

# Unique Obsessions: Behind Scientific Discoveries

By

NORBERTO CASTILLO, O.P.

In a conversation interview recorded by A. Moskowski (1970), Einstein responded to a question concerning the reasons for his scientific success with the statement: "I am as stubborn as a mule"; "I am stubborn, and I have a good nose".<sup>1</sup>

The target of the question was not at all clear if it was directed to the theoretical nuances of his celebrated theory, or, perchance to some other "reasons" which may have brought about the celebrated theory. Einstein reacted with a answer which appears spontaneous and reflexive, referring to be what seems to be some kind of "behavioral reasons" which led to his success, e.g., to reasons of habit

---

<sup>1</sup>A. Moskowski, *Conversations with Einstein*. Trans. by H.L. Finch. (London: Sidgwick and Jackson, 1970); as quoted by Burton Vorhees and Joseph Royce in "Einstein and Epistemology", in *Einstein And The Humanities*, D. Ryan (ed), (London: Greenwood Press, 1987), p. 25. Bronowski has this to say, "The man who proposes a theory makes a choice – an imaginative choice which outstrips the facts. The creative activity of science lies here, in the process of induction understood in the making of hypothetical theories. For induction imagines more than there is ground for, and creates relations which at bottom can never be verified. Every induction is a speculation and it guesses at a unity which the facts present but do not strictly imply . . . To put the matter more formally, a scientific theory cannot be constructed from the facts by any procedure which can be laid down in advance, as if for a machine . . . the theory is inevitable only to him; it is his choice, as a mind and as a person, among alternatives which are open to everyone . . ." in "The Creative Process" *Creativity*. ed. by John Roslansky, (Amsterdam: Noreth Holland Co., 1970) p. 10-11. And we query, is this why discoverers tend to speak in metaphors, images, analogies, etc., when they are asked on details about their discoveries? The observations made by Bronowski formulates the highly inverse proportion between 'believing' and 'proving', the former seemingly anterior to the latter. As alleged, there is almost unfathomable gap that exists between the data, and the theory or hypothesis 'assumed' to have been derived from such data.

and style, the 'physiognomy' of the *kind* of man in *his* kind of a scientist, or the *kind* of scientist in *his* kind of science!<sup>2</sup>

If, by his own admission, Einstein's theory *succeeded*, it was because he was 'as stubborn as a mule'. The theoretical construct owned its substance and style to the distillations of the flesh and blood of his purposiveness, decisiveness, or come you may again, his 'stubbornness'.

Success is indeed a very relative term. In most instances, as is very markedly seen in scientific discoveries, success refers to a Kuhnian tangible milestone and lighthouse of accountabilities and consequences, where the novel, the fruitful, and the accredited solution-construct is enthroned, and subjected to the wear-and-tear of scientific self-criticism, the one built-in mechanism of science which have occasioned and continued to ignite unparalleled growth and progress in this galactic field. The scientist is in an eternal flux almost obsessively, and "in striving to bring his creativity into play, does not know, 'when' he feels that it has manifested itself, just how he achieved it."<sup>3</sup> This apparent void of 'when' emphasizes the cardinal factor of the need of peer approval as a manifest sign of the confidence which is canonized on the depth and fruitfulness of the reality which the discovery proposes to the scientific world.

Unlike trophies of victories or plaques of appreciation, the 'eureka' and the AHA form experiences are so to say, and for whatever forms of credibility they are stamped with, are taken as some sort of anti-climactic to the series of plots both convention and mostly unconventional, that really made the discovery matter, unofficially yes, and that which matters in this paper within the 'canonical framework' as far as possible. As in any team effort, the players who feed the ball are just as important, and truly deserves 'effective and affective' attention in whatever measure that is taken in the pursuit toward the victory lane, before and after, as the points actually scored by the pointmakers. As coaches would have it; the more practice, indeed the greater the possibility of attaining the trophy. No pain, no gain.

As in any honest venture despite the equipment of the best and the firmest of good intentions, real discouragement are wont to set in, not unlike what Polanyi

---

<sup>2</sup>Take for example what Carl Hausman says, "...On one hand, the agent does not begin a creative process with a preconception of the *explicit* structure of the end toward which his act is directed. On the other hand, the agent in some way is *responsible* for the new Form that appears in relation to the creative process. Thus, an artist struggles to effect something the *exact* character of which he does not envisage. Yet he does *know* when he has achieved that for which he struggled. He does know when all requirements have been met . . .", in *A Discourse on Novelty and Creation* (The Hague: Martinus Nijhoff, 1975, 1975). p. 46., emphases mine. The theme on responsibility and similar other emotive affectivities will be a recurring theme in this whole paper. Note that this author differs in opinion with Yukawa, for example, who would rather think otherwise, vis-a-vis, that the discoverer would be in a 'better' position 'to know how', than in knowing 'when.' See H. Yukawa, "The Conception and Experience of Creativity," *Creativity and Intuition*. Trans. by John Bester. (Tokyo: Kodanasha Int'l Ltd., 1973) p. 123. I tend to believe however that Hausman who is more of an Art and Esthetics philosopher and Yukawa, do not bear substantial differences. They seem to differ in levels and stages within the whole process, in their manner of speaking. Hausman, with the respects, is a 'secondary commentator'; and Yukawa's achievements makes him a primary source.

<sup>3</sup>H. Yukawa, *Ibidem*.

(1981) describes referring to the role of imagination in science, as "The enterprise that I am undertaking here has been severely discouraged by contemporary philosophers. They do not deny that the imagination can produce new ideas which help the pursuit of science or that our personal hunches and intuitions are often to the point. But since our imagination roam unhindered by argument and our intuitions cannot be accounted for, neither imagination nor intuition are deemed rational ways of making discoveries. They are excluded from the logic of discovery, which can then deal only with the verifications or reputation of ideas after they have turned up as possible contributions to science."<sup>4</sup> Einstein harbored the same anxieties about unhindered imagination and intuition, yet he considered its study as 'worthwhile and equally important'.

But when scientific discoveries do happen as they did happen, they would be an extremely rare event. It is a very curious matter to find out the nature of those varying 'ingredients' which are attendant to the discovery from the standpoint of a success-referent.

## PRIMING ORBIT

In fact, even if they are 'made' to happen, the awesome number of inputs hardly ever make things as the discoveries, happen, for they never, never, "ultimately" happen, the way we would like them to happen. As it was once said, discoveries happen to the 'prepared' man. At first glance, the tense and the accent seem to be quite misleading. There is no such thing as the 'prepared' man in the strict sense of the term. There is only the man who never ceases to prepare. It is only in this sense that the scientist could possibly consent with temerity to assume the responsibilities of being a 'prepared' man. Yukawa' writes his views on this matter,

A considerable period of preparation is necessary before a particular man can display creativity. He must, in short, have acquired all kinds of knowledge and also, probably, have undergone all kinds of training. It is only after many kinds of prior conditions have been satisfied that creativity can show itself. By the time one has done research for a long continuous period and become a full-pledged research worker, one has developed within oneself a relatively stable system of knowledge. This system of knowledge has been integrated by one's own efforts into a particular definite form. And this business of integrating by oneself is, of course, an extremely valuable experience in itself. It means that one is able to teach others, and to pass on one's knowledge.<sup>5</sup>

Yukawa' cites two general expediences which he deems valuable toward the formation of a 'good' researcher; namely, an exposure to a general knowledge and training "of all kinds", as one of the requirements of the "prior conditions of many kinds"; and the self-integration of these multifarious experiences into a stable sys-

---

<sup>4</sup>Michael Polanyi, *"The Creative Imagination"*, Creativity in Science and Art. Dutton & Krauz. (The Hague: Martinus Nijhoff Publ., 1981), pp. 91-108.

<sup>5</sup>Yukawa', *Op. Cit.*, p. 125.

tem of knowledge which has attained its personal level in the researcher. Note that, he does say 'when' the creativity can show itself, and he is able to run through the ingredients of a true researcher's life which he himself had gone through. It is also worth noting how emphatic he is with both, the necessary depth and breadth of the knowledge of the scientist that may, at a certain point, be expected to function and operate!

Time is both the essence and function of any scientific pursuit worth its calling. The 'functional' depth for example, would be reflective of a level of interiority and conviction which enables the scientist to play the role of a magistral guide and role model. It is this kind of fruit that the kind of tree that he is, is personified. He is able to lead and to instruct; he is able to inspire and to induce others to pursue the lifestyle of a researcher.

Indeed it was only towards the later part of his discoverer's life that Yukawa' regretted quite explicitly in his autobiographics *Creativity and Intuition*, that his early specialization in his field may have kept him away from the 'finer' things in the life such as philosophy and literature of a generalist, or even that of the latest trends in his own field of physics. Indeed how true it is also in science that 'trends' set the tone for relevance, and relevance for the required fruitfulness of a scientific discovery! Science could be everything but that of being archaic. Otherwise, we will be witnessing what Yukawa' was referring to as the 'estrangement of science from culture'.

Creativity then, as a fact of human achievement is defined in terms of the civilization which accepts it, and in so doing, conveys to us the valuable information of the culture at hand, canvassing the indices of the dynamics of the judgmental circumscription of the art and science of defining. On these gnawing preoccupations lie society's receptivities and acquiescence, which culminates in the installation of an achievement as salutary for all. Hence, we may have a creative work that is an answer to a simple 'need', or as response to a more sublime 'want'.

It seems to Yukawa', that for a system of knowledge to attain 'stability', there is the need for such system to possess a 'general' nature in the sense of a manifest interfacing multidisciplinarity and globality. Such globality seems to speak of an emerging maturization of the systemics of the knowledge, an applied and an existential sensitivity to a broader spectrum of issues which society or the world at large, is confronted with. Not quite strangely we find Yukawa' and Einstein, to mention just a few, in the arena of the political world spreading the gospel of peace towards the later part of their careers.

Scientific discovery finds its apex in the interpersonal and the societal, in what is at once, ethical and global. And if we are to take the considered prognoses of Schroedinger and Weyl (see note 6), any attempt at a masquerade towards an "isolationist" work in science, e.g., as some sort of a 'culture-free' and 'value-neutral' enterprise, is courting what is likely to be at once artificial, unscientific,

and therefore fatal, to the very nature of the study of science itself. A scientific problem-objective is by its very nature, specific, and develops its own bill of particulars. This is not at all possible in abstractor, either in the state of the ante or, in the post term of the discovery. Scientific discoverings as concrete human acts, are events which are necessarily made in context.

This is one enterprising reason for the discovery's ambiguities and therefore, of the timeless fascination lend to it by those who prefer both, the risk and the adventure of the multicolored nuances resulting from the interplay of personality, social milieu, and the challenges of history. Moreover, it is viewed that these 'discoverings' are best analyzed, and therefore better understood and appreciated, within the parameters of their respective contexts. Yukawa' in the same opus we have cited, apparently referring to the 'external conditions', e.g., of freedom, observes that "Geniuses appear in batches", "as it happened in Newton's time, in Faraday' and Maxwell's time . . ."

By and large, it will be extremely excruciating to dissociate the respective historical milieu of say, Einstein, Yukawa', Newton, Copernicus, or Galileo, from their achievements. Far from it, we are not positing any kind of their being subject to the 'slavery of their times and circumstances', a position which does not at all seem to lend a tenable intimation to these rare and sterling personalities of equally rare credentials. Rather, we deem it more plausible and tenable that these select men have 'successfully' risen to the challenges of their historical moments and eventually transcended their own times and space. Paraphrasing Einstein, these men possessed a unique kind of stubbornness 'with *the* cause', and an olfactory sense of their historical state with destiny.

The emergent scientist, and most especially the 'hardest core' of them, are a difficult bunch of intellects to please. They are ever settled in what they are involved in, or they will never be, for any matter which catches their hunches, as Einstein's self-deprecatory analogy of his person to a mule may indicate. That science as it should be, should always be on the move, is an ontological prophecy and potential that will never find culmination and completion. It is on this fundamental tentativity that science continues to sustain its high gear stance and makes itself a clear sign and symbol of the scientist's nature and being as a unique societal figure.

Scientists though, may come and go. They leave their epitaphs and footprints, in the sand of their past accountabilities. Not quite strangely, the unveiling of the unexpected, the unknown, and the unpredictable, is the precise undefinable factor which alone, makes a scientist quite properly, unfulfilled.

The solution-construct is then subjected to further tests of fire - of justification - where only the fair and the fit deserve to survive and grow. It is necessary that the 'accomplishment' must be accepted in order to attain what we would call 'success'.

## THE LURE OF THE TEMPLE

Purposiveness, decisiveness, or stubbornness. These are human drives which can either build – or destroy. And by dint of good fortune, we have men like Einstein, Poincaré, or even a Darwin; who have experienced the Science and the Art of canalizing their energies into brilliance, their wills of stones into gems, their insights into leaps of foresights. Mankind indeed, is fortunate to have these men's tales of woes and glory, among several others of their own gifted kind, whose accomplishments have become priceless legacies, and indeed as timeless reminders, that his intellect sets him apart from nature, because it is his very nature. Experience will continue to teach him that his nature and his object will never be entirely comprehensible, and this very incomprehensibility is a very intimate and precious gift in itself. Such gift is responsible for the ignition of the kindling temperature which provides the eternal spirit of wonder and which makes his sojourn here on earth both a challenge and a task. Its loss is perhaps enough reason to believe that one has lost one's right to one's beingness.

The lifetime that these men have spent and invested in an endless and mounting pursuit of the 'precious grail' of their science, cannot but intrigue and whet the curious appetites of devotees of various sorts. The same inestimable man in the Nobel prize for his meson theory can also be profoundly mystical and esoteric when he wrote,

Why is it precisely, that he is always striving to find more universal laws governing the material world, to find more fundamental structural elements? Surely, there lurks somewhere in the scientific mind, even if he does not realize it himself, a desire for that same world of eternal rest? In my own mind, at least, that desire certainly exists, whatever may be true of other scientists. And this desire and the desire to press ahead into the unknown, "open" world have, it seems, been two forces continually drawing me from opposite sides.<sup>6</sup>

Strange it may appear for a scientist in the likes of Yukawa' of the meson theory fame to use 'this' kind of language and 'those' kinds of ideas! Here we encounter metaphoric suprascientificals, both conceptual and verbal. It is an

---

<sup>6</sup>*Ibid.*, p. 80. This is another major theme which I wish to emphasize in this paper. E. Schrodinger writes for example that "... there is a tendency to forget that all science is bound up with human culture in general, and that scientific findings, even those which at the moment appear the most advanced and esoteric and difficult to grasp, are meaningless outside their cultural context. A theoretical science unaware that those of its constructs considered relevant and momentous are destined eventually to be framed in concepts and words that have a grip on the educated community and become part and parcel of the educated world picture - a theoretical science, I say where this is forgotten, and where the initiated continue musing to each other in terms that are, at best understood by a small group of close fellow travellers, will necessarily be cut off from the rest of cultural mankind; in the long run it is bound to atrophy and ossify however virulently esoteric chat may continue within its joyfully isolated groups of experts. "Are there Quantum Leaps" *The British Journal For the Philosophy of Science*, v. 111(1952) pp. 109-110. Also, we find H. Weyl writing thus, "Scientists would be wrong to ignore the fact that theoretical construction is not the only approach to the phenomena of life; another way, that of understanding from within (interpretation), is open to us ... Of myself, of my own acts of perception, thought, volition,

ominous leap to make, from the "search for more fundamental structural elements" to an entirely different world of what appears to be a praeterconscious world which naturally does not lend itself to the 'normal science' modes of explanation, at least in rational terms, the way a scientist does in his usual manner.

Einstein encounters the same difficulty in answering the question of motives and finds his reasons in situations which scientists pine and ache for that utopic locale which would provide the appropriate fertile 'spaces' in the pursuit of their respective personal tasks and obsessions. Either way positively and negatively, the scientist moves to assert on the prioritization of his commitments, thus;

What leads them into the Temple? The answer is not easy to give, and can certainly not apply uniformly. To begin with, I believe with Schopenhaur that one of the strongest motives that leads persons to art and science is flight from everyday life, with its painful harshness and wretched dreariness, and from the fetters of one's own shifting desires. One who is more finely tempered is driven to escape from personal existence and to the world of objective observing and understanding. This motive can be compared with the longing that irresistibly pulls the town dweller away from his noisy, cramped quarters and toward the silent, high mountains, where the eye ranges freely through the still, pure air and traces the calm contours that seem to be made for eternity.

With this negative motive there goes a positive one. Man seeks to form for himself, in whatever manner is suitable for him, a simplified and lucid image of the world, and so to overcome the world of experience by striving to replace it to some extent by this image. This is what the painter does, and the poet, the speculative philosopher, the natural scientist, each in his own way. Into this image and its formation, he places the center of gravity of his emotional life, in order to attain the peace and serenity that he cannot find within the narrow confines of swirling, personal experience.<sup>7</sup>

It is very noteworthy that Einstein conjuncts science with art. In a positive sense, the modes of image formation processes performed by the natural scientist and that of the artist is quite similar too, to the image processes done by a poet and by a speculative philosopher. The worldview therefore, whether it is 'constructed' by a natural scientist, or 'envisioned' by a painter, or 'theorized' by a speculative philosopher, or 'mused' by a poet; is a "simplified and a more lucid" form of the world of their experience. Man by nature, is not to be chained to his experiences *per se*, and though never sufficient, he must necessarily feed on them. Thus, he is never satisfied with mere experience of aggregates for quite naturally, "peace and

---

feeling and doing, I have a direct knowledge that represents the "parallel" cerebral processes in symbols. This inner awareness of myself is the basis for the understanding of my fellowmen whom I meet and acknowledge as beings of my own kind, with whom I communicate sometimes so intimately as to share joy and sorrow with them. *Philosophy of Mathematics and Natural Science*. (NJ: Princeton U Press, 1949)

<sup>7</sup>A. Einstein, "Motiv des Forshes" in *Ideas and Opinions of Albert Einstein*, Sonja Bargmann. (NY: Crown Publishers, Inc. 1954), pp. 224-227.

serenity" are not to be found in this suffocating and raw context. It is a forging search for a personal 'center of gravity' which is not found in the quicksand of experience! It seems that it is only in the context of freedom where the mind seeks and discovers its 'natural habitat' and finds enough breathing space to expand and find comfort in.

The roots of multidisciplinary as an inevitable consequence of an 'evolved' and 'involved mature science' encounters an Einsteinian master key. To Einstein, the modal worldviews cruise and interface at a certain peak and level, within which they dissolve into participative and unitive matrices. This level is attained through and increasingly graduated process of purgation from the "fetters of one's own shifting desires", from noise, and from emptiness, not unlike perhaps to what Plato in the Republic called the "corrupting influences". It occasions an assundering of the bondage from the slavery to the trivia and trifles of everydayness, of being pushed around, or against. This is the thirst for the Temple of Science.

Such forces for adventurism and the flight to a world which even Scientists cannot as yet fully fathom in terms of desire or rest, can only be comprehended, if that is at all possible, by what scientist's fall back on as intuition, images and analogy.

That there was such a 'mysterious cloud', or some kind of a 'bush of fire' which magnetized and continued to haunt these people no end, was certain; and that an extraordinary input of an equally extraordinary kind of energies, lifestyle, and determinations have to be posited in order to set the stage management of the processive attainment of the pinnacles of discovery, were no less certain.

But what we hold as certain at this point, is not quite 'certain' as 'dissected' because we have only established a fuzzy sort of 'thereness' (*an sit?*), of the process, compared to the need of finding out the former's existential requirements of 'whatness' (*quid sit*) of the product which ultimately begs the issues on the attendant process obtaining thereof. For example, we are quite aware of the Theory of Relativity, or of Darwin's Natural Selection Theory in codified forms. But we want to gather an account, if that is all or in part possible at this juncture, of the *human factors* involved in the *ante hoc* of the scientific discovery.

## THE "REAL" SCIENCE

The reverse induction of recreating and reenacting the scientific discovery is an altogether different process of rewinding reels of realities, of capturing flashbacks, and of highlighting flashpoints. This is quite understandable when we begin to handle such commodities which are frothing with rare uniqueness and personal signatures as inevitable in scientific discoverings. In a scenario where there are no fixed methods and the attitude that reigns is that of a majestic character, then, the only choice available which is far from being the best, points at the complex polymers of metaphors; the clouds of dreams and the fires of ambitions of the discoverer. The study of the *nature* of scientific discovery veritably becomes an

attempt at the adventure of intellectual re-materialization of what may be deemed as pertinent attitudes rather than of positions; of nurtures rather than fixtures. It is the moral lesson of the morale behind the construct, the humanity underneath the equations which is rather, what may be the 'better' half of codified science. Yukawa' describes the relevance and value of discerning this 'other side' of the construct which provides an altogether different world of, and about, the construct,

To judge by results is perhaps only natural, but this will not elucidate the essential nature of creativity. One must consider rather, why there was such a manifestation of creativity, what state of affairs was before its manifestation, and where it had lain hidden all the while.<sup>8</sup>

Yukawa' lends us his sharp insight into the problem of creativity by identifying and actually formulating some major problems. Perhaps, more than discovering the hidden treasures of the universe, the discovery of the process of discovery appears more fascinating. It is then thinking about the thinking which we may assume to think as the thinking which took place in a scientific discovery; and similarly, it is feeling the feelings that we think were the kind of feelings that percolated in such a historic event. The situation is similar to the interaction between Karl Popper's world 1 and world 2.

It seems that the fundamental issue on 'determinations' is quite universal as indeed it is a very basic human drive. But 'however' the explications of the process goes, the elucidations will obviously be circumscribed by 'whatever' the goal and objective therein attaining. This serves as the scientist's 'limiting factor' and the gravitational pull which orchestrates his diverse activities. It was the ancient sages who I think coined the dictum: What is primary in intention is ultimate in execution; a conviction which is similar to Gombrich's formulation of "making comes before matching."<sup>9</sup> The priority in time between execution and intention is beyond doubt crucial to a certain point, as the nebular circumstances which surround and grip science now are.

## THE "GENETIC" OPACITY

Prigogine notes this phenomenon of recent developments quite distinctly when he wrote,

Until recently, however, there was a striking contrast. The external universe appeared to be an automation following deterministic causal laws, in contrast with the spontaneous activity and irreversibility we experience. The two

---

<sup>8</sup>Yukawa', Op. cit. p. 126.

<sup>9</sup>See E. Gombrich, *Art and Illusion*. (London: Phaidon, 1960), as quoted by K. Popper in "Natural Selection and Emergence of the Mind," in *Evolutionary Epistemology, Rationality, And The Sociology of Knowledge*. Radnitzky and Bartley (eds), (Illinois: Open Court, 1987), p. 146.

worlds are now drawing closer together. Is this a loss for the natural sciences? Classical science aimed at a "transparent" view of the physical universe . . . Whenever a stochastic description becomes necessary, this is no longer so. We can no longer speak of causality in each experiment . . . Therefore, the modern trend as compared to the classical one leads to a kind of "opacity" as compared to the transparency of classical thought.<sup>10</sup>

While such pathetic picture of the scientific climate is said to prevail as Prigogine observed, he diagnosed the situation as caused by the advent of quantum mechanics and metastasized by randomness and probability. More than the conceptual frames however, he points at the conceptual process, the very operative mental activity that the mind finds itself obtaining at present. Thus he continues, . . .

modern psychology attaches much weight to the opaque functioning of the unconscious. Perhaps this is an image of the basic features of human existence. Remember Oedipus, the lucidity of his mind in front of the sphinx and its opacity and darkness when confronted with his own origins.<sup>11</sup>

The turnabout from the 'transparency' of classical science to spontaneous activity and irreversibility, was indeed a radical change in direction of pointers towards a greater approximation of reality, e.g., bifurcations, nonlinearity and inequilibrium conditions. But we still find ourselves in a dangerously tenuous and abstract situation insofar as scientific activity maintains, or more so aggravates the phenomenon of "non-inclusion or distantiation" of the scientist in the very vortex of the scientific activity, which he himself orchestrates. Such dis-involvement, which seems to be the theoretics and praxis of the idea of 'objectivity', does not augur the optimism of a kind of a mutual discovery, both that of nature and of the scientist. Science cannot be an absolute judge of itself and of its products even if in fact, it is error conscious and self-critical.

Science is 'better' understood, when viewed from the spectacles of other spheres or disciplines, vis-a-vis, with, by, and through the humanities, on the ground. Only then will science be what it should be aiming at – at globality and at the global man. This wider perspective assumed by science as an 'evolved and involved mature science' does not necessarily rob science of its specific character and autonomous nature. Rather, the specificity of science assumes a greater meaning and relevance, and a wider ambience of its being prognostic by nature. As the study of the future, much of science's potentials is lost opportunity if it avoids its incontrovertible ethical dimension.

This is what Prigogine, I believe, was referring to at, as scientific opacity. Indeed, such blindness is highly contagious to a select group of men who find

---

<sup>10</sup>I. Prigogine and I. Stengers, *Order Out of Chaos* (London: Heinemann, 1984), p. 311.

<sup>11</sup>*Ibid.*, p. 311

themselves in the 'fast lane', whose task it is, to decode the manifestations of the world around us. Speed and momentum can be defying, scientific findings can be enthralling, laboratory activities can be addicting. But the business of science can never be, or it should never be - 'busy-ness', pure and simple. This point which is seemingly a deadend or 'sudden death' nature should never be allowed to contemporize in the life of a scientist, wherein his knowledge of the grandeur and intricacies of science lead to a closed exclusion of the knowledge of himself and of his own nature. Holton (1978), seems to point out what most contemporary scientists may have undergone, and which he explains as the roots of this 'opacity' to the scientists' formative and competitive years in his opus, "Psychology of Scientists and Social Concerns."

The symptoms are initially identified as in a caricature which I would toy with, as a queer case of 'being able to hear and not being able to listen; of being able to look and not being able to see; and of being able to touch and yet, he is not able to feel'. This manner of diagnostic description may sound too 'rhythmically Socratic', but we want to emphasize the fact of the scientist's other type of blindness in spite of perhaps, his rare and incisive familiarity of his external environment. Again, we sally forth in a similar tone and vein, 'while the doctor can manage darkness for others, he cannot do so for himself, especially so regarding the darkness of his origins.' This is the lament of Prigogine!

What we are trying to illustrate is emerging at this juncture. The chief product of science is not at all and does not end with the scientific construct as such, but rather, on the quality of immanence and the depth of interiority impacted on the scientist's globality by the construct. The critical nature of science must indeed extend itself into a kind of criticism of the self. In this sense, the scientist performs an inner task which is more than that of Janus. He does not only gaze at the horizontal past and the future. At the same time, he introspects even as he builds his architectones in the vertical sphere. Scientific knowledge then becomes as a convergent venue for the self-renewing and the self-affirming. But is this still science?

Science hence, becomes a study of man, ultimately in its long range and vicarious channels of the data on nature. Its message becomes double prong: one, for himself as a scientist in the service for others; and the other, for himself - 'about' himself. Indeed, it can be said that the scientist is a man in the world, and for the world, but not of the world.

Science in its *ante hoc* phase is like a game of chess, except for the behavioral difference that the scientist and nature are both looking 'at each other', eyeball to eyeball, never with heads down and bent, but straight up, away from the chess board. For the most part, the game continues in a nonverbal, almost vibrational and wave-like. 'Seeing', 'feeling', and 'listening' and the like, serve as very vital interpretive and exegetic modes.

In this matrix, science is a dialogic reconstruction and discourse between the projections of nature as witnessed by the scientist as a spectator on one hand: and

the qualified depth and modal impact as a response of the scientist as an actor, on the other hand. At different levels, both nature and the scientist are actors and spectators. Nature leads the "domesticated" scientist into its secrets, the Solomon's mines so to say, as the scientist like Sheba brings his most precious gift, his gift of self.

The "*modum recipientis*", or the modal impact lends itself in and with the concomitant factors of style and other inputs which are of personal ingredients. The 'listening', etc., of the scientist depends to a large degree on his emphatic contact and his participation coefficient put in as his personal pledge and investment of his self and personhood. It is a contact which is both physical and spiritual, and undergoes no doubt, the attendant pains of catharsis and the consequent joys of affirmation. In 1918, Einstein wrote to Plank to greet him on his sixtieth birthday with these words.

... The state of man that enables a man to do work of this kind (physicist is akin to that of the religious worshipper or the lover; the daily effort comes from no deliberate intention or program, but straight from the heart . . .<sup>12</sup>

In their own inimitable way, scientist too are romantics. From their attitudes towards their work in general to the poetical interrogation of nature, to their language of the 'hows' and the 'whys' of scientific discovery, scientific romanticism is a fact. And there is no holding back, nor is there any more cogent reason to be bashful about it.

To worship is to love and vice versa. The good worshipper is a good lover. There is no counting of the cost, be it in effort, in time, or energy. Even failures and successes are transcended. But as the discoverer is one who is 'prepared', which we have mentioned above, he is one whose running antennae are always "set" for the "eyeball", and a knack for discerned details. There is no such thing as a direct insight on a *post hoc*, ergo *propter hoc* linear event. This asking too much on the preternatural interpretation which elevates the process to the level of the mystical. Scientific discoveries are a processive stone-by-stone affair, wherein the mosaic of the unknown is constructed by men whose images looms larger than life.

Even the physical confines of a room, or a laboratory cease to demarcate. At different levels, the conscious and the subconscious continue to dwell as his preoccupations on nature jell into his beingness. It is a tenacity and an obsession within an open framework.

It comes to a point that a kind of 'natural selection' imbues the persistent suitor of nature so that,

The important thing if one is to achieve creativity, I feel, is to keep plugging away at one thing despite all the miscellaneous tasks and the superfluity of

---

<sup>12</sup>*Ibid.*, p. 312.

information with which everyday life seeks to claim one's attention. What is needed in other words is tenacity of purpose.<sup>13</sup>

If as the ancients have always considered the wise man as distinguished and marked by order, the scientist cannot afford to be no less. He crafts an organization of his purposes and sub-purposes into a hierarchic pyramid so that intersecting occupations cleave into the one thing necessary smoothly and in a most natural manner. Einstein's "good nose" begins to function at this point in discerning and discriminating the various parts that must make up the whole, and the most symmetrical whole achievable that could be constructed with the parts. Deep within Einstein was the enthralling potential to translate the life of the scientist, his life, into its most endearing transformation, which revealed the enamored roots of his tree of science. Indeed, nothing less of the heart, as it is all or nothing. He describes these 'roots' as the heart, the heart of the scientist, and from this heart emanates his lifetime commitment. Nothing less of this commitment can make a scientist lay down his life for the sake of science.

### THE EXTRAORDINARY ORDINARINESS

Howard Gruber speaks in a similar vein as he sees the same passion pulsating when he writes,

Clearly, mere knowledge and intellectual skill, even at a very high level, are not enough to marshall the energies of the person for the longer searches of time needed for creative work. A strong emotional bond with a chosen subject and a larger vision, are essential. The creative person must develop a sense of identity as a creative person, a sense of his or her own specialness. But this cannot be found on empty fantasies. Tasks must be self-set. A group of personal allegiances must be formed to provide the mutual support (and sometimes collaboration) that creative work requires. As the individual senses this entire system that is beginning to function, a new excitement must rise in him and he must be willing and able to assimilate this state of heightened emotionality without retreating to ordinariness.<sup>14</sup>

The sense and tone of Gruber captures and encapsulizes the man in the scientist who must emerge into the acceptance of a big man's commitment to indulge in a specific game of the generals and consequence, almost with a childlike trust, with nature. As such, the commitment is continuously forged into a strong but pliable sheets of affirmations; personal as it is passionate, cosmic as it is visionary. The scientist is no longer in the world of nature, he is of the world of nature. The identity shifts from a recreation, to that of a restoration. But such identification does not submerge the uniqueness of the scientist, rather, it enhances his unequivocal specialness for the decision was of his own making and the choice was his in search for his own meaning and role, and partake of the arrow of time.

---

<sup>13</sup>See E. Hubert, "Einstein's Image of Himself as a Philosopher of Science" in *Transformation and Tradition in Science* ed. by E. Mendelsohn. (Cambridge: Cambridge University Press, 1984), p. 190.

<sup>14</sup>Yukawa', Op. cit. p. 131.

Thus a developing clinical eye and trained touch instinctively "smells" the problem and recognizes the probability of solutions of his own, no matter how tentative, or from his own kind of peers. Peerdome is not constricted to his special area of concentration, but extends to other fields as widespread as the concerns of "the diaspora in an agora." The circle of mutual feedbacks however thins out as one goes farther away from the scientist's 'center of gravity.'

Gruber's highly charged description of the commitment of the true scientist with shining fragments such as "strong emotional bond," "larger vision," "identity," "specialness," "self-set," "personal allegiances," and "without retreat to ordinariness," captures the essence of the bubbling inner dynamics which drives the man into his science. The conjured images, even with seeming redundancy, reinforces the picture of the scientist's inner features, in clearer contrast, and certainly, succeeds in presenting an improved anatomy of the 'stubbornness' which makes the figure of speech, a towering figure, a decisive univocity of intents.

The portrait looms into a canvas and his presence assumes a command and a commandment. If scientific discovery must be unearthed backwards, the major difficulty lies in the fact that such a life was built on an intense fast forward track. No single scanner has the capacity of doing this job. To read life, one must aim to live it; to interpret life, one must overcome it.

The study of nature seems to be best approximated in an attitudes of a game or play, 'a strong emotional bond,' notwithstanding. Plato in *TIMAEUS*, considered the study of nature as best accomplished in a manner of play, though we are forewarned that he may not have the special regard for this kind of study which his mentor possessed.

Einstein recalls this element of childlike mirth as the heart of the scientist,

When I asked myself how it happened that I in particular discovered the Relativity Theory, it seemed to lie in the following circumstances. The normal adult never bothers his head about spacetime problems. Everything there is to be thought about, in his opinion, has already been done in early childhood. I, on the contrary, developed so slowly that I only began to wonder about space and time when I was already grown up. In consequence, I probed deep into the problem than an ordinary child would have done.<sup>15</sup>

Einstein as a child was in a school condition which his teacher would consider a 'slow learner'. He was perceived to have been weak in the languages, but seemed to have shown some precocity in numbers.

---

<sup>15</sup>See Howard Gruber's, "The Evolving Systems Approach to Creative Scientific Work: Charles Darwin's Early Thought," in *Scientific Discovery: Case Studies*. BSPS Vol. 60 (Holland: Dordrecht, 1980) p. 118.

Such delayed misfortune led to a fortune of sorts in other aspects. We have seen it above from his own words. The 'wonder' element comes abnormally late in life and it becomes an advantage in such later stage of appearance. The child in the man ignites the fire of wonderment and the man in the child pursues the insight which ordinarily, would have been dismissed by a normal adult as childish. □

*Institute for Advanced Studies in the Humanities,  
University of Edinburgh.*

*University of Santo Tomás, Manila*