PHILOSOPHY OF SCIENCE

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These assorted archive records, mostly dated by 1980's and early 1990's, were intended to later complement the brief summary given in *Philosophy of Consciousness* (published in 2009). They are presented here in no particular order, illustrating the different aspects of same general approach. Some applications to special sciences are to be formatted as separate collections.

Definite Science

Some people believe that the impressive success of the scientific method in the course of the last couple of centuries is due to some inherent feature of science that makes it superior to any other area of human activity. Promoted by the academic circles and the market of knowledge, this belief tends to acquire the traits of a full-fledged religion, with the same devastating effect on the human spirituality. The superstition grows in the conditions of mass ignorance as to the origin of science and its place in the whole of culture. Indeed, controlling and manipulating the minds of the wide public is much easier when almost anything at all can be called science and thus endowed with a portion of the unlimited power of judgment. That is why any attempt to honestly outline the domain and the limits of science is important, to get rid of the artificially inflated authority for the sake of justifiable authority and well-grounded trust. On the other hand, it is only on the basis of a clear vision of the purpose that the inner organization of science could be consolidated and consciously improved.

To start with, let us agree with the majority of working scientists that their occupation has to do with some sort of highly gratifying and inspiring creativity. Those devoid of narcissist snobbism will also admit that there are other kinds of creativity, whatever a proud scientist might think of their (im)perfection. For the closest relatives, it is natural to consider art and philosophy which are akin to science in that they do not immediately produce things, but rather influence their production, in some vague and elusive manner. Let us assume that art, science and philosophy share a common realm, representing the three culturally distinguishable modes of operation.

Science is often said to be more attractive than its two companions, since it seems to produce direct prescriptions, something ready-made and immediately applicable. That is, the product of science (commonly known as *knowledge*) is to be *learned*, accepted as it is and operated as a black box. This feature can be exploited by politicians to impress the average mass and implant the thought of a mystical superiority of the scientist (which becomes hate when it comes to revolt).

This prejudice has no real justification. However explicit, the prescriptions of science can never be immediately usable, as they need to be roughened and adjusted to the ocean of detail that have been omitted in the scientific abstraction. Eventually, such purpose-trimmed knowledge may closely resemble an *example* (like the patterns of art) or a general *principle* (as suggested by philosophy). The portion of each source in a particular act will depend on the overall character of activity and the operating environment. Learning anything, we creatively transform it into an individually shaped hybrid, where the specific contributions are no longer separable. The trivial wisdom is to consider it as a normal and necessary feature of the cultural process, with the joint effort of all the modes of creativity and their unity embodied in the final product. The practical corollary of this idea is to stop talking about superiority and closer investigate the possibility of mutual enhancement.

As long as we stay inside science, it will remain incomprehensible mystery. The only possibility of definition comes from comparison to other entities *of the same kind*, that is, equally necessary and closely interacting. Such a common environment is to constitute a higher-level entity, correlating all the

specific manifestations and developing them together, both historically and in the course of a parent activity. That is why, comparing science to art and philosophy, we must treat them on the same footing, as the complementary branches of the whole. This whole, in its turn, could be compared to some other phenomena and thus become as definite. In principle, the same technique is applicable on any level, leading to rather complex hierarchical structures; however, too ramified constructs can hardly be of practical importance, as the degree of interdependence of distant levels of hierarchy significantly grows with the overall complexity, and, on the current level of operation, simpler constructs of a different character could be much more appropriate. In particular, the structures of rather distant levels in a extensively unfolded hierarchy may seem the instances of the same structure, adding little to our understanding of hierarchical complexity.

With this reserve, let us proceed. A most general idea of science can (for instance) be derived from the fundamental structure of any activity implying an *object*, a conscious agent (the *subject*), and a final *product* to reproduce in a regular manner. This regularity means that the object area and the aptitude of the subject can be treated as the aspects of the product, so that the process of reproduction comprises three interdependent branches: material reproduction (industry), spiritual reproduction (reflexive action, self-production, creativity), and cultural reproduction (in the from of specific cultures and history); each thread can be considered as the synthesis of the other two. The names refer to the most general view of the world's self-reproduction: since there are no other worlds, the world as an object is what we call *nature*; as the universal subject, the world deserves the name of *spirit*; the rearrangement of the world due to conscious activity is *culture* as the unity of nature and spirit.

The actual degree of separation of the three modes of reproduction depends on the stage of development: basically, the aspects of the same are first mangled together (the *syncretic* state); later they become formally independent and opposite to each other (the *analytical* phase); as the interdependence of the different fields grows, complex *synthetic* forms come to life, lifting the interaction of components and incorporating it in a higher-level entity as inner motion. The same road is open for industry, spirituality, or cultural development taken as relatively closed and self-sustained. Specifically, our attention is to turn to the levels of creativity. There too, there is a syncretic layer related to the necessity of adjusting our behavior to the stream of the everyday life, with incidental whirls scattered over easy and smooth flow. Here, the stable core of the subject is reproduced in a system of habits and beliefs, as tradition and establishment. The creative solutions are built into the very course of activity, the decision being identical to the act. It is on the next, analytical level that the creative product will represent the modes of activity rather than industrial production, and its material implementation has nothing to do with its consumption value. Art, science and philosophy reflect the subject's organization in intentionally artificial forms, any reflection being thus separated from the reflected; that is why we call this stage analytical. People are perfectly aware of the prevalence of (certain aspects of) the subject in the product of their activity. However, the three levels of analytical self-reflection are very different in their choice of the mode of scheme transfer, the way they influence the regular (industrial) activity. This is where we seek for a general definition of science.

The product of art is to express the organization of activity in an implicit manner, as a sample of behavior corroborating its feasibility. Acquaintance with art is to tune the inner attitudes of the subject, as if suggesting to follow its ways. There is no difference whichever material will carry the message; moreover, artists are to explore all the open possibilities, to find the most vivid and subjectively persuasive implementations. The same inner pattern can arise from a variety of impressions; their hierarchy will be referred to as an artistic image.

Science is the opposite of art in the sense that quite different patterns are to be implemented in the same outer forms, the standard modes of action. This explicit expression is a kind of second-order reflection, when we reflect over the ways of our creativity, deliberately fixing the material of the product in addition to the conscious choice of content. Since any content is the unity of material and form, the invariance of material will inevitably make science formal. That is, instead of syncretically grasping the whole, a scientist is to show a wide range of outer relations of the object thus defining it an indirect manner, through a number of phenomenal hints. This may produce a double effect: since the object is

defined through other objects, there is an impression of supreme objectivity, independence of the subject; on the other hand, the absence of direct reference feeds doubts about whether anything at all actually exits out there. To hold down this dilemma, people need a better social organization ensuring more collaboration with no division of labor (which does not deny flexible redistribution).

The opposition of art and science is to be eventually resolved in their unity. This requires a new level of analytical creativity representing this unifying effort as both the objective necessity and subjective choice. This is the primary mission of philosophy.

Philosophy is much like art, as it is free to choose any form of expression, any material implementation. On the other hand, philosophy is like science in that its product is to be obtained in a formalized manner, as an ultimate abstraction. This synthesis is possible through development of specific philosophical categories and categorial schemes combining the traits of both the artistic image and the scientific notion.

Knowledge as scientific product is a hierarchy of notions, each of them referring to a certain class of outer dependencies, the possible manifestations of the object. The same object can be reflected in many notions, according to its current place in the culture and the modes of reproduction. Thus, gas or fluid can be treated as a continuous medium; in a different context, they will be pictured as a collection of molecules. Similarly, a star can be described by its overall luminosity and color, while a closer look is to find a plasma ball. To choose the appropriate notion, we start from a practical need, gradually gathering the significant detail, which provides a lower-level context for minute distinctions. In science, this activity-centered hierarchical structure lying in the core of knowledge gets formally reversed: instead of a multi-faceted activity (as defined by its product), we start from a formally isolated object, expanding its notion in a hierarchical structure embracing a range of practical applications. That is, the primary question “how can we do it?” is now reformulated as “what can be done with that?” Either approach is perfectly justifiable; they complement each other. However, they will remain abstract opposites until we indicate the mechanism of their interaction, which brings us back to the apparently omitted subject link.

Since science has intentionally replaced the subject with a formal procedure, it can no longer develop on its own, without recourse to the outer sources of inspiration. A most abstract theory still needs situational prompts and hints; it has to borrow both its objects and methods from something beyond its domain. From within science (and cognition in general), such transcendental revelations may seem mystical and absolutely intractable, imposed by a supreme force, or innate to any thinker. To get rid of this uncanny turn, we must recall the creative companions of science, art and philosophy. The former provides preliminary abstractions ready to shape into notions; the latter suggests the directions of methodological development. It is important that science never deals with the raw experience of everyday life, and it never means any direct influence on the ways of industry and creativity. These relations are always mediated by art and philosophy, which, in a way, behave like loving parents providing their child for whatever it may need, while protecting it from too much complexity and engagement, to give enough room for play and try. A grown-up may forget about parental support, or even blame it; this does not undo the fact.

Growing among artists and philosophers, science will inevitably reflect that milieu in its inner structure. The three levels of analytical creativity reappear in any special research as empirical, theoretical, and methodological levels of a particular science. Since, in this hierarchy, theory plays the role of “science in science”, some theoreticians (urged by politically biased philosophers) tend to despise observation and experiment as second-grade science, proclaiming formal constructs the only true knowledge; the formal aspects of methodology are then absorbed by such theory as a very limited and restricted kind of logic. However, any theoretical product is also subject to inner gradation, with phenomenological theories or conceptual models being as productive as apparently rigorous deductive schemes. There are no crisp boundaries, and the relics of art or philosophy will always show up in a most pretentious formalism.

Just like any creativity necessarily combines all the levels of hierarchy, science (as long as it deserves the name) requires an empirical background, implies certain methodological basis, and needs

a kind of theory; depending on the placement of inner accents, the variety of the possible types of science comes to life, none of them being inferior to another in any respect. Similarly, scientific theory develops all its levels in parallel, with more stress often put to one of them, but the rest carefully packed inside. Any violation of this integrity, lack of due reserve and balance, will result in pseudoscience, regardless of the degree of explicit cultural presence.

Once again, starting with cultural syncretism (habits, intellect, skills), this presence develops various analytical forms (special sciences), whose interaction results in the synthetic idea of science. Since market economy is based on the universal division of labor, institutionalized forms of science take their place among the other market values, giving rise to numerous social bodies pretending to officially represent science as such. Most often, this academic establishment is alien to the current diversity of scientific thought; its primary concern is to appropriate the product, sell and resell it until the last traces of science are obliterated and political interest absolutely prevails. Unfortunately, such parasitic structures are much more visible to the wide public, and their apparently inviolable social status adds to the impression of "scientific objectivity", subject-devoid knowledge, which is firmly (that is, officially) established and not subject to change.

For a lay person, the authority of science is measurable by the level of investment and the income of professional scientists. This is the cultural aspect of science, its place in economy, as a specific product representing a class of activities. In the background, there still exist the objective and subjective aspects (the nature and spirit of science), picturing science as an occupation (regardless of social acceptance) or reflection as such (taking the form of inquisitiveness and curiosity). Each scientist combines these three levels in an individual proportion; as an echo of class struggle, some inclinations may contradict to the rest, bringing down the overall efficiency of science, its objective adequacy, and the degree of personal satisfaction. In particular, the market-oriented structure of institutionalized science often results in huge bulks of routine work devoid of a single glimpse of scientific creativity; this may scare away many talented minds who prefer remain off-stream amateurs rather than yield to social pressure and prostitute their gift. In a class-free economy, science will take much simpler and more straightforward forms, thus becoming accessible to the broadest range of those interested, and commonly affordable.

Since science is essentially formal, it is bound to develop a relatively closed subset of the common language incorporating the abstract structures that constitute the scientific vision of the object area, its notion. The commonality of the industrial schemes of activity leads to the resemblance of one conceptualization to another; in science this dependence is apparently reverted: the generality (and hence insufficiency) of the language of science is said to introduce a unified picture of the world, which seems to implemented some primary knowledge beyond questioning. Once again, in the class society, this tends to enhance the normative aspect of institutionalized science prescribing people what should be done instead of being sensitive to what they need. This is how science is manipulated by the ruling class into blind apologetics, "proving" anything that suits the wealthy customer. In particular the very idea of formal primacy is eagerly promoted, to prevent masses from striving for a better life.

The language of science is in no way restricted to words; most often, it includes schemes and formulas, notation standards, as well as certain conventions about the modes of clipping the common vision of the world into science. As the degree of formality increases, this slang becomes overgrown and almost incomprehensible, even by scientists. Hence the well-known maxim: just calculate, and never ask why. The academic community blames any attempts to clarify the meaning and sense as non-scientific and mean. Yes, the purpose of science is not science; but why should we lock ourselves within, forgetting about the immensity of the world around? That would dismiss the very idea of knowledge, as it happens to be knowledge about nothing.

In the class society, the governing circles are interested in the alienation of science from the mass, and that is why institutionalized science is urged to cultivate formality, diluting the notion in a terminological game. Being foreign to ordinary people, scientific language brings up an army of interpreters, explaining and explicating the supreme revelations in any possible way, thus fertilizing the soil for politically influenced vulgarization and brainwashing. From the reflective standpoint, such

degradation of science is an indicator of its insufficiency, the objective necessity of switching to a different paradigm. That is, overcomplicated structures and exaggerated stress on computation, the race for precision and rigor, eventually lead science to a dead end; our notions have reached the limit of their applicability and further development will suggest a higher-level picture, to fold too extensive hierarchies in simpler and much more embraceable schemes easier to practically apply and transfer. That is exactly what any language (taken in its communicative function) is intended to do.

The two complementary aspects of this hierarchical vision concern the unlimited capacity of cognition and the absence of any ultimate goal. There is nothing in the world that could not be assimilated in human culture; on the other hand, no knowledge is absolutely comprehensive and complete. The hierarchy of notions will always grow both upwards and downwards, infinitely expanding its qualitative and quantitative diversity. This inherent incompleteness makes science truly objective, as it is to perfectly match the motion of the world as it is, including cultural history. However, thus understood, science is entirely different from both the vulgar yearning for a perfect reflection of nature as a ready-made something outside us, and from the positivist denial of any meaningfulness of knowledge at all. In the infinite world, there is no beginning, and no end. Still, every portion of that infinity, however infinite in itself, implies definite limits, and this is what science has to discover. Studying the inner organization of a thing, we come to the recognition of its bounds. This knowledge is twice objective, as it will reflect not only the world as it is but also its ability to change, and inevitability of change.

The original idea of reason does not stop at that. We can never be content with the change as such, regardless of hierarchical development. The next step is to acknowledge the progressive character of motion and comprehend the random flicker of inanimate nature and the rigidity of organic metabolism as manifestations of a universal order. Conscious activity is primarily the way the world implements the directedness of change, and it is our mission to determine and control that direction.

Science and Mathematics

Millennia ago, primitive people were deeply impressed by the experience of how doing something a definite way would produce a quite expectable effect. They could not explain it, it was magic. They tried to do the same in different contexts. Sometimes it worked; this enhanced belief in the magical rite. Sometimes it failed; this was attributed to either an inaccurate reproduction of the right scheme, or the interference of some supernatural forces. This magic attitude to the world is reproduced today in the traditional belief of many people that there can be no science without mathematics, and that, if anything has been mathematically proven, it must be true, unless an error has crept in the derivation.

In the infant centuries of the human consciousness, it was quite a miracle that a series of formal manipulations could produce a trustable result of a practical importance. This ability to predict (or prophesy) was considered as a mystical power granted to the select few. Today, the elements of mathematics have become a part of the general education standard; however, up to now, teachers of mathematics (stifled by the harsh competition for payable hours) tend to stick to the medieval dogmatic style, with the rules of operation presented as if they descended to us from heaven. That is why many people beware of coming too close to these sacred truths in school, pretending to be not gifted enough for math. Those few who like tossing abstract quantities still have no idea of how it works; so, they prefer to turn their ignorance into superiority and stay convinced that formal deduction is the highest form of rationality, its essence and law.

In science, the magical function of mathematics has lead to the distinction of the so called “exact” sciences from contemptible under-sciences, which cannot be taken for serious until they grow up to the age when at least some mathematical slang gets in.

At a closer examination, one finds that the role of mathematics in science is immoderately exaggerated. Thus, in experimental science, success is by 99% due to the instrumental skills of the observer and the eclectic mentality of the interpreter. Applied science is entirely dependent on the ability

to adapt any formal results to the real needs. The only domain where mathematical methods can pretend to a significant part is fundamental theory; but such theories constitute a very small (if not negligible) portion of science. Even there, in the realm of pure abstractions, the most important results usually come from the considerations far from mathematical reasoning, like the sense of completeness, love for beauty, taste for unification, personal predispositions *etc*. In physics, we justify the choice of mathematical constructs by "physical conditions" and discourteously reject "unphysical" answers; in some other sciences we use mathematical labels as sheer metaphors, just because "it looks like that". Most often, as millennia ago, we just try our formal schemes in a range of object areas. Sometimes it works; this feeds our mystical belief in the power of mathematics. Sometimes it fails; this makes us seek for formal mistakes, or blame the experiment for insufficient purity. Like a capricious child, great theoreticians get sulk and say: you should not behave like that, I want you please me!

The fans of formal science forget a simple truth: before one can think formally, one is to acquire the very capacity of thinking. To shape something, you need something to shape. However vague and mutable, our tentative considerations lay the foundation of any superstructures, preceding any formal embellishment; in this sense, such science is truly fundamental. Deny that raw, syncretic thought, and you will annihilate any thought at all. As any other human activity, science combines different levels of reasoning, including formal derivation and formal construction. But the weight of the latter largely depends on the practical context, as well as on the idea of the required outcome. In many cases, a very general framework is quite enough, outlining a range of possibilities, without too much numeric detail. It would be unwise to employ a cumbersome (and expensive) computational technique just to get that gross estimate. Conversely, in applied engineering, we need a workable combination of anything at hand, right now; too much mathematical science would only hamper quick assembly of the product from the ready-made blocks. That is, the right place for mathematical modelling is well in between, far from the creative frontier, on the level of mass consumption, when a well-known thing is to be brought to the highest possible perfection; this has much in common with esthetical judgment, and that is why we appreciate the undeniable beauty of mathematics.

Science can be rigorous and predictive without exaggerated formalities. Simple logic (not necessarily formal) will often do. The attempts of philosophizing mathematicians to treat logic in general as a part of mathematics, a kind of calculus, cannot be but ridiculous. Anyway, in pure mathematics, all the new ideas come from outside; mathematical intuition does not obey formal prescriptions.

The success of mathematical methods in science can be explained by the relative rigidity of the forms of human activity, by their preservation in the course of cultural development. From time to time, this development requires a significant shift in the modes of action, and a new range of formal stability is to be established, to give birth to new mathematics and the new notions of mathematical rigor. The penetration of mathematical language and formal method in special sciences employs the same mechanism as any other boundary research: any interaction of earlier independent scientific disciplines is mutually advantageous, pouring in new blood in each of the original sciences; additionally, it may open new interdisciplinary domains.

Mathematics is a science like any other, and true scientists have nothing to compete for. Cultural distortions hinder universal cooperation; economic and social inequality is reflected in the dominance of one science over the others, the usurpation of power and formal autocracy. Still, no tyranny can last forever; mathematics is to join the free community of sciences some day, for the common benefit.

Theories of Everything

The very idea of science implies a certain degree of separation of the scientist from the rest of the world. The "outer" world (nature) is to be represented in the material forms of a different kind, which, in addition to being regular things, also serve to represent the scientist in nature. This mutual reflection is implicitly dependent on the stage and direction of cultural development, comprising both material production and spirituality (the historical forms of subjectivity). In its full development, the object area

of science is to coincide with the whole cultural domain, which is eventually to embrace and creatively rearrange all the world. This objective aspect may provoke an illusion of the (at least principal) possibility of some ultimate science explaining anything at all.

However, this can never be anything but illusion. The very separation of science from its object, as well as the difference of the material of the scientific image of the object from the matter of the object, suggest the thought of an essentially partial representation of the world in science, leaving enough room for other modes of reflection. The closest relatives, also representing nature in conventionally natural forms, are the arts and philosophy; however, there are other levels of reflection that do not oppose the image of a thing to the thing itself (syncretic and synthetic creativity). Just like science, every other level of this hierarchy is to asymptotically encompass the whole world; this does not remove their qualitative difference (that is, the distinction of their products). A keener sight might discover that the overall growth of the domain of reflection is intimately associated with mutual reflection of the different levels, which will thus transgress their original limits and get saturated with newly adopted elements, until there is virtually no difference, and this particular categorial structure is no longer adequate. That is, fully developed science is no longer science, and doing anything scientific way means self-restriction, selection of a definite level of treatment, a specific scale.

Science in general is a limited reflection of the world; this results in unfolding both a hierarchy of special sciences and an inner hierarchy of science, distinguishing, in particular, the empirical, theoretical and methodological levels. Any individual science is obviously bounded by the limits of its object area; every component of science cannot exist without the other components, complementing its inherent insufficiency. However general, none of these specialized formations can pretend to a comprehensive representation of the whole. This principle is entirely applicable to the evaluation of the power and limitations of scientific theory.

There are no all-unifying theories, and the very idea of a comprehensive theory is logically inconsistent. Moreover, it is the extremely narrow character of a higher-level abstraction that makes it so robust and practical: fundamental theory is not applicable to a thing, but this opens wide vistas for adaptation. The traditional idea of generality treats special theories as minor branches of a more general theory, which, in its turn, is derived from some universally valid scheme. This is a mirror-reflected picture of real development, which grows abstractions from numerous typical examples and efficient modes of action. That is, cognition is to cut the branches of a living tree, to get to the bare trunk, and this kills the tree as it were, making it just the raw material for woodworking. Still, this experience brings us to the idea of the presence of the trunk in the many trees we do not care to cut down. This theory may seem most fundamental, as we discover a trunk every time we come closer to a tree; however it is to eventually fail in some new areas of experience, with the twofold effect on our trunk science, either expanding the notion of a tree, or admitting the existence of the entities other than trees. Both solutions represent the aspects of the same: a theory of everything can no longer be trusted as such.

Scientists may strive for a uniform explanation of very different experiences, they may construct absolutely general theories containing all the other theories as special cases; however, some day, yet another experience is bound to come that won't fit in the seemingly comprehensive theorization. The world is qualitatively infinite, and no theory can describe any of the world's turns. Time is the other side of this qualitative infinity: things change, and this devalues the universality of any science, and hence that of any single sublevel.

With that in view, what is the use of modern integrative initiatives, like the unified field theory? Yes, one can show that all the existing field theories can be derived as special cases from a single theory with enough spatial dimensions. What of that? In principle, this could be predicted from the very beginning, since all the field theories are based on the same logical scheme, which makes them *a priori* combinable in a single theory of the same kind. Obviously, the particular ways to construct such a unified theory may differ, and one could put forth the program of the search for observable effects favoring one of the possible solutions (or all of them). Suppose we can overcome the technical difficulties and complete this work. Does it give us a clue to understanding anything except a narrow class of physical processes? Even admitting that every material thing consists of particles and fields, we

cannot reduce the whole world to these partial manifestations. In particular, any collective motion is qualitatively different from the motion of the constituent bodies, and there is no way to entirely explain higher-level effects on the basis of their lower-level mechanisms.

Any theory reflects our current experience in our close environment (albeit extended to the cosmological distances and energies). Being essentially anthropomorphic, physical theories just cannot be extrapolated to the whole world in a straightforward manner, like many scientists do, to impress ignorant sponsors and journalists, for cheap popularity, thus collecting money for serious research. All the talk about the Big Bang, the expanding/collapsing Universe, dark matter *etc*. is nothing but a kind of pun, a mental game without too much pretense, just to imagine what happens if… Such over-extrapolations may be useful within science to clarify the logic of a theory and outline the limits of its applicability. In this function, they do not refer to any physical reality but the reality of the human thought. Presenting such prototypes of some future theory as absolute truth and the highest achievement of science is always an ideologically motivated act, stretching a formal scheme to support a political claim. This ideological load has nothing to do with science; still, some (former) scientists can be dragged into the fraud by lies and psychological manipulation.

In the economy based on the division of labor, science is always incorporated in many individual sciences never reducible to each other. You may call one of these science an all-embracing super-science; this does not change the very fact of its singularity, its being one on the many. The hierarchy of generality can always be folded and unfolded another way, so that no theory can be universal in an absolute sense; this essential relativity is due to the very separation of any science from its object area. The immediate corollary is that any individual theory must deal with something particular, and never speak about the whole world, taken in all possible respects. With too wide generalizations, we inevitably drift from the domain of science into the realm of philosophy (which is not science).

Since any cultural distinctions in science (both informal and institutionalized) originate from the current structure of human activity, and hence are application-bound, any science is to keep within its cultural niche, on a certain level of hierarchy, developing models of a limited relevance to involve a very specific range of phenomena. As human activities evolve, sciences mutate into other sciences, treating other (but as specific) phenomena. However general, an individual science is restricted to only one of the infinity of the possible relations of the humanity to the world; this concentration on the product gives science its influence and strength, making it truly practical.

The impossibility of all-unifying science does not mean that a result obtained within one particular science cannot be used in another. However, such a scheme transfer is never accomplished through mere extrapolation, but rather employs the mechanism of activity exchange. People learn from each other doing different things in a similar manner, and one science can borrow certain tricks from another (or even from any non-science), adapting them to a different context. With all the superficial similarity, the sense of the same method is bound to change from one science to another. A formal apparatus borrowed from elsewhere needs to be reinterpreted and adapted to the description of the host object area. Quite often, this implies drastic modifications; there is no “exact” reproduction of a formalism, since the same construct is to refer to a different class of things, with its specific constraints.

As yet another aspect of that mutability, note that the very idea of comprehensiveness is beyond science and scientific everything is different from the whole of any other vision of the world, as well as the individual science do not share the same notion of completeness. In the developing world, science develops as well, never reaching any limits: you can talk about everything, but you will never tell everything about it.

Science is to produce approximate models of the world, and no such model can pretend to describe the whole universe, albeit in an artificially isolated domain. In certain respects, the diversity of scientific theories can be ordered by a kind of generality, but, as in any hierarchy, each level retains its specificity and cannot be reduced to any other level. Moreover, in a different cultural context, this hierarchical structure can be unfolded in a quite different manner, with formerly “special” sciences becoming more general than the former unified descriptions. Apparently, such hierarchical conversion means scientific revolution; but who can swear that the present picture of world is already complete and shaped forever?

The Formal Mystery

Any study becomes scientific starting from the moment (and inasmuch as) it loses its anthropocentric character. That is, our notions and the forms of expression are treated in science as extraneous to the content of our knowledge, which could as well be arranged in any other way, still referring to the same natural things and events. I do not mean that this cognitive attitude to nature is the only (or the best) option: it cannot be universally right, or preferable; but this is how science works, and we respect its place in the whole of the human culture.

With this intentionally exaggerated objectivity, scientific research requires a highly developed capacity of abstraction and demands a regular critical reassessment of its basic principles, to prevent inadvertent recurrence of the primitive anthropomorphism. For a human being, it is quite a challenge to stop sitting in the center of one's personal universe and agree that somebody else might look at it from a different angle. As we all know, some steps in that direction took many centuries and a lot of courage, and even heroism. Today, most scientists agree that the humanity is a tiny spot in the magnificent picture of the Universe, so that the whole of the human history is to unfold on a local scale in no way comparable to the cosmological measures. When, in a billion years (or maybe much sooner), the human race will be entirely exterminated in the next metagalactic cataclysm, there will be nobody to deplore it. However, we still take a very tender pride in our artificial toys and fancy ourselves the discoverers of the ultimate truths of an imperishable value.

Yes, in a way, each portion of knowledge refers to an objective situation that can be reproduced in an infinity of contexts in different respects. That is, our knowledge (however imperfect) contains absolute truth; otherwise, it just would not be knowledge. However, this does not mean that we can always guess what we actually know. Consciousness is different from mere awareness, and self-consciousness is very different from mere consciousness. People invent lots of useful (or funny) things, including scientific theories; but we do not need explicit reasons, as long as everything goes the right way. Some things are used to produce other things; then yet another thing is to mediate the production of the means of production, and so on. One can never judge about the value of a new something until practically trying it; still, neither failure nor success can serve as a decisive argument, since there are no universally applicable tools, while utterly useless inventions can find a quite unexpected niche, as it happened so many times in the history of the humanity. That is, as long as our practical activity runs on, we can be sure that we have learnt something about the world; but we can be as sure that the form of our knowledge (science) is a very approximate expression of what we know, and it is certain to be replaced by a more appropriate formulation later on.

That is exactly where a human scientist tends to slough in anthropocentrism. Besides the already mentioned gnoseological diversity, there is a strong psychological bias. One cannot be entirely honest towards one's dear creatures; we like them as they are, and their obvious drawbacks get lovingly reinterpreted as signs of perfection. With those millennia of incessant effort to set up the scientific method, how can we be wrong after all?

But look at the history of science. Babylonians and Romans were as fond of their tables for operating with what they considered big numbers; still, that kind of math is out of any relevance nowadays. Similarly, the founders of mathematical analysis were debating its different formulations; today, the whole of that calculus is often said to be old-fashioned and obsolete, while physicists savor the cuisine of the abstract algebra (until it happens to fade in the face of a new formal toys to come).

Philosophically naive scientists are apt to identify the form of their science with its object. They develop notions and concepts to describe a specific application area; the inner relations between these abstractions are to explain a range of observable regularities. However, notions and concepts can only *represent* certain practical aspects of the application area; they never refer to any *real* objects. A trivial mathematical example: we can enumerate various collections of objects with natural numbers, but there is no such thing as a natural number as such, and a correct scientific theory would be very careful to ensure that different enumerations are indeed commeasurable within its application area. Three bananas and three years of prison cannot be equivalent but in a very special sense; while we can formally add

three and three to get six, one will have to work hard to practically demonstrate the sum of bananas and time units. This example might seem too simplistic in view of the higher arithmetic; but recall the childish belief of modern physicists that their ability to combine space and time in an invariant quantity (the interval) means physical equivalence.

By the way, in law, if one crime is punished with three years of prison, and another crime is punished the same way, the total for a criminal condemned for the both will hardly ever be six years; the legal rule of penalty accumulation is far from the plain mathematical sum. The same holds for most economic estimates; nothing to say about subjective experiences like love, boredom, or pleasure. When apparently commeasurable quantities do not sum up, this usually means that there is a qualitative difference that does not allow direct summation; that is, the units of measurement for such quantities merely coincide in the terminological sense, with the same word used to denote practically different things. To allow combinations of such quantities, we need to construct a higher-level framework picturing them as limit cases.

Popular literature is replete with all kinds of superfluous identifications. This is a normal mechanism of common-life abstraction preceding a scientific generalization. Thus, for biologists to borrow certain physical ideas, there is no need of an in-depth study of physics: popular accounts of physical research are enough for productive metaphors. However, in such adoption, lack of physical intuition proper may lead to exaggerating the formal aspects to the detriment of objective analysis. For live example, a paper on neurophysiology declares: “Any flow of energy may arrange things.”[1] I have fed this phrase to some of my scientific acquaintances and obtained an illustrative picture: putting aside the weird wording, physicists generally agree with this statement and admit that it could be taken for a starting point for further discussion. Isn’t it a hidden concession to anthropocentrism? In reality, the situation is exactly the opposite: we characterize certain kinds of motion (which manifests itself as rearrangement of things) with the notion of energy flow. Things move *as if* there was a kind of flow; but this abstraction does not move or arrange anything. Taking abstract ideas for real things is a philosophical illusion known as objective idealism. With such a background, any scientific study is to eventually degrade to mystical phantasy.

Similarly, our ability to model the interaction of material bodies with geometrical shapes does not mean that there is nothing beyond these shapes. This is how we see it as we look at it from a definite viewpoint, within the present experience of manipulation and observation. Search for other aspects of the same is a necessary part of human cognition, which can never cease to be human, but is free to get rid of any portion of its inherent anthropocentrism.

Scientific Vulgarity

When there is too much of a good thing, it somehow does not feel just so good. This perfectly applies to the present state of science and the ways it enters the mind-in-the-street.

Modern industry demands intricate cooperation of billions of people, each worker producing the prerequisites of somebody else’s work. There is nothing that a single person could do; even the most basic physiological functions are gradually cultivated to the degree of utter impossibility of doing the same outside a specific artificial environment.

Some ideologists admit exceptions for the sphere of spirituality, including art, science and philosophy. Individual creativity may seem to dominate in such immaterial production. This illusion flatters the pride of those who do not have to fight hard for mere survival, and who can afford themselves enough leisure for apparently purposeless pastime. However, even such abstract doers need certain material conditions to implement their musings as well as some acquaintance with what can, in principle, be done. Their inspiration always comes from the outside; their product must eventually be presented to the public. And this already implies dependence on the overall level of material production and the current cultural trends. An artist, a scientist, or a philosopher needs social support; even imaginary

[1] M. Crocco, in: *Ontology of Consciousness* (H. Wautischer, ed.), MIT (2008), p. 360

audience (or self-reference) is to condense from the historically known forms of communication and productive collaboration.

In this view, a sequence of great names in the history of science does not much impress a person of reason, who perfectly understands that such verbal marks are only used for convenience, to refer to the objective aspects of science, just like scientific terminology is merely to materialize scientific notions to simplify scheme exchange. A genius feeds from the great pasture of minor predecessors, and the quality of this grass determines the merits of the breed. A wider access to the present conceptual diversity means more chances to consolidate it in an obvious achievement fit to become a guide sign on the way to the future.

This brings up the question of the erudition standards required to ensure the cultural acceptance of the scientific outcome of each individual contributor. Early renaissance writers dreamt about truly encyclopedic education, combing experiences of all kinds into a comprehensive picture of the world. By the XVI century, it was already clear that this ideal is utterly unreachable: the overall bulk of knowledge could overwhelm the brightest mind of the epoch, raising the a problem of triage, sorting out real values from the relics of clumsy tradition. François Rabelais gave a vivid parody of the idea of educational universalism. Later thinkers grouped around a new encyclopedic project suggesting that a well educated person is to merely get acquainted with the principal achievements of human spirituality, possibly cultivating in-depth knowledge in a few special domains. Today, this attitude seems as utopian, since the diversity of the culture has grown beyond any limits, while the volume of special research in each science can no longer be assimilated within one's lifetime. Our approach to learning is to mutate once again; the reign of popular science has come.

The flux of news is impossible to master. Things happen every second, and a thousand reports break in. There is no way to keep on the edge of novelty; even less chance to learn from the past. We are too slow to follow ourselves. So, a lay person is to stick to odd fragments, popular descriptions, strained interpretations, random hearsay. The dawn of vulgarity, that new sun of the humankind.

Is it any different with scientists? The keenest mind will have no advantage before the rest as soon as it dares to get beyond the professional domain. However the domestic erudition is hardly any better. No scientist can read every book about their science. Yes, there are repetitions that could be skipped with a light heart. Still, the alternative expositions of the same carry the air of mental freedom which is of crucial importance for scientific creativity; to deliberately leave out this part of work is like cutting off a chunk of the brain. Now, look at those heaps of scientific journals! Their gross volumes could exponentially expand if there had been enough wealthy subscribers. An active researcher has to filter out papers on a narrow topic of current interest; and this too is becoming a sort of separate research, however armed with advanced indexing facilities. That is, any knowledge at all tends to coincide with good luck, a condescension of infinity; instead of trustable truth, the wide public is fed with sheer opinions inevitably acquiring a tint of vulgarity. Modern science is not convincing; it may give clues to doing things, but it does not give any reasons. Scientific talk is utterly incomprehensible; to get at least something, people have to develop their own vision of the world from scratch, regardless of any professional assessments.

What market economy can suggest to cure the pest? Quite expectedly, it does not much care. Capitalism is about dividing money rather than sharing knowledge. For all occasions, the same answer: division of labor. If you are too feeble to manage the whole, let others profit from what they can grab. Unfortunately, infinitesimal allotments do not give enough crop to stay in. The old pun about a professional who knows everything about nothing is no longer funny, since nobody could be said to completely master a thing. Desperately trying to remain experts in naught, scientists lose their market value as the very notion of creative priority becomes diluted in an impersonal mass effect. Just say something, and you'll find that a thousand people have already said the same in many ways and treated in a most comprehensive manner, albeit in a different respect. Don't complain that it's impossible to review all the relevant literature; it's your personal problem.

As a matter of fact, the inevitable degradation of an individual is built in the class economy from the very beginning. *Divide et impera*, the slogan of the Ancient Rome. Capitalism admits everybody's

equal capabilities, and free choice of occupation, but as professional specialization takes over, there is no way to change the once chosen specialty, and any economic shift turns out to be a personal crash. Market competition did much to increase the overall productivity in industry; however, the rate of acquiring new skills remained on the same level, so that it takes a lot of time (and money) to switch to a different job. Capitalists are not interested in drastically reducing the learning time; moreover, there is no free access to many proprietary fields and copyrighted literature, which hinders preventive self-education.

In science, the situation is basically the same, with hardly affordable education, low quotas of professional licensing (and hence limited access to research facilities), and the practical impossibility to trespass on a foreign domain. The ideologists of the market science insist that, since organic metabolism is too slow, the human brain is no longer sufficient to respond to the present educational demands, and the gift of individual creativity is to be eventually sacrificed to some systems of distributed knowledge, with highly specialized biological elements entirely dominated by the collective whole. Each person will be included in a number of social networks and perform a partial function of an essentially biological nature, with intellect superseding reason.

Admitting that reason is in no way restricted to sheer biology, I cannot agree with the logic of enslaving individuals rather than liberating them. Yes we need a better thinking material, but all kinds of social interconnection will serve as an extension of one's personality rather than its replacement. Computers do not come to subdue the humanity; they merely amplify its mental capacity, just like mechanical machines amplify the strength of the arm and the precision of fingers. The discouraging complexity of modern science is mainly due to inadequate modes of knowledge production and consumption intrinsically related to the principal traits of the market economy. Instead of accumulating knowledge, the focus should be shifted to its reproduction; similarly, the mass production system of today will be replaced by a flexible (and more economical) paradigm of production on demand. Instead of knowledge exchange (learning), we can share access to knowledge production tools, reproducing every particular detail when we really need it and forgetting it as soon as we come to a general idea enough to make any practical decisions. We don't need a hammer when a nail has been driven in a wooden plank; still, we keep it within reach to employ the next time, when needed.

In this way, people can drastically reduce the bulk of irrelevant data, to concentrate on creative tasks proper. Since knowledge production tools are much more portable than traditional databases, there will be no professional barriers, and no professional cretinism; every person can enter any domain at all without additional education, since the universality of cognition will do the rest. Such economy is incompatible with the market: there is nothing to trade or exchange, while everybody is free to share and participate. Economic and cultural development will proceed in this direction, gradually extending the sphere of market-free cooperation.

It is important that the very idea of science is essentially related to social self-reflection rather than material production. That is, the products of science do not need to be stored as ready-made things, provided they have been incorporated in culture as fundamental principles. Books, papers, samples, or experimental setup do not contain knowledge; they merely present it in one of the possible forms, sometimes far from being optimal. The diversity of the material traces will grow; but all we need is to keep on our universality, deliberately switching to a different, more adequate language when the former mode of expression gets too complex, and hence too restrictive.

Can we find any existing prototypes of this new level of scientific thought? Yes, in a way. Comparing science to philosophy, we observe that the latter does not need too much detail to come to a universal scheme of practical importance, including scientific applications. The apparent immensity of knowledge has nothing to do with the character of philosophical categories which contain all the possible explications in a folded form that can produce an elaborated hierarchical structure wherever needed. Once we have comprehended the whole, we do not need to "prove" it every time. A similar principle is implicitly built in scientific methodology, and it can be developed into a full-fledged hierarchy of knowledge production. Don't try to learn everything; just take the necessary minimum to understand. Don't seek for formal perfection; this diverts you from true comprehension hiding the forest behind the

trees. Observe the principle of reasonable sufficiency and forget about professional segregation, cooperating with artists and philosophers, or any amateurs, taking what they really mean, regardless of the obviously non-scientific attitude. This will bring you to the level of culture as a whole, liberating from too narrow subcultures, and hence to the infinity of science as such, overcoming the vulgarity of special sciences.

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