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# The Metabolism of Science

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with: a laboratory work sheet excerpts from Faraday's diaries the Carmen Arvale in translation

# TUBROLUC PLON

Heuristic means creative or inventive, in the life of the intellect. Eureka, I have discovered, contains the same Greek stem. Euristics or heuristics formed a recognized field of philosorhy. Today, the sciences have no common consciousness left. And the very term heuristics for their common method of producing new sciences and new methods within one single science, has been for rotten.

The progress of science depends on the reconquest of this Heuristic principle. Otherwise, the terms which every science uses and from which it takes its start, remain accidental. The sciences lose their power to prune their tree or branches as soon as they to positivistic. Pecause scientific positivism means that scientists decline to discuss the conditions under which any new science springs from the life of society, scientific positivism makes science into something for which the scientists need not render accounts to anybody. Scientific positivism expects that everybody in the community will contribute taxes and donations for the sake of science but that this naive faith of the people in science otherwise may be taken for granted.

Scientific positivism and the disappearance of Heuristics, then, are one and the same event. From 1870 to 1940 we may say that science cut the umbilical cord which connected it with the religion of the community, and declined to discuss the proper relations between folklore, science, and slogans.

But science is a halfway-house between the lore of yesterday and the slorans of tomorrow. "Evolution" was a victory over folklore when it came into scientific use. It is a derelict, a sloran of the educated mob compared to today!s scientific problems.

Rene Descartes, the father of modern science, called it a halfway-house. We propose to take this expression up once more and to expose its location between two ends of a road to the sight of society. If somebody lives in a house halfway between two towns, he may dream of being alone in the country. Not until a bridge becomes unpassable or foreign soldiers maraude, does he wake up to his HALHWAY-HOUSE reality. Something like this is happening to many good people in the palace of science because of the atomic bomb. They do realize that their home stands in some community. But they are quite helpless to determine the relations of their spiritual home, science, and the community. For what is a community. A community is the group in which lore and mores, sciences and techniques, slogans and p litics, move in a perpetual interplay by the compelling force of common speech and language.

The compelling character of the term hATURE, for instance, bound the Nature of Man, the Nature of Jod, and the Nature of Science into one functioning triad of lore, research, and slogan. Nature of Man today must be dismissed as inept a term. Society is man's secret. He has no NATURE: Immediately, the natural sciences are dislodged; the one term the community shared with the scientific brotherhood has collapsed.

#### Introduction

The compelling character of the speech that the community instills into the future scientists, and the compelling character of the conventions that the scientists formulate, on the community, are the topic of this paper. The interaction of science and the people is not a material interaction as though the people "benefit" by science. The story is much more the story of a delicate dynamic belance between the forces of community life on the levels of an interacted community, an uprocted intellectual group, and a rercoted society.

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This interaction is based on the vicissitudes of speech in the community, in science, and in politics. This is the lifeblood which runs in the arteries of the communities, in the veins of politics, and through the lungs of science, hach time it is in a different state.

The scientific positivists have never allowed themselves to name and to nonder over this metabolism of speech through the medium of the sciences. "That of it," they would say of language; "it is a poor instrument anyway. Our thoughts suffer from the illerical character of human language. If nothing but speech ties together 1) the community prior to science, 2) the scientists, in their halfway house, and, 3) the enlightened society, after science has done its work, then it is not worth while to look into the entter. That is in words."

The misery of our present state appears in this horrid phrase: "Nothing but words; nothing but speech."

Speech is everything. The health of science, the health's of the community, the attainments of society, depend on the recirculation of speech between the two ends of the read and the MALT'A Y HOUSE of the sciences. This, then, is the there of our paper, and, therefore, it is called THE ANTOLISM OF THE SCIENCES.

#### I. The Nature of the Physical World

"The Nature of the Physical World" is the title of a well known volume of Gifford Lectures by the physicist Eddington. It is an elegant title. For in it, the social, religious, political, and mental issues straddled by science, are reflected as by a prism. Innocent and scientific it may sound; in fact, it is past innocence and this side of science. To determine its place in our society, is the aim of this essay.

We shall see that the religion of the physicist stands revealed and not only of the physicist. The religion behind all science stands revealed and the religion which these scientists share with the nations of the world. For on the basis of this religion the nations allow and demand that a universal science shall operate right across all their political borders. From 1440 to 1946, that is until physical research came under government control, science was inter national.

That a book title is so pregnant with meaning, is rare. But that a book title in itself is symptomatic of the faith in the community in which it is published, is to be expected. Books hold the position of children of their authors. In naming our children, we cannot help declaring our faith or unfaith. Eugen, Amos, Baldur, Harold, speak on the monumental level of life-long names. Our words may be of the moment. If I call my child Trifle, I certainly betray some definite cynicism about the value of a human soul. Because, our names ride on the wavelength on which more than one generation overlap. The name which I give must be valid in the spirit of my own time and in the spirit of the child's lifetime, and finally, in this child's children's lifetime. Now whenever we declare ourselves in the face of more than our own generation, we are compelled to disclose our religion. In our own time, we may put our light under the bushel and may conform. Between the spirits of many generations, we must become emphatic and are found out with regard to the things in which we really glory. And a man glories in his faith or in his cynicism, in his personal or in his conventional faith. But glory he does when he must represent his whole age and its spirit in the teeth of other unknown generations.

Hence, names are the declarations of our faith whether we like it or not. This being so, The Nature of the Physical World declares the faith in which science and the nations of the Renaissance world glory. The average academic reader already at this point may rebel. He knows how book titles are fabricated by publishers. The irreverence of the commercial book market now fills the academic spectator with irreverence for all book titles.

May I suggest that this, though clever, does not seem clever enough? (The objective observer of the wiles and tides of book titles combined complete contempt for mere salesmanship with the utmost reverence for the stream of speech which the publishing craze pollutes. It is the academic mind's curse that it will not revere the very names which it must use, to be respected **iterat** by society. And yet, "science," Plato, truth, happiness, greatest number - all these words are indispensable for the very existence of any science inside our ruthless society. But let it be understood at the outset that the flippancy of the enlightened reader with regard to book titles may easily davide lines of an access to the workings of his own mind. For he too, opens books and looks at books and writes or plans books or is in search of books treating certain questions and not all those are free who boast of being without roots in or ties to the living tissue of language.

Hence, 1 cannot help it if right here some readers will part company with me. There is today a large group of scientific and lit-erary men who are eager to scrutinize any footnote and any word or term used inside a book, and who, nevertheless, will treat my thesis as absurd that book titles are the clearest expressions of a society's religion. These men point to the racket of catch words, of slogans, to the arbitrary inventions of book titles by enterprising publishers or agents. And they actually think that the abuse of our good faith in book titles refutes the right use. Actually all the facts of which they complain prove my point. Corruptio optimi pessima. The most important elements of life are of course most often falsified. advanced stage of our investigation with much greater ease and profit.

But it seemed wise to bid farewell right here to the sophisticated people who no longer are able to see what they are doing when, they themselves read the New York Times Book Review, mostly interview with this group of readers unfortunately lost, I return to our and serious issue that "The Nature of the Physical World" is the very

statement in which science glories.

And since I now have ascertained our right to take this book title seriously, a very startling admission may be added.

Books with this and many similar titles have become part of our religion. They are expected by the public, they are desired and they are written. They are part of our living faith. To believe in our right and our duty as well to produce books on the Nature of the Physical World, in other words, is a part of our religion since the Renaîssance.

It is a vital part of the living faith in which the Cardinals who fly to Rome by plane and the Japanese suicide flyer find themselves united. On the other hand, it is only a small part of the religion of a Cardinal or of a Japanese. And this is the exciting truth that the belief in a Nature of the Physical World can never be more than a part of our faith and on the other hand can never be treated as anything less than a religious act.

We are today attacked from both sides, one side claiming that one may have science although society treats it as a commodity, the other side pretending that the faith in science is all that is needed. Science today is in danger of decay because some idolize it and some look upon it without religion. Sectarian science and commercial science are equally ugly, and equally destructive of scientific progress. The most orthodox Churchman today must take pity of

these dangers to science. And it is as an orthodox thinker of the Christian dogma, that I wish to defend the religion of science today as a vital part of my religion, against its abuse.

I wish to develop the faith of Renaissance Christianity out of this book title, The Nature of the Physical World. For this purpose, I shall take the following steps.

First, we shall analyze briefly the name of the book. Of this name, we may get hold in one glance. Second, we shall look upon the work sheet of some hours of laboratory work. On it, the things a beginner is doing from respect to the Nature of the Physical World, can be seen; things which the good man does to himself by the way since all faith makes us do terrible things to ourselves. The work sheet shall reveal to us the neophyte's self-immolation. Third step: The state of mind of a mastermind over decades shall become pellucid through extracts from Faraday's daily notes.

These three steps unfold, for widening units of time, the living faith in the Nature of the Physical World. The fourth step will be to discover parallels to this name of our book, in all other fields of science, and to deduce the common law of their formulations. We shall compare this linguistic pattern of the last four hundred years of the Renaissance with the religious pattern of antiquity. And at the end, we may understand our own faith somewhat better, a faith which produces such an exciting, mysterious and absurd title of a book.

For let it be understood at the outset that it is exciting, absurd and mysterious, all three. The Nature of the Physical World? Aye, why not the physics of the natural World? or The World of Physical Nature? We may well ask so naively. For, the three terms composing the title, actually say three times one and the same thing. One "X", so to speak, is labelled, whether we call it "World", ~ "Physis", or "Nature". Physis in Greek is the same as Nature in Latin and World in Anglosaxon. If we should give a definition of this "X" behind all three terms, we might say, the world, nature, physis, are different expressions for the universe when we speak of it and treat it as speechless.

But then, the treble repetition is an obvious mystery. Perhaps it is not for our blunted academic sensibilities which are easily imposed upon by Hegelian pomposities. But for a singer of the wild, it would be only too obvious. He would immediately compare our title to the magic formulas known to him, for the obvious reason of its being repetitive. Any magic formula operates by emphatic repetition in such a manner that the very fact of repetition is in itself a part of the formula. Usually, the Open Sesame is said thrice. In Macbeth, the three witches sing: "Thrice to thine and thrice to mine and thrice again to make up nine". A Roman prayer, in fact the oldest Roman prayer preserved and a descendant of the Greek pattern of prayer at the same time, is built in the same manner of threefold repetition. As we shall have to say more of this prayer later on, its full text is given in the appendix. The power of the thrice repeated lines, Usener has called this the world-wide tyranny of trebling, is apparent right through it.

"The Nature of the Physical World" speaks of the same thing, of the speechless universe, thrice. The Nouns used are equivalents. Herakleitos the Greek said of physis the very things we say of the World and Cicero or Lucretius said of Nature. In as far as the book title is repetitive, the formula is magical in its appeal to the public. But you and I know that it is not black magic which is offered us. It is legitimate white magic, alias science.

Then, the saving grace must spring from the alternation between the three linguistic layers, Latin, Greek, Anglosaxon. And this indeed is the case. We do not accuse Eddington of an unduly superstitious appeal nor do we accuse science of being black magic. However, we insist that whenever science invites a legitimate and yet not scientific public, the relationship of science to magic is undeniably conspicuous.

However white science appears to us it retains a definite though antithetical relation to magic. It is an incantation and it casts a spell. You may say that it is a legitimate incantation and these spells are desirable. But this is not under debate. I would say that science is verified magic, magic come true. Just the same, it is important that we have admitted this verified magic into our ken.

By saying this, I have already stated that science has been admitted by the children of God despite the fact that God has not created a "physical" world and that we as his children, know absolutely nothing of such a physical world. God created the world; he did not create the physical world as a world by itself. If this should surprise you, you merely have to analyze now the second quality of our book title: its absurdity. If one world is postulated as "physical", another world, which is non-physical, is admitted, too. The one adjective "physical", limits the world which is thus qualified. And immediately, the mental world, the political world, aye, finally even this strangest term of a Christian World, rise-before us. The Renaissance mind is seriously impaired by this divorce. Scientists often look down on people who speak of God's face or God's finger as being hopelessly superstitious while they speak of God's mind, themselves. But the mind of God is as much a metaphor as his elbow. Our mind is not nearer to God than our body. Yet this division of the world into a physical and a mental has blinded many as though the mind were more divine than our kidneys. To the fundamentalist thinker within me, my acquiescence in a physical, mental, Christian world is absurd because **T** virtue of my orthodoxy, I hope to believe in the fact that God created One World which includes all of me, mind as well as body. But to my "re-search" mind, the split is a natural!

Therefore, I find myself compelled to retain both positions. It is true that God created One World inclusive of minds as well as bodies. On the other hand, the absurdity that there is a special physical world, is at the bottom of all science; and we, that is to say the peoples of the Christian nations, have become persuaded that we should allow ourselves to split the wholeness of One World into a physical and a non-physical world. We have become convinced that ultimately we shall benefit by supporting the absurdity of separating a physical from a mental world, and of making the one, the physical, into the object of the other, the mental.

This then is the exciting paradox revealed at first glance to us by the mysterious and absurd title, that we have admitted into our society a process which contradicts the first article of our faith, a process which shares its formula with all magic.

Now we take the second step. It leads us into a laboratory. The work sheet which I reproduce - I myself assisted in this work during the war - reflects the physicist's self-immolation on the altar of science. With the worksheet, the reader so to speak, holds in his own hands the dichotomy of a physical world which has become the object of a non-physical world, and of a mental world which has become the subject of the objectified physical world.

#### II. Our Fission in Mind and Body

We shall observe the process by which at the end, two fruits are produced by faithful research which do not exist in reality but merely in experimentation: a new subject and a new object as the world has not seen.

The reader finds that the worksheet is divided into two pages. On the page to the right, he finds the term "data", with (A), (B), (C), (D), (E) neatly listed. On the left page he finds scrawls. We will now please concentrate on the difference in style between the two pages written concurrently by the same man during one and the same experiment.

We are interested not in the experiment as such or in its result but in the int erplay between the two pages. The right page is employed for "data", the left for figuring. In this, two processes are set in motion, the right page process towards creating objective result, the left page towards creating one unified subject The data may be called data of observation since the term data mind. means observations made by the five senses either on an instrument as to its readings or on matter as to its visible, audible, smellable, tasteable, touchable behavior. The figures are immersed in a process of computation. They are added and multiplied, etc. by "arithmetic" or "algebra" depending on the necessity of computing either figures or letters. As the handwriting shows, the observer meets his sense data with a firm hand. He faces the facts of the experiment as one individual who meets other individuals. His statement is definite, his form of writing well defined. He stands at attention like a soldier on guard, fully equipped with his faculties of keen observa-tion. But there also is caution. The reader finds under (A) and (B) that 3 or 4 different readings are listed. As a soldier on guard does not shoot before he has asked several times, so the sense data must not be guess work. Science in an experiment repeats the readings. By this precaution, modern physics reverses the process of magic. In antiquity, the word or formula would be repeated three or four or seven times to make sure that it did catch the natural process. We do not repeat the magic formula, but the observation. We do not suspect the reality outside but our own senses. We check and recheck our data. The three or four readings of one and the same phenomena check our sense report of the external world. Hence, we have the right to say: One observation no

observation. The isolated data is still "pre-objective". Only a series of data leads beyond mere impressions. Not one impression is a real datum; the whole list is one. Hence, the reader of our sheet finds behind all these sequences of data a ±.005 or ±.01 cm (.39%) is the stigma attached to the senses. Pre-objective impressions never are perfect. A margin of error remains. And by this margin of error, the whole list of observations is still off the ideal mark of perfection. Ideal science can only deal with reversible process which can be repeated. For, in an experiment, unique processes can never be objectified.

Three steps are taken: a single impression on a sense of our body, a sequence of such impressions is formed, an average is taken with a possible error of so and so many per cent. This means that the primitive single sense reaction is thrice removed from the real standardized observer in us.

Now, we pass over to the opposite page. At first sight, the style stands revealed as dramatically opposite. The hand which was so definite and firm on the right page, has moved hastily and nervously. It is not tied down by the horizontal and vertical lines of the sheet. It runs in more than one direction. Most computation sheets look even more ghastly and criss-cross. Is this accident? We do not accept this escape. In style, anything spontaneous has the weight of substantial truth, of a telling fact. Any work sheet, by the way, in hundreds or thousand of cases, produces the same effect.

Therefore, we have the precious evidence of the grammatical dualism which is operative during the period of suspended judgment. The left page is the subjective page. Computation is a purely mental activity. And because it is, the bodily phenomena which accompany it, show not a man on guard and at attention, but relaxed, indifferent to appearances, introvert in slippers. For the grammarian, mathematics is not a question of content but of form. What is computation doing, in this wholly introspective process on the left page?

We find, for instance - the reader need not fear that he has to figure it out himself - the equations  $R = \frac{.2525}{2} + \frac{(2.57)^2}{2(2525)}$  and

R = 13.20 cm + .13. What does this represent? the two fractions of the first equation, one at single power, the other to the square, have been reduced to one expression. Well, "what of it", the objection may come; "this reducing is our daily bread". But this daily bread of physics by which he reduces different expressions to unity, is as admirable and as mysterious as real bread. Could it not be that the daily routine blinds us to the transformation's full significance?

Something went overboard, for unity's sake, in the reduction. It was treated as ballast. In this special case, it was, among others, the term "to the square" in (2.57)<sup>2</sup>. To reduce to a common denominator means to sacrifice a nomen, an expression, a particular name. Mathematics redefines its expressions so long and so consistently as to achieve the greatest possible unity of expression. The mind on the left page, sacrifices expressions, and there may be as many as a hundred of such mental sacrifices, on one page.

What is the net gain? The subject who at the end, says 13.20 cm, although in his private life he speaks of inches, has sacrificed his historical vocabulary and nomenclature. By this purification, he has become one mind with all other people who compute, all over the globe. His mind now is a so-called transcendental ego, a mind detached from place and time. Place and time always are limited by names with their local and temporal associations. The transcendental Ego who emerges from our left page, is detached from his native and social attachments, and ower allegiance only to the republic of physicists. In this republic, a special language is whispered, the language of mathematics. This language because it is a secondary language, is not spoken but moves by signs. Also, being secondary, it is nameless. But it is meaningless unless it emerges from a primary layer of speech. Mathematics on the left page must receive something which they can reduce. Or, there is no room for its proceedings.

Let us assume that on the right page the data were partly measured in inches, partly in centimeters. On the left page, we then would read the reduction of inches to centimeters or vice versa. In this manipulation, it would be obvious that one expression, "inch", or "centimeter" was sacrificed to the victor. But the expressions

.2525 and  $(2.57)^2$  are two "expressions" in no less degree than

inches and centimeters. All expressions are Names waiting to be sacrificed in the quest for unity. If they were left to themselves, they would remain <u>inaccessible</u> to each other. We have to reduce them by <u>cutting off the head of one</u> of them before they can be incorporated in one statement: Computation requires amputation. Why? By these amputations, the scientist becomes one mind with all other people who compute, all over the globe. The mind that emerges from those emputations owes allegiance only to the international republic of science. Incessantly, computation sacrifices expressions for the sake of unity. I have given the history of the decimal system which was introduced by the men of 1789, in my book "Out of Revolution". It certainly is a most dramatic conflict between two sets of values, one scientific, the other social. However you side in it, it is a real conflict because names deserve to be kept, at times. Reducing Dante and Milton to a statistics of their verbs, in the data of their poems, may be valuable. Mario Prat has reduced d'Annunzio's famous poem L'onda to a string of quotations from the Italian Dictionary which the "poet" simply had versified. But these reductions are irrelevant in genuine poetry for the simple reason that in poetry, the names are relevant.

For the sake of unity, I split. This sounds like a contradiction in terms. Yet it is true. The allegiance of my mind to the republic of computation in which we are all of one mind, and the allegiance of my five senses to the sense data in which they are immersed, produce a rift in me. Because the experiment takes time, the time in which body data and mental reduction, resist each other, our attention is drawn to this conflict of body and mind. And when many men undergo such experimental training and experience, they begin to divide their own being into body and mind. But they mostly overlook the fact that it is not their own body and their own mind which are

separated, in the scientific process. Our two pages tell the true story of this division of mind and body. It is perceptible only when the mind enters into the fellowship of other minds, and when the body bends over and attaches itself to matter, to other bodies, as their pure organ of sense registration. Man, in a scientific experiment establishes two specific fellowships: one för his senses, one for his mental powers. Truly suspended like Prometheus on the rock, the scientist may not descend from his suspended and outstretched position between sense data and computation before he has not bent the two worlds of mathematics and of material physics to each other, through his power of reducing one to the other. Mind and body are means to an end. Man divides himself into mind and body, temporarily, for a specific purpose. And the purpose is to force the world of the senses to admit of a unity in figures. During the suspense of the experiment, the mind all the time becomes more of a mind; the body the more faithfully we observe, becomes all the time more clearly the body. Objects and subjects do not exist, but are polarities produced in the action by which we split inside temporarily for the purpose of uniting afterwards more consistently. A given diversity and a de-sired unity contradict each other in the beginning. The physicist undergoes voluntarily, for the sake of solving this dilemma, a cleavage inside himself. With his body he forms an element of the physical world, with his mind, he forms an element of the mental world.

The division in Mind and Body, in a mind of mine which is a part of The Mind, and in a body of mine which is immersed in a physical continuum of bodiliness, is not a natural fact of our existence. To the contrary, it is a sacrifice of our **Contrant** destiny for the contrary, it is a sacrifice of our **Contrant** destiny for the contrary of the division, lest mankind perish. Their whole being, this side of any such separation in mind and body, must stay in organship to creation.

Science requires the sacrifice of this naive organship of the creature man so that he may instead become instrumental for the construction of a polarity; in this polarity, his unity is pulverized between the two foci of an ellipse as all his observations push him one way and all his computations the other.

#### III. The Secret of the Scientist

We have explored the style of the worksheet for one experiment. Let us now ascend to the next level of time, to the life work of a physicist over a number of decades.

In Faraday's many volumes of daily entries we have access to the whole life work of a great master. The last paragraph of the seven volumes of Faraday's daily reports on his work bears the number 16,041. And one of his last public utterances was: "For all the phenomena of nature lead us to believe that the great and governing law is one".\*

\* In "The Correlation and Conservation of Forces" by E. L. Youmans, New York, 1867, p. 376. Further see W. H. Bragg, Michael Faraday, 1931, p. 22 and 25. T. H. Gladstone, Michael Faraday, (London 1873), p. 123 ff.: "His Method of Working".

16,041 and One, Unity against the ocean of 16,041 data, this is the polarity of his grammar. Both poles are stressed and should be stressed. Tyndall said of him: "A good experiment would almost make him\_dance with delight".\* Yet Lord Rutherford also could write:

\* John Tyndall, Faraday as a Discoverer, London 1870, p. 186.

"When we consider the life work of Faraday, it is clear that his researches were guided and inspired by the strong belief that the various forces of nature were inter-related and dependent on one another. It is not too much to say that this philosophic conviction gave the impulse and driving power in most of his researches and is the key to the extraordinary success." (Report on the Faraday Celebrations 1931, 39).

Because Faraday spent his life suspended between the One Nature beckoning from the future, and his daily 16,000 experiments, it was written of him: "The Contemplation of Nature and his own relation to her, produced in Faraday a Kind of exaltation".\*\*

#### \*\* 1.1.

The diaries establish this respiratory process of the mind in action between 16,041 reasoned out doubts and the foreshadowing of One Faith. And the quotations which now follow are not more than a few examples.

"Surely, this force of gravity must be capable of an experimental relation to electricity, magnetism and other forces, so as to bind it up with them in reciprocal action and equivalent."

"I must look at Weber's results to see how they build in with these considerations and what the results are."

"Astonishing how great the precautions that are needed in these delicate experiments. Patience."

"Query those results."

"Must clear all this up by further experiments."

"The hypothesis is not so much mine as one renewed from old times. Look at Euler's letters and what he says."

"Let the imagination go, guiding it by judgment and principle, but holding it in and directing it by experiment."

"Consider for a moment how to set about touching this matter by facts and trial."

"To point out or to lead to a knowledge of what it either cannot explain or has not explained, is quite as important for the progress of knowledge as to establish what it can do."

The analysis so far reveals that true, i.e. new Future as believed in by Faraday takes the form of commands. Whereas the grammatical form by which we project past occurrences into the future is the so-called Future tense:"The sun will rise tomorrow at six. Tomorrow, the letter will arrive in London. Your convalescence will require one more week." Faraday's grammar knows the genuine Future which appears in the form of the imperative: "Consider, Query, Patience, Must clear, Let the imagination go." The command differs from the mechanical future. The latter predicts that the past will go on. The imperative prescribes that something new shall interrupt this predictable march of events. The curse of our time is the idea that the specious mechanical future of prediction is equally representative of "Future", as the imperative. Hence, when people analyze the meaning of the term, "future", they analyze the gram-matical form of "It will". But the bed-rock of genuine future is in the imperatives which we read in Faraday, or for that matter, in any creative life; in these cases an imperative crosses out all the causal processes by a break in continuity. Faraday is such a break in continuity. And this is incarnated in the grammar of his diaries. This pure future comes to us as commands and the predicting Future of, "it will rain", is secondary to the imperative "Drop the atomic bomb", "Take this train", "Become a doctor", "Don't go to college". The character of the future as completely different and independent from the past, stands out in these imperatives with primeval distinctness. We may use circumlocution and say: "I shall not go to college, after all". But this then is simply the report to a third person of an inner imperative already obeyed. When Justice Holmes said to the usher who helped him into his coat, "I shall not be back tomorrow", he used the specious future of reflection and report. But to the President he wrote the same day: "I bow to the inevitable". In other words, in his letter of resignation he admitted that he had - it was on the same morning in court - received the clear imperative: "Resign". Without this imperative, neither his famous remark to the

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usher nor his letter to the President make sense. With the for the functions another grammatical fog is lifted, this time from the present tense of human language. The present state of mind in Faraday is one of suspense. "It was almost with a feeling of awe that I went to work, for if the hope should prove well founded, how great and mighty and sublime in its hitherto unchangeable character is the force I am trying to deal with, and how large may be the new domain." Or "After all, there is much which renders these expectations or similar ones hopeless"; "Such beautiful delicate indicating curvatures"; "Strange"; "Of a sudden all wrong and I do not see why "I beging to despair".

The normal form of his present is emotional and exclamatory. It is a specious and indirect, present which we call the present indicative. The subjunctive is the normal approach to our present state of mind. True enough, the Yankee will not have it so nor will the grammar book. They insist that the circumlocution of "This is beautiful" holds the same rank of truth as Faraday's honest shout, "Such beautiful..lines!" The genuine forms of speech in a present are not indicatives but emotional exclamations or affirmations. As Faraday wrote, "How great and mighty and sublime is the force I am trying to deal with". That is man's present, in fear and trembling, if he is not in the grammar school of the logician or in college but face to face with the forces we are asked to deal with, our present is an exclamation and a suspense.

The place for the indicative of scientific grammar is neither in the future nor in the present of a real man like Faraday. But listen to this noble series of indicatives:

"There was a fire on Thursday evening in Broad Court, Anny Lane. The clouds were low and received a strong illumination from the fire beneath them. The angle taken from the top of the Royal Institution by a quadrant formed by the clouds, the Institution, and the fire, was 24 degrees. Hence the height of the clouds will be...equal... to...." Or, "Soon after sunset observed a cloud forming just the brow of Shakespeare cliff. It streamed inwards, increasing in size, but all seemed to pour nearly from the same spot; the air which came from over the sea there taking on a visible form and passing in to the interior as a cloud. By degrees the generation of clouds took place along the whole line of cliff from Dover to Folkestone hill, the hill still carrying the portion formed over the land. We ascended the cliffs about half a mile beyond Folkestone hill about half an hour after sunset and found all above enveloped in dense, moist mist, so as to deposit water on our clothes; the temperature also low to the feelings."

The real living person of a Faraday meets the Future by commands, the Present by exclamations, the past by narrations. But the unscientific mind confuses all this. Listen to Faraday: "What a weak credulous-incredulous, unbelieving-superstitious, bold-frightened, what a ridiculous world ours is, as far as concerns the mind of man. How full of inconsistencies, contradictions, and absurdities it is. I declare that taking the average of many minds that have recently come before me (and apart from that spirit which God has placed in each) and accepting for a moment that average as a standard, I should far prefer the obedience, affections and instinct of a dog before it."\*

\* Letter to Schönbein, July 25, 1853, cd. by G. W. A. Kahlbaum and F. V. Derbishire, London, 1899.

Faraday himself, by his clear for any other force is not that the power is mysterious and unexpected but that it funder law, and that the taught intellect can even now govern it largely.

"The human mind is placed above, and not beneath it, and it is "such a point of view that the mental education afforded by science is rendered supereminent in dignity."

Here we have the terms, "supereminent", "dignity", "above" and "beneath", as attributes of the mind. We shall have to explain this ascent to Olympus, this emergence to some "higher" eminence from the dogmentality. And we shall do so when we return to the religion of the book title, The Nature of the Physical World. For the time being, we have to explain the Olympian mood of the research worker. It results from the divine freedom which he has. The great thing about science is the right to systematic error. This frees them from the consequences of error which hit the ordinary shepherd or sailor who makes a mistake. The shepherd in Montana perishes if he makes one serious mistake about the weather; so does the sailor. The admissible margin of error in the life of ordinary working people is to speak quite arbitrarily - perhaps 5%. In Faraday's 16,041 experiments, about one per cent were successful and the rest was error.

Why is that so? The scientists have been set free for the purpose of systematic error. Science is a systematic and voluntary relapse of society into all possible errors. The shepherd cannot afford to suspend judgment. Nor can the man in the airplane or you in front of your class, or Mr. Roosevelt on the day of Pearl Harbor. Life's battle is immediate. Faraday in his lab, may err a thousand times with impunity. It takes the complete isolation of a lab to establish the privilege of making innumerable mistakes. We cannot experiment with war; we must win or perish. We cannot experiment with marriage or we shall never know what "for better for worse" means. But mind you; science begins and recurs exactly at the point at which the mistakes do not matter or at least matter much less than in immediate living. When we have made sure that the number of mistakes may be legion, we have cut loose from the routines of habitual manipulation. As long as we can only allow for say 20 or 30% mistakes, we still move under the pressure of life's battle, and therefore cannot be quite objective. We have not moved into the realm of science unless we know that we are free to make countless mistakes. Innumerability is essential to the errors of science! In this poetic realm of suspended judgment the emotions of purgatory are infinite in number. As Kant has said: all research is tumultuary. Scientific doubt is not the doubt between good and evil. Scientific doubt combats thousand and one possible explanations. It is always bad science which thinks of a "black and white" solution. The number The number of possible solutions must be enhanced above this purely logical level of an either or before we can speak of scientific research at all.

The physicist's experiments are not reactions to the past but anticipate or pre-empt a future. Faraday's experiments were not experiences because he undertook them in the light of his faith in the unity and infinite definity of Nature. But then, his work done during the forty years of his present day life, received its sanction and its authorization not from the past but from the future. Science is provoked by society's faith in a free and different future. Science is the pronaos, the vestibule of the future sanctuary of mankind. The laboratory of Michael Faraday is a vestibule in as far as a genuine future which differs in quality from the past, is believed in and finally is incarnated. The scientist in his research is exempt from the Law of Laplace under which nature groans: "We ought then to regard the present state of the universe as the effect

of the anterior state and the causation of the one which is to follow"% This law of Laplace is not valid for the man of science himself. Faraday's present was not at all caused by the past. Indeed, all the past before he lived contradicted his faith. His vision of

\* Theorie Analytique des Probabilites, 1902, p. 3.

nature was not anything of the past. It marched ahead of him. And the spelling of Nature with a capital N always means exactly this; he who spells it this way, reclaims Nature to be a power of the future under which we may gather against the past. The research man gets himself out from under the past.

Mankind's Future logically precedes mankind's present. We have no present as soon as we loose faith in the future. What we call present, is the result of a struggle between the future and the past, in us. Mechanisms are repetitive; science is not or it ceases to be science.

The scientist is the miracle which supersedes the course of nature and interrupts its trends. The physics which the physicists discover are causes and effects which always have existed. The physicists, however, who discover them, have never before existed. Their faith emancipates their present from their past.

And it is not the physicist only who must have this faith. All the Archimedes in Syracuse may be murdered by the soldiers. The laymen, therefore, and the scientists must be steeped in the same faith. You think that the facts found by science are after all for believers and unbelievers. Be not mistaken. Physics itself is impossible among unbelievers. The faith in science is a condition for its existence. And this faith, "There shall be science", is in itself no scientific proposition at all. It is a social imperative of religion. Societies have been and shall be again which reject physics. Our society had to learn that physicists were not witches. And that took a change of faith, with the nations. For the nations, Nature had to become a beacon of faith shining in the darkness of the world before physicists could get away with experiments.

Fortunately, nations do change their religions. It is an old saying that it is easier for a nation to change its religion than for a scholar or scientist to change his mind. The task of the 16th century was to change the nations. We have come on the more difficult time of history at which the scientists must change their categories. They must re-recognize the religion which unites them with all people long before the first experiment in any laboratory can possibly take place.

The founding fathers of any science always live by faith alone. But the people in the amply equipped laboratories do not need the stout heart of the Curies in their garage or of Heinrich Hertz in his barn. And it is the mass of the employed scientists who endanger today the future of science because they ignore the faith which the founding fathers and the community must share before the city of

science can be built. The imperative, let there be science, is prescientific. It was spoken over Faraday before he himself could call himself a scientist. Who then is this strange fellow who all of a sudden, in the midst of life, may proclaim that there shall be science?

## IV. The Progress of Prayer and of Science

With this strange question, we are back to Edington, because the Gifford Lectures are meant for exactly this man. He must be neither a scientist nor a fool, neither a man without leisure nor a man without seriousness. If we could find out who this human being is who reads books on the Nature of the universe, or at least is expected to read them, we would have found the the religionist of science, the man inside the scientist and the physicist and within the laity, both, through whom science becomes real.

We are looking for the believer in science. Who believes in its processes before there are any results? And I may say in advance that this man must be appealed to by the treble formula which puzzled us so much, the formula of quasi magic in which the nature, the physis, and the world resounded all three. Because this man in you and me will not buy the book otherwise.

Of this strange law, an easy test is available, a veritable experimentum crucis. Take the three following book titles: The World, Physics, Nature, and ask yourself what you would expect behind their cover. The title "physics" would make you expect a textbook on physics. The title "Nature" would make you think of Thoreau, Rousseau, or poetry. The book, The World, might be by Wendell Wilkie or Mr. Haushofer. The three books, in any case, are written for three groups of readers clearly, because they cater to quite separate interests.

It follows that "The Nature of the Physical World" must be addressing a fourth man in you and me. He is not the romantic Rousseulte in us, nor the practical student of physics, nor the man of the world, the politician. For heaven's sake, who is this man?

Faraday has paved the road for an answer to this question when he haid that the human mind is placed above and not beneath the forces of nature, by science. The man of faith wishes to rise, to ascend above his state. The book The Nature of the Physical World is not written for the practical man or the man of leisure or the politician, but for the man of history, the man who by his faith makes history while all the three others, the practical physicist, the politician and the romantic vacationist, are his parasites. It is the man who takes risks because he can experience and bear with both, the being beneath and the rising above. The man who buys the textbook "Physics" buys admission to the standing above without first sharing the darkness of the World. The man who buys the book on Nature, plays with the world. And the mind who takes the world as it is, prefers permanent darkness. But the living man in in process and is able to experience the change from level of consciousness to another, and back again. The real man can be overwhelmed by wonder and can see nature as brought under law, both.

The complete man is not the layman or the physicist, but the man who is alternatingly capable of the wonder before and the precision afterwards without ever thinking that one alone is enough. It is the man who towers above his own fission in a mind and a body.

This is implied by our worksheet. Only I must now invite you to read it once more with ultimate precision. I challenge you to reject the notion that the left page was written by the student's mind, and the right page by his body. It was one and the same who wrote both pages. This man did not have a body and did not have a mind as we usually put it. He became all body and all mind, in alternation.

He tried hard to make his mind meet all other minds in his computing. And he tried hard to immerse his body into the cosmic continuum of the material world. He split himself as best he could. But he did not succeed completely. Please reflect on the mystery that the mind right and the body left, both have scribbled and written. It is true that the style of the handwriting on the two sides differs. Nevertheless, in each case, the same hand moved over the paper; the same fingers clutched the pen, the same shoulder turned, His eye looked on. His elbow rested on the table; his buttocks pressed the chair, in both cases. His feet dangled. Also his brain was at work when he registered as a sensorium. And his senses were alive while he computed on the right hand side. The same person used the same faculties when he registered as a body and when he computed as a mind.

But then, an incredible hoax has been perpetrated by those who try to tell us that mind and body are two things, that man should have a healthy mind in a healthy body, etc. Yes, in my judgment it is a hoax. No such two things exist. The mind is me when the sequence is: brain, eyes, hands, fingers, buttocks, skin. And the body is me when the sequence is skin, buttocks, arms, eyes, brain. I do not have a body and I do not have a mind. The same being, in both cases, is arranged differently. The style of the two handwritings proves that on the left side, we have man in slippers so to speak; then he is as much mind as possible and on the right side he is in full battle dress, as much body as he possibly can squeeze out of himself.

When we speak of our mind and our body, we speak of different styles of being. We may be a mind or a body, in alternation. The whole man is present in both. Mind and body are modes of myself. And they are not arbitrary tendencies. They are enactments of my own faith and decisions.

I become mind and I become body because I alternate between the outer cohesion with the material world and the inner fellowship with minds. At any time in history, this hinge between an outer and an inner relationship of myself, has existed. But in the science of the Renaissance, these two opposite styles of being a body and of forming a mind, reached their absolute and ultimate perfection. Not with some accidental mind but with all minds must my mind square in mathematics. And not with some little corner of the globe but with the whole universe must my body vibrate, in the globe but with the

using the same complete world than the body of say a swimmer. And the mind of the physicist moves in a more complete mental continuum than the mind of the friend at dinner. The conditions of mathematics and physics must be such that anybody on earth would make the same experience under the same conditions.

The consequences of our discovery that mind and body are styles of bein<sub>6</sub>, are considerable. If it is true that I go in to play the mind and go out to play the body, the creation of this very alternation becomes the true and central concern of the living man. To be able to pass from the outside to the inside and back again, becomes the real crux of life. Never can I hope or wish to be all mind or to be all body. The nudist and the philosopher both are undesirables. My foremost attention must be directed towards being the door into both forms of being. My ego may be the mind who gets his name immortal as Ampere or Volt. My It may be my unconscious body. But you, the person, is the threshold and the gates, the ambivalent and ambiguous free creator of the body- and of the mind-situations. As I take the elements of my being into the outer or the inner world, me is both, the Ego of the Mind and the It of the Body and yet more than both together. Me also is the hinge, the either - or, and the this and that, man's soul is gates and a door. And it never is it more than when he institutes the scientific process. The soul is the hinge which allows us to be scientific. In order to do justice to the title of Eddington's book, we had to reach this one conclusion. The book was written for people who have a soul which is free to immerse herself as body into the world and as mind into the fellowship of minds.

From 1500 to 1900 the fact that man was a door could not be mentioned without ridicule. And this made all other civilizations and people inaccessible. Modern Western man seemed so different from all other men as they all stress this existence of Gates and doors. And we laughed it off. We need not laugh any longer. The people of antiquity are brothers.

Now, by rediscovering this quality of the soul as the condition for science, we may re-establish our identity with men of other civilizations. The men of these other epochs recognized that man was the master over two spaces, an inner and an outer. All ritual all over the world and all magic testifies to this faith. This seemed bare superstition. But it was superstition solely in as far as their world was limited, with the Egyptian sky or the Peruvian sky making law for their sky-worlds. Our arrangement of all sky worlds into a sky world of sky worlds, the whole physical world, seems better. It is indeed the most radical arrangement, among all the arrangements of two spaces, one of the mind pointing inward, and one of the body pointing outward. Among the many thinkable gateways between an inner mental and an outer, physical space, our natural science is based on the most universal form. It is an optimum solution among its equals. But it still is their equal in this distinction or alternation of an outward and an inward process. The world of the outer space does not any more exist than the world of the mind on which we insist. Existence and Insistence are

corollaries of our own arrangement of two spaces. As Faraday lucidly writes: The mind is placed above the outer space when a whole second world formed by all the minds in society which we delegate to cope with the three dimensional spatial realm as expert physicists.

All societies delegated their priests for the same purpose. The priests of science may be better priests but they are the priests of the people's faith, just the same. One day, "We", the community, decided that a certain group among us would, over centuries, be free to move back and forth between the two spaces in alternation. Whereas the Egyptians assigned the Nile valley to their priests for observation and computation, the Christians believed not in the Nile, or the Yellow river valley in China, or the Gulf of Mexico. They believed in One world. And so the physicists from the new day of science, were under orders not to think of a smaller world than God's complete universe. The physicists of the Renaissance received their marching orders not from any Greek tradition nor from themselves but from the common faith of Christianity in the Oneness of the created world, as one whole, as that infinite creature, which the Cardinal Nicolaus of Cues had a certained the world which the creator had called into being. While all worlds of the ancients, of the Greeks and the Hindoos the Chinese and the Mexicans, were finite, the World which God created according to the first article of the Nicene Creed was infinite. Infinity in every direction distinguishes the World of which Faraday searched the secrets, from all former socalled sky-worlds from all non-Christian natures of the cosmos.

Otherwise, the modern physicist works under the same conditions as the old priesthoods. The outer world of three dimensions, length, width, depth, does not exist except as corollary to an inner world in which all minds unite. This inner world in which the scientists through the last four hundred years of physics have united, has not three dimensions of space at all. Neither has this inner world and twin space, the same time as nature. In the outer world, time may be considered a fourth dimension of space. We have seen that the predictions for mechanisms make all time one-dimensional so to speak as the whole predicted time span is nothing but the past continued ad infinitum. The time which prevails inside the republic of scientists is of an antithetical nature. Here the present of the physicist is cut off from the past. There can be no science under fate, under a time which is the fourth dimension of space. Scientists live by faith in a future which differs in quality from the past, and create a present which is not dependant on the past, by this faith. The time of the scientific world is composed of three tenses, and the pull of the future and the push from the past combine to produce a present of scientific research. Time is three dimensional in history, in the history of science.

Society expects from the inner space in which all minds may become one mind and from its three dimensional time, new revelations on three dimensional space. The physical space examined by the physicists is only one of the two spaces postulated by the existence of a science of physics. The other space inside which physicists write monographs, keep each other company and communicate their ideas to each other, does not form a part of the space of their objects.

The Science of physics is a historical mandate given to a group of people by Christianity at a certain moment and for a certain future. Eddington himself uses language created by this mandate: "The physicist is accustomed to state lengths to a great number of significant figures... These lengths are a gateway through which knowledge of the world around us is sought.... The first step through this gateway takes us to the geometry obeyed by these lengths...." (p. 160 f.) He has no other language at his disposal except the commands of religion: A Gateway has to be built. It is a cheap escape to call these commands metaphors. They are indispensable metaphors.

And the faith of the laity in this gateway is just as much a condition of successful physics as the skill of the experts.

Eddington, in his booktitle, appealed to the fundamental faith of society which called physics into being. We have found the key to his magic formula World Entry Physics.

The key to their explanation is in our hands since we understand the three tenses and the rythm between the three tenses in the life of science. Each of the three terms connotes one of the three tenses. 1) World, the anglosaxon term, is the world before we feally know it. A man goes into the world. And Milton says: The World was all before them.... This world is full of riddles, full of powers that be, full of surprises. World Wars, World Crises, World revolutions may remind you that the World to this day still has this quality of being unpredictable and of being not our home. I am not a match for this world; no man is. This world puts me on the run. 2) Physics, Physis. Physical - these Greek terms are used when we have succeeded in explaining this same world. This physical universe has become predictable. The world which no longer holds secrets, is the object of physics. We stand above it and overlook or survey it in our courses. We have made it speak to us, in figures. The two terms world and physics are the two tenses of reality before and after we have science.

The man who says Nature is the man to whom the world already is a task of his faith, but not yet a result of his work. He no longer is panicky as the individual who is no match for the world. He has calmed down to asking the question together with others: what are these forces and powers which destroy us when we meet them every one of us, alone. Mature is the world for the universe which men in fellowship have the courage to ask. Singly, nobody has any choice: the world frightens and defeats his mind. The community is the unit in which the monster can be faced and confronted.

He who meditates over the nature of anything, has turned from his flight. The individual is chased by the world and never at rest. It is inexorable that the world keeps us in constant movement. Meditation itself is the act of faith by which we turn around and this is not possible outside the peace of a community.

The results of our confrontation is yet unknown when we say "nature". In clear distinction from the figures of physics, nothing as yet is deciphered. Nothing as yet can be predicted. But the

the world trend of running before the impact of **the stopped and a** counter movement sets in. The man who asks what is the nature of war, is not at war. He has gained time. He is establishing the gates between the two trends of being chased by war and of examining war.

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Nature is the threshold word of our language. It describes man's power to turn about towards a part of the chaos around him with the courage to confront it. Nature is the turning point at which we erect the doorway between mere blind experience and impressions and our inner response. This turning point says: so far, every one of us singly, has been made to run. Now, we as a group, pause and look around. The good old term is, we reflect, we look around collectively. Nobody can reflect except as member of the common peace. The term Nature creates this room for inner reflection. It balances the idiomatic term World of the panicky individual and the learned term physics of all mankind.

This fundamental tripartition of the objects of science according to the three phases of their treatment by us, is valid for all scientific research of the last five hundred years.

ake	God	Deity	theology	Divinity
	husbandr	<u>у</u>	morals	economy
	workers	labor	tactics of	labor policy
	teller		numerals	arithmetic
	healing		medicine	biology
	man		humanity	anthropology

I myself have written on "The Revolutions of the Christian World". In this case I spoke in precise parallel to Eddington. "Revolutions" corresponds to "Nature", "Christian" is Greek corresponding to physical, World is identical.

> The Word of God Scripture Biblical Criticism

The same Greek root may serve different sciences, but their different Anglosaxon and Latin predecessors then prove their profound inner difference, Compare psychology and psychoanalysis. They are confused often because both speak of the psyche. Go back to their Anglosaxon and Latin phases, and they deal with a different topic. Psychology is preceded by the soul and the person. The naive individual believed in the soul, the Person was the communal and social question, the psychologist discards the soul just as Bertrand Russell discards the world. But psychoanalysis deals with the Anglosaxon sinner and the Latin Ego. The sequence sinner; Ego, psychoanalysis is proven by the psychoanalytic patient who does re-press something. I therefore, find the two trebles, soul, person, psychology as against sinner, cgo, psychoanalysis, especially illuminating. Another triad is people, society, masses while hyperid, sociology. Even popular science still obeys this law. Eddington could have written a so-called popular book on the secrets of the universe. But his publisher would have sold the book by putting on the blurb: by the Nobel prize winner and great physicist. In other words: Even the camouflaging of the law does not abolish it. The book, sells because the author has the Greek name. Miss Mead may write, "And keep your powder dry". But she sells her wisdom on man's humanity as a learned anthropologist. Behind the most revolting race for a catchy title the solid faith of society in its scientists shows.

Our observation of three phases places the scientific process in the historical realm of three dimensional time, with a future which is free from the past, and a present created by faith.

This gives the first explanation for the usage of beneath and above, higher, superior. Nobody has ever tried to show, how this stepping stone from below to above is established. Because nobody has paid attention to the necessity for an about face, from mankind to anthropology, from fire to pyrotechnics. Take the music of Wagner on the fire around Brunhild. Poetry tries to roproduce the wild fire under whose impression we are awed. Science on the other hand, is pyrotechnics looking down on fire and manipulating or managing it. Our faith in the arts and the sciences accepts both states of mind as corollary. One produces the other incessantly, or life dies. The weakness of Eddington's book, by the way, is that he does not understand the interaction at all. He has a static and logical conception of the two states of mind. Art and Science condition each other; he ignores this.

The world is before us; nature is with us; physics lie behind us. And who is this "us"? It is the eternal creature man who in any moment of history must be capable of being awed by the wild, of facing about for the crusade, and of delegating work to the experts. If we wish to live at all, we must allow for the perpetual inter-action of all three tenses. The next science under this law may be a science of wars. He would be soulless indeed who could not say: "O world war, world war One, world war Two, and now for heaven's sake world war Three, o destruction, o atomic bombs, let us not go on with them. Come to our rescue, nature of war itself. Turn around"! What is the nature of war but the parricide in all of us, the same belligerency which made me fight through this paper. Belligerency, conflict, parricide, therefore, hitherto running away with us, should re-align with us and become our tool in fighting war by a science of polemics. Yes, we are parricides. War, parricide, polemics, may well be the next triad in the march of progress. If so, it would only happen by no longer shunning war but by facing our own belligerency. The League of Nations and the UNO, are silly because they exercise war as war without ever stopping and making a full about face. They deny their own belligerency and call them-selves peace-loving. They are therefore, utterly pre-scientific and religious. Theirs is not the triad of progress but the superstition of panic. They treat their own nature not as polemical. And so a third conflagration is bound to occur. He who does not aver that Cain is in his heart, can never rise to the occasion of creating peace. Science docs not evolve naturally. Science is an unnatural rise to the occasion.

And the unanimous voice of history is on our side. The ancients knew of the threshold value of contemplation. And I will now risk any good impression I may have made so far as a thinker by reading to introduce yes the pagan prayer of Greek origin which in 400 B.C. and for seven hundred more years was prayed annually for the pacification of the

township of Rome. In it, the Arval fratres prayed for defense against pest, plague, dearth, to the God of Mors, death, to Mars. You need not remind me that the gap between their prayers and modern science is profound. Granted that it is, one point, the central point which modern man must recover, they and we have in common; they knew and practified the about-face as a group, the very step which our routine scientists, routine bigots, and routine politicians abhor. By this about face, their faith created a gateway into a free and better future, just as Faraday's faith created his 16,000 experiments. Do not despise to look at the similarity. Our whole college education after this war will go stale, if we do not confess our humanity as a group which must turn about.

The text of the prayer is simple. Every element is repeated thrice. The center is held by the abrupt verse in which the God is invited to turn. He, Mars, so far leads the attack of all the evil powers against the city's bounds.

Now he is implored: Leap upon our threshold, stand there firmly. This re-alignment accomplished, the evils become blessed elements of welfare. And now the god is for them whom he slew before.

An ominous and sinister power outside their ken, greater than they the Lord of Death, is conjured. By naming it and by analyzing it, they feel that already they have to some extent light it up on their own side. The same Mars who a moment before bore down on their fields as the wilding, - ferus is the word for the wild beasts, now has given them some of his own ferocity. This is the meaning of their song of triumph. On the other hand, in this very act, he has turned his direction and looks from their threshold outward while he before drove inward against them. Death becomes Mars and Mars becomes triumph! In Afschylos, Seven against Thebes, 705 ff., you find a telling parallel.

Not by accompanying the trends but by turning in a courageous fellowship, do we rise to the occasion. We create a change in the world if we dare to stop and to rename one of its elements as part of our own nature. War drives us, panick, Belligerency, an element of life, which may be put to good use or a bad. It is indifferent. The Latin term which the group fixes on a part of the world, has this quality of making it indifferent and thereby making us free to manipulate it. It always takes a change of mind to establish such a threshold. Faith in a future freed from panic, has the power to build such gates. The hinges in which the door of "Nature" swings and by which any part of experience may become manageable, is our own speech. We speak to each other where before everybody had shouted for himself. And the world quiets down and licks our hands. But this right word of ours is not found without an excited social upheaval. The right word is not a logical deduction, but an act of faith in our sharing some quality of the monster ourselves. This partial identification with the world in terms like "nature", with God in "deity", with material interest groups in "labor", with war in "parricide", with sinning in the inflated Ego of us all, is the bold moral act which is at the bottom of science. The scientists must tell their students that science stems from faith.

This faith is not a private but a vast public and historical experience. And it now is possible to answer the most fundamental objection which usually is raised when such strict laws of speech are discussed as we here have discovered. People say: It is impossible that the vernacular, the Latin, and the Greek play intellectual roles. Speech is too accidental and arbitrary. It does not help, in such a case, to point to the Dictionary which on every page bears out our contention. Words have lost their meaning, speech has lost its creative significance for the modern mind. The fourty thousand words in the Webster carry no weight against a conviction that words and usages are arbitrary, must be arbitrary. For the free thinkers religion de-The individual words are traced to their pends on this dogma. But whole layers of inspiration are not etymological origin. discerned. In a microcospical example, I shall try to expose the shortcomings of this attitude first. And from there, I shall proceed to delineate the hourglass which has been created for the perpetual translation from the vernacular into Greek via Latin.

The example which is intended to prove that the modern mind is dogmatically prejudiced, since the Renaissance, against the functional interaction between the vernaculat, the Greek, and the Latin, is a mistake in translation made by Luther and the King's James' Bible. In John 19, 20, we read of Pontius Pilate's inscription on the Cross INRI, Jesus Nazarenus Rex Judaeorum. This formula INRI is expressed in the language of Rome. Accordingly, the gospelwriter adds the following remark: "And it was written in Hebrew, Roman, Greek." The Jews had resisted Greek influence. Rome which brought not philosophy but the sword, forced Jews and Greeks together into one world. Peter went to Rome from Jerusalem. And Luke wrote his two books so that the Lord in Jerusalem and Paul in Rome might be shown in paralled. The Roman language of INRI is the form of the inscrip-tion which is quoted to this day. And the gospel speaks not of Latin but of Roma's tongue because the Roman Empire spoke, not some Italian landscape. However, our translators in their Renaissance mood, changed the unanimous tradition of the text. Luther and the Authorized version changed the order of the original: "Hebrew, Roman, Greek, "and instead they wrote without any basis in any manuscript: "And it was written in Hebrew and Greek and Latin." Not the living relation between Hebrew, Rome, Greece, at the moment of the crucifixion but the classroom know-ledge that we put the Hebriw first, the Greek second, the Latin last, dictated this translation. A scholastic sequence of languages to be learned, took the place of the vivid picture of an interaction between the Jews of Herod, the Romans of Tiberius, the Greek of the traders and rhetors.

After this, it will be understood that the Church created on hourglass between the vernacular and Greekidost, language of the mind and science. The Church interceded between the language of the mind, for a thousand years. As the heiress of Rome, the Church spoke Roman.

Our translations of the text of John which do not say "Roman" but "Latin", while John wrote "Romaisti", weaken the significance of the act of Pilate when he wrote INRI. So do we when we call the whole layer of terms which stem from the language of the Roman Church, merely words of Latin origin. It was unimportant that Nature, Person, Society, Ego, morals, divinity, were words of an Italian idiom. It was relevant that these terms were parts of the language of the Church. For it was thereby the language of the place in which the Gentiles learned to face the most heinous and hideous features of their own panic. The folly of folks who whirl in isolation, is unlimited. The Church was the meeting ground on which the Gentiles learned to face-about, to turn upon themselves and to form a fellowship which could cease to shout and could face God's Person, the World's nature, and Man's societies. The Renaissance of Nature's Science was preceded by a renovation of the science of God's Persons, of theology and it now should be followed by a science of society's conflicts. But this acquence of science: from Anxelm to Freud makes sense only because the language of the Roman Church gave the laity the courage to put all these aweful and awe-inspiring issues on the agenda, one after the other.

The process resembles an hourglass, with the Roman of the Church forming the small aperture between the vernacular and the Greek. Everybody knows of this hourglass in practice and testifies to his knowledge by speaking of laymen and experts, of laymen and clergy. Our whole discussion has simply gone behind this usage of the term "layman", laity, and given him the linguistic status of the man who speaks the vernacular, who does not yet speak the Roman of the Church nor the Greek of science. But consider the astounding fact that the laity has two opposites: one contrast is formed by the clergy. The other contrast is formed by the scientific experts. The layman has, in other words, two groups which work on him: the Roman and the Greek, religion and science. Both came upon the laity with the dignity of something ecumenic and universal. Thus the hourglass was construed from which the sciences could proceed and progress. That science is a child of the Christian era, is written into its constitution by the very terms "science" as well as "laity." For science itself is a Roman term and it was under this term that layman could be educated to honor it. And Laity is a Greek term and it was under this term that the schoolmen of theology and the academicians of physics could be made to serve the people instead of using their knowledge for witchcraft and magic.

The hourglass is threatened by masses who hate to be called laymen, by prioris who hate to be called ministers and by scientists who hate to be called believers. And this threat stops the process of scientific growth. For, the destruction of the hourglass would be the end of all science.

Wherever we have not yet faced about and admitted our own true nature, we still face destruction. With physics far advanced, we have difficulties in realizing that its birth occurred in the same emphatic manner, by a jump of the whole man, body and soul, outside the pressure of the world as it then was and looked. Madness, wars, degeneration around us still wait for their physics. And we must pray that the staffs of the older sciences will help us to rebuild the moral fiber and the religious intensity which once gave rise to physics.

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The progress of science depends not on the frantic talk about the atomic bomb but on the progress of rational prayer. Before we do not face the nature of war, we misinterpret the lesson embodied in the progress which has led us from the "world" to "nature" and on to "physics". This religious intensity is once more reflected in the rather fundamental triad of the book title "The Nature of the Physical World". Chorus of the Priests of the Roman Commons (older than 400 B.C.)

to the Lord Mar or Mars whose elements are in mildew and fecundity, ruin and protection pest and health terror and taking charge invasion and defense ruthlessness and fidelity. "Mars is the power of doing and averting harm."\*\*)

Ι.

Ah our Common's Lares, save us; Ah our Common's Lares save us, Ah our Common's Lares, save us.

II.

- 1. And no pest and ruin, Mar, Mar, overrun more and more people. And no pest and ruin, Mar, Mar, overrun more and more people. and with pest and ruin, Mar, Mar, have done for any more people.
- 2. Be sated, wilding Mars, bound on our threshold, stand, this spot, this spot; Be sated, wilding Mars, bound on our threshold, stand, this spot, this spot. Be sated, wilding Mars, bound on our threshold, stand, this spot, this spot.
- 3. Thy twelve elements our twin groups shall call upon in their responsory, Thy twelve elements our twin groups shall call upon in their responsory, Thy twelve elements our twin groups shall call upon in their responsory.

III.

This done, ah Mar, Mors, save us, This done, ah Mar, Mors, save us, This done, ah Mar, Mors, save us.

End-chant and Dance: (Now the God has entered us, we no longer call him but he speaks:) Triumph, Triumph, Triumph, Triumph\*)

والم فرود براه من مرك الله والله والله والله من الله الله الله الله والله والله من من من ملك مالك الله

\*) The sound of Triumph, had not developed a nominative at that time but was the God's own speech from the lips of his people.

The text and translation have been constructed on the basis of the famous lecture by Eduard Norden at the Harvard Tercentenary, Aus Altroemischen Priesterbuechern, now Acta Regiae Societatis Humnaiorum Litterarum Lundensis XXIX, 1939, 107-280. \*\*) W. Warde Fowler, The religious experience of the Roman people 1933

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