LANGUAGE, LOGIC AND SCIENCE

Antonino Zichichi

INFN and University of Bologna, Italy
CERN, Geneva, Switzerland

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Closing Lecture

27th Session of the International Seminars on Planetary Emergencies and Associated Meetings
Paul A.M. Dirac Lecture Hall, Erice, 24 August 2002

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1 The Culture of our time and the one needed.

The end of the bipolar world has brought up the need for the Culture of our time to be in phase with the greatest achievements of our intellect. These achievements are not only those originated from Language, as it appears to be the case with the status of our present Culture. Rigorous Logic and Science must be brought into the cultural patrimony of our third millennium. In fact a new Culture is needed in the third millennium, since the number one enemy of humanity is Ignorance.

From the first years of our Erice Seminars on Planetary Emergencies, the Cultural Emergency has been considered. However top priority was given to other emergencies more strictly related to the risk of Nuclear and of Environmental Holocausts. It is the unexpected arrival of **Terrorism** which gives the Cultural Emergency a high priority, since Terrorism and the reaction to Terrorism are strongly correlated to the lack of a Culture, as said above, in phase with the greatest achievements of our Existential Sphere.

We will see that these achievements are not one (Language) but three: Language, Rigorous Logic and Science. While everybody can speak and write and therefore can perfectly understand the existence of Language, not so many people know Rigorous Logic and its achievements; probably even fewer people know Science and its great discoveries. Even worse, Science and Technology are often considered undistinguishable. In the Culture of our time the word "Science" is used in an improper way, as if very many intellectual activities were "Science". If everything is Science, nothing is Science.

We will try to explain why the basic features of our intellectual achievements must be classified in terms of Language, Rigorous Logic and Science, without any

confusion. In fact people equate Culture with Language. We will point out the difference which exists between the “**basic**” and the “**applied**”. In fact “**basic**” Language, Rigorous Logic and Science can never be against mankind, while “**applied**” Language, Rigorous Logic and Science can be for man and against.

The third millennium needs a Culture where Language, Rigorous Logic and Science are all in. The Erice Seminars have been engaged in the 53 Planetary Emergencies. We have contributed to overcome the risk of the Nuclear Holocaust and have implemented dozens of pilot-projects to overcome the risk of the Environmental Holocaust. The totally unpredicted phase, following the end of the bipolar world, has brought to the first line of our attention the Cultural Emergency, since **Terrorism** brings with it the message that the number one enemy of humanity – as said before – is “Ignorance”.

To fight this enemy, we need Culture. Not the old one, which is responsible for the present status, but the new one whose bases will be not only Language but Rigorous Logic and Science, in order to help the North (rich) and the South (poor) to get together and work to combat Ignorance. This paper is a contribution to avoid the risk of a Cultural Holocaust.

2 The greatest achievements of our intellect.

Our Existential Sphere has two components. One is in the Immanent, the other is in the Transcendent.

The Existential Sphere in the Transcendent manifests itself in what is called Religion. We will discuss the Immanent only.

A careful study of the Immanent Reality leads to the conclusion that it is based on three pillars: **Language**, **Rigorous Logic** and **Science**, which are the greatest achievements of our intellect.

- **Language**, from which collective and permanent memory are born, thanks to Writing.
- **Rigorous Logic**, which has given rise to the great constructions of Geometry, Arithmetic, Analysis, Algebra, Topology. From now on, Logic will mean “Rigorous Logic”.
- **Science** (with its three levels), which allows the certainty that the world is not ruled by chaos but rather by a rigorous Logic with laws that are valid

from the heart of a proton (a millionth of a billionth of a centimetre) to the fringes of the Universe (a million billion billion kilometres).

- The three levels of scientific credibility:

All the levels must be formulated in a rigorous way, and there should be no contradiction between them.

An example of the link between the three levels of scientific credibility: Cosmic Evolution must be formulated in a rigorously mathematical way, and must be based on the discoveries of the Fundamental Laws made at the first level.

No phenomena known in the Galilean sense (i.e., rigorously reproducible) exist that cannot be explained as a consequence of the Logic of Nature: this represents the greatest conquest of Reason in the Immanent.

This study, undertaken by Galilei just four centuries ago, leads us to the greatest synthesis of all times. Were it not for Galilean Science, we would not be able to say that Fundamental Laws of Nature, Universal and Immutable, exist; nor that these Laws lead to the unification of all the phenomena, as shown in Fig. 1, by the convergence of the three straight lines. Each one represents the variation of the so-called “gauge coupling” versus Energy (the horizontal axis in Fig. 1). The fact that these three lines converge towards a unique point is a remarkable result coming from studying all possible phenomena in the visible Universe, which appears to us with just four dimensions.

The Grand Unification brings with it the need for a Superworld, a mathematical structure – at present of purely theoretical nature – with forty-three dimensions: eleven of the “boson” type and thirty-two of a “fermion” type.

The data reported in Fig. 1 represent the most extraordinary conceptual synthesis of all time.

The temporal succession of the three pillars – in the history of our Civilisation – is shown in Fig. 2.

Language: no-one knows when man started to use this very efficient way of communicating with his fellows. Let us suppose 10^5 years ago. The first written records of human culture date back to about 10^4 years. This is the beginning of collective memory. Here is the Dawn of Civilisation.

Logic started with Epimenide about 2.5×10^3 years ago.

Science with Galileo Galilei 400 years ago.

Science could not arise before **Logic**.

Logic could not arise before (written) **Language**.

Fig. 2

Written Language (permanent collective memory) could not arise before the invention of the Spoken Language. Spoken Language very probably came after thousands of years of gesticulation.

When we say “**Language**”, we mean in fact all human activities where the fact that mankind has discovered the **Logic** of Nature (**Science**) plays practically no role.

Thus, for us, **Language** means Poetry, Literature, Music, Arts, Theatre, Economy, Politics and other manifestations of the human intellect such as Philosophy which — I repeat — could exist even if neither **Logic** nor **Science** had ever been discovered.

The Existential Sphere is characterized by Creativity, Leadership, Innovative Leadership, Motivation.

By these terms we mean the following:

- 1) Creativity is the ability to generate something never before known nor seen nor observed.
- 2) Leadership is the ability to inspire and motivate people.
- 3) Innovative Leadership is the ability to inspire and motivate people for creative performance.
- 4) Motivation is the motor to reach a goal.

In our Immanent Sphere of activities, the three basic pillars, **Language**, **Logic** and **Science** all need Creativity, Leadership and Motivation, the most difficult one being Creativity.

This is why I will concentrate my efforts to discuss Creativity. Let me say that Creativity, no matter where (**Language**, **Logic**, **Science**), needs Memory and Imagination as background. In fact Memory is needed in order not to repeat mistakes and not to restart from **zero** again and again. Imagination is needed because you have to imagine things never thought of before.

Finally, having exploited Memory and Imagination, Creativity corresponds to turning the outcomes of Imagination into Reality.

We will now discuss the three pillars; in § 4 the Creativity in them and in § 6 the distinction between “basic” and “applied”.

3 Language, Logic and Science.

In Fig. 3 there is a synthetic representation of the sequence needed to arrive at the three pillars. The Universe could have existed without Life. Life without Conscience. Conscience without Creativity. Creativity without Reason. We are the only form of living matter with the extraordinary privilege of possessing Reason.

It is thanks to this privilege that Language, Logic and Science have been discovered. We will see later (§ 6) that “basic” Science must be distinguished from “applied” Science (Technology) as well as “basic” Logic and Language must be distinguished from their applications.

In Fig. 4 the sequence Language, Logic, Science is shown as it did happen.

Fig. 3

Fig. 4

Fig. 5 synthesizes the content of Language, Fig. 6 the content of Logic with its sequence of Arithmetic, Algebra, Analysis and Topology. In Arithmetic, thanks to Cantor, it has been discovered that there are two levels of Infinite, aleph-zero α_0 and aleph-one α_1 . The third level of Infinite, α_3 , is present in the theory of functions. We use the Greek symbols α instead of aleph.

In Fig. 7 the three levels of Science are exemplified in terms of the Galilean inventions, discoveries and basic measurements for the first two; the third one refers to the XXth century invention, discovery and measurement of what happened to the cosmic evolution 300.000 years after the Big-Bang (see also Fig. 1 – upper part).

Fig. 5

Fig. 6

SCIENCE AND ITS THREE LEVELS

1st level

Invention:	• <i>Inclined Plane.</i> • <i>Pendulum.</i>
Discovery:	• <i>The Law of Inertia.</i> • <i>$F = mg$.</i> • <i>Action = Reaction.</i> • <i>The Principle of Relativity.</i>
Measurement:	• <i>“g”.</i>

2nd level

Invention:	• <i>The Telescope.</i>
Discovery:	• <i>The irregularity in celestial bodies: the Moon (craters ...); the Sun (spots).</i> • <i>The Jupiter Satellites.</i> • <i>The Saturn “ears” (rings).</i> • <i>The phases of Venus.</i> • <i>The structure of the Milky Way.</i>
Measurement:	• <i>The cosmic clock: the Jupiter satellites.</i>

3rd level

Invention:	• <i>Microwave Detectors (Penzias & Wilson).</i>
Discovery:	• <i>The Cosmic Microwave Background Radiation.</i>
Measurement:	• <i>The Black Body Spectrum at 2.7° K.</i>

Fig. 7

Following Galilei, Enrico Fermi emphasized in the XXth century that even the most advanced frontier of Physics needs – as ever – inventions, discoveries and measurements (of the fundamental quantities). Fermi – the greatest Galilean of the XXth century – pointed out that no one should be considered a “physicist” if he has

never invented anything, nor discovered anything nor measured a basic quantity. This is illustrated in Fig. 8.

Fig. 8

And now Creativity.

4 Creativity in the three pillars.

Creativity has distinctive features in the three pillars of our Immanent Sphere.

In **Basic Language**, **Creativity** has the following parameters: aesthetics, beauty, to end up with something which has to be “magnificent”. That is why it is necessary to corroborate the concept of **Creativity** with other parameters such as, “satisfy specific formal-aesthetic standards”, “be fascinating”. We will see in § 6 that the **Applied** part of **Language** needs public appeal, success and “be of value to society”. In all cases, **Creativity** corresponds to turning the new form of art or music or literature (or all others) into reality.

In **Basic Logic**, **Creativity** has just one parameter: non-contradiction. A logical structure that leads to self-contradiction cannot exist. The existence of a

logical structure corresponds to demonstrating that the new logical structure invented does not lead to self-contradiction. The most impressive and fascinating example is the Infinite.

In **Basic Science**, **Creativity** has one and only one parameter. No matter how elegantly they may be expressed, there are no beautiful or ugly ideas in Science, just true or false ones. By ideas we mean theories. Here Creativity needs not only to rely on a logical structure which avoids self-contradiction, but **it must overcome the reproducible experimental proof**. In other words, a theory logically rigorous and non self-contradictory does not necessarily fulfil the requirements of being scientifically proven.

There are many logical theoretical structures which are not found in Nature, e.g. a space with infinite dimensions does not lead to any self-contradiction. It therefore exists from a mathematical point of view, but the space where we live has a finite number of dimensions (probably forty-three, if the Superworld exists). Space with an infinite number of dimensions does not exist for Science. A theory that can be corroborated by the baptismal fire of experimental proof enters into the logic structure of Galilean Science: one that cannot, is discarded.

Creativity in Basic Science thus corresponds to establishing a truth by **experimental reproducibility**, exactly as advocated by Galileo Galilei.

As mentioned before, the background needed for **Creativity** is **Memory** and **Imagination**.

Memory has a common role in the three pillars and it is essential in order not to repeat what has already been “created”.

Imagination in Basic Language corresponds to inventing new forms of poetry, of music, of art and of other intellectual activities.

Imagination in Basic Logic means to invent new mathematical structures with their axioms and their rules.

Imagination in Basic Science corresponds to thinking of a new principle, of a new phenomenon, of a new law and to imagining a new experiment. Let me point out that the greatest steps in Science have been originated from the “**totally unexpected**” results of reproducible experiments (Radioactivity $\Rightarrow$ Fermi Forces;

Strange Particles $\Rightarrow$ Flavour Charges, Stability of Matter; Lamb-shift $\Rightarrow$ Virtual Phenomena etc. ...).

It is very important to make a clear-cut distinction between **Science** and **Technology**.

For this to be done, it is necessary to have a look at the Technology from the dawn of civilisation to Galilei, and at the Technology from Galilei to our days.

5 Technology.

Let us call the former “pre-Galilean Technology” and the latter “post-Galilean Technology”. The pre-Galilean Technology was based on trial and error, and not on the understanding of Fundamental Laws which could give rise to applications such as the wheel or the fire.

This is why, during the ten thousand years that preceded Galileo Galilei, there were two, and only two, inventions: the fire and the wheel. No-one knows who was the man who first succeeded in deliberately producing a spark to start a fire. And no-one knows who was the man who invented the wheel. What we do know, for sure, is that the **wheel** and the **fire** have been understood after the discovery of **Science**: the wheel by Galilei and the fire by Einstein. The post-Galilean Technology has its roots in well-understood Fundamental Laws of Nature^(*)^(**).

Post-Galilean Technology requires our intellect to work in such a way as to produce an “**invention**”: it covers all the activities that arise from the applications of the great scientific discoveries.

Basic Science requires our intellect to work in such a way as to produce a “discovery”. **Science** cannot **invent** a new Law of Nature. **Science** can only **discover** a new Law of Nature. On the other hand, technological progress is based on a new idea which puts together, in an original way, different “structures” or “pieces” and

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(*) The invention of the “Steam Machine” precedes the discovery of Thermodynamics. However it is thanks to Thermodynamics that this technology has been fully understood and has given rise to vast technological inventions in this field.

(**) The optical instruments existed before the understanding of the “dual nature” of light.

uses them in a way which no-one had ever tried before. This is the meaning of a technological “**invention**”.

Since each product of our intellect has to be defined in a way which distinguishes it from others, we should not confuse “invention” and “discovery”.

Technology “invents” while **Science** “discovers”.

The myth of equivalence between **Science** and **Technology** has to be fully discredited.

There is another myth too which needs to be discredited: the myth of the strong correlation between Science and war-weapons. This myth claims that, if the world is stuffed with H-bombs, this is due to Science.

The Stone Age produced peace-tools and war-weapons. The Iron Age produced the scalpel and the sword. The choice of using either scalpel or sword was a cultural one. The choice of producing either peace-tools or war-weapons could not have been scientific, since Galilean Science did not yet exist.

Post-Galilean Technology, through “inventions”, is the means by which the Fundamental Laws of Nature discovered by Science can be given meaning and application in our daily lives.

These applications should not be attributed to Science.

From now on, post-Galilean Technology will be simply referred to as Technology.

Technology is the element of rupture that opens our eyes, confronting us with the choice of using it for the benefit or the detriment of man and society.

6 Examples of Basic and Applied in the three pillars .

Science is neither good nor evil. Unfortunately, people currently use the word “science” to mean the “use of science” (i.e. technology) which is no longer “science”, just as the “use of language” is no longer “language” and the “use of logic” is no longer “logic”.

Let me elaborate further on this point. An example of **Creativity** in **Basic Science** is the discovery of the “Standard Model”, i.e. the superb synthesis that can

explain all phenomena of our world in terms of three Fundamental Structures (called the three families of elementary particles) and three Fundamental Forces of Nature.

An example of **Creativity in Basic Logic** is the invention of the rigorous and formidable logical structure called the Infinite.

Examples of **Creativity in Basic Language** are the *Pietà* by Michelangelo, the *Primavera* by Botticelli, the Ninth Symphony by Beethoven, the Fifth Symphony by Mahler, the *Divina Commedia* by Dante.

All these achievements are for mankind.

Examples of **Applied Science, Logic and Language** do exist. These “applications” can be **for** and **against** mankind.

For example, **Creativity against mankind in the Use of Science**, also called **Applied Science (Technology)**, corresponds to war technology.

Creativity against mankind in Applied Logic corresponds to the invention of computer technology applications for the control of billions of people, thus destroying individual freedom.

Creativity against mankind in Applied Language corresponds to the invention of ideologies like Marxism and Nazism.

Examples, which are for mankind, do indeed exist in the domain of **Applied Science, Language and Logic**.

Peace technology, instruments to help mankind in Medicine, Agriculture and Meteorology, correspond to **Creativity for mankind in Applied Science**.

Creativity for mankind in Applied Logic corresponds to the invention of new robots to avoid dangerous and unpleasant work for man, of specialised computer-based applications for medicine, for weather forecasting, etc.

In **Applied Language**, the creative power for mankind corresponds to the performance of pieces of poetry, of music and of art, plus all other activities designed to **help increase the quality of every-day life** in all sectors that would exist even if **Logic and/or Science** would have never been discovered.

The components for mankind in **Applied Logic** and **Applied Science** contribute enormously to improve the quality of life. The three pillars have a

common task and reach the same goal in their applied part **for man**, i.e. to improve the quality of every-day life, as shown in Table 1.

Table 1

It is evident that with all three pillars, **Language**, **Logic** and **Science**, **their use** can be for mankind and against mankind. The **Use of Science (Technology)** — as we have already emphasized — is the most spectacular way to distinguish the “**basic**” from the “**applied**” part of the same pillar. The terrible weapon able to destroy a metropolis as big as New York — the H-bomb — is not the result of **Creativity in Basic Science** but in **Applied Science**. Nazism and Stalinism are not the result of **Creativity in Language** but in **Applied Language**.

Science, in the Immanent (therefore without appealing to any existential topics connected with the Sphere of the Transcendent), is the source of a new hope, well-rooted in the Fundamental Laws of Nature so that the components mentioned above can all aim at good and never at evil.

In order that the above may happen, it is necessary that the **Applied Science** (i.e. the technological applications of the great scientific discoveries) be entrusted not to political bodies but to the scientific community itself. This is in flagrant conflict with Democracy. A scientist is in fact not elected to be a scientist.

It has never been that way because political activity belongs to **Applied Language**. And this can be for man (Democracy) and against (Dictatorship). Nevertheless everybody considers we scientists as responsible for the **Applied Science**. Worse than this, people think that **Science** was born of Technology. Some would even say that we scientists would not be here, if it were not for the technological development.

The claim, by the fellows responsible for the Culture of our time, that Technology precedes **Basic Science** is due to the fact that the “fire” and the “wheel” were invented before Galilei discovered **Science**. To corroborate this claim they put forward the invention of the telescope, as we will see in § 7.

As mentioned above, the “fire” and the “wheel” were understood after **Basic Science** had been discovered by Galilei. To “invent” a new instrument does not necessarily mean to understand “why” it works. The spectacular successes in the construction of Pyramids and of other masterpieces of Architecture, all over the world, did not give rise to the discovery of the first pieces of the Logic of Nature, such as the Principle of Inertia and the other two laws of Mechanics.

A discovery in **Basic Science** corresponds to “understanding” all possible instruments that can be invented. For example, the discovery of a Fundamental Force of Nature, the electromagnetic force, has allowed us to understand that all our senses, sight, hearing, smell, taste and touch, are manifestations of the same and unique fundamental force. This force originates from a unique entity, called “the electric charge”. If we could switch off this “charge”, our five senses would cease to exist.

Thus all present and future “inventions” connected with sight, hearing, smell, taste and touch are understood, even before they are really implemented.

Before **Basic Science** was discovered thanks to Galileo Galilei, it was the other way round. Since the Fundamental Laws of Nature did not exist, the technological inventions were always rotating around the same two original ones, the “fire” and the “wheel”. Since neither the “fire” nor the “wheel” were “understood”, the technological development could not produce anything really new.

7 The Galilean Technology.

It is said that the great discoveries by Galileo Galilei were the results of an important technological invention, the “telescope”. In fact, it is thanks to the telescope that Galilei discovered that the Sun and the Moon were not “perfect” bodies, despite being **celestial**. The Sun had “sunspots” and the Moon very many irregularities: mountains and craters. Jupiter had satellites, like our Moon. And Saturn had “ears”, better known as rings nowadays.

If it were not for a peculiar feature of our Solar System, namely the existence of an immense number of Asteroids, the surface of the Moon might have been less battered, and at first sight might have appeared nearly perfect to Galilei’s telescope. Jupiter could have been without satellites and Saturn without rings. The irregularities of the Sun’s surface could have been much weaker and nearly undetectable by the primitive telescope invented by Galilei. In other words, all the astronomical discoveries of Galilei are “irrelevant” details when compared with the great achievements of Galilei. Let me recall some of these.

The Law of Inertia; the discovery that acceleration — not velocity — is proportional to a force; the *Principle of Relativity*: “No matter what you do, under no circumstances will you ever detect an effect (experimentally reproducible) that depends on the velocity of a system, if this system travels at constant rectilinear velocity”. Notice that this formulation of the principle of relativity includes “all possible effects”, not only those due to the motion of material objects. In fact, the principle of relativity as formulated by Galilei includes all phenomena and therefore the Electromagnetic ones which gave rise to the invariance for Lorentz transformations, better known as Einstein’s “restricted” relativity.

All these discoveries by Galilei needed neither the technological development of the telescope, nor any technological instrument whatsoever.

All Galilei started to do was to take a piece of stone, tie it up with a string and study its oscillations. He took another piece of stone, as much as possible looking like a sphere, and studied how it rolls down a piece of wood. Then he varied the angle of the plane of the wood.

He discovered that motion obeys the law of constant acceleration and this is how Galilei measured “g”: the acceleration due to the gravitational attraction of the earth on all material bodies.

He discovered that a “feather” would fall down like a “hammer” if it were not for the resistance due to the “air”. On the Moon, where there is no “air”, both the **feather** and the **hammer** would fall down in exactly the same way. During Galilei’s time there were no planes, nor missiles, and to think of the man on the Moon was not so easy. “Galilei was right” David Scott exclaimed, when 400 years later he let a feather and a hammer fall down on the Moon.

The great contribution of Galilei to human knowledge is not due to the telescope, i.e. to a technological invention, but to the firm conviction that Fundamental Laws of Nature had to exist. He discovered that this is indeed the case, using the most simple elements of our world: a **stone**, a **piece of wood** and a **string**. And his heart-beat as a **clock**. Can this be **called Technology**?

Galilei was convinced that each piece of matter must carry the imprints of the fellow who created the Universe, with its Laws, rigorous and valid everywhere in

Space and Time. Galilei could have discovered neither the laws of the pendulum nor the laws of the “inclined plane” but the chaos. Galilei opened the human intellect to a new horizon. We are, among the many thousands of forms of living matter, the only one to whom a great privilege has been granted. The privilege of being able to understand the **Logic of Nature**. Among all possible logical structures, one has been chosen. The task of **Basic Science** is to discover this **Logic**.

In this task we have reached the most incredible synthesis of all times.

I have already mentioned the synthesis: it gives us the feeling that we have understood almost everything about the world. And this, thanks to the so-called Standard Model from where the new theoretical frontier called the Superworld emerges.

If there is the Light, there must be the Superlight. If there is the Electron, there must be the Superelectron. If there are the Stars (ashes of the world), there must also be the ashes of the Superworld, i.e. the Superstars (if they exist, we would not see them because they cannot emit Light). Despite two decades of intensive research, we have not been able to detect any evidence for the existence of the Superworld. I believe that it should exist. But this is a “philosophical” dream corroborated by a mathematical structure. What is missing is the experimental proof. In other words the Logic is there, the Galilean proof is not.

8 **Conclusive Summary.**

To sum up, it is **Creativity in Applied Language, Logic and Science** that can be for, but **also** against, mankind. On the other hand, **Creativity in Basic Language, Basic Logic and Basic Science** can never be against mankind. Let us recapitulate.

Creativity in Basic Language needs **neither** to obey the principle of “non-self-contradiction” **nor** to overcome the baptism of fire of the experimental proof.

Creativity in Basic Logic needs to fulfil the principle of “non-self-contradiction” but no experimental proof is needed.

Creativity in Basic Science needs to overcome the principle of the reproducible experimental proof. And this means to check our imagination with the

fellow who created the **three Basic Structures** (three families of elementary particles) and the **three Fundamental Laws** of the Universe. As Isidor I. Rabi used to say, “he is smarter than all of us”.

Thus **Creativity** in **Basic Science** is the most difficult one, when compared to **Basic Logic** and **Basic Language**, since **Basic Science** means the Logic of Nature and this **Logic** has been chosen by a fellow who is “smarter than all of us”.

A synthesis of how the three pillars could be expressed in terms of a possible set of formulae is shown in the following Figures. In Fig. 9 we refer to Language which is a function F_{La} of the various components R , Cr , Co , Li and U . In turn, each component has a series of functional structures, such as $f_{La}^j(R)$, where the index j runs over a finite number of inputs according to the various contributions so far known. The meaning of the various symbols like Σ , Π , $\oplus$, $\otimes$ and the indices (j , k , l , m , n ,) is not the standard one. Their purpose is to recall that many different possible combinations either simple (Σ) or complicated (Π) exist where the various parts of the achievements in Language can all contribute to some original structure of the Language itself.

As it appears from Fig. 9, Language is very complex in its structure. The “basic” part of Language must have as final purpose to be “magnificent” and therefore this is the “condition” to be compared with that of Basic Logic and of Basic Science.

Logic is much simpler, as shown in Fig. 10. It depends on Arithmetic, Algebra, Analysis and Topology. As repeatedly emphasized, Logic must satisfy one and only one condition: non-contradiction.

In Fig. 11 there is the structure of Science which depends on, and therefore needs, – as previously emphasized – inventions, discoveries and measurements. The only condition being reproducibility.

Applied Language, Logic and Science in their components for man have a common condition, i.e. to improve the quality of life, as already shown in Table 1.

The quantitative measurement of this is our average lifetime which has reached – in the most developed parts of our Earth – the value of 80 years.

$$\begin{aligned}
 u \equiv F_{La}(R, Cr, Co, Li, U) &\equiv \sum_{j,k,l,m,n} [f_{La}^j(R) \oplus f_{La}^k(Cr) \oplus f_{La}^l(Co) \oplus f_{La}^m(Li) \oplus f_{La}^n(U)]^{\oplus} \\
 &\oplus \prod_{j,k,l,m,n} [f_{La}^j(R) \otimes f_{La}^k(Cr) \otimes f_{La}^l(Co) \otimes f_{La}^m(Li) \otimes f_{La}^n(U)]^{\Rightarrow} \\
 &\Rightarrow \text{Be Magnificent}
 \end{aligned}$$

Reason	$\equiv$	R	$\Rightarrow$	j	=	1, 2
Creativity	$\equiv$	Cr	$\Rightarrow$	k	=	1, 2
Self Consciousness	$\equiv$	Co	$\Rightarrow$	l	=	1, 2
Life	$\equiv$	Li	$\Rightarrow$	m	=	1, 2
Universe	$\equiv$	U	$\Rightarrow$	n	=	1, 2

LANGUAGE

Fig. 9

Fig. 10

Fig. 11

Finally we have in Fig. 12 the complete structure of all sequences.

Language can discuss in all possible ways, including the totally unrealistic ones, the Universe, the Life, the Conscience, the Creativity, without any boundary condition, but one: to be “magnificent”. The most genuine expression of Language is Poetry. In fact with Language, we can say anything and its opposite, the total being zero. Following Borgés, Poetry should be totally deprived of any meaning but be “magnificent”. It is the “magnificent” nature of Basic Language which makes Poetry to be the best and most significant part of the first intellectual achievement of our Existential Sphere in the Immanent.

Fig. 12

Logic stands in its box totally isolated from the rest since it deals with axioms and rules and its existence needs only the condition of “non-self-contradiction”. Logic is the purest and most rigorous form of thought which is totally invented by our intellect without any reference to the chain illustrated in the upper part of Fig. 12.

Science studies the Universe using the three levels and obeying the condition that all measurements must be reproducible. The achievements of **Basic Science** give man a great intellectual dignity and must generate an awareness in mankind in order that Motivation, Creativity, Innovation, Leadership, Innovative Leadership, be all turned in the **Applied Science** to good and never to evil.

9 Acknowledgments.

I would like to express my warmest thanks to my co-Presidents Professors Tsung-Dao Lee and Kai Siegbahn for having discussed with me the content of this paper and to our colleagues, shown below, for their contribution – during this Seminar – to the items of interest in the various components of this paper.

LANGUAGE:	Alain Peyraube
CREATIVITY:	Norbert Kroo
POETRY:	Senator Josef Jarab
POETS AND DREAMERS:	A. Adamishin
RELIGION:	Eda Sagarra
THE CHARM OF SCIENCE AND ITS VALUES:	Edward Teller
TOTAL LACK OF VALUES FOR GENOCIDES:	Richard Garwin
ROMAN EMPIRE:	William Shea
HIGH-TECH TERRORISM:	Karl Rebane