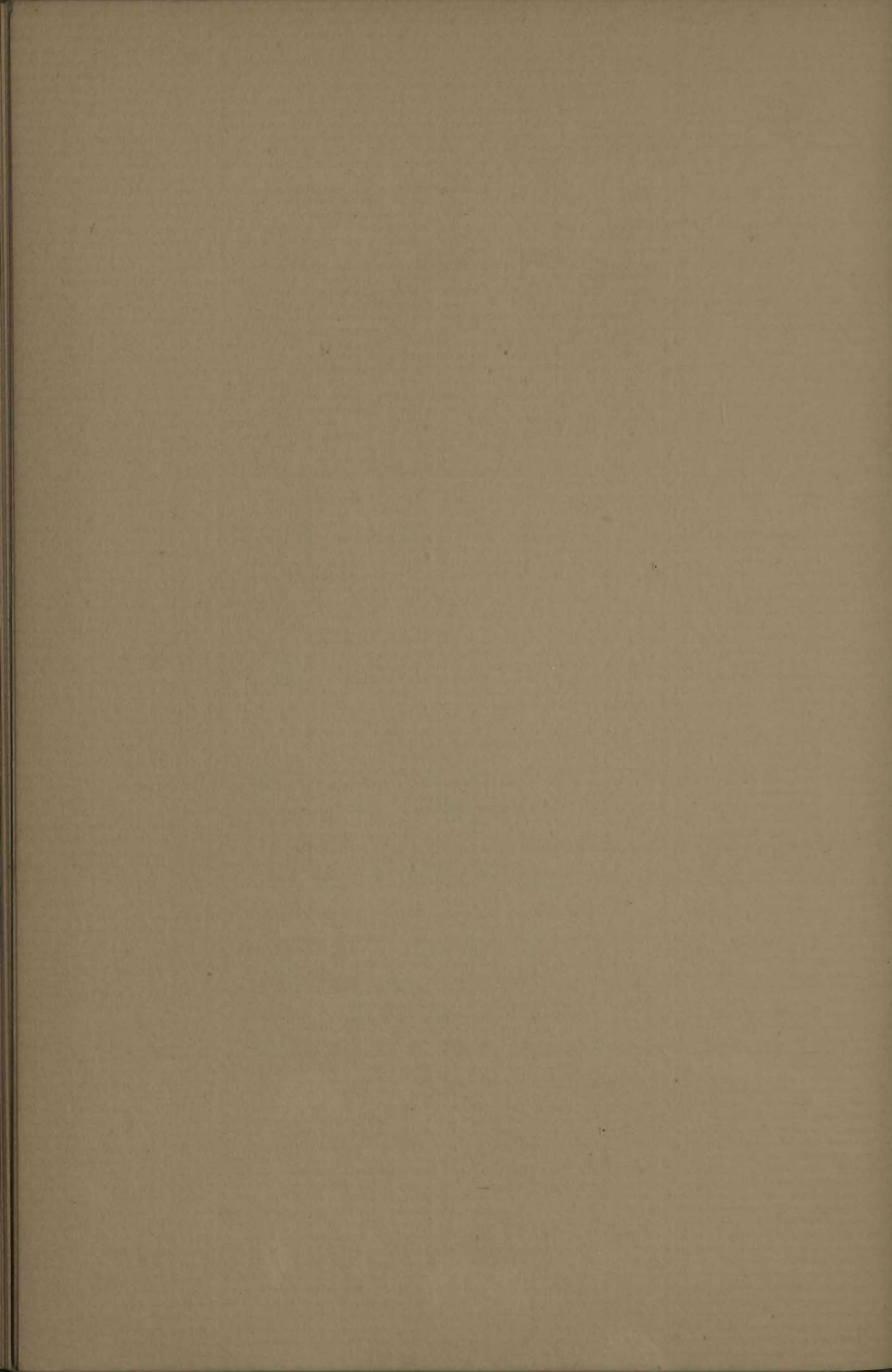
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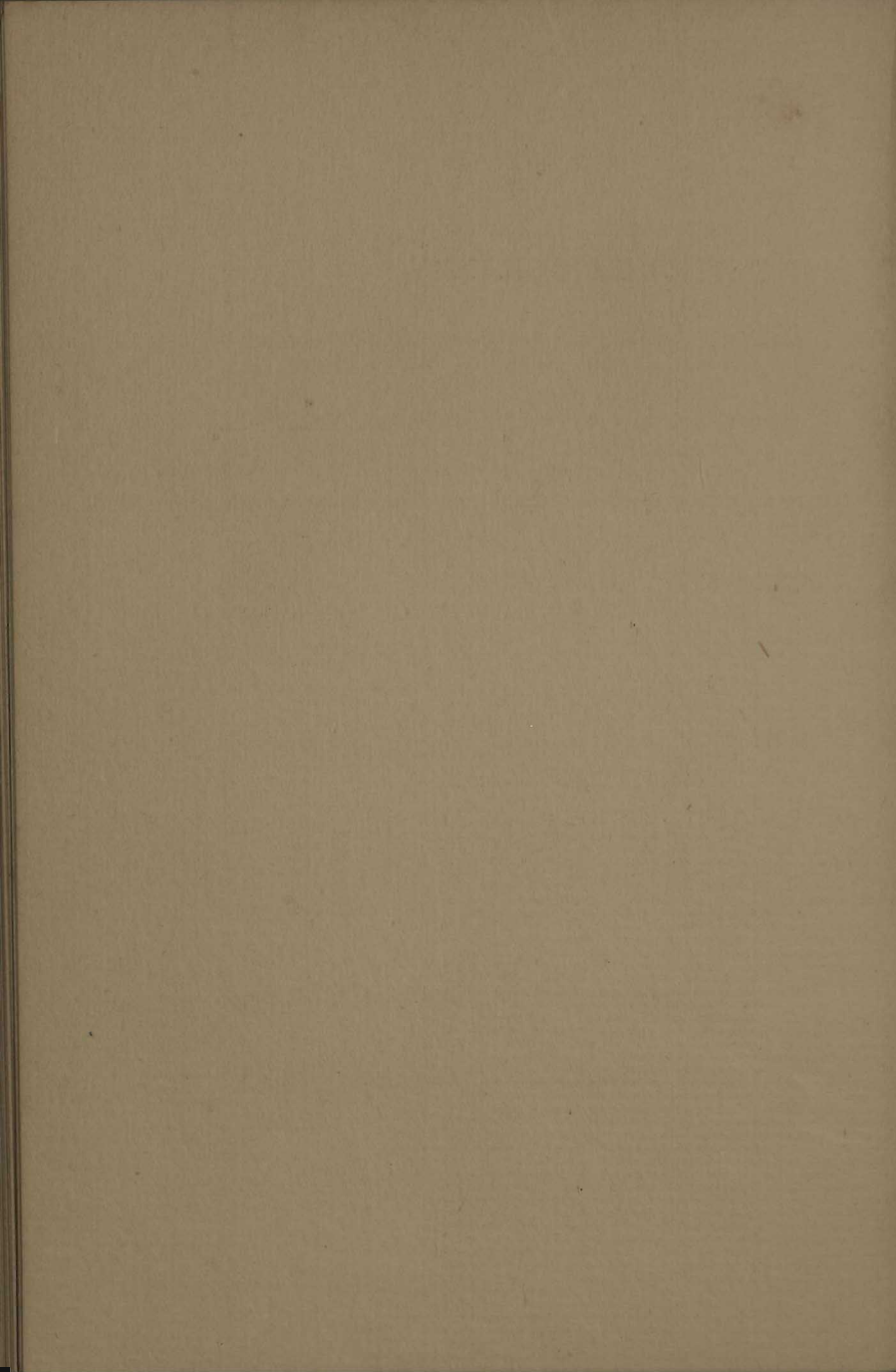
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I bow before Him and am silent. The farther I push forward, the farther He withdraws His bounds. The more I reflect, the less I understand. The more I gaze, the less I see, and the less I see, the more certain am I that He exists; for if He does not exist there is nothingness everywhere, and who can conceive that nothingness exists?

I am glad to understand nothing. If in this life I could know or conceive what God is, I would rather that I had never been, for the Universe would be merely an incommensurable absurdity. As it was said thousands of years ago in the *Sama-Veda*: "To be not wholly ignorant of Him is not to know Him. He is regarded as incomprehensible by those who know Him best, and as perfectly known by those who know of Him absolutely nothing."



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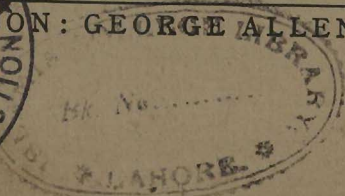
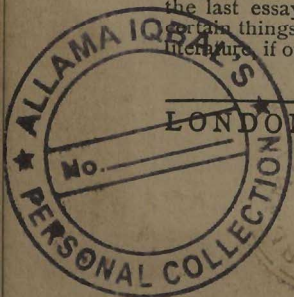
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